

(No. 64.)



1886.

PARLIAMENT OF TASMANIA.

RAILWAYS AND PUBLIC WORKS:

REPORT OF THE ROYAL COMMISSION.

Presented to both Houses of Parliament by His Excellency's Command.

ROYAL COMMISSION
ON
RAILWAYS AND PUBLIC WORKS.

REPORT
OF
THE COMMISSIONERS,

TOGETHER WITH

AN ABSTRACT OF THE MINUTES OF PROCEEDINGS OF THE COMMISSION; REPORT OF THE EVIDENCE TAKEN; APPENDICES, &c.

PRESENTED TO BOTH HOUSES OF PARLIAMENT BY COMMAND.



Tasmania:

WILLIAM THOMAS STRUTT, GOVERNMENT PRINTER, HOBART.

1886.

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ROYAL COMMISSION ON RAILWAYS AND PUBLIC WORKS.

(Seal.) *VICTORIA* by the Grace of God of the United Kingdom of Great Britain and Ireland Queen Defender of the Faith.

To our trusty and well beloved The Honorable WILLIAM AUSTIN ZEAL of Victoria Member of the Legislative Council HENRY CHARLES STANLEY Esquire of Queensland Member of the Institute of Civil Engineers and ARTHUR WILLIAM LAWDER Esquire of Hobart in Tasmania Member of the Institute of Civil Engineers.

GREETING—

WHEREAS we have thought it expedient to cause enquiry into the Plans Estimates and Mode of Construction of certain lines of Railway hereinafter mentioned AND ALSO to enquire into and report upon the mode in which Public Works of the Colony have been carried out during the last three years KNOW YE that We reposing great trust and confidence in your fidelity discretion and integrity have authorised and appointed and by these presents do authorise and appoint you The Honorable William Austin Zeal Henry Charles Stanley and Arthur William Lawder to enquire into and report upon the Plans Estimates and Mode of Construction of the under-mentioned lines of Railway that is to say—

The Line from Deloraine to Formby.
The Line from Launceston to Scottsdale.
The Line from the Corners to St. Mary's.
The Line from Bridgewater to Glenora.

AND ALSO generally to enquire into the mode in which Public Works of the Colony have been carried out during the last three years AND for the better discovery of the truth in the premises We do by these Presents give and grant unto you or any two or one of you full power and authority to call before you all such persons as you shall judge necessary by whom you may obtain information in the premises AND OUR FURTHER will and pleasure is that you or any two or one of you shall reduce into writing under your hands what you shall discover in the premises and do and shall on or before the twenty-second day of April next report and certify unto Us in Our Executive Council in Tasmania in writing under your hands respectively your several proceedings by force of these presents together with what you shall find touching or concerning the premises upon such enquiries as aforesaid AND WE FURTHER will and command and by these presents ordain that this Our Commission shall continue in full force and virtue and that you Our said Commissioners or any two or one of you shall and may from time to time proceed in the execution hereof and of any matter or thing herein contained although the same be not continued from time to time by adjournment AND WE do hereby command all and singular Our loving subjects whomsoever within Our said Colony of Tasmania that they be assistant to you in the execution of these presents AND We direct and appoint that Thomas Cook Just Esquire shall be Secretary to Our said Commissioners and We command that he be assistant in the execution of these presents.

IN TESTIMONY whereof We have caused these Our Letters to be made Patent and the Public Seal of Our Colony of Tasmania and its Dependencies to be hereunto affixed WITNESS Our trusty and well beloved SIR GEORGE CUMINE STRAHAN Knight Commander of the Most Distinguished Order of Saint Michael and Saint George Governor and Commander-in-Chief in and over the Colony of Tasmania and its Dependencies at Hobart in Our said Colony of Tasmania this twenty-third day of February in the forty-ninth year of Our reign.

GEO. C. STRAHAN.

By His Excellency's Command,

ADYE DOUGLAS, *Chief Secretary.*

TASMANIA

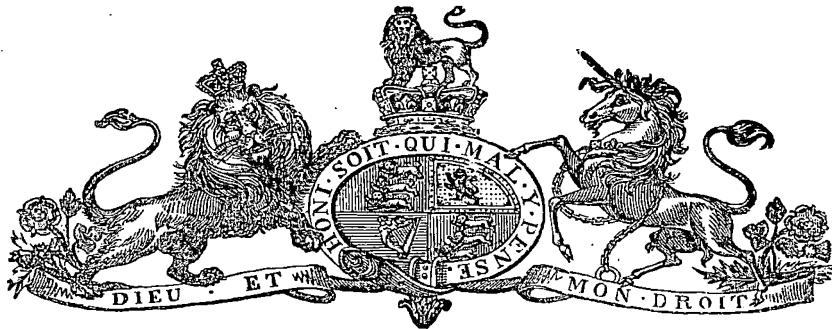
Scale 15 miles to an inch



REFERENCE

- Towns settled and partially so
- Town Reserves
- Railways constructed and being constructed
- Railways proposed
- Roads
- County boundaries
- Railways { Constructed (old Lines)
- do (new Lines)
- Under construction

Compiled and drawn by
Leventhorpe Hall
January 1884.



R E P O R T.

To His Excellency SIR GEORGE CUMINE STRAHAN, Knight Commander of the Most Distinguished Order of Saint Michael and Saint George, Governor and Commander-in-Chief in and over the Colony of Tasmania and its Dependencies.

MAY IT PLEASE YOUR EXCELLENCY.

WE, your Commissioners appointed under the authority contained in the Commission prefacing this Report, and bearing date 23rd February, 1886, beg most respectfully to submit the following analysis of our labours while carrying out Your Excellency's commands that we should inquire into and report on the circumstances arising out of the construction of the Railways and Public Works of this Colony during the past three years.

After an exhaustive and, we trust, impartial investigation of those matters which we deemed pertinent to the question at issue, we venture to hope that the conclusions at which we have arrived will, if given effect to, be of considerable value to the Government and people of Tasmania.

We deem it necessary to report that our duties have extended over a period of nine weeks, during which time we have held forty-six (46) meetings and examined and re-examined forty (40) witnesses.

We have inspected the whole of the Government Railways specified in the Commission, some of the principal Road works, and such Public Buildings as are either now in course of construction or have been built during the past three years.

These inquiries necessitated a minute examination into the administration of the Public Works Department, which controls the Railways, Roads, and Public Buildings branches of the Government Service.

We have obtained valuable evidence from Government Officers, local Officials, Contractors, and skilled witnesses, some of whom attended at considerable inconvenience, to explain the mode of constructing public works and to give explanatory details relating thereto. This evidence, which is attached, will be found supplemented by documents giving a reliable history of those works.

In considering our Report, we have been impressed with the difficulty of dealing with all matters upon which evidence has been taken, and have therefore confined our attention to the most important questions involved. A review of the evidence will, however, place the Government in possession of a large amount of valuable information, which cannot fail to be of service in connection with the Public Works Department.

We have also directed special attention to the probable ultimate cost of those Railways now in course of construction, and the causes of increased expenditure incurred thereon above the Departmental estimates.

As the scope of our authority involved an enquiry into the method of laying out and forming such of the Main Roads of the Colony as have been constructed out of the General Revenue, and as an inspection of those works would have taken more time than we felt could be beneficially employed in their examination, we issued a circular to the Chairmen of Road Trusts, wherein we invited their opinions on the manner in which Public Works had been carried out in their Districts. In response to this circular we have received a number of replies from many of the official heads of those Trusts, which are embodied with this Report, and to which we specially direct Your Excellency's attention, as containing suggestions of great value and the widest public interest.

The great distances we had to travel, and the difficulty of promptly securing the attendance of witnesses, though it has prolonged our labours, has enabled us to glean much interesting matter, which, if carefully utilised, cannot fail to be of considerable service to the Government in carrying on future public works.

In initiating all large undertakings, especially in sparsely populated and newly settled countries, the want of reliable information,—the difficulty of securing competent and intelligent officers having the necessary technical skill to deal with novel and complicated works and forms of procedure,—renders the launching of any unusual work not only a hazardous experiment, but frequently an unsatisfactory and difficult task.

It is well known in the Australian Colonies the prevailing tendency in the administration of Municipal affairs is to rest too much on the central Government. We cannot urge too strongly the advisability of extending the principle of local government, and encouraging the Boards and Trusts to rely more on their own resources in carrying out the necessary works in their respective districts. We believe, in the majority of instances, these works would be more economically supervised by such bodies than by the Public Works Department, and the adoption of local responsibility would relieve the General Government of an intricate and thankless duty.

While dealing with the construction of Public Works, be they railways, roads, or buildings, we deem it our duty to call attention to the want of a necessary enactment, framed on an equitable basis, with the view of permitting the Government to resume land without delay whenever it is required for public purposes and in the public interest, without waiting until its value can be determined by arbitration or private treaty. Such powers are entrusted to other Colonial Governments, and, taking their experience as a guide, we think a Bill might be prepared for the consideration of Parliament, and, if approved, passed into law with great advantage to public interests.

We bear testimony to the *esprit de corps* which pervades the ranks of the Public Service, and appears to animate all those officers with whom we have come in contact, and the loyalty they show towards their respective chiefs.

We now enumerate for the guidance of Your Excellency those principal works inspected by us, in the order in which our enquiry was conducted, commencing with the

DERWENT VALLEY RAILWAY.

The evidence elicited shows this Railway was projected in 1880-81. The first proposal of the Department was to start from New Norfolk Road Station, closely following the Main Road on the south bank of the River Derwent to New Norfolk, then to cross that river below Blockey's, then proceeding by the route of the contract line past Messrs. Downie's homestead along the north bank of the Derwent, which it again crossed, then recrossed, and for the fourth time crossed again, until the localities of the Ouse and Hamilton are reached.

The Railway now in process of construction leaves the Main Line at North Bridgewater, and from its commencement skirts the marshes fringing the north bank of the river to the Derbyshire and Pulpit Rocks where the Derwent washes their bases, then it contours around the foot of those natural headlands, thence, taking a direct course to New Norfolk, joins the original line above described.

The reasons which brought about the change of route from the south to the north bank of the Derwent are not clear, as will be seen on comparing question No. 6 with Nos. 69, 70, and 232. If, however, the opinions of the Engineer-in-Chief and Mr. Mault were decisive (questions 72 and 1538) the northern line is the best—an opinion, however, in which we do not concur, because it involves the construction and maintenance of an additional mile of railway, it unnecessarily exposes the works of the line to the floods of the Derwent, and places the railway station a long distance from the town of New Norfolk. The northern line provides for the erection of a costly viaduct at Bridgewater, which it is proposed to build parallel to the Main Line Railway Bridge. It is doubtful whether the advantages expected from this extensive work will be realised if the estimate (question 2176) of the Engineer-in-Chief (£24,000) is found necessary. The interest on this capital sum, calculated at 5 per cent., will involve the Colony in an annual charge in perpetuity of £1200, to which must be added the cost of maintenance.

Under these circumstances, it appears to us to be the duty of the Government to carefully consider whether an equitable arrangement cannot be made with the Main Line Company for the use of their bridge, which is reported (question 554) by the Engineer-in-Chief to be not only "in a sound condition," but in a "better condition now than it has ever been."

The surveys of the Derwent Valley Railway were made by Mr. Mault (questions 1512, 1530), and were, we regret to say, very inefficiently performed: no proper regulations were framed or any system of inspection (171 to 182, and 219, 220) or check adopted by the Department. Little skill has been evinced in dealing with natural obstacles, as at the Derbyshire and Pulpit Rocks, and, in laying out the line at Back Creek, difficulties appear to have been sought for with no apparent object, and dealt with in an unscientific manner. Unfortunately the execution of this latter work is a costly and disastrous failure, and the responsibility appears primarily to rest (questions 141, 155, 229, 230) with the then Resident Engineer, though the Engineer-in-Chief approved of and adopted the altered route. The evidence shows (questions 1992 to 1994) that at Back River a culvert, a river wall, and some pitching were originally built,—the two latter works at a cost of £972 1s. 5d.,—and each failed, and that work to the value of £919 18s. 5d. was buried in the embankment. The new wall is now being built 4 feet thick, with a vertical face; it is stiffened by massive counterforts, and is backed up by lime concrete 5 feet 8 inches in thickness. Comment on such an unusual and extravagant form of construction is unnecessary. An examination of the longitudinal section of the railway discloses a series of errors such as can only be accounted for by gross carelessness. Questions 1365, 2240 to 2247 and 2252 determines this, and being the testimony of Government officers, must be regarded as accurate: it is, however, but too fully corroborated by other persons connected with the contract, as a perusal of the evidence shows.

Respecting the bridging for waterways, and the general design of the works to carry those streams, we shall deal with them under the heads of Culverts and Bridges, commencing with the first-named structures.

The provision of Culverts, such as their character and design, appears to have been principally left to the discretion of the then Resident Engineer (questions 58, 73, 77, 80, 83), though the Engineer-in-Chief (question 89) admits his share of the responsibility. A perusal of the evidence warrants the belief that no investigation of the watersheds was made, and no attempt (questions 205 to 207, 1523 to 1525) to determine the catchment area of streams, which, having their sources in a mountainous and broken country, rendered a careful survey doubly necessary. To this neglect may be attributed the loss and damage to the works from the flood of November, 1885. Referring to the evidence it will be seen the following alterations to the culverts have been made:—

Question

- 749, 756. At 15ch. a 4ft. × 4ft. 9in. culvert altered to 3ft. 3in. × 4ft., altered again to 15ft.
 776. At 1m. 14ch. 50l. a 2ft. 6in. culvert altered to three 10ft. openings.
 778. At 1m. 41ch. a 1ft. 6in. pipe culvert altered to two 10ft. openings.
 780. At 1m. 62ch. an additional culvert, two openings, each 2ft. 7½in. × 1ft., ordered.
 782. At 1m. 63ch. ditto, ditto.
 784. At 2m. 38ch. a 1ft. 6in. pipe culvert altered to 2ft. 7½in. × 1ft. 6in.
 788. At 3m. 4ch. a 1ft. 6in. pipe culvert altered to a 10ft. culvert.
 791. At 3m. 6ch. no provision, but a 15ft. opening ordered.
 791. At 3m. 34ch. a 3ft. culvert altered to three 15ft. openings.
 793. At 8m. 28ch. additional box drains ordered.
 805. At 9m. 16ch. no provision made, but a 2ft. 7in. × 1ft. 6in. culvert ordered.

The whole of the above substituted and larger works are alleged to have been rendered necessary after the flood of November, 1885, had proved the waterways of the original culverts insufficient.

In addition to the foregoing, the following extra culverts have since been either ordered or built:—

- At 10m. 57ch. (question 1386) an 18in. pipe altered to a 7ft. × 5ft. culvert.
 At 14m. 27ch. (question 1389) a 4ft. 6in. culvert altered to two openings 3ft. × 2ft.

Besides these alterations, a large number of radical changes have been made in the size and form of the waterways (see questions 1390 to 1413), which prove that the plans adopted by the Department were crude and ill-considered, and the provision altogether inadequate.

The culvert and retaining wall at Back River as originally built failed from a disregard (questions 144, 833, and 1222) of those precautions usually observed when building on doubtful foundations, and a departure from the ordinary principles of construction, whilst the form and quality of the material was

determined chiefly on questions of cost (page 61, par. 9). In the design of the present wall a want of constructive skill is apparent, an unnecessary mass of material (page 74, par. 10) being used in what can only be regarded as a rough and unscientific design.

The bridges known as Nos. 1, 2, and 3, to be built across the Derwent, were, as regards size, detail, and number of openings (questions 73, 95, 97, 98), determined by the Engineer-in-Chief, and he asserts he furnished the necessary data to Messrs. Edwards, who made the designs (question 95) and duly submitted them to him (the Engineer-in-Chief), who adopted (question 96) and approved of them. These statements seriously conflict with Mr. Edwards's version of the matter, he alleging (question 618) that the only bridge he was connected with was that known as No. 2, and that he (question 628) began to make the drawing of No. 3 bridge, "but the Engineer-in-Chief took the work into his own office." Mr. Edwards further asserts that the designs he submitted were only "type drawings" (question 632), to be adopted or otherwise at the discretion of the Engineer-in-Chief.

No. 1 bridge has stone abutments and piers, and is to be provided with ordinary web-plate girders. Nos. 2 and 3 bridges have stone abutments with novel piers, composed of wrought iron cases to be filled with concrete. The girders for all three bridges are to be alike, therefore a description of one serves for all of them.

The masonry in No. 1 bridge has nearly all been built, and, as far as our examination went, we found the work sound and good. The abutments are built of solid masonry (in our opinion a waste of material), while, on the other hand, the piers are constructed of a minimum size, considering the site, the wear and tear to be expected from floods, and the character of the work the bridge will have to withstand.

The design of the girders show them to be strong enough, and calculated to do more than can be required of them; but the manner in which it is proposed to fix them on the masonry; the small distance they are spaced apart, making their base only equal to their height; the want of strong external stays to the girders on the piers; the absence of diagonal bracing to the upper members of the girders; and the neglect to provide any means of fastening the timber floor to the upper bed-plates, constitute grave defects in the design.

Respecting the construction of the girders, we refrain from entering at length into this matter; we presume it involves a question of public policy (question 1033), which we think it inadvisable to discuss. As to the manufacture of the ironwork, we find the work roughly put together, and not built under that strict supervision which the specification requires. There appears to have been no proper system of test adopted, or any attempt to determine the quality of iron used. The contractors, however, assert that all the ironwork is of an approved Staffordshire brand, and has undergone rigid tests (questions 5931 to 5943).

We disapprove of the proposal to weaken the superstructure of Nos. 1 and 3 bridges by widening the timber-deck from 8 feet to 14 feet, which the Engineer-in-Chief (question 2161) proposes with the view of forming a combined track for road and rail traffic. This means to build a pier about 60 feet in height, and on this to fix two girders 6 feet apart, and to secure to these girders a timber floor 14 feet wide, forming a roadway with an overhang of 4 feet outside the web of the girders. Such a design would be condemned by any practical builder as deficient in the elements of stability and correct proportion.

To add to the risk of heavily laden trains safely crossing these bridges, the plan and section show that the approaches to No. 1 bridge are by descending inclines on sharp curves. In addition, therefore, to the weight of the rolling load, the girders have to resist the momentum of the train caused by the inclines and the centrifugal force brought into play by the action of the curves.

The Engineer-in-Chief alleges (question 2164) that the roadway to bridges Nos. 1 and 3 would be "quite as satisfactory as the Cataract Bridge at Launceston." We can discover no parallel either in the form or conditions of the two structures—one design being radically bad, the other stable and well proportioned.

We have not entered into the dispute between the Department and the Contractor, nor accepted his representations unless they are confirmed by the evidence of Government employees. Suffice it to say, we think Mr. Falkingham's objections as to the proposed mode of constructing the piers of Nos. 2 and 3 bridges to be valid, and we admit the force of his protest. We are also of opinion that the proposal to place the girders as close together as the drawings indicate is objectionable, and affects the stability of the bridges.

Respecting the cost of the works, and the probability of their being completed within the Engineer-in-Chief's estimate, we find, in Parliamentary Paper No. 117, of 11th September, 1883, the Engineer-in-Chief assumes the cost of the Derwent Valley Railway from South Bridgewater to Hamilton (34m. 40ch.), with a branch to Macquarie Plains (1m. 64ch.), to be £250,000, which sum includes legal charges, contingencies, and a complete equipment for the line: this shows the average cost to be £6887 per mile for 36·3 miles.

On the 11th December, 1883, the Engineer-in-Chief again reports to the Hon. the Minister of Lands on the cost of an alternative line *via* North Bridgewater to Glenora, a length of 23m. 16ch. This estimate, which was printed on the 17th December, 1883, as Parliamentary Paper No. 5, amounts to £140,000, and on the preceding basis provides for legal charges, contingencies, and equipment. This gives the average cost to be £6034 per mile; and seeing it includes the cost of bridges Nos. 1, 2, and 3, shows an

average saving of £853 per mile as compared with the estimate of 11th September, 1883. It must be noted, however, that the estimate of 17th December last does not include the cost of the proposed bridge adjoining the Bridgewater causeway, estimated at £24,000, and if this is included the average cost of the northern line will be increased to a sum of £7069 per mile.

The Engineer-in-Chief, on the 21st September, 1885, (Parliamentary Paper No. 126), estimates the total cost of the Derwent Valley Railway at from £155,000 to £160,000; and adds, "I am sanguine of being able to finish for the lower amount;" but during the course of his examination by us (question 544) he admits that £164,000 will be the probable ultimate cost of the line, and this latter sum (question 2103) does not include the cost of the proposed viaduct at Bridgewater.

Mr. Falkingham's tender for the works of the Derwent Valley Railway amounted to £80,614, and he estimates their total cost (question 1047) to be £100,000. He takes a more sanguine view of matters than the Resident Engineer (Mr. Sheard), who, in a report furnished to us on the 15th March, 1886, assumes the total cost of Mr. Falkingham's contract to be £106,303 2s.

The foregoing is all the information we have been able to elicit from the Department, consequently we are not in a position to furnish reliable or final estimates. We are, however, of opinion that the estimate of £164,000 will be considerably exceeded in the construction of the Derwent Valley line from North Bridgewater to Glenora.

In recommending the use of the girders which have been constructed by Messrs. Kennedy and Knight for the Derwent Valley Railway, we wish it to be clearly understood that we have done so solely with the view of utilising them, and preventing that loss to the Government which their rejection would have undoubtedly involved.

Had our decision as to suitability of design and width of span for these bridges been unfettered, we should have recommended a larger span (probably not less than 150 feet clear waterway) and an altogether different form of construction.

CORNERS TO ST. MARY'S.

This line commences at the Corners Station of the Main Line Railway, trends generally in a north-easterly direction, and follows up the watershed of the South Esk River to Fingal. At Avoca (16½ miles) the line crosses the St. Paul's River by a timber viaduct 555 feet in length, and after skirting the northern boundary of the town keeps nearly parallel to the main road as far as Fingal (34 miles). This town is also passed on its northern side, and five miles further on the line crosses the Break-o'-Day River by a timber bridge of 30 openings of 15 feet each, at a point some distance to the northward of the original Parliamentary survey; thence the line traverses the foot of the range on which the Mount Nicholas Coal-mine is situated, approaches St. Mary's on the northern side of the main road, and terminates at a point 46 miles 68 chains from the Corners.

The Parliamentary and permanent surveys have both been effected by officers of the Department,—the contract system having been abandoned. The route generally appears to have been selected with judgment, and the evidence shows that the details of the survey have been carried out in a fairly efficient manner, and at a reasonable cost (questions 3120 and 3842-3845). Sufficient attention has not, however, been paid to the question of waterways, and this has led, in several instances, to additional provision having to be made during construction, though not nearly to the same serious extent as in the case of the Derwent Valley Line. Whilst on this subject, we would observe that no definite instructions appear to have been issued to surveyors, especially in regard to any systematic method of determining the necessary waterways, and that there has generally been an absence of a proper inspection of survey work.

In the vicinity of Fingal, between the town and Fingal Rivulet, the line traverses some low-lying ground, liable to be affected by the overflow of the flood waters of that stream (questions 3129-33, 3464), and it is, we think, to be regretted that steps were not taken to place the line on higher ground beyond the reach of such floods. It appears probable, from the evidence, that an alternative line might have been obtained to the southward of the town (questions 3124-6); and, although the Engineer-in-Chief is of opinion (questions 3644-45) that such a deviation would have been disadvantageous in some respects, we submit it would have been more satisfactory that the question should have been decided after actual comparative surveys of the two lines.

We noticed that between miles 42 to 47, where the line ran through some low swampy ground, the bank has had to be raised several feet and the flood openings considerably increased. It seemed to us that it would have been better if this low ground had been avoided and the line kept on higher ground, as the bank will need careful watching for some years to come.

Two important deviations from the line as approved by Parliament have been adopted—one near the town of Avoca, and the other at the crossing of the Break-o'-Day River, in the vicinity of Killymoon.

At Avoca the line as originally surveyed kept to the southward of the town, and between the points of deviation followed a nearly straight course. The line as constructed turns to the northward at 14 miles 47 chains, skirts the banks of the South Esk River near its junction with St. Paul's River, and passing to the northward of the town, rejoins the original line at 18½ miles. On the first survey the line crossed the

St. Paul's River at a very favourable site for a bridge, the length of which would have been 240 feet less than the present one. The grades as shown on the section would not have been more severe, whilst the curves were less numerous than those on the existing line. An excellent site for a station was available within 60 chains of the town, where comparatively little excavation would have been entailed, and no expensive approach such as that to the present station would have been called for.

The reasons assigned for the adoption of the present line in preference to that approved by Parliament are neither very intelligible nor satisfactory. The Engineer-in-Chief admits that the weight of the evidence, both from an engineering and traffic point of view, was strongly in favour of the original line, that he himself had some years ago selected the Rockford site as the best for station purposes, and that the same had been confirmed by every engineer who had been over it (questions 3684, 3675, and 3677); but states that in order to satisfy the wishes of the residents of Avoca, who had petitioned that the line should be brought through the town, he instructed Mr. Climie to examine and report on the proposed deviation (question 3665). (See Appendix U.) This report being favourable, he recommended the Minister to accede to the prayer of the petition; but it is to be regretted that before doing so the Engineer-in-Chief did not take steps to satisfy himself of the correctness of Mr. Climie's conclusions, nor obtain any information as to the relative value of the land upon the two lines (question 3746). The deviation has been shown to have cost nearly £3000 more than the estimate of the original line (questions 3203-3670), of which £1475 is due to the extra cost of the bridge over the St. Paul's River (question 3289), whilst the station has been located in a most inconvenient position as regards the present working of the line, and one which must entail considerable future expense when the development of the traffic necessitates enlarged accommodation.

The second of these deviations, near Killymoon, was made with the object of affording better accommodation to the anticipated traffic from the Mount Nicholas coalfield (question 3936); but seeing it increased the length of the line by nearly three-quarters of a mile (see Appendix V.), and that the works have proved more costly, it is, we submit, open to question whether, in view of the coal traffic not being an established one, the alteration was warranted, and that it would not have been more judicious to provide for such traffic as it developed, by branch lines.

It appears that these deviations were not formally sanctioned, although the Engineer-in-Chief explains that he obtained the verbal approval of the Minister to them. We submit that all important deviations from the line as passed by Parliament should invariably be duly authorised by the Government; and in this view we are supported by the opinion of the Hon. the Minister of Lands and Works (see answers to questions 6675-6).

The plans, sections, and contract drawings, as well as the specification and schedules of quantities for this line were, in common with most of the other railways, prepared, under contract, by Messrs. Edwards & Co., who, in designing the works, acted upon the general instructions of the Engineer-in-Chief (questions 6036, 6037, 6057-60). The reason assigned by Mr. Fincham for following so unusual a course was the difficulty he anticipated in obtaining an efficient staff, and the short time allowed him in which to get out the contracts (questions 3729-31 and 4844-56).

The contract drawings were merely looked upon as typical of the general character of the structures, and the Engineer-in-Chief left to the Resident Engineers on the different lines the preparation of all special or detail drawings required during the progress of the works. These detail drawings appear in most instances to have been issued to the contractors solely upon the authority of the Resident Engineers without bearing the signature of the Engineer-in-Chief or being otherwise identified by him (questions 3348-52), contrary to all recognized practice (question 3110). This system we cannot too strongly condemn, as leading to a divided responsibility and the absence of the necessary control which an Engineer-in-Chief should exercise over works carried out under him. Written instructions for the guidance of Resident Engineers prepared by the Engineer-in-Chief duly provide that no alterations shall be made without his written authority (question 1681); but these appear in a great measure to have been regarded as a dead letter, and, in the case of the Fingal line, were not even issued to the Resident Engineer (questions 3346-7.)

The railway works generally have been tendered for as "schedule contracts," and, provided due care is exercised in the preparation of the schedules, the system is an excellent one, and in many respects preferable to "lump sum" contracts; but, on the other hand, if the quantities have not been calculated with due care and accuracy, this method is liable to become a dangerous and misleading one. We regret to record our opinion that the manner in which the schedules of quantities have been prepared, both for this and most of the other lines, has not been reliable; for, whilst some of the more important items have evidently been arrived at by calculation from the sections and drawings, there is evidence that in many of the other items the quantities have merely been assumed (questions 3709-19). This has led, in the case of the Fingal line, to most unsatisfactory results, inasmuch as the schedule quantities have proved of very little guide to the work as actually executed (questions 3087, 3088, 3373-75, and 3717-23), and has been the cause of misleading the Government as to the probable expenditure. The Engineer-in-Chief explains that he was unable to check the schedules of quantities previous to the work being tendered for, and that an application for professional assistance to enable him to do so was not favourably entertained by the Government (questions 3729-36). It appears, however, to us that that officer hardly realised the grave responsibility he incurred in consenting to the preparation of such important details connected with contracts involving large sums of money, under so imperfect and unsatisfactory a system, without formally recording his disapproval, and so relieving himself from the consequences (question 3737).

From our inspection of the works we are pleased to state that so far as they have progressed they appear to have been faithfully executed, and reflect credit on the contractors, as well as the officers of the Department employed in supervising them. The permanent way has been fairly well laid, and the ballast, especially from 8 miles onwards, is of excellent quality. At the time of our visit the road was not in such good order as could be desired, but, no doubt, the contractors will remedy this before the line is opened for traffic. We found that laying on formation has been permitted without the very necessary precautions stipulated in the specification being enforced, and, in the absence of the formal approval of the Engineer-in-Chief as required under the conditions of contract (questions 3601-10, and 3749-55), which we consider highly objectionable.

The material and workmanship of the timber bridges, as also of the masonry and concrete culverts, so far as could be judged by external appearance, is unexceptionable; but in the case of the latter works, we regretted to observe that the face and wing walls of the culverts at 5m. 40ch., 8m. 25ch. (Stony Creek), and 11m. 44ch., showed unmistakable signs of failure. The walls have bulged considerably and are cracked in several places from the pressure of the embankment, and will probably require, sooner or later, to be rebuilt. From the evidence before us, and a careful examination of the drawings, we must record our opinion that the failure of these works is due to insufficient strength and faulty design (questions 3083-85, 3273-80, 3435-46, 3623-40).

At a point on the line near 32 miles (Vinegar Hill) our attention was drawn to the fact of the slopes of the railway cutting having encroached upon the embankment of the main road running parallel to and above the line, and there are already indications of slips in the made ground. It appears that it was originally intended to build retaining walls at this place, and provision was made on the contract drawings accordingly. These have, however, unwisely we think, been omitted, and we are of opinion that both for the protection of the railway and safety of the road traffic, suitable retaining walls should at once be erected. The extra cost of these is estimated at £2572 (question 3508).

The fence adopted on this line is chiefly that known as "Bain's patent wire fence," and however efficient such a fence may be for sheep purposes only on level country, it appears quite unsuited to afford adequate protection to the railway where traversing undulating or irregular ground.

Some attempt has been made to adopt typical designs for station buildings on this line (questions 3929-33), but, taking the buildings at Avoca as a sample, a more economical design, we think, might have been adopted, and more convenient accommodation secured in proportion to the cost.

No provision has so far been made for signals at any of the stations (questions 3620-22), and the Engineer's Department does not appear to attach much importance to their use (questions 3881-98, 3907-11), nor have scotch and stop-blocks been supplied to the different sidings, though the Department acknowledges the necessity of them (question 3901).

In a revised estimate furnished to Parliament in September, 1885, the probable total cost of the line is given by the Engineer-in-Chief at from £150,000 to £156,000; and this he explains was arrived at from "fuller information afforded by the Resident Engineer" as compared, it is presumed, with the rough estimate of £4000 per mile prepared by him from a flying survey and supplied to Parliament during the previous session (question 3856). According to the evidence the ultimate cost is given at £173,000 (question 3857.) The latter estimate, however, is based on the amount of the contract as tendered for, and makes no allowance for extra charges, though the Resident Engineer states in evidence (questions 3330-31) that he estimates the contract will probably amount to £85,507, whilst the contractor's engineer places it at £89,476. Assuming that the actual result will lie somewhere between these two estimates, and allowing for the cost of the retaining walls at Vinegar Hill, as well as the rebuilding of those portions of the culverts which have failed, it seems improbable that the line when completed and equipped will have cost much under £180,000. Although well within the preliminary estimate of the Engineer-in-Chief, it will exceed the revised estimate of September, 1885, by between £24,000 and £30,000. From the return furnished by the Department already alluded to, it appears that a part of this discrepancy (£12,376) is due to the omission of certain charges for rails made in the Crown Agents' accounts but not recorded in the office here. The balance of the difference is due to provision for expenditure not covered by the original estimate, such as signals, telegraphs, &c.; and probably also to an increase in quantities actually executed as compared with those entered in the contract schedule.

LAUNCESTON AND SCOTTSDALE RAILWAY.

The original survey was made from Launceston, *via* right bank of the Tamar, Lower Piper, Upway, and Alford, to Scottsdale. Length, 67½ miles; an average grade over all of 1 in about 115½; maximum grades of 1 in 40, and minimum curves 330 feet radius. Estimated cost, £300,000, or £4444 per mile (question 4755.) This route being objected to by Parliament, a line through the Upper Piper, joining into the original line two or three miles west of the Denison Goldfield, was surveyed, and this combined route was sanctioned by Parliament (question 4755.) Length, 59½ miles. An average grade of 1 in about 106½; maximum grades, 1 in 40; and minimum curves of 330 feet radius. Estimated cost, £300,000, or £5042 per mile (question 4871.)

During the progress of the permanent survey the Engineer-in-Chief deemed it advisable to adopt a new route between Upper Piper and Scottsdale, south of the original line, whereby about 12 miles of rail-

way will be saved, the length of this entire new alignment being 47 miles; an average grade over all of about 1 in 84; maximum grades, 1 in 40; and minimum curves, 330 feet radius. Estimated cost, £370,000, or over £7872 per mile.

We observe that the Engineer-in-Chief took upon himself the grave responsibility of projecting the survey of an entirely different route from the line approved by Parliament between Upper Piper and Scottsdale, and this deviation has since been adopted in the permanent line. He states (questions 4893-4896) that he had the approval of the Government before it was committed to the expenditure upon construction (question 4895), and this has been acknowledged by the Minister of his Department (question 6677), but no formal or official sanction appears to have been obtained by him. The plea of shortening the line as against a corresponding increase over the sanctioned estimate seems hardly satisfactory—the more particularly as he failed to advise the Government upon the cost of working the difficult line now under construction (questions 4796 to 4810, 4903, 4926 to 4936).

This line runs through a rough and difficult country, and demanded both judgment and skill in its location. The officers employed seem to have performed their work well; but it is much to be regretted that in the survey of an important and difficult line like this that more time should not have been taken and strenuous efforts made to secure more easy curves and gradients than now exist. The Engineer-in-Chief seems to have been content to secure a grade of 1 in 40 with 5 chain curves, and to have given his surveyors these limits in the first instance. No profit seems to have been gained by the experience of working other similar combinations in the colony, and the cost and difficulty of the working of this line does not appear to have been taken into calculation at all (questions 4926, 4927), efforts being directed to obtaining the *shortest* line (questions 4755, 4769, 4448) with the said steep grades and sharp curves combined. Owing to the difficulty and expense of working this line as laid out, very considerable traffic at high fares and rates will be necessary to make it pay even its own working expenses as a direct return.

Curves of 5 chains radius obtain frequently upon the maximum grade of 1 in 39.6, and upon other inclines but little less steep, notably in the steady ascent of about three miles in the Denison Gorge; and the total resistance on this combination will be, as compared with a straight level road, as much as 8.58 to 1, or, roughly speaking, the load an engine will be capable of hauling over this road will be less than one-eighth of its load on a level.

Investigation of the working powers of the Government engines in use (mentioned in question 5503) shows that the goods engine will be capable of hauling at most about 90 tons, exclusive of engine and tender, upon the steepest part of the road, at a speed of 8 to 10 miles an hour; but the passenger engines will not be able to haul up more than 40 tons, exclusive of engine and tender, at 14 miles.

The waterways appear to have been approximated and adopted without calculation or reference to the several watersheds, except in a few instances (questions 4268-4271, 4368-4377, 4645, 4727.)

Very insufficient measures were taken to find out the quality of the strata on the line of tunnel (questions 4658-4665, 4583, 4869), hence considerable expense, delay in the completion of the contract, and opening the line for traffic is likely to obtain.

No deviations of the fixed route appear to have been made, but an alteration of levels has been carried out between 7 to 9 miles, which appears to be an improvement, involving no extra cost.

The surveys have been performed by officers employed by the Department, paid from special item in construction estimate (question 4915.)

The preparation of plans, specifications, and quantities, as far as was necessary to the letting of the work, was performed in contract by Mr. Edwards, under the direction of the Engineer-in-Chief (question 4228.) The drawings are simply "types," and are not got out with special regard to locality (question 4223-7.) The Engineer-in-Chief seemed to consider it the duty of his Resident Engineers to prepare all detailed drawings for important works, to which they very rightly objected; and some of these plans appear since to have been supplied by the Engineer-in-Chief, but are not signed, and should be duly attested by him (question 4990.) The schedule quantities were also got out by Mr. Edwards, and, as in the schedules for other lines, in some items they do not fairly represent the actuals, and no check seems to have been made by the Engineer-in-Chief or the Resident Engineers (questions 4863-4866, and other evidence.) The work had not progressed sufficiently far to bring any differences or omissions prominently into notice. Messrs. Boland & Scott's contract does not comprehend the construction of station buildings, turntables, &c. (question 4145.)

No written instructions similar to those issued on the Derwent Valley Railway appear to have been supplied by the Engineer-in-Chief to the Resident Engineers on this line.

Some delay in giving possession of the land for the works has taken place in the neighbourhood of Launceston, but this is of little importance. Land for side cuttings has very properly not been made over where spoil from cuttings seem sufficient for the embankments within the lead limits.

The clearing has been very heavy and costly, owing to the large timber and thick bush for most of the way. It is stated in evidence that a liberal safety margin will be cleared, particularly along the edges of deep cuttings, which is satisfactory.

Several kinds of fencing are to be adopted (questions 4715-4722, 4910-4915)—post and four rails; post and wire, with wooden top rail; all wire fence, with hardwood posts; log fence; chock and log fence; paling; and "Bain's" patent wire fencing. Of these, Bain's patent fencing appears most objectionable from its unsuitability to uneven ground, and more especially on the rough country through which this line runs. It is also a frail barrier, the only resistance to overthrow being posts sunk two feet into the ground at every 50 feet apart. It is entirely unsuited for a railway fence, and should not be adopted for this purpose at all. The small initial saving in its adoption over the cost of post and rail fencing will be more than counterbalanced in the cost of its maintenance.

The rates for earthwork have been taken out for each mile separately, with no reference to quality, and difficulty may be found in arranging terms with contractors in the case of deviations or alterations of levels.

Owing to the want of exact information as to the character of strata on the line of tunnel, no decision about lining has been arrived at (questions 4869, 4658), and, consequently, no materials are being provided. The contractor, however, is making some bricks to start with, but as he states it will require as many as he can make in two years should the whole tunnel have to be lined (question 4586), some action on the part of the Department should at once be taken in the matter if the line is to be opened for traffic within the contract time. The Government Engineer in charge of the line considers also that the completion of the tunnel will take about two years (question 4152), before which time it does not seem possible to carry on the platelaying further, as there is no other service road.

Some very substantial-looking concrete culverts have been constructed within the first ten miles, and it is to be deplored that this style of construction could not be carried out all through; but on the Scottsdale side of the tunnel temporary log culverts are to be adopted under embankments, which are expected to save ultimately about £7500 (questions 4975-4982), but which cannot be contemplated as suitable for a permanent railway, even if it be possible to replace them by concrete structures hereafter without risk to the bank.

The designs for the bridge over the Piper River show concrete piers without any batter (questions 4500-4501), which is objectionable and unworkmanlike.

The timber viaduct at Dogwood Gully, 13m. 75ch., is on a 6-chain curve. It is preferable on such steep sidelong ground to a very high retaining wall and small culvert, but is not permanent even if sufficiently stable, and from its position its renewal will involve considerable difficulty. Efforts should be made in this and similar localities to eliminate the curve across the roadway and adopt concrete abutments and iron girders (see page 173), or the viaduct should be constructed entirely of iron.

It is to be regretted that, with a view of saving expense, more investigation has not been made to ascertain if good hydraulic lime could be obtained within a convenient distance of the line on the Scottsdale side of the tunnel. Its adoption might have effected a considerable saving in the cost of the works, more especially where the log culverts have now been put in (questions 4746 to 4753).

There does not appear to have been sufficient foresight displayed in the supply of ballast, and it appears clear that if no suitable material, either gravel or stone, should be obtainable between the tunnel and Scottsdale, that there will be a delay of many months in the opening of the line owing to the supply having to be trained out through the tunnel after it has been completed, for the ballasting cannot be thus performed with anything like the rapidity with which it is possible to lay down the rails (questions 4308-11).

The plans for station yards which have come under our notice indicate that sufficient provision has not been made for the safety of the public, and we recommend that the plan, together with a section showing the gradient in the approaches to each station yard, be invariably sent to the Manager of Government Railways for his approval of the provisions for working the expected traffic.

The staff employed upon the line appear men well qualified to construct the railway in a workmanlike manner, and the contractors seem satisfied with their contract, and to desire to give every satisfaction to the Department.

From the information obtainable in the present state of the works, it is not easy to form an accurate opinion upon the sufficiency of the estimated amount, viz., that sanctioned by Parliament, with the addition mentioned by the Engineer-in-Chief (questions 4875-4902), viz., £370,000. The evidence of the Engineer-in-Chief is to the effect that it will not be exceeded (questions 4876-4919 and Appendix Y.) The additional £70,000 over the original estimate for the line sanctioned by Parliament is accounted for by Mr. Fincham as partly due to the shortening of the route, likewise to excess in quantities calculated from more accurate data obtained (question 4880), and partly to the cost of surveys, plans, supervision, &c., not included in the original estimate (question 4915).

In reference to this line especially, the Commissioners consider that it would have been more satisfactory to the Government if some reliable calculations showing the cost of working the line in relation to its financial prospects should have been placed in the hands of the Minister for due consideration before the construction was undertaken. Similar estimates are invariably now prepared for the information of projectors of railway companies where any steep gradients have to be contemplated. As matters now stand, it will be sufficient to say that this line is not likely to pay 4 per cent. upon the capital of £370,000 over and above the cost of working until the gross earnings reach the sum of £75,000 per annum.

MERSEY AND DELORAINE RAILWAY.

In 1875 Mr. Josiah Human was employed by the Government to lay out and survey this line, extending from Deloraine to Coiler's Creek, thence along the Mersey and Deloraine Tramway line (under purchase by the Government) to Latrobe, and on to deep water at Torquay, the east bank of the Mersey. His estimates comprehended the following:—

	£
Purchase of tramway.....	12,500
Engineering survey	1500
Cost of 13 miles new line Deloraine to Coiler's Creek.....	41,949
Cost of 17 miles tramway reconstructed.....	21,833
Cost of 5 miles, Latrobe to Torquay	20,276
Rolling stock.....	7000
	<hr/>
TOTAL	£105,058
	<hr/> <hr/>

Mr. Human also surveyed and estimated for an alternative line from the Latrobe terminus to Torquay, and also for a line "branching off above the railway (tramway?) bridge on the Mersey, passing at the back of Kelcey's, and thence to a shipping-place at Horsehead Creek," the last-named running entirely on the west bank of the Mersey.—(See letter dated 27th April, 1875, from Minister of Lands and Works to Mr. Human: Par. paper 73 of 1875.)

In 1882 the Latrobe to Torquay section was abandoned, and a survey made upon the route quoted above, but extending to Formby. The whole project from Deloraine to Formby, including the above alignment and the old tramway branch into Latrobe, appears to have been submitted to Parliament, and in the same year Parliament authorised the construction of a line from Deloraine to Latrobe (to include the conversion of the old tramway), and from the Latrobe station to Formby. (Act 22 of 1882, clauses 5-2.) This involved practically a loop through Latrobe (about 1½ miles longer than the original alignment), and two crossings of the Mersey River. Another deviation was made at Horsehead Creek, where the original route crossed the creek by a long embankment, and this was given up by the Engineer-in-Chief for one round the head of the creek. This seems to have been a justifiable alteration on the grounds of safety—(questions 5163, 5164, 5182-5187.

The Whiteford Hills station is placed upon a grade of 1 in 50, which is decidedly objectionable on the grounds of safety, and it does not seem clear why (judging from an inspection of the ground) the alignment should not have been laid out so as to have secured a level station yard.

The preparation of plans, and the necessary details for letting by contract the works of this railway were carried out by Mr. Cresswell, under the direct supervision of the Engineer-in-Chief.

The contract was let in the end of 1883 to Messrs. Fergus and Blair, and it included the construction of the railway from Deloraine to Formby, and comprised the conversion of the tramway works from Coiler's Creek to Latrobe into a part of that railway. The amount of Messrs. Fergus & Blair's contract was £94,000.

One of the principal works was, as above mentioned, the reconstruction of the Mersey and Deloraine Tramway, which had been in use for some years, and provided for a portion of the trade of the District. This tramway extended in the direction of Deloraine for a length of 17 miles, and terminated at Coiler's Creek. It was apparently projected to carry the timber and agricultural produce to the seaboard from that well known rich tract of country, especially suitable for agriculture, lying in and around Deloraine, Chudleigh, and Kimberley, and extending a great distance towards Latrobe.

The evidence shows that the Government acquired the rights and privileges of the Tramway Company before the Session 1880-81, for the sum of £6000 (question 5188.) The works at that time were in a state of disrepair; and, according to the testimony of Mr. Ryton Oldham, the engineer who supervised the reconstruction of the tramway, all the culverts and the two Mersey bridges were removed and entirely new works rebuilt; the cuttings were cleaned and widened; the slopes flattened and retrimmed; and the formations regraded. The embankments were likewise widened, resloped, and raised to their present level.

The railway, generally speaking, is carefully and judiciously constructed. The heaviest works are the bridge over the River Meander at Deloraine, and the three bridges spanning the Mersey. Of the latter, the first bridge is situate at Kimberley; the next one mile south of Latrobe railway station; and the third nearly three quarters of a mile north of Gilbert-street, Latrobe, on the north boundary of the town, and about 100 yards below the present river bridge on the highway leading from Latrobe to Emu Bay.

The first important work on the railway is the bridge crossing the River Meander at Deloraine, close to the railway station. This work is of a composite character, the materials are sound and good and appear to have been carefully put together; no settlement or fracture appears in any portion of the structure.

The abutments and piers are built of concrete, on which wrought-iron web-plate girders, of a very strong but ordinary type of construction, rest; the several members and minor parts of these girders are extra strong, and the whole of the iron used, as well as the workmanship, is of a superior quality. The manner of supporting the timber floor is the unusual feature of the design. It consists of what is known

as a "slung road," that is, the timber deck is hung to the lower flanges of the girders by bolts. This plan is not now usually adopted in girder bridges, but it is unobjectionable as long as the bolts are kept sound and tightly screwed up.

In the construction of the three bridges over the Mersey a novel and, in our opinion, an unfavourable departure from the ordinary practice of bridge building has been introduced, viz., the use of timber piles which compose the piers supporting the girders which carry the railway. This seems to us to invert the usual mode of building, inasmuch as it adopts as a correct principle the use of perishable material in foundations and sub-structures, and of a permanent and practically imperishable material in the superstructure. Had these conditions been reversed we think little exception could then have been taken, especially if the erection of such a class of work was controlled by the necessity for economy; but we think, under any circumstances, cast screw piles or cylinders might have been advantageously adopted.

In justification of the Engineer-in-Chief we remark that he explained to us when giving his evidence that in adopting piles for the piers of the Mersey bridges he was guided by motives of economy and the belief that he could in due time build within the enclosure formed by these piles either masonry or concrete piers, his design allowing sufficient space for that purpose. This, we think, he will find a difficulty in doing.

These bridges are each built with concrete abutments, timber (pile) piers, and wrought-iron web-girders, in which the same plan of attaching the timber floor to the lower flange of the girders has been adopted as that described in the Meander Bridge, Deloraine. The same remarks are therefore applicable to these girders as to those described in the last-mentioned bridge.

On the remaining portion of the line the minor works require no special comment, and they appear to us to have been built in a careful manner.

The position of the railway at Formby calls for some remark from us, inasmuch as it appears to have unnecessarily encroached on the public road and Esplanade, and has practically destroyed both of them. Its position also renders a direct and easy access to the Mersey for drays and vehicles very difficult, and it cuts off the approach to the Ferry between Formby and Torquay. We are of opinion that in view of the future development of the marine trade of those towns, which is now rapidly increasing and will, we think, continue to extend when the bar across the sea mouth of the river is dredged away, that it would have been more judicious to have constructed the railway on the west side of the public road at Formby, and built the station to the north of O'Meara's Hotel, even if such a deviation had necessitated the purchase of a quantity of valuable private property,—and this, in the future, may have to be carried out, under disadvantageous circumstances.

The whole of the works comprised in the contract of Messrs. Fergus and Blair appear to have been carried out in a fairly efficient manner.

The first estimate of the line from Deloraine to Formby *via* Sherwood was furnished to Parliament by the Engineer-in-Chief in 1882, and amounted to £120,000 (see Appendix Z1.) This included the sum of £6000 for the purchase of the old tramway line from Coiler's Creek to Latrobe, and "was based, with some revision, upon Mr. Human's survey and particulars of line from Deloraine to Latrobe, and upon a trial section from Sherwood to Formby." The Engineer-in-Chief states that at the time this estimate was compiled it was understood that all the large bridges were to be constructed of timber, and that the expenditure for rolling stock was to be limited to £12,000.

The Act of Parliament (46 Vict. No. 22) authorising the construction of this line virtually determined that it should pass through the town of Latrobe (see Sub-sect. 2 of Sect. 5), and this necessitated a considerable deviation being made in the permanent survey from the plans as laid before Parliament (question 5163); but in addition to this the Engineer-in-Chief, upon his own responsibility, adopted a further deviation in the vicinity of Horsehead Creek, with the object of avoiding a tidal estuary of the Mersey crossed by the original survey.

The former of these deviations, it is stated (question 5170), has involved an expenditure of not less than £13,000 in excess of the estimate of the original line; whilst the latter, which was anticipated to effect a saving of £1500, has in reality augmented the expenditure by £500 (question 5636.)

When inviting tenders for construction, the Engineer-in-Chief estimated the value of the work to be tendered for at £83,000, and the contract was eventually let, after the two lowest tenderers had withdrawn, to Messrs. Fergus & Blair, by special arrangement, at £94,000 (question 5195). It is not clear, seeing that this amount was £11,000 above the Engineer's estimate, why fresh tenders were not invited, in accordance with the usual mode of procedure under such circumstances, or why the alternative suggestion by the Engineer-in-Chief, of letting the work in smaller contracts, was not acceded to. From the returns furnished by the Engineer's Department it now appears that the total sum paid to the contractors in final settlement of the contract amounted to £100,944 (question 5198), and that the ultimate cost of the line when all outstanding liabilities are discharged will probably be £190,456 (question 5205, and Appendices Z1 & Z2.)

The increase on the contract amount as tendered for is attributed chiefly to excess in the earthwork quantities and additional ballast required at the old tramway line over that estimated. It appears from the evidence that the necessity for reballasting this section of the line was pointed out in Mr. Human's report (question 5208), but the Engineer-in-Chief preferred accepting the estimate of the then resident engineer, Mr. Cresswell (question 5202), and hence the discrepancy.

In explaining the difference between the original estimate (£120,000) and the actual cost of the line (£190,456), the Engineer-in-Chief has furnished a statement (question 5206) of the special items of excess in cost amounting in all to £49,416, which he claims as not having been contemplated under his original estimate. He stated, that of the balance £15,000 is due to rise in price of labour between the time of preparing his estimate (1882) and the letting of the contract (1883) (question 5219), and the increase in quantities of work as actually executed is placed at £6000—in all, £21,000.

In considering the above return, the items under the head of "Latrobe deviation," extra "expenditure for land compensation and rolling-stock" are, we think, legitimate causes of increased cost; but the other items, such as those for additional stations, accommodation works, and maintenance, we cannot but regard as arising through omissions in the original estimate; whilst in respect to the extra outlay for iron over timber in the construction of the principal bridges, the Engineer-in-Chief himself clearly accepts the responsibility (questions 5174-5).

As to the estimated increase due to the alleged rise in price of labour, the evidence is rather conflicting, though, no doubt, some rise in wages did take place during the period referred to. Reference, however, to the Statistics of the Colony fails to bear out the estimate of the Engineer-in-Chief (question 5218), and it does not appear that a greater increase than 10 per cent. can be fairly attributed to this cause. After allowing for this the balance of difference is, we believe, due to underestimating in the first instance, and the increase in actual quantities as the outcome of insufficient care in the preparation of the contract schedules, for which the circumstances of the case do not, in our opinion, afford any valid excuse.

PUBLIC WORKS.—ROADS AND BRIDGES.

In pursuance of the general powers embraced in the Commission, we proceeded to enquire into the mode in which the Roads and Bridges of the Colony are provided for, surveyed or designed, constructed and maintained. As it would have been impossible, without unduly prolonging the enquiry, that we could visit all the roads, we decided upon confining our inspection to a few leading lines which might be regarded as fair examples of the whole, and issuing a circular to the Chairmen of District Road Trusts requesting them to forward in writing any concise statement as to the manner in which public works have been carried out in the several districts during the last three years. We issued eighty-two of these circulars, and have received forty-three replies, which will be found printed in the Appendices to this Report. The general tenor of these replies will show that the conduct of public works in the several districts has been fairly satisfactory, but special points of administration are referred to and suggestions made, some of which are valuable and should be acted upon. Complaints as to particular works, the manner of supervising and carrying out contracts, &c. are included in some of the letters received, and these we have referred to the officers of the Public Works Department whose special province it is to deal with them. In addition to the actual inspection of works and enquiries from the Trusts, we examined a number of officials connected with the Roads Branch of the Public Works Department and several officials of the District Road Trusts. We also examined influential residents acquainted with the construction and maintenance of roads and bridges.

From the evidence thus obtained we gather that there is considerable lack of system in dealing with the public highways of the Colony, and a division of responsibility decidedly inimical to the attainment of the best results. It appears that the Main Roads are constructed in the first instance from moneys voted by Parliament, under the direct supervision of the Public Works Department; they are then handed over to the District Road Trusts for maintenance, the funds for this purpose being derived, firstly, from local rating by the inhabitants of the Districts, and, secondly, by a graduated subsidy granted by Government, and in some cases by extra special votes granted by Parliament in aid of particular works. Here a cumbersome and apparently unnecessary dual control is introduced, which can scarcely be expected to work satisfactorily. The rule seems to be that wherever the funds necessary for the construction or maintenance of roads, either in the whole or in part, are derived from the Public Treasury, that the local bodies are not to be trusted, and that the moneys must be laid out under the direct supervision of the Public Works Department. This appears to us to strike directly at the root of local self-government, a principle adopted and encouraged to the utmost in the other Australian Colonies, with the very greatest advantage to the State. We believe it would be found economical and satisfactory were the local Road Trusts entrusted to a greater extent with the control of road expenditure within their districts, especially after the works have reached the maintenance stage. Their operations might be made subject to reasonable supervision by the officers of the Department; but your Commissioners believe that the knowledge of local requirements possessed by Trustees, and the interest which they in common with the inhabitants of their districts have in making the funds partly subscribed by them go as far as possible, would tend to practical economy and a better distribution of the moneys at disposal. These remarks apply particularly to Roads. With the question of Bridges we deal further on.

It is in evidence that an objection to entrusting the expenditure of moneys voted from the Public Treasury to Road Trustees is that in some districts suitable men do not take an interest in public works, and that in several instances there is a want of the scientific and practical knowledge and skill necessary to enable the members of Trusts to deal with expenditure on roads in a satisfactory way. This is an objection which is not found to militate against the success of the system of local self-government in other Colonies, and your Commissioners are at a loss to know why it should have so much weight in Tasmania. Settlers who go out to conquer the forest and make homes for themselves on the bush lands of Tasmania must be to some extent men of energy, perseverance, and intelligence. The qualities requisite to enable a man to clear and fence land, build huts, and undertake the various duties of a settler's life, are precisely those requisite in the road trustee charged with the duty of finding the best and most convenient highways,

and of making and maintaining them. Were such men entrusted by Government with more responsibility, it would be their duty and privilege to acquaint themselves with the best modes of construction; their technical knowledge would grow with their necessities, and in course of time the country would be possessed of a body of road trustees well informed and competent to perform the work devolving upon them. This, at least, has been the experience in the other colonies. In connection with the objection referred to, it is worthy of consideration as to whether the present system does not deter men of superior ability from interesting themselves in local works.

The evidence is conflicting as to how far Road Trustees are consulted by the officers of the Public Works Department when deciding upon new roads or other important works. In some cases their opinions seem to be sought, but in many instances this is not the case. We consider it most desirable that before any new works are undertaken the views of the local authorities should be ascertained.

Our attention was directed to the manner in which the public roads of the Colony are surveyed or laid out, and it seems to us to be of a very primitive nature. The roads appear generally to follow the original tracks opened up by the timber splitters, these are located afterwards by the land surveyors, in the majority of cases without much regard to grades or suitability of direction. So soon as they are established land is taken up along their course, and settled; and when traffic develops, and it is found that the road requires to be varied, claims for compensation from adjoining owners render the expense enormous, and frequently prevent much needed alterations and improvements from being carried out. In our opinion, surveys of all roads should be made by properly skilled road engineers, and, if possible, ahead of settlement. The road should be charted, and plans and sections should be prepared where the character of the country requires it, according to which the road should ultimately be made when the traffic warrants the expenditure. Such a system might involve a small outlay at the commencement, but it would save much waste of money subsequently, besides affording confidence to settlers in selecting land by the certainty of the road alignments.

A prominent point impressed upon us in evidence, and in the letters from the Chairmen of Road Trusts, was the necessity for undertaking the construction of road works at an earlier period of the year. It is represented that at present these works are generally performed in winter, when the difficulty in obtaining material is great, the cost of carriage high, and the influence of traffic on the broken-up roads most detrimental. The result is to greatly increase the amounts of the tenders, and render the work when performed less permanent and satisfactory than it would be if carried out during the spring or summer seasons of the year.

In the construction and maintenance of bridges, your Commissioners observe there is room for improvement. The bridges throughout the Colony appear to have been constructed upon many varieties of design, and in numerous instances to be unsuitable to the locality; not sufficiently permanent, and most expensive to maintain. The erection of bridges upon timber pile piers over tidal rivers and creeks infested by the marine worm (*Teredo navalis*) appears to be a great mistake; and although it may curtail present outlay, is a never-ending source of future expense. It is desirable that standard designs of bridges should be prepared suitable to the several classes of locality, and adapted with due regard to natural conditions and available materials, but always aiming at permanence in the under structure at least. In tidal rivers masonry or concrete piers, or iron screw piles or columns, might be adopted, while in other localities not under tidal influence timber structures might be the most advantageous. It would be easy to prepare type designs which might be adapted, as proposed, and such a system would lead to economy. As regards the upper structure of bridges, timber tops are no doubt the most economical in many localities, but they are not permanent, and it is questionable whether iron or steel girders would not be found the cheapest and most satisfactory in the end. By the adoption of such, single spans would be found sufficient in many cases, thus affording increased waterway, entire immunity from danger from drift timber, and much more sightly and elegant structures.

A custom prevails in this country of loading the wooden floors of bridges with road metal, tar, &c. to about 6 inches in depth, the object being to protect the timber from the warping influence of the sun and weather. The contra argument is that the metal imposes upon the bridge a great unnecessary deadweight, which decreases its efficiency, and, besides that, it holds the water, and is calculated to cause the rotting of the timber in a much shorter space of time. The evidence on these points is conflicting; but we may state that in the neighbouring Colonies the bridges are, as a rule, not so loaded, and it is found that the hardwood roadways last extremely well.

It is in evidence that bridges, when constructed, are, with the roads, handed over to the Trusts for maintenance. It appears to us that this is a case where the objection to the authority of local Trustees might fairly be raised. The maintenance of bridges is a matter in which technical skill and a knowledge of the various forms of structure are very necessary. There is also the probability of several Trusts being interested in one bridge to be considered, with the contingent risk of a conflict of authority. Under all the circumstances brought out in evidence, we incline to think that the construction and maintenance of all principal bridges should be left in the hands of the Government. The Public Works Department hold the plans, and are intimately acquainted with all the details of these structures, and the officers of that Department are far more likely to perform the work connected with them satisfactorily than the local Trusts.

It was represented to us that the specifications as drawn for roadworks are, in many cases, not sufficiently explicit, and that conditions are included which are regarded as oppressive by many contractors. The official evidence on this subject shows that these conditions are looked upon as necessary for the

protection of the Department; but also proves conclusively that they are seldom or ever enforced,—in fact, may be regarded as a dead letter. It is pointed out to us that the effect is to throw a great advantage into the hands of “experienced” contractors, who know the ways of the Department; while such conditions deter new and probably timid men from taking the responsibility which they are supposed to imply. As a consequence, the service suffers by the diminished number of tenderers, and the exclusion of new men. Your Commissioners are of opinion that no conditions should be included in any contract which it is not intended to enforce strictly.

A system prevails, where proper data has not been obtained for the specifications of particular works, of issuing alternative plans to be adopted by the Engineer-in-Chief after the acceptance of tender. Such a system is likely to be productive of great loss, and cannot be satisfactory to the Government. In such cases contractors are sure to load their tenders to meet the contingency of having to construct the work on the most expensive of the alternative plans. In our opinion tenders should not be called for until the Department is in possession of all data and has decided upon the actual plan to be carried out. Its officers would then be able to check the contractors’ prices in a satisfactory way, and we believe much money would be saved.

Complaint was made by some of the witnesses to the effect that plans and specifications on which tenders are called for are frequently not left at the offices named in the advertisement in reasonable time to enable contractors to consult them prior to the date when tenders have to be sent in. This is a departmental matter obviously capable of easy adjustment. We merely call attention to it.

In the construction of important works such as breakwaters and other harbour improvements, it appears from the evidence that difficulties arise, first of all, from the cutting down of original engineering estimates, and, secondly, from the voting of the required amounts piecemeal. On the expenditure of the first amounts voted, the works are brought to a standstill until more money is obtained, thus producing disorganisation. Such a policy, if adopted, is short-sighted in the extreme. It is all important that such portions of the works as are undertaken should be carried out direct to their finish. Every stoppage causes serious deterioration, if it does not actually jeopardise the whole of the work already done, while great additional expense is entailed by the breaking up of an organised staff of skilled workmen and the employment of another. Such considerations are worthy of most serious attention.

Officers of the Public Works Department and others connected with the construction of road works by day labour represented to us in evidence that much inconvenience and dissatisfaction was created by delays in paying the men. This is, we presume, a mere matter of Treasury regulation; but it is very desirable in the interests of the Public Service that immediate attention should be given to it, and the form of procedure simplified.

It appears to us desirable that some system of examination should be introduced to test the qualifications of candidates for the position of Road Inspectors. The office is a most important one, and it is necessary that the person holding it should have at least an elementary knowledge of surveying, the principles of construction, and the use of instruments—(see questions 2309, 2310.)

PUBLIC BUILDINGS.

The Public Buildings we have inspected under the terms of our Commission comprise the following :—

1. That building adjoining the Supreme Court and fronting Franklin Square, Hobart, now being erected, and which it is proposed to devote to the use of His Excellency the Governor, the Honorable the Executive Council, His Honor the Chief Justice, and the Attorney-General, with such other departmental accommodation as the edifice affords.
2. The large building in Davey-street, Hobart, (adjoining the Lands Department, and of which the latter is a design in miniature), now nearly completed, which it is proposed to devote to the official use of the Honorable the Minister of Lands, the Government Printer, and other public servants.
3. The new Custom House, Launceston, facing the Wharf and the North Esk River.
4. The new Post Office, Launceston, situate at the intersection of St. John and Cameron streets, and in close proximity to the present Government Buildings.

It will be convenient to first consider the Hobart Offices.

Public Offices.

The plans we examined were explained to us by Mr. Eldridge, the Government Architect, who described the uses to which the various portions of the buildings were to be devoted. We feel unable to express a definite opinion on the nature of the accommodation, the size of the rooms, or their suitability for the purposes to which they are to be devoted; on general grounds, however, the Government are to be congratulated on the extensive suites of offices they will shortly acquire, which, we imagine, will permit departmental work to be more satisfactorily performed, and that concise classification of public documents and records which is impracticable in the cramped space the present offices afford.

The design of the building in Franklin Square is a harmonious reproduction of that part of the Supreme Court which fronts the gardens. The various architectural features and details are effectively worked out, and the general appearance of the façade is much enhanced by the suitable tone and colour of

the stone and its uniform good quality. The bricks used in the building appear to be hardly as well burnt as is desirable. It was pointed out to us that the pale colour and the absence of the usual glazed vitrified appearance caused by intense heat is a peculiarity due to Hobart clay, and is not, as we believe, to deficient burning.

There is nothing of importance to record respecting the Davey-street Offices which has not been covered by our remarks on the Executive Council Chambers.

If there is a matter we may criticise and call attention to, it is that the various chambers in the buildings, though sufficiently large for present requirements, will, in the future, be found rather below that standard of official accommodation which finds illustration in the neighbouring Colonies.

We think all public buildings and their sub-divisions should, in a growing Colony, provide for future requirements rather than be merely suitable for present wants.

The Custom House, Launceston.

The future appearance of this large edifice can only be judged by an inspection of the plans prepared for its erection. These were shown to us during our inspection by Mr. Corrie, the Architect in charge, who, with the Clerk of Works, accompanied us over the buildings. Judging from what we saw we think it will be found suitable, and that its rather ambitious appearance will be appreciated by the inhabitants.

We are not possessed of sufficient information to say whether the accommodation in the new Custom House will meet the wants of the merchants and traders of Launceston, but from what we observed, and judging by the standard of the present offices, we believe the increased space the new building provides will be more than sufficient for present wants.

The site of the new Custom House is on spongy and treacherous ground, formed of vegetable matter and the accumulation of silt deposited there during an indefinitely long period.

The plan adopted by the architect has been to form a substructure by driving piles into the solid ground. Around these he has placed a thick layer of concrete, and on the top of the piles and concrete he has laid a stout timber floor, on which the brick foundations are built. Such a form of construction, whatever its suitability may be, is, without doubt, stable and secure, but it must have been an expensive work. We arrive at this conclusion by examining the brickwork already laid under the front portico, which measured upwards of eight feet. In such a locality we are of opinion a cheaper and equally stable foundation could have been obtained by sinking shafts of small dimensions at stated distances apart, filling these with concrete to the level of high water spring tides, and on this concrete to throw relieving arches from pier to pier, which would have carried a ponderous superstructure. This would have been a cheaper form of construction, and is one which is often adopted with great success on doubtful and rotten ground.

The quality of the bricks used in this building did not impress us favourably; they appear badly burnt, and the clay not thoroughly tempered. On the face of them we noticed a vegetable film had already made its appearance, which, in our judgment, confirms our allegations.

In other respects we are satisfied the work is well constructed, sound, and strong.

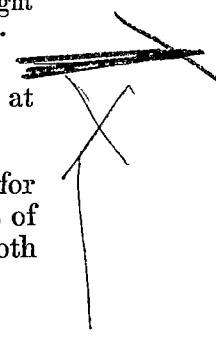
The Post Office, Launceston.

The foundations of this new office are so far advanced that a general estimate can be formed of the sizes and positions of the apartments on the ground floor. The Architect in charge explained the plans and elevation of the building and pointed out the general details. We think the elevation will be imposing in appearance and the effect good. However, this will be better judged of hereafter.

The same defects are apparent in the bricks used in this building which we observed in the new Custom House. We noticed that the relieving arches of the basement windows were built in an unworkmanlike manner, without the use of centering. These are minor defects, and would not be specially mentioned, but we felt we could not express unqualified approval of the work or describe it in any other way than it appeared at the time of our inspection.

We were impressed with the cramped and restricted area of the land on which the building stands, and our opinion is that sufficient consideration has not been paid to future expansion. The subway leading from St. John-street around the building is extremely narrow, and will hardly permit speedy egress and regress for the carts and conveyances which will use it when mails are received and dispatched. We suggest further consideration should be given to this matter by the Hon. the Treasurer, with the view, if thought desirable, of acquiring additional land as to remedy the defects to which we have briefly drawn attention.

On a careful review of the evidence taken by us, the conclusions we have arrived at are as follows:—

1. That no proper system has been observed by the Engineer-in-Chief for providing uniformity of design and procedure in carrying on the works of his Department, each railway showing widely different types of work both
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as to style, form, and general details, thereby materially increasing their cost, and rendering a larger staff of officers necessary than otherwise would be required.

2. That the Engineer-in-Chief has permitted the Resident Engineers to add to and alter drawings of important works without his being consulted, or, if consulted, not duly considering the effect such alterations would have on the Parliamentary Estimates ; and that it has been his practice to allow such alterations to be entered upon without his written consent being first obtained, as provided for in the respective contracts.
3. That the Engineer-in-Chief has verbally recommended important deviations on lines authorised by Parliament to the responsible Minister without obtaining the written approval of the Minister ; and that such deviations have sometimes been made although the Engineer-in-Chief has apparently been aware that they involved extra cost and were not always desirable.
4. That a large proportion of the increased expenditure on works, and the defective supervision of others, is mainly traceable to the want of an organised staff of responsible and qualified officers.
5. That the system which has hitherto obtained of letting works on partial or incomplete data is highly objectionable and misleading, and has led to the greatly increased cost of some of the works.
6. That the continuance of the Engineer-in-Chief as the official head of the Roads and Bridges and Public Buildings branches is inadvisable in the interests of the Public Service, such extensive duties placing upon him a larger amount of work than he can efficiently perform, and preventing that intimate supervision of the details of his office which is so essential in the administration of all public works.
7. That, in future, and as far as Parliamentary procedure will permit, it is desirable that all road works be undertaken in the spring or during such seasonable weather as will allow of an economical disbursement of the public funds; and that those works be undertaken at such opportune times for the farmer as will prevent undue competition with him for labour during the harvest.

We therefore respectfully submit for Your Excellency's consideration the following recommendations :—

- 1st. That the office of Engineer-in-Chief be confined to the control and supervision of Railways, and be altogether dissociated from the supervision of Roads, Bridges, and Public Buildings.
- 2nd. That the Engineer of Roads and the Government Architect have each sole control of their respective branches of the Public Works Department, under the Minister of Public Works.
- 3rd. That for the future no important deviation involving any considerable outlay be made in the route of any Railway unless it receives the written consent of the responsible Minister, and until a formal report, plan, and estimate has been submitted to him by the Engineer-in-Chief.
- 4th. That the construction of all country roads be undertaken in the spring season ; and that the advice and recommendations of those Local Trusts in which any new road is situated be obtained and duly considered by the responsible Minister before such works are undertaken.
- 5th. That the designs of those Bridges known as Nos. 1, 2, and 3 on the Derwent Valley Railway be altered as follows :—
 - (a.) As to No. 1 Bridge.—That such portions of the masonry of the piers and abutments be taken down and rebuilt as will permit of the girders being spaced eight feet apart from the centre to centre of their respective webs.

That the curves on the approaches be done away with for a distance of three chains from the abutments, and straight lines of entry on to those bridges be substituted therefor.

That the grades on the approaches to this bridge be done away with for at least five chains from the end of the abutments, and that level benches be substituted for such grades as are now proposed.

(b.) As to Nos. 2 and 3 Bridges.—That the piers and abutments be built of masonry of similar quality to that contained in No. 1 Bridge; and that the widths of the piers and abutments be so increased as will allow the girders being spaced in a similar manner to that proposed for No. 1 Bridge.

(c.) That the use of the wrought iron cases or caissons be abandoned.

(d.) That the timber decking placed on the girders of Nos. 1, 2, and 3 Bridges be securely fastened, and the rails laid as a fixed road.

(e.) That the girders be efficiently stiffened by external wrought iron stays over the piers, and that suitable internal transverse bracing be introduced.

The following voluminous evidence, together with such appendices and correspondence as will, we think, clearly elucidate the matters dealt with by your Commissioners under the terms of Your Excellency's Commission, are herewith presented, with great respect, by

Your Excellency's most obedient Servants,

W. A. ZEAL, *Chairman.*

HENRY C. STANLEY, *M. Inst. C.E., Chief Engineer
of Railways, S.D., Queensland.*

ARTHUR W. LAWDER, *M. Inst. C.E., F.G.S.*

THOS. C. JUST, *Secretary.*

Hobart, 22nd April, 1886.



*ABSTRACT of the Minutes of Proceedings of the ROYAL COMMISSION ON RAILWAYS
AND PUBLIC WORKS, Tasmania, 1886.*

MEMBERS :

The Hon. WM. AUSTIN ZEAL, Esq., M.L.C., C.E., Victoria, *Chairman*.
HENRY CHARLES STANLEY, Esq., M. Inst. C.E., Engineer-in-Chief, Queensland.
ARTHUR WM. LAWDER, Esq., M. Inst. C.E., India.

THOMAS COOK JUST, Esq., Hobart, *Secretary*.

All the Commissioners and the Secretary were present at all meetings.

BOARD ROOM, PUBLIC BUILDINGS, HOBART.

TUESDAY, 23RD FEBRUARY.

Commissioners met at 11 A.M.

The Hon. W. A. Zeal, Esq., M.L.C., C.E., was appointed Chairman of the Commission.

The Chairman explained the objects of the Commission, and said Ministers requested the Commissioners to commence their enquiry with the Derwent Valley Line of Railway, and make a Progress Report thereon as soon as convenient.

Resolved, That the Secretary communicate with the Hon. Commissioner of Lands and Works, and request to be supplied with all papers and correspondence to be submitted to the Commission, but especially—

1. A large Map of the Colony showing the lines of Railway.
2. Derwent Valley Line :
 - (a). Plan of the District.
 - (b). Plans and sections of the Railway.
 - (c). All papers and correspondence referring thereto.

The Chairman was authorised to write to the Hon. the Premier and request an advance of £200 towards the expenses of the Commission.

The Engineer-in-Chief (Mr. Fincham) attended during the afternoon, and tabled a large number of plans and documents connected with the Derwent Valley Railway. He stated the matters in dispute between the Government and the Contractor, and at great length explained the plans.

The Commissioners resolved to visit the works on Thursday, leaving by express train, and the Secretary was instructed to make the necessary arrangements.

Commission adjourned at 5.10 P.M.

BOARD ROOM, PUBLIC BUILDINGS, HOBART.

WEDNESDAY, 24TH FEBRUARY.

Commission met at 10 A.M.

The following correspondence was received :

1. From Engineer-in-Chief, requesting that special care be taken of documents submitted.
2. From the Hon. the Speaker of the House of Assembly, setting aside a Committee Room for the meetings of the Commission.
3. From the Hon. the Premier, forwarding the Commission signed by His Excellency the Governor.

The Secretary reported that he had made all arrangements for the inspection of the Derwent Valley Railway works.

The Secretary reported receipt of a number of papers and plans from the Engineer-in-Chief.

The Secretary was instructed to invite the Engineer-in-Chief to accompany the Commissioners over the Derwent Valley Railway.

The Commissioners proceeded to discuss what should be the scope of the enquiry ; and resolved—

“That the enquiry be confined to the following limits :—

1. The manner in which the plans and estimates for Railway work have been prepared by the Public Works Department, and the mode of construction followed in executing the same ; to include—
 - (a). The preparation of surveys and plans.
 - (b). Estimates of cost of works.
 - (c). The mode of construction, embracing method of tendering for and the supervision of the various Contracts ; also the quality and character of the works as executed.
2. The mode in which the Public Works of the Colony have been carried out during the last three years—
 - (a). The Public Works Department, how organised.
 - (b). Preparation of plans and estimates, and mode of supervision of works.
 - (c). Character and quality of works.”

Resolved, That a copy of the above be forwarded to the Hon. the Premier for the information of Ministers, with a request to be informed as to whether it meets their approval.

The Commissioners proceeded at 12.45 to inspect the iron girders for bridges being constructed at the Derwent Iron Foundry.

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COMMITTEE ROOM, HOUSE OF ASSEMBLY.

The Commission reassembled at 2 P.M.

The Secretary reported that he had forwarded the letter as to scope of enquiry to the Hon. the Premier.

The afternoon was spent in reading the correspondence tabled by the Engineer-in-Chief.

The Commission adjourned at 4.10 P.M.

DERWENT VALLEY RAILWAY WORKS.

THURSDAY, 25TH FEBRUARY.

The Commissioners proceeded by express train, and, in company with the Engineer-in-Chief, Mr. Fincham, Mr. C. K. Sheard, Resident Engineer, the Contractor, Mr. Falkingham, Mr. J. C. Climie, Contractor's Engineer, and Mr. E. L. Parker, they minutely inspected the works of the Derwent Valley Railway.

COMMITTEE ROOM, HOUSE OF ASSEMBLY.

FRIDAY, 26TH FEBRUARY.

A number of additional plans and documents were received from the Engineer-in-Chief.

The Commission proceeded to consider the mode in which evidence should be taken, and the order in which witnesses should be called.

After considerable discussion as to whether the parties interested, other than the witnesses under examination, should be permitted to be present, and a reference to the Assistant Clerk of Parliament as to the practice observed by Select Committees, it was

Resolved, "That the examination shall be in private, only the witnesses under examination to be present."

The Commissioners settled the order in which witnesses should be examined, and directed summonses to issue.

The estimates of cost of the Derwent Valley Railway as submitted to Parliament, the various Railway Acts, and the original plans of the line, were then considered and inspected by the Commissioners.

The Secretary was instructed to arrange for the visit of the Commissioners to New Norfolk to take evidence.

Commission adjourned at 4 P.M.

SATURDAY, 27TH FEBRUARY.

The Hon. N. J. Brown, Esq., M.H.A., Minister of Lands and Works, attended, and was examined.

The Secretary was instructed to apply to the Hon. the Premier to have the evidence printed at the Government Printing Office as the enquiry progressed, to afford witnesses an opportunity of revising and correcting the same before publication of the Report.

The Secretary applied for the assistance of additional Reporters to record the evidence, and received instructions accordingly.

A letter was read from the Hon. the Premier approving the resolution of the Commissioners as to the scope of the enquiry.

The Commissioners discussed the mode in which evidence should be taken, resolving that in consequence of the serious nature of the enquiry the evidence should be recorded as given, question and answer.

The question of preparing a Progress Report on the Derwent Valley Railway was discussed, and it was resolved to leave the decision on the point until after hearing the evidence of the Engineer-in-Chief.

Commission adjourned at 1.10 P.M.

MONDAY, 1ST MARCH.

Correspondence read :—

1. From the Hon. Minister of Lands and Works, forwarding the dates of various reports respecting the Derwent Valley Railway.
2. From the Hon. the Premier approving the appointment of Reporters.
3. From the Hon. the Premier approving of an advance of £200 to defray the expenses of the Commission
4. From the Hon. the Premier authorising the printing of the evidence.

Mr. James Fincham, C.E., was called in and examined on the Derwent Valley Railway.

The Commission adjourned at 4.10 P.M.

TUESDAY, 2ND MARCH.

The examination of Mr. James Fincham, C.E., was continued.

Commission adjourned at noon, and proceeded to examine the iron girders and caissons being constructed on the Wharf. They were accompanied by Mr. Fincham, C.E., and Mr. Edwards, C.E.; also by Mr. Jowett, Government Inspector of Ironwork.

On returning to the Committee Room, Mr. Fincham handed in a series of plans of bridges erected in South Australia.

Commission adjourned at 1, and reassembled at 2 P.M.

Mr. George Hay Edwards was then called in and examined.

Commission adjourned at 4.30 P.M.

BUSH INN, NEW NORFOLK.

WEDNESDAY, 3RD MARCH.

Commissioners left Hobart, and proceeded by express train to New Norfolk, meeting at the *Bush Hotel*.

A statement from Mr. J. C. Climie, C.E., as to the Derwent Valley Railway, was received and read.

Mr. Jonathan Falkingham, contractor, was called in and examined.

Commission adjourned at 4 P.M.

THURSDAY, 4TH MARCH.

Mr. Charlie K. Sheard was called in and examined.

The following witnesses were called and examined as to the flood-levels on the Derwent, near New Norfolk :—

Mr. George Godkin, farmer, The Falls.

Mr. John Godkin, farmer, Ballymoon.

Mr. Walter Matthews, farmer, The Falls.

Mr. Alfred Mault, C.E., was called in and examined.

Commission adjourned at 4 P.M.

FRIDAY, 5TH MARCH.

Correspondence read :—

1. From the Secretary to the Hon. Minister of Lands, asking when the Commissioners proposed to inspect the works of the Mersey and Deloraine Railway, in order that an engine and carriage may be placed at their disposal.

To be acknowledged, and the Secretary instructed to reply that the visit would be about Friday next.

2. From the Hon. N. J. Brown, M.H.A., as to his re-examination.

3. From Mr. C. K. Sheard, asking as to whether enquiry is to be made as to disgraceful work attempted to be erected by the Contractor of the Derwent Valley Railway, especially as to the foundations of No. 7 pier, No. 1 bridge; also as to foundations of Back River retaining wall, on east and west side of No. 5 counterfort; also as to a dangerous side-cutting at the Plenty,—stating that if the Commissioners do not intend enquiry into these matters he will put them in the hands of the Minister.

To be acknowledged, and Mr. Sheard informed that the Commission has no authority to interfere in matters governed by the terms of the contract between the Government and the Contractor; their enquiries will be confined to the mode of construction and the stability of the works.

Mr. Alfred Mault, C.E., was called in and further examined.

Commission adjourned at 1, and re-assembled at 2 P.M.

Mr. John Campbell Climie, C.E., Contractor's Engineer, was called in and examined.

Mr. Edward Leonard Parker, C.E., Contractor's Engineer, was called in and examined.

Commission adjourned at 6 P.M.

AT CHAIRMAN'S ROOMS, ORIENT HOTEL, HOBART.

SATURDAY, 6TH MARCH.

Commissioners returned to town by the steamer *Monarch*, met at noon, and considered and settled their programme for the ensuing week.

COMMITTEE ROOM, HOUSE OF ASSEMBLY.

MONDAY, 8TH MARCH.

Commissioners proceeded to discuss the evidence taken at New Norfolk, and adjourned from 1 to 2 o'clock.

Afternoon Sitting.

Correspondence read :—

1. From Mr. A. Mault, C.E., asking if he should make an examination to enable him to state the area drained by the Railway.

Mr. Mault to be informed that the Commissioners require him to state how he obtained the information which enabled him to determine the sizes of the culverts and bridges required for the various waterways crossed by the Railway.

Mr. James Fincham, C.E., was called in and re-examined on the Derwent Valley Railway.

Commissioners adjourned at 4.30 P.M.

TUESDAY, 9TH MARCH.

Telegrams received from Messrs. McNeil, Grant, & Bath, stating that all arrangements had been made for the visit of the Commissioners to the Fingal Railway works.

Correspondence.—A large number of papers and documents were received from the Engineer-in-Chief and Mr. C. K. Sheard respecting the Derwent Valley Railway works, which were considered by the Commissioners.

Commission adjourned from 1 to 2 P.M.

Afternoon Sitting.

Commissioners proceeded to revise and settle their programme for the week.

PROGRESS REPORT.

The Commissioners considered the subject of a Progress Report on the Derwent Valley Railway, and resolved to forward the following:—

Committee Room, Hobart, 9th March, 1886.

MAY IT PLEASE YOUR EXCELLENCY.

Acting under the authority vested in us by the Commission dated 23rd February, 1886, we have the honor to acquaint Your Excellency that we have entered upon an investigation of those matters entrusted to our discretion and care.

We first directed our attention to the contract and works of the Derwent Valley Railway, which appeared to require our immediate consideration. We held several meetings at Hobart and New Norfolk, and at both places have examined important witnesses and documents, and also visited and inspected the works in course of construction.

The result of our proceedings has induced us to present a progress report, and to recommend—

That the construction of the masonry and ironwork of what are known as Nos. 1, 2, and 3 Bridges over the River Derwent be suspended pending further consideration of a report thereon, which we shall submit in due course.

We have the honor to be,
Your Excellency's obedient Servants,

WM. A. ZEAL.
H. C. STANLEY.
W. A. LAWDER.

At their own request, Messrs. Fincham, C.E., and C. K. Sheard, C.E., were re-examined as to flood-levels on the Derwent Valley Railway.

A plan was received from Mr. J. C. Climie, C.E., of a section of the wall at Back River as recommended by him.

Commission adjourned at 4.30 P.M.

WEDNESDAY, 10TH MARCH.

The Commissioners revised the printed proofs of the evidence given by the several witnesses.

SCOTTSDALE RAILWAY.

Mr. James Fincham, C.E., was examined as to the preliminary survey of the Scottsdale Railway, and the best mode of examining that Railway; when he suggested that the Commissioners should consult Mr. J. M. M'Cormick, the Resident Engineer, who would produce all the plans and sections and point out the best way of examining the line.

The Secretary was instructed to telegram to Mr. M'Cormick and ask him to meet the Commissioners at Evandale Junction to-morrow.

Commission adjourned at 4.30 P.M.

THURSDAY, 11TH MARCH.

The Commissioners proceeded by express train to Deloraine, accompanied by the Engineer-in-Chief. They were met at Evandale Junction by Mr. F. Back, Manager of Railways, Mr. A. Weedon, Deputy Manager, and Mr. J. M. M'Cormack, Resident Engineer of the Scottsdale line, with whom they had interviews.

MERSEY AND DELORAINÉ RAILWAY.

FRIDAY, 12TH MARCH.

The Commissioners proceeded to inspect the works of the Mersey and Deloraine Railway, accompanied by the Engineer-in-Chief. They made twenty-three stoppages on the line, and minutely examined the works.

On arrival at Latrobe Station a meeting was held, when—

The Chairman called attention to a report in the *Launceston Examiner* of that date, of a banquet given to the Members for the District of Wellington, wherein Mr. J. W. Norton-Smith, M.H.A., was reported to have said:—"If the Royal Commission carried out their work properly it would be a great thing for Tasmania, for there was a very uneasy feeling throughout the Colony that there was a great deal of waste in the Public Works Department. He sincerely hoped the Royal Commission would do its work thoroughly, but he feared if Wellington was a criterion of the manner in which their work was to be done it was reducing the thing to a farce. (Applause.) One day alone, Friday, was given to the examination of the Mersey railway. (Laughter, and a voice—"It could not be done in the time.") Saturday was to be spent in examining the roads on to Emu Bay, and on Sunday the works at Mount Bischoff would be examined, and then off the Commission went back to Launceston. (Derisive cheers.) It was making the enquiry a perfect farce."

Resolved,—That the Secretary forward the following telegram to Mr. J. W. Norton-Smith:—"The attention of the Commissioners has been drawn to a report in this morning's *Examiner* of remarks made by you at a banquet at Burnie last evening, and they instruct me to say that they are anxious to obtain any information which will make their enquiry into the manner in which the Public Works of the Colony have been carried out during the last three years a useful and practical one. They invite you, or any person capable of doing so, to give them any evidence calculated to bring about the foregoing result. Please wire reply to Latrobe this evening.

(Signed) THOS. C. JUST, *Secretary*."

A reply was received in the evening from Mr. Smith:—

"I would suggest examination of Mr. Wm. Jones, Emu Bay; Mr. Moore and Mr. C. B. Fenton, Table Cape; Mr. H. G. Spicer, Circular Head, in regard to construction of works. (Signed) J. W. NORTON-SMITH."

MERSEY AND DELORAINÉ RAILWAY.

Mr. Fincham pointed out that the deviation made in the route of the Railway along the eastern bank to connect with the town of Latrobe involved the construction of two bridges over the River Mersey, and an additional length of about 93 chains of Railway.

SATURDAY, 13TH MARCH.

ROADS AND BRIDGES.

Commissioners started at 9 A.M. from Latrobe, in Mr. Atkinson's conveyance, for Emu Bay.

At Hamilton-on-Forth they were met by Mr. J. T. Brown, Inspector of Works, and Mr. Hargrave, an Engineer employed on the Railway line.

The Commissioners inspected the new bridge in course of construction over the River Forth; and also examined a plan submitted by Mr. Hargrave of a proposed branch line of two miles on the railway from Formby to the Leven so as to accommodate the township of Hamilton-on-Forth. The cost of the branch was estimated at £9207.

Proceeding onwards, the Commissioners again met Mr. Brown at the Leven, and inspected the new bridge recently erected there. They next inspected the bridges over the rivers Blythe and Emu, and arrived at Burnie, Emu Bay, at 5.30 P.M.

The Commissioners had interviews in the evening with the Hon. Wm. Moore, M.L.C., and Mr. J. W. Norton-Smith, M.H.A., and arranged to take evidence respecting the public works of the district on Monday morning.

COMMERCIAL HOTEL, BURNIE, EMU BAY.

MONDAY, 15TH MARCH.

In answer to summonses, the following witnesses attended and were examined:—

1. J. W. Norton-Smith, Esq., M.H.A.
2. The Hon. Wm. Moore, Esq., M.L.C.
3. Mr. Wm. Reid Bell, C.E.
4. Mr. William Jones.
5. Mr. J. W. Thomas Browne, C.E.

Mr. Stanley was detailed to proceed with the Hon. Wm. Moore and Mr. Norton-Smith to inspect works between Burnie and Circular Head.

Commission adjourned at 5 P.M.

TUESDAY, 16TH MARCH.

The following telegram to the Chairman, from the Hon. Minister of Lands and Works, was read:—

"Contract provides only for suspension of work by written notice from Engineer-in-Chief. If Engineer-in-Chief, not being in possession of any reason why work should be suspended, does not give written notice, Government must give notice, and this practically means suspension of Engineer-in-Chief. Have you considered this, and, if so, do you still urge suspension? See clause 21 of contract.

"(Signed) NICHOLAS J. BROWN."

The consideration of this telegram was postponed until the return of Mr. Stanley.

The following witnesses were called and examined:—

1. Mr. Edward Derwent Atkinson, C.E., District Inspector.
2. Mr. William Peart, Sub-Inspector of Roads.
3. Mr. William Mollison, Sub-Inspector of Works.

Mr. Stanley returned at 12.30 P.M., and reported that he had proceeded with the Hon. Wm. Moore and Mr. Norton-Smith as far as Sisters Creek, and inspected the roads and bridges there.

The Commissioners discussed the telegram from the Hon. Minister of Lands and Works, and resolved upon the following reply, which was forwarded:—

"The late Premier, the Hon. Adye Douglas, requested the Commissioners to make a progress report on the Derwent Valley Line, and they have done so. That report is based upon inspection of the works and evidence obtained. It is for Government to decide what course they will follow.

"(Signed) W. A. ZEAL, Chairman."

Mr. Stanley reported that during his trip to Sisters Creek he had inspected—

1. Proposed deviations in the line of road between Emu Bay and Table Cape.
2. The bridge over the Inglis River at Table Cape.
3. The Flowerdale Road, at its junction with the Main Road.
4. The bridge over Sisters Creek.

Mr. Edward Derwent Atkinson was recalled and examined by Mr. Stanley as to construction of roads between Emu Bay and Table Cape.

Mr. Stanley tabled the specifications and plans for the bridge over the Hellyer River referred to in the evidence of previous witnesses.

A letter was read from Mr. J. W. Norton-Smith, M.H.A., submitting a statement supplementary to his evidence, which was ordered to be printed.

Commission adjourned at 5 P.M.

WEDNESDAY, 17TH MARCH.

Commissioners started from Emu Bay at 8 A.M., and travelled by Mr. Atkinson's conveyance to Formby, where they took train for Launceston, arriving at 7.30 P.M.

INSPECTION OF FINGAL RAILWAY.

THURSDAY, 18TH MARCH.

The Commissioners left Launceston by ordinary train on the T.M.L.R. for the Corners Station, where they were met by Mr. Thomas M. Bath, one of the contractors of the Fingal line of Railway, and by Mr. J. M. Home, C.E., Resident Engineer. An engine and truck were in attendance, and the Commissioners proceeded to examine the line. Twelve stoppage swere made, and all works of importance to Fingal carefully inspected.

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During the afternoon the Commissioners inspected the railway bridge at Avoca, also the public road bridge over the South Esk River erected about 18 months since. They also proceeded by conveyance to view the alignment for the Railway as originally surveyed, about a mile from the township of Avoca.

Stayed at Fingal for the night.

FRIDAY, 19TH MARCH.

The Commissioners proceeded by conveyance, with Messrs. Bath, Rennick, and Home, and inspected the Killymoon Bridge and the laying of the permanent way to about 42 miles. They then proceeded to St. Mary's, inspecting portions of the line *en route*, and returned to Fingal, then by special train to the Corners and back to Launceston.

PUBLIC BUILDINGS, LAUNCESTON.

SATURDAY, 20TH MARCH.

PUBLIC WORKS.

It was resolved that the following circular be forwarded to the chairmen of all District Road Trusts :—

Launceston, 18th March, 1886.

SIR,

The Royal Commissioners appointed by His Excellency the Governor are now engaged in taking evidence as to the manner in which the Public Works of the Colony have been carried out during the past three years. It is hardly possible, without unduly prolonging the enquiry, for the Commissioners to visit every Municipal or Road District in the Colony; but with a view to make their report as complete and useful as possible, they will feel obliged if you will forward, in writing, any concise statement as to the manner in which Public Works have been carried out in your district during the period mentioned. If you think it necessary that the Commission should examine witnesses on points of administration and construction only, they will endeavour to make arrangements to meet your convenience.

I have the honor to be,

Your obedient servant,

THOS. C. JUST, *Secretary.*

Correspondence.—Letter received from Mr. H. W. Hargrave, forwarding a general plan showing the country between Formby and Emu Bay, with line of railway authorised for construction from Formby to Uiverstone marked thereon, also proposed extension to Emu Bay.

A telegram was forwarded to the Engineer-in-Chief, stating that his attendance in Launceston would be required during the ensuing week.

FINGAL RAILWAY.

Mr. Thos. Manachi Bath, one of the contractors for the Fingal Railway, was called in and examined.

MONDAY, 22ND MARCH.

The Secretary reported that he had issued circulars to 82 Road Trusts, and forwarded copies to the Press.

Mr. T. Manachi Bath was further examined on the Fingal Railway.

The Commissioners proceeded to Mr. W. H. Knight's Foundry, Wellington-street, and inspected the iron girders there being constructed for the Derwent Valley Railway.

Commission adjourned at 1.30 P.M.

Afternoon Sitting.

Commission re-assembled at 2.30 P.M.

Mr. John Home Home, C.E., was called, and examined on the Fingal Railway.

Commission adjourned at 5 P.M.

TUESDAY, 23RD MARCH.

A letter was read from Mr. E. D. Atkinson, stating that the plans and specifications of the Hellyer River Bridge were in the hands of an intending contractor at the time they were enquired for by the Commissioners at Emu Bay.

A number of papers received from the Engineer-in-Chief respecting the Derwent Valley Railway were tabled.

FINGAL RAILWAY.

Mr. Edward C. Rennick, C.E., was called and examined as to the Fingal Railway, and put in a number of documents connected therewith.

Mr. John Home Home, C.E., was called and re-examined. He handed in papers showing the estimated cost of the routes proposed, and a transverse section of the country on the west bank of the St. Paul River at Avoca from the original line towards the line as contracted for and executed.

Mr. James Fincham, C.E., was called and examined.

Commission adjourned at 1.30 P.M.

Afternoon Sitting.

Commission met at 2.30 P.M.

Mr. James Fincham's Examination on the Fingal Railway was continued.

Commission adjourned at 4.30 P.M.

WEDNESDAY, 24TH MARCH.

The Secretary reported that he had been in communication with the Hon. the Premier as to the printing of the evidence, which was then going on. He read the correspondence.

The Secretary reported arrangements for the Commissioners' visit to the Scottsdale Railway, which were approved.

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FINGAL RAILWAY.

Mr. James Fincham, C.E., was further examined as to the Fingal line of railway.
Commission adjourned at 1.5 P.M.

Afternoon Sitting.

Commission resumed at 2.15 P.M.

Mr. James Fincham, C.E., handed in a number of papers connected with the Fingal line of railway.

CONTRACTS FOR IRON.

Mr. Wm. Knight, Mechanical Engineer, was called and examined as to his contract for iron girders for the Derwent Valley Railway.

SCOTTSDALE RAILWAY.

The Commissioners proceeded to the office of the Resident Engineer of the Scottsdale Railway, and inspected the plans of that line, which were explained by Mr. M'Cormick.

Commission adjourned at 4.30 P.M.

INSPECTION OF SCOTTSDALE RAILWAY.

THURSDAY, 25TH MARCH.

The Commissioners left Launceston at 9.30 A.M., accompanied by the Secretary, Mr. James Fincham, C.E., Engineer-in-Chief, Mr. J. M. M'Cormick, C.E., Resident Engineer, and Mr. T. M. Atkinson, C.E., Contractors' Engineer. They were met on the works by the contractors, Messrs. Boland and Scott.

The party rode along the Railway, closely inspecting the works as far as Piper's River. The Commissioners remained at Mr. Boland's for the night.

FRIDAY, 26TH MARCH.

Examination of railway works continued as far as *Bachfield's Hotel*, near Chester's. The Commissioners then walked to the proposed site of the tunnel at 26 miles, and examined the nature of the country generally. They next inspected the site of the line at the Denison Gorge, and the nature of the curves from the Denison Station site to the crossing over the Denison River. They returned to Bachfield's in the evening.

UPPER PIPER'S RIVER ROAD.

SATURDAY, 27TH MARCH.

The Commissioners, with the Engineer-in-Chief, started by Rankin's four-in-hand break at 9 A.M., and drove along the Upper Piper's River Road to Launceston. Mr. Henry Norton Taylor, District Inspector of Roads, attended the Commissioners, and pointed out the main features of the road.

The party reached Launceston at 1.30 P.M.

PUBLIC BUILDINGS, LAUNCESTON.

MONDAY, 29TH MARCH.

Correspondence:—

Letters in reply to Circular were received from the following Road Trusts:—

1. New Norfolk Trust, Mr. J. A. Moore, Chairman.
2. Upper Derwent Trust, Mr. W. E. Shoobridge, Chairman.
3. Sorell Creek and South Glenorchy, Mr. G. A. Waller, Chairman.
4. Hamilton, Mr. J. King, Chairman.
5. Longford, Mr. W. H. D. Archer, Chairman.
6. Westwood, Mr. John Millar, Chairman.
7. Latrobe, Mr. S. Steinberg, Chairman.
8. Table Cape, Mr. C. J. Mackenzie, Chairman.
9. Waratah, Mr. E. J. Hall, ditto.
10. Fingal, Mr. John Stanfield, Chairman.
11. Portland, Mr. J. C. Macmichael, Chairman.

The Secretary reported that he had been in telegraphic communication with Mr. H. G. Spicer, Chairman of the Circular Head Road Trust, as to attending and giving evidence before the Commission. Mr. Spicer found it inconvenient to attend, but would forward a written statement.

FINGAL RAILWAY.

Letter read from Mr. J. H. Home, C.E., forwarding a copy of estimates of work remaining to be completed on the Fingal Railway, after certificate No. 11, of 26th January, 1886.

SCOTTSDALE RAILWAY.

Mr. J. M. M'Cormick, C.E., Resident Engineer, was called in and examined on the Scottsdale Railway.

Commission adjourned at 1.30 P.M.

Afternoon Sitting.

Commission resumed at 2.30 P.M.

Mr. Hales, C.E., was called in and examined on the Scottsdale Railway.

Commission adjourned at 5 P.M.

TUESDAY, 30TH MARCH.

Letters from Road Trusts in reply to Circular:—

12. Southport Trust, Mr. John Hay, Chairman.
13. St. Paul's Trust, Mr. James F. Rigny, Chairman.
14. Leslie Trust, Mr. J. L. Livingstone, Chairman.

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DERWENT VALLEY RAILWAY.

Letter read from Mr. A. Mault, forwarding reports as to culverts and waterways on the Derwent Valley Railway, and also on a proposed alternative line at Back River, and on the Back River retaining wall.

SCOTTSDALE RAILWAY.

Mr. T. M. Atkinson, C.E., was called and examined on the Scottsdale Railway.

The Commission adjourned at 1.10 P.M.

Afternoon Sitting.

Commission resumed at 2.30 P.M.

Mr. Martin Boland, one of the Contractors, and Mr. Marshall Cresswell, C.E., were called and examined on the Scottsdale Railway.

Commission adjourned at 4 P.M.

WEDNESDAY, 31ST MARCH.

Letters from Road Trusts in reply to Circular :—

15. St. Leonard's Trust, Mr. W. C. Grubb Chairman.
16. Bothwell Trust, Mr. W. Nicholas, Chairman.
17. Richmond Trust, Mr. S. T. Dickson, Chairman.
18. Glebe Town, from the Secretary.

SCOTTSDALE RAILWAY.

Mr. James Fincham, C.E., was called and examined on the Scottsdale Railway.

Commission adjourned at 1.30 P.M.

Afternoon Sitting.

Commission resumed at 2.30 P.M.

The Secretary handed in a paper from Mr. Audley Coote, M.H.A., being copies of questions forwarded by him to the Hon. Minister of Lands and Works on 16th March last, referring to the Scottsdale Railway, and which he desired to have referred to the Royal Commission.

Paper read.

The Chairman stated that the Hon. the Minister of Lands and Works had informed him that the questions would reach the Commissioners on the following day, with the remarks of the Hon. Attorney-General. Mr. Coote would be examined on the following morning.

Mr. Jas. Fincham, C.E., was called and further examined on the Scottsdale Railway.

Mr. Fincham handed in a paper on the Fingal Railway showing analysis of works and estimates of liabilities to complete the line to 9th March, 1886.

Commission adjourned at 5 P.M.

THURSDAY, 1ST APRIL.

Correspondence.—Letter received from the Hon. Dr. Agnew submitting the questions forwarded to Government by Mr. Audley Coote, M.H.A., on 16th March, with comments thereon, and stating that Ministers consider the points mooted therein are generally quite outside the scope of the functions committed to the Royal Commission.

Having considered the comments, the Commissioners resolved to accept the view of the Government, and to examine Mr. Coote as to Questions 10, 15, 18, and 19 only. (See Appendix AA 2, p. 291.)

Letters from Road Trusts in reply to Circular :—

19. The Forth Trust, Mr. J. H. M'Call, Chairman.
20. Kingston Trust, Mr. Edward Innes, Chairman.
21. West Mersey Trust, Mr. B. W. Thomas, Chairman.

SCOTTSDALE RAILWAY.

Mr. Audley Coote, M.H.A., was called in and examined on the Scottsdale Railway.

MERSEY RAILWAY.

Mr. Ryton Oldham, C.E., was called and examined in reference to the Mersey Railway.

Commission adjourned at 1.30 P.M.

Afternoon Sitting.

Commission resumed at 2.30 P.M.

Mr. James Fincham, C.E., was called and examined on the Mersey Railway.

Mr. Fincham handed in a number of papers on the Scottsdale and Mersey Railways.

Commission adjourned at 4.30 P.M.

FRIDAY, 2ND APRIL.

Correspondence.—From Mr. C. H. Grant, Manager of Railways, in reference to flood-levels on the Main Line Railway at Bridgewater.

Letters from Road Trusts in reply to Circulars :—

22. St. Mary's Trust, Mr. John Lade, Chairman.
23. Kentishbury Trust, Mr. John Hope, Chairman.
24. Clarence Trust, Mr. Wm. Young, Chairman.

MERSEY RAILWAY.

Mr. James Fincham, C.E., was called and further examined on the Mersey Railway.

Mr. Ryton Oldham, C.E., was also further examined on the Mersey Railway.

RAILWAY MANAGEMENT.

Mr. Frederick Back, Manager of Railways, and Mr. Aubrey Weedon, Deputy-Manager, were called and examined as to the working of the Government Railways generally.

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ROLLING STOCK, &c.

Mr. Wm. E. Batchelor was called and examined as to Rolling Stock, &c.

MERSEY RAILWAY.

Mr. Marshall Cresswell, C.E., was called and examined on the Mersey Railway.

The Commission adjourned at 5 P.M.

SATURDAY, 3RD APRIL.

Letters from Road Trusts in reply to Circulars :—

25. East Mersey Trust, Mr. Robert Beveridge, Chairman.
26. Longley Trust, Mr. Dominique Ludbey, Chairman.
27. Chudleigh Trust, Mr. Jas. Lovejoy, Chairman.
28. Lake River Trust, Mr. Thos. Gatenby, Chairman.

MERSEY RAILWAY.

Mr. Marshall Cresswell, C.E., was called and further examined on the Mersey Railway.

ROLLING STOCK.

The Secretary reported the receipt from Mr. Batchelor of a statement as to the Rolling Stock on Tasmanian Government Railways at 3rd April, 1886.

ROADS AND BRIDGES.

Mr. Henry Norton Taylor, Inspector, and Mr. Walter Cousins were called and severally examined on the construction of Roads and Bridges.

PUBLIC BUILDINGS.

Mr. Leslie Corrie, Superintending Architect of Buildings, Launceston, was called and examined as to the new Post Office and Custom House, Launceston. He handed in and explained the plans of those buildings.

Commission adjourned at 1.30 P.M.

Afternoon Sitting.

The Commission resumed at 2.30 P.M.

The Commissioners proceeded, with Messrs. Corrie and Taylor, to inspect the works at the new Post Office and Telegraph Office; and at the Custom House.

The Commission adjourned at 4.30 P.M.

MONDAY, 5TH APRIL.

The Commissioners started from Launceston by the 8.30 ordinary train (T.M.L.R.) and proceeded to Parattah Station, where they inspected the Railway line from Parattah to Oatlands, afterwards proceeding to Hobart by express train.

HOBART—COMMITTEE ROOM, HOUSE OF ASSEMBLY.

TUESDAY, 6TH APRIL.

Correspondence.—Letter read from Mr. C. K. Sheard denying his responsibility for designs of works on the Derwent Valley Railway.

Letters from Road Trusts in reply to circular :—

29. Loinah Trust, Mr. S. Palmer, Chairman.
30. South Arm Trust, Mr. George Gellibrand, Chairman.

The Commissioners were engaged during the day in revising proofs of evidence.

Commission adjourned at 4.30 P.M.

WEDNESDAY, 7TH APRIL.

Letters from Road Trusts in reply to circular :—

31. Liverpool Trust, Mr. O. Geeves, Chairman.
32. Frankford Trust, Mr. N. Smith, Chairman.
33. Tankerville Trust, Mr. Jas. Phillips, Chairman.
34. Horton Trust, Mr. H. G. Spicer, Chairman.

The Commissioners were engaged during the morning in revising proofs of evidence.

Commission adjourned at 1.30 P.M.

Afternoon Sitting.

Commission resumed at 2.30 P.M.

CONTRACTS FOR IRON.

Mr. Robert Kennedy was called in and examined as to his contract for construction of iron girders for the Derwent Valley Railway.

BRIDGES, &c.

Mr. George Hay Edwards, C.E., was called in and examined as to designs for iron bridges and works generally.

Commission adjourned at 4.30 P.M.

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THURSDAY, 8TH APRIL, 1886.

Letters from Road Trusts in reply to circular :—

35. Augusta Road Trust, Mr. R. Hickman, Chairman.

Mr George Hay Edwards, C.E., was called and further examined as to general designs for works.

ROADS AND BRIDGES.

Mr. James Fincham, C.E., was called and examined as to the construction of roads and bridges generally.

Commission adjourned at 1.15 P.M.

Afternoon Sitting.

Commission resumed at 2.30 P.M.

DERWENT VALLEY RAILWAY.

A letter was read from the Hon. the Premier calling attention to the position of Government in reference to the works of the Derwent Valley Railway, stating that works had been suspended in connection with Nos. 1, 2, and 3 bridges on the recommendation of the Commissioners, and that claims for compensation would arise on the expiration of thirty days from 17th ult. ; asking for Progress Report.

To be acknowledged, and the Hon. the Premier informed that the Commissioners hoped to send in a conclusive Report about the end of next week. In the meantime they do not consider it desirable to send in any further Progress Report.

ROADS, BRIDGES, AND PUBLIC WORKS.

Mr. James Fincham, C.E., was called in and further examined on Roads, Bridges, and Public Works generally.

Mr. Fincham handed in a statement as to the measurements of locomotives ordered for Launceston and Scottsdale Railway.

Commissioners adjourned at 4.45 P.M.

FRIDAY, 9TH APRIL.

Letters from Road Trusts in reply to circular :—

36. Westbury Trust, from the Secretary.

ROADS AND BRIDGES.

Mr. William Duffy, Chief Inspector of Roads, was called and examined.

BUILDINGS.

The Commissioners proceeded, with Mr. W. W. Eldridge, Government Architect, to inspect the Public Buildings now in course of erection at Hobart.

Afternoon Sitting.

Mr. W. W. Eldridge, Government Architect, was called and examined in reference to buildings.

Commission adjourned at 4.30 P.M.

SATURDAY, 10TH APRIL.

Letters from Road Trusts in reply to circular :—

37. Westbury Trust, Mr. Joseph Barwick, Chairman.

RAILWAYS AND PUBLIC WORKS.

The Hon. Nicholas John Brown, M.H.A., was called and re-examined on Railways and Public Works generally.

FINGAL RAILWAY.

Mr. J. C. Climie, C.E., was called and further examined on the Fingal Railway.

MERSEY AND DELORAINE RAILWAY.

Mr. Wm. John Duffy, C.E., was called and examined as to his connection with the Mersey and Deloraine Railway.

Commission adjourned at 1.30 P.M.

MONDAY, 12TH APRIL.

Letters from Road Trusts in reply to circular :—

38. Gould's Country Trust, Mr. A. Johnston, Chairman.

The Commissioners were engaged during the remainder of the day in the examination of plans and revision of proofs of evidence. Adjourned at 4.15 P.M.

TUESDAY, 13TH APRIL.

Correspondence :—

Letter from Mr. G. H. Edwards, forwarding copy of letter addressed by him to the Engineer-in-Chief, dated 7th January, 1886, in answer to comments in the *Mercury* on the Derwent Valley Railway bridges.

To be acknowledged, and Mr. Edwards informed that the whole of the matters to which the letter refers have been already fully elicited in evidence.

Letter from Mr. W. H. Knight, Launceston, stating that the cost of altering a set of the 64-foot girders, as per sketch sent by the Chairman, would be £90.

Letters from Road Trusts in reply to circulars :—

39. Lower Derwent Trust, R. J. Wills, Chairman.

Commissioners were engaged during the remainder of the day in revising proofs of evidence, and adjourned at 4.45 P.M.

WEDNESDAY, 14TH APRIL.

DERWENT VALLEY RAILWAY.

Letter read from the Hon. the Premier, again calling attention to the position of Government in relation to the contractor for the Derwent Valley Railway, and asking for such a Progress Report as would enable the Government to deal definitely with the contractor in respect to the work at the bridges known as 1, 2, and 3, stating that the period of thirty days during which no liability for compensation could arise would expire on the 15th instant.

The Commissioners discussed the letter, and authorised the following reply :—

Committee Room, Hobart, 14th April, 1886.

SIR,

I HAVE the honor to acknowledge your letter of 13th instant, on the subject of the position of the Government in relation to the contractor for the construction of the Derwent Valley Railway, and again requesting that such a Progress Report as to the works of that railway may be sent in as would enable the Government to deal definitely with the contractor in respect to the work at the bridges known as Nos. 1, 2, and 3.

Your letter has been submitted to the Commissioners, and after careful reflection they empower me to say that while they are most anxious to meet the wishes of the Government in minimising the responsibilities attached to the administration of the affairs of the Derwent Valley Railway contract, the Commissioners—not being at present possessed of the necessary definite data—are unable to comply with your request.

The Commissioners are now concluding their labours, and are making every effort to that end. They are convinced that whatever may be the nature of their recommendations respecting Nos. 1, 2, and 3 bridges, the position assumed by the Government towards the contractor would not be materially affected even were the Commissioners enabled to make and forward another Progress Report.

I have the honor to be,

Sir,

Your obedient Servant,

W. A. ZEAL, *Chairman.*

The Hon. the Premier.

Letter received from Mr. J. C. Climie, forwarding statements as to the Derwent Valley, Scottsdale, and Fingal Railways.

The Commissioners were engaged during the day in the revision of proofs of the evidence, and adjourned at 5 P.M.

THURSDAY, 15TH APRIL.

Various returns were received from the Engineer-in-Chief.

Letters from Road Trasts in reply to circular :—

40. Bream Creek Trust, Mr. R. M. Copping, Chairman.

41. Upper Huon Trust, Mr. Albury, Chairman.

The Commissioners were engaged during the day in the revision of evidence, adjourning at 5 P.M.

FRIDAY, 16TH APRIL.

The Commissioners were engaged all day in the revision of evidence, adjourning at 5 P.M.

SATURDAY, 17TH APRIL.

Correspondence.—From the Hon. the Premier forwarding, at the suggestion of the Hon. Minister of Lands and Works, a form of Return prepared by him, with instructions for District Road Inspectors.

Letters from Road Trusts in reply to circular :—

42. Ringarooma Trust, Mr. A. K. Wettenhall, Chairman.

43. North Macquarie Trust, Mr. John Taylor, Chairman.

Letter received from Mr. Geo. H. Edwards, C.E., forwarding his agreement with Government in reference to designs for railways.

Letter received from Mr. C. H. Grant forwarding a list of gradients on the Main Line Railway.

From the Hon. Minister of Lands and Works forwarding eleven plans and specifications having reference to the flood-levels at Bridgewater Causeway.

The Commissioners were engaged during the afternoon in the revision of proofs of evidence, adjourning at 5 P.M.

MONDAY, 19TH APRIL.

The Commissioners were engaged during the day in the revision of proofs of evidence and the preparation of their Report, adjourning at 5.15 P.M.

TUESDAY, 20TH APRIL.

The Commissioners waited upon the Hon. Dr. Agnew, Premier, and arranged in reference to sending in the Report in terms of the Commission.

The Commissioners were engaged during the remainder of the day in the revision of proofs of evidence and on their Report, adjourning at 5 P.M.

WEDNESDAY, 21ST APRIL.

A number of documents were received from Mr. G. H. Edwards, C.E.

The Commissioners were engaged during the day in the revision of proofs of evidence and on their Report, adjourning at 5.45 P.M.

XXX

THURSDAY, 22ND APRIL.

The whole sitting was occupied in the revision of proofs of evidence and preparation of Report, the Commissioners adjourning at midnight.

FRIDAY, 23RD APRIL.

The Draft Report of the Commissioners was read and discussed.

Mr. Stanley moved, Mr. Lawder seconded—

“That the Report now read be adopted as the Report of the Royal Commission, and forwarded to the Hon. the Premier for presentation to His Excellency the Governor.” Carried.

Mr. Stanley moved, Mr. Lawder seconded—

“That the Commissioners record their appreciation of the able and zealous manner in which Mr. T. C. Just has performed the duties devolving upon him as Secretary to the Royal Commission on Railways and Public Works, and the valuable aid he has afforded them throughout their extended and intricate enquiry.” Carried.

Mr. Stanley further moved, Mr. Lawder seconded—

“That the Chairman be requested to bring the foregoing Resolution under the notice of the Hon. the Premier.” Carried.

Mr. Stanley moved, Mr. Lawder seconded—

“That a vote of thanks be accorded to the Chairman for the very able and impartial manner in which he has presided over the enquiry.” Carried.

A number of accounts were passed for payment.

The day was spent in the revision of proofs of evidence, and the issue of instructions to the Secretary as to closing up the affairs of the Commission.

The Commissioners finally adjourned at 11 P.M.

THOS. C. JUST, *Secretary.*

ROYAL COMMISSION ON RAILWAYS AND PUBLIC WORKS.

MINUTES OF EVIDENCE TAKEN BEFORE THE COMMISSION.

SATURDAY, FEBRUARY 27, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

The Honorable NICHOLAS JOHN BROWN, Esq., M.H.A., *Minister of Lands and Works, examined.*

1. *By the Chairman.*—When was the Derwent Valley Railway first brought under the notice of Parliament? In the year 1880 or 1881, I, as a private member, moved for surveys of three lines of Railway,—viz., the Railway to Fingal, the Derwent Valley line, and the Scottsdale line. Previous to that a flying survey of the Derwent Valley line had been made by the Engineer-in-Chief, Mr. Fincham : this was in consequence of the request of a large deputation which waited upon the Government during the recess. You will find in the records of Parliament the report of the Engineer-in-Chief on this flying survey.

2. What route or routes were then proposed? The route then proposed was on the south side of the River Derwent. The Parliamentary survey was made on that side by Mr. Mault.

3. On what plans and estimates was the decision as to the route and construction of the line arrived at? The Engineer-in-Chief was requested by Government to have a survey made on the north side of the river, and the estimate of cost was made on that survey, which was carried out by Mr. Mault.

4. That was on the south side? No, that was on the north side. We first made a survey on the south side, and then made one on the north side, and the estimate submitted to Parliament was founded on the latter survey. You will observe the estimate of cost is for the alternative line.

5. We have two sets of Parliamentary plans submitted, one dated September, 1883, the other December, 1883 : for what reason was the second or northern line substituted for the other? It was on the report of the Engineer-in-Chief that the cost would not be very much greater, taking into consideration the fact that an expensive bridge at New Norfolk would be avoided. It was further recommended by the fact that it would not interfere with the road on the south side of the river. The Parliamentary survey on the south side showed frequent crossings of that road, which would have involved costly deviations of the road.

6. There was no Parliamentary pressure? No, none at all ; it was simply from financial reasons, and reasons affecting the convenience of the public. There was another consideration. We knew that our road bridge at Bridgewater would shortly require renewal ; there was £10,000 voted for that. We thought we could combine the two, and make the new bridge carry the road traffic and the railway traffic.

7. Did the Engineer-in-Chief furnish the Minister with any estimates other than those laid before Parliament? No, no other estimates than those laid before Parliament.

8. Do I clearly make myself understood—was any other estimate made for the information of the Minister? No, none but what you see as having been laid before Parliament.

9. Was the money voted by Parliament for the construction of this Railway sanctioned for expenditure by the Department upon these Parliamentary plans and estimates only? Yes ; but I should add that the Engineer-in-Chief, Mr. Fincham, had always called attention to the fact that estimates furnished on a Parliamentary survey must be taken as approximate only, and not accurate. No correct estimate could be made until the whole survey was completed, the quantities taken out, and so on.

10. Did the Engineer-in-Chief then make any subsequent estimate after the completion of the contract survey? No.

11. Is it the practice of the Department to sanction expenditure without the previous submission of detailed estimates by the Engineer-in-Chief? No, not without such detailed estimates as are furnished in Parliamentary papers now before you.

12. *By Mr. Lawder.*—Are those understood to be detailed? Yes.

13. *By the Chairman.*—Was the Engineer-in-Chief instructed to prepare estimates of expenditure under the heads “land compensation and rolling stock,” besides the estimates for work shown in Parliamentary Paper No. 5, Session II., 1883,—I mean in reference to the last three items on that paper? The rolling stock estimates were arrived at by consultation between the Engineer-in-Chief and the late manager of the Launceston and Western Railway, Mr. Lord. They were submitted to Parliament with Mr. Lord’s concurrence, with the exception of the estimate for the Mersey line, which was cut down below the estimate made by Messrs. Lord and Fincham. Some members of the Ministry then in office considered that, with the broad gauge stock running on the Launceston and Western line, we should be able to do without the

full equipment recommended by Messrs. Lord and Fincham. Subsequently it has been found that this view was erroneous, and we have had to exceed the estimate first submitted to Parliament.

14. Could we obtain those original estimates? Yes, I will endeavour to have them furnished to you. I should like at this stage to call the attention of Members of the Commission to the report of the Engineer-in-Chief, Paper 126, Session 1885, which was furnished to both Houses of Parliament, wherein, referring to estimates, he says:—"I desire to point out that Parliamentary Surveys can only afford approximate data for estimates of cost, and that the time at disposal generally does not allow of full detailed contract particulars and quantities, marking line completely on ground, arrangements for purchase of land, &c., before submitting proposals to Parliament. In preparing both the Parliamentary Surveys and Estimates I have followed the practice which obtains universally in England in connection with Railway proposals submitted for sanction of Parliament there." The estimates given in that paper are prepared in accordance with the final estimates based on quantities.

15. Is the Engineer-in-Chief considered responsible for his estimates for land compensation, &c.? No; No; these estimates cannot be more than a mere guess. He could not really know what would have to be paid for land until the matter had gone to arbitration.

16. What plan is adopted in arriving at the amount of land compensation to be paid? Notice is first sent to the owner of the land informing him that it is required, and if the valuation has been arrived at by a Government valuator, the amount so fixed by the valuator is offered to the owner, with the alternative of arbitration should he decline to accept it. In some cases it is accepted; in the majority of cases it has not been accepted, and the awards made by the arbitrators have, as a rule, been far higher than the Government valuation.

17. The owner is allowed an appeal to the Supreme Court? Yes. In one case only as yet has the appeal been carried out. That was by the owner of land in the Fingal district. He was offered £300. He claimed £2665. The award of the umpire was £398. He appealed to the Supreme Court against the award and he got nothing, the Judge certifying that the advantages the owner obtained through the railway being constructed exceeded the amount of value of land taken for the Railway, and each party was ordered to pay his own costs. This has been the only case brought before the Court. There are other cases pending.*

18. Are the roads affected by the railway on the north side of the Derwent under the control of the Public Works department or under the supervision of the Road Trusts? Under the supervision of a Road Trust.

19. What are the departmental regulations respecting the width and character of road diversions? That information you will probably get from the Engineer-in-Chief. I cannot give it at the moment.

20. Is it usual for Road Trusts to be consulted respecting these deviations, and have they been in these cases—I ask this particularly in reference to some new roads we observed along the line? I have no doubt, speaking generally, that the Road Trusts have been consulted, but I cannot say whether they have been consulted formally or merely informally. It is the custom to obtain their concurrence in any alteration that may be made. The Engineer-in-Chief will be able to explain this more fully.

21. *To Mr. Stanley.*—Does the Act make any provision for the width and character of these roads? Not the Railway Construction Acts; but under the ordinary Roads Construction Acts, main roads are defined as one chain wide, and cross roads as half a chain wide. There is great laxity in carrying out the provision, and except in the larger districts no one takes any notice. That road on the northern side of the river carries so little traffic that it is hardly worth considering. There may be an occasional horse-man; that is about all.

22. No vehicular traffic? Very little. Perhaps an occasional bullock cart, or wood cart.

23. *To the Chairman.*—We want to know what power the Road Trusts have to obtain roads of a proper width? They would be entitled to road facilities such as they had before. That was proposed to be afforded by means of the punt now established on the river. That was intended for the convenience of the public during construction, but it is now proposed to continue it.

24. *To Mr. Lawder.*—Is any provision made for fences on these narrow roads, or any other provision for the public safety; in one case the diversion is parallel with the railway and on the same plane, and there is only 10 feet wide from the end of the sleepers, so that vehicles must travel close to the train? It is proposed to have gates at such places.

25. They may have gates—but is it not proposed to have fences? I am not prepared to say at once what the Engineer-in-Chief may have done in this particular case, but ample precautions will be taken.

26. But are fences usually adopted? Yes. You will find that the Engineer-in-Chief intends to erect fences where necessary.

27. *By Mr. Stanley.*—You said it was intended to erect a new bridge over the Derwent at Bridge-water to accommodate the railway as well as the road traffic: is there any reason why the present railway bridge should not be utilised? One reason is that the bridge will not last more than a few more years. It has been represented to me that the bridge was not constructed of good timber in the first instance, and it cannot have a life of more than three or four years now. We expect that the main line traffic will then run over our bridge.

28. *To Mr. Lawder.*—Were any more detailed estimates or any greater details demanded by Parliament or the Minister before the expenditure was authorised? No.

*MEMO.—FINGAL LINE.

R. G. Talbot claimed for 33a. 1r. 2p., and necessary cattle creeps and crossings, £2665. He was offered £300, three cattle or sheep creeps, and two level crossings. (£300 to include compensation to tenant.)

Award.—£398, five cattle creeps, and two crossings, which was taken to Supreme Court by Mr. Talbot, when Judges decided that the benefit to property far outweighed any damage he had sustained, and decided that he should not receive any compensation.

29. What class of officers are generally appointed as valuers of land? They are men of experience, integrity, of course, and good position, men of intelligence, who, from their previous avocations, must be supposed to have a fair knowledge of the value of land.

30. Are they Government officers? No, only appointed for the time.

31. Can you give any information as to how the expenditure is checked as against the estimates under the various sub-heads? It is done in the office under the supervision of the Engineer-in-Chief. It is done by the Accountant in the Engineer-in-Chief's office, and the sanction for the expenditure and the check are kept in the same office. Up to a recent period the accounts of expenditure were kept in the Launceston and Western Railway Office, but I was dissatisfied with the result of it,—that is to say I found that certain expenditure went on without the knowledge of the Engineer-in-Chief or my own, as to the extent to which we were operating upon the votes. I then had the accounts removed so that they might be kept under the eye of the Engineer-in-Chief.

32. Do you mean that expenditure went on without the knowledge of the Engineer-in-Chief? Yes, without his knowledge as to the exact state of the accounts, that is as to balances available. It was only for three or four weeks, and it was owing to this I removed the accounts.

33. Are payments made on the signature of the Engineer-in-Chief? Yes, on his signature. Of course, first of all a certificate is sent by the resident Engineer, and the accounts are checked in the office; the payments are then certified by the Engineer-in-Chief.

34. Does he sign the cheque for the amount? No, the Treasury actually pays the amount.

35. Then the claimant gets the money from the Treasury? Yes.

36. There is no payment made in the Engineer-in-Chief's office? No, excepting small matters under petty cash accounts.

37. *To the Chairman.*—Do the estimates before us include the cost of sleepers? I think you will find they are mentioned; they are included under the head Permanent Way Complete.

The Chairman said this would complete the examination. He thanked the Minister for his attendance.

MR. BROWN: I would request to say a few words. It is, that generally the Engineer-in-Chief has been very much hurried in making estimates of Railways: he has made them, no doubt, upon less information than he ought to have had before him. Ministers and Parliament were always in a great hurry over railways (I suppose it is the same elsewhere), so that a great pressure was brought to bear upon the Engineer-in-Chief. Parliamentary pressure was put both on Ministers and the Department to get these works pushed on, and estimates were consequently made on mere Parliamentary surveys, which are necessarily only approximate.

The Chairman intimated that should the Minister wish to submit any other information during the course of the enquiry the Commissioners would be glad to receive it.

The witness then withdrew.

MONDAY, MARCH 1, 1886.

PRESENT:

The Hon. WILLIAM AUSTIN ZEAL, M.L.C., Chairman.

HENRY CHAS. STANLEY, Esq., C.E.

ARTHUR WILLIAM LAWDER, Esq., C.E.

MR. THOS. COOK JUST, Secretary.

JAMES FINCHAM, Esq., C.E., examined.

38. *By the Chairman.*—Your name, please? James Fincham.

39. You are a Civil Engineer? I am.

40. What office do you hold under the Government of Tasmania? I am Engineer-in-Chief.

41. How long have you held that office? Since April, 1877.

42. Have you in that capacity had entire charge of the Public Works of the Colony? I have had charge of the whole of the Public Works of the Colony. The terms of my appointment are—speaking from memory—"Engineer for Government Railways and Public Works for the Colony of Tasmania."

43. *By Mr. Lawder.*—Does that mean the whole engineering charge of Public Works—is that specified? It means Engineer for Government Railways and Public Works.

44. Are all the works in your sole charge,—the appointment is indefinite—there might be half a dozen engineers? It has amounted to being Engineer-in-Chief; it is generally understood that I have the whole of the Public Works of the Colony under my charge.

45. *By the Chairman.*—Will you state the course adopted in your Department when a line of Railway has been approved by Parliament to be surveyed? I generally, in the first place, make a preliminary examination of the country myself, and I then employ an Engineer to make a more minute survey of the country through which the Railway may have been ordered.

46. And then do you prepare estimates on the information so obtained? Where directed to do so, yes.

47. Are those estimates submitted to the Minister for the information and approval of Parliament? Do you refer to Parliamentary estimates?

48. I mean the survey you make of a line of Railway authorised by Parliament to be made. You say you make estimates: are these submitted to the Minister for the approval of Parliament, or are they in the nature of confidential estimates to the Minister? In the first instance they are confidential estimates.

49. Then they may or may not be submitted to Parliament? I always assume they will be submitted.

50. When Parliament has decided on the construction of a line, do you then commence a permanent survey? Yes, unless the permanent survey had already been sanctioned in advance. In some cases we have had special votes for contract surveys; in other cases the vote has been passed before the line has been located.

51. Do you then, after having made a permanent survey, prepare more reliable estimates? I make estimates then in accordance with the contract to be submitted for tender, so as to be able to check the tenders that may be sent in.

52. Are those estimates submitted and adopted by Parliament? No.

53. If your estimates, so made, are exceeded by the tenders submitted, what course is followed? I submit a statement of the case to the Minister of the Department.

54. And what does he do usually? Generally, in fact in every case, the tenders, with any particulars I have to furnish, are submitted to the Minister, and by him to the Cabinet. I don't know of any case where the particulars have not been submitted to the Cabinet.

55. Suppose you estimate that a line will cost a particular amount, and that amount is exceeded by the tenders, what would the Minister do? He would most likely give me authority to go on with the works; he would seal that by approving of the tender which involved the excess,—in each case after consulting the Cabinet.

56. Would that increased estimate be accepted by the Minister without the authority of Parliament? Yes. The tenders would come in during the vacation possibly; authority would be given to me to proceed with the works, and the motion for authority for the required excess would be submitted to Parliament at its next meeting.

57. Are you primarily responsible for the designs of the works? I consider I am responsible for every design that goes out of the Public Works Department.

58. State how you arrived at the required waterway for the bridges and other culverts and outlets on a line of railway? My usual practice is to require the Engineer in charge of a survey to make the necessary examination and exploration of the country, and so to fix the waterways required. He then makes his notes on section, and they are submitted to me for approval with the general section when it is completed.

59. Is it his duty then to obtain local information? Yes, it is always done so; the same is the case in the other Colonies, I believe.

60. Do you determine the required capacity of those structures on the result of ordinary or extraordinary floods? We are guided generally by local information, and by information as to the capacity of existing waterways on roads in the district.

61. And are you guided entirely by that evidence, or do you make such extra provision as may be required? Where we deem it requisite, we make extra provision.

62. How do you obtain reliable evidence as to the local rainfall? The waterways, as I before said, are fixed by the Resident Engineers after a careful examination of the ground. I do not check the waterways of each opening or culvert by any calculations as to rainfall and so on, but I am guided by local experience.

63. Do you check the area of the watershed? No, I do not.

64. Does the Resident Engineer so check it? I cannot say.

65. Is there no Meteorological Department in Tasmania where you can obtain evidence of the rainfall? There is a Meteorological Observer, and no doubt information could be obtained of the rainfall.

66. Has it been the practice of the Department to consult him at all? No, not at all.

67. Who determined the route of the Derwent Valley Railway? Do you mean the general route? It was sketched out by me.

68. Yes, generally? It was sketched out by me, but I left it to the Engineer who surveyed it for Parliament to adopt any improvement he might think fit and submit to me for approval.

69. You are aware that the line was in the first instance surveyed to go on the south bank of the river. Why was the northern line substituted for the southern line? At the request of Members of Parliament.

70. Was that request backed up by local requirements,—in other words, did the residents of the district make application that the route should be altered, or did it arise from the representations of Members of Parliament only? As far as I am aware, it was solely from the suggestions made in Parliament. Directions then followed for a survey of the alternative route.

71. Which do you consider the better line of the two? I consider the north line the better line.

72. That is, the adopted line? Yes, although it is longer. By it I save one costly bridge over the Derwent at New Norfolk Township.

73. Who determined the sizes of the culverts on this line? The sizes of the most important bridges and openings were fixed by myself; the others, which are of minor importance, I left to the Resident Engineer, who would be in possession of local knowledge.

74. As we have been told that these works were in the first instance under the control of Mr. Mault,

and latterly of Mr. Sheard, can you fix what particular works were determined on by each of these officers, and in what manner the designs for the works were exceeded? Do you mean as to waterways?

75. Yes, and culverts? Generally speaking, all the culverts and waterways that were not constructed at the time Mr. Sheard took charge of the works were revised by him, and in some cases altered, I believe.

76. Generally, did Mr. Sheard alter any of the culverts or waterways between the junction at North Bridgewater and New Norfolk. That was the first portion of the line commenced? He did not alter them, because he found them completed.

77. Those had been determined by his predecessor? Yes; I cannot say over what length precisely, but over a great portion of the line between Bridgewater and New Norfolk.

78. Mr. Sheard or Mr. Mault will be able to give precise information? They will, Sir.

79. Then Mr. Sheard would entirely undertake the supervision and determination of the culverts from the New Norfolk Township terminus of the line? He would.

80. Did the Resident Engineer refer the size and description of the culverts to you for approval? In Mr. Mault's case, no; that is where alterations were made from the contract section in which the waterways were marked. I know of only one case where I have been referred to, and that was in the case of the culvert at Om. 15c. from the North Bridgewater junction. Mr. Mault asked my permission to put a pile culvert in on account of the want of foundation for the brick culvert originally intended.

81. Then he had authority to determine these culverts: he had authority to make any alteration without referring the matter for your consideration or judgment? He had not; but I should always allow a Resident Engineer to make minor alterations of that kind without consulting me. I should expect to be consulted about alterations in larger and more important works.

82. But see, the specification is clearly that the works cannot be altered without your written authority. Did you think it desirable that the Resident Engineer should have that large power? It is only in the case of the Derwent Valley Line that it has been so. On the Fingal Line all the alterations are submitted to me. On the Scottsdale Line I fixed the waterways over the whole line, and inspected the site of each culvert with the Superintending Engineer.

83. Did you or the Resident Engineer consider the broken and mountainous character of the watershed between Bridgewater and the Pulpit Rock.—Do you think this has been considered sufficiently in regard to the carrying capacity of the waterways? I suppose so.

84. Have the culverts on the Derwent Valley Line proved to be too small to carry off the water during ordinary floods? They proved to be too small during the storm some two or three months back. The previous rainfall had not injured them.

85. Was that a storm of unusual violence? Yes; the main Dromedary Creek, for which a waterway of 6 feet is provided, proved sufficient even for that exceptional storm.

86. Is it not prudent, or is it not the usual practice, to make such provision in the shape of culverts and bridges on lines of railway as will be sufficient to carry off the water in every storm? Certainly.

87. Can you enumerate the positions on the line where these culverts have failed? No; not from memory.

88. If you were to take the section? No, I could not do so without referring to plans at the office. I know of one instance near the junction at Bridgewater. In that case I condemned the culvert when I first saw it, and months since I ordered a larger opening, and the mishap would not have happened had orders been carried out. Mr. Sheard will be able to reply as to the general culverts.

89. Who do you consider responsible for the failure of the culverts? The Resident Engineer primarily, myself indirectly.

90. When you say the Resident Engineer, you mean? Mr. Mault.

91. Has the matter been referred to you as a whole, and how have you dealt with it—that is, the failure of all these culverts? After the failure the matter was referred to me by the present Resident Engineer, and I went over the line with him and fixed on the alterations that are now in course of being carried out.

92. Why did you not use open top culverts instead of earthen pipes where unusual carrying capacity is required—that is, open culverts which carry the bank on two stone walls, with longitudinal baulks? I do not follow you.

93. In some cases the Commissioners saw during their inspection that the earthen pipes had been choked up on the higher side. I say why did you not use open top culverts instead of these earthenware pipes where the effects of a sudden storm would cause a flood? I said before that the description and size of the waterways fixed by the Resident Engineer were considered sufficient. Where the pipes would carry the water I should prefer them to a perishable timber structure.

94. But those open top culverts are not perishable: they are two stone walls with longitudinal timbers? That would be a question of expense. If an earthenware pipe would carry as much water as an open culvert such as you describe, I should prefer it for the sake of economy.

95. Who designed what are known as the first, second, and third bridges over the Derwent River? I gave the general directions as to the details, the spans required, and the number of openings, &c. to the firm which was employed in lieu of an office staff. The different designs were then made by them and submitted for my approval, while I from time to time visited the office and examined the works in progress.

96. Did you fully consider and finally approve of these designs after they had been prepared? Yes. I had to decide at once on the letting of the contract, because of the ordering of the iron-work required from England for the purpose of the local manufacture.

97. As you said you determined the details, how did you arrive at the necessary requirements of these details,—such as the waterways, the carrying capacity of the girders, and so on? I said I decided the

general lines, the spans, the number of openings, and so on. I was guided in that by the known flood levels, the extent of waterway required in the width, and also by my experience of other bridges across the Derwent, which enabled me to fix the size of openings sufficient for any timber likely to come down the river during floods. The size of the timber likely to come down largely guided me in fixing the spans, while also considering economy of construction.

98. Did you satisfy yourself that the iron girders were designed of sufficient strength and correctly proportioned? I did.

99. What test or formula did you use to prove this? The standard of the English Board of Trade.

100. Can you supply the Commissioners with any of these data? The girders were calculated for a working compressive strain of four tons per square inch and for a tensile strain of five tons.

101. Have these girders been tested by you or any other officer of the Department during construction? They have been under constant inspection.

102. Have you inspected those now standing on the wharf? I have.

103. Are you satisfied with the workmanship and details? Generally. The work is a little rougher than the best English work, but it is strong and sufficient.

104. Have you provided for any camber to these girders? The specification, I believe, provides for that. I don't think the camber is shown on the drawings, but I believe you will find the girders have been built with a camber.

105. You fancy they have been built with a camber? I feel sure they have.

106. Are any other instructions given in regard to the camber of these iron girders that we do not find in the specifications; are there any figured dimensions on the drawings? I do not remember.

107. Perhaps you could let us know afterwards? I will do so, but I feel sure these girders are being built with a camber.

108. Who is the officer who inspects these girders during progress of construction? Mr. Jowett. They are also seen by myself and the Resident Engineer from time to time.

109. What position does Mr. Jowett hold in the service? He has been an inspector of works for seven or eight years past.

110. Has he any special knowledge of the construction of iron-work? Yes; he is a mechanical engineer by trade.

111. Take, for example, the No. 1 bridge across the Derwent: how did you determine the size and thickness of the piers? The piers were first of all taken for masonry at a tenth of the span to be built in lime mortar, and I afterwards decided to adopt 5 ft. 3 in. as the size to be built in cement mortar, as being safer and more than an equivalent.

112. Are you now satisfied that these piers are correctly proportioned to carry the maximum load and to resist all the strain on the girders likely to be occasioned by passing trains? Perfectly.

113. Why did you build the abutment of the No. 1 bridge in solid masonry? Because it cost no more than the expensive wings that would have been required along the water's edge, and made a much more efficient job.

114. Are these abutments built in mortar or cement, or partly one and partly the other? Cement below and lime mortar above.

115. Do you not intend to provide wing walls to protect the toes of the bank from the action of floods in the river? They are not necessary. The embankment on one side is protected by a rocky spur jutting out into the river, and it is formed almost entirely of solid rock from the adjacent cutting.

116. You are of opinion, then, that the provisions made are sufficient to protect the embankment? Thoroughly.

117. Are you satisfied that the bridge has sufficient waterway? Certainly, Sir. Practically the girders span the whole of the flood waters.

118. Why did you sanction the introduction of descending grades on to the approaches of this bridge? Those descending grades do not exist now. I made a slight diversion of the line at that point and did away with the descending grades. [The witness referred to the sectional plans, but the alteration was not shown. He said it would be supplied from the office.]

119. You will supply the Commissioners with the plan of the altered grades at No. 1 bridge? I will.

120. It has been alleged there will be considerable top hamper on the girders when loaded trains are passing: are you satisfied that all conditions have been considered and provided for to prevent the public being exposed to undue risk? Perfectly; not only from the calculations made, but from examples of other bridges that I can quote—bridges more than equal in span and length.

121. Can you submit these designs for the inspection of the Commissioners? I can, and will do so. I will also undertake to show that these bridges are not of the same strength in the girder portion as those now under construction.

122. As to No. 2 bridge, without going into details as to construction of girders and so forth, will the remarks you have made in reference to No. 1 bridge apply equally to No. 2 bridge? Yes, and to No. 3 also. The girders are identical throughout.

123. As to No. 2 bridge, what determined you to use caissons for this bridge? I would rather call them wrought iron cases.

124. Well, wrought iron cases. On what grounds did you adopt them? Simply economy, especially as I did not sacrifice efficiency. The contract provided for the adoption of one of four different designs for piers. First, masonry piers, then cast iron cylinders, five feet diameter, with wrought iron solid bracing

between, cast iron cases to concrete piers, and wrought iron cases to concrete piers. The cost of the pier as adopted is about £12 15s.—that is the contract price per foot of depth. The cast iron cases with concrete filled in, £16 per foot of depth; the cast iron cylinders with solid wrought iron bars between, £18 15s. per foot of depth. So that between the first and last mentioned there is a saving of something like £6 per foot in depth. Taking the pier at, say, 45 feet, there is an average saving of about £270 on every pier.

125. Are you satisfied that these wrought iron cases are sufficient to resist all lateral and tensile strains? I have every confidence in them.

126. Did you make any calculations to determine this? I made calculations as to the pressure on the pier, top and bottom, and as to the weight on the pier. The extreme pressure on the top of the pier is under two tons per square foot; the extreme pressure at the base does not exceed $3\frac{1}{2}$ tons per square foot. The weight of the pier, which is one solid mass, is something like 185 tons, and the dead weight on it 30 tons, making 215 tons. The strain is principally a vertical one, and for a dead load is only some 30 tons over the top of the pier.

127. Can you supply any data which will support these statements? I can.

128. Will you do so? I will, Sir.

129. Are you aware of any existing bridge where similar principles of construction are adopted? Yes, I have seen similar bridges on a line I was connected with in England, for the foundations of a pier carrying two arches over the river Ouse.

130. *To Mr. Stanley.*—Were these wrought iron caissons? Yes, five feet square, securing wrought iron jack arches turned into them at water-level. The main pier ran up from that.

131. *By the Chairman.*—What was the main pier? Brick-work.

132. How would that compare as to the strength with the design you have adopted? Unfavourably, I should say, in consequence of the enormous weight of the arches on either side resting on these. I have a very light top weight. Besides, I assert that good cement concrete in itself would be sufficient when set to take the whole weight.

133. And to resist all the strain it would be subjected to? And to resist all direct vertical strains; but I would not risk a concrete pier of that thickness without its being enclosed as is done in this case.

134. How will the girders which are erected be tested when in position? By running an engine over in the ordinary way.

135. Are the girders for No. 2 bridge now in course of construction, and what number, if any, are built? I cannot tell you how many are built.

136. Who is undertaking the construction of them? Messrs. Kennedy and Sons are the sub-contractors under Mr. Falkingham for those in Hobart, and Mr. Knight is the sub-contractor for those made in Launceston.

137. Does the Launceston firm undertake the contract for any of the girders of bridges 1 and 2, or are they principally connected with those for No. 3 bridge? I don't know how the contracts are divided. The girders are identical throughout, and I cannot say without enquiry which portion is being made by Mr. Knight, and which by Messrs. Kennedy. I believe the Messrs. Kennedy have done the whole of the No. 1 bridge girders, and the same firm is doing most of the wrought iron cases.

138. As to the design of No. 3 bridge, the Commissioners have not visited the locality of this bridge, but understand that the design of the girders is similar to those for Nos. 1 and 2? They are similar; I can produce the working drawings.

139. Will the same evidence, then, given as to Nos. 1 and 2 bridges apply equally to the girders of No. 3? Equally so, Sir. They are similar girders, and nearly similar piers, in No. 3. The only difference is, that in No. 2 the portion below the water is made rather longer.

140. Otherwise No. 3 bridge is a duplicate of No. 2 bridge? Yes, in regard to the system of construction. Of course No. 2 bridge has stone piers introduced; in No. 3 there are none.

141. As to the Back River Bridge. The Parliamentary survey shows the route of the line more inland than that followed by the present route. The present route follows the margin of the river; the Parliamentary route shows the line more inland. What induced you to alter the route, and run parallel with the river at this Back River Bridge? It was a question of economy, and it was done on the advice of the Resident Engineer, who made the alteration practically. We never follow a Parliamentary line closely.

142. Was that Mr. Mault or Mr. Sheard? Mr. Mault made the Parliamentary survey, and also the Contract survey.

143. Has the retaining walls built failed at that point? Yes, the original wall has failed.

144. Can you state the cause of the failure? Utter inadequacy of strength.

145. Who designed and is responsible for the failure of this wall? In the first instance, the Resident Engineer, Mr. Mault, ordered the work to be carried out without reference to me, or any permission to depart from the standard of strength fixed in the plans.

146. Were you aware that the design was being departed from? Not in the least.

147. Did you not inspect the work during the process of construction? After it was very nearly finished I inspected it. The greater portion of the length had been built and backed in when I first saw it.

148. Did you then approve or disapprove of what had been done? I commenced to examine the face, showing it to the Contractor, and to his men, and to Mr. Mault. I marked many places where I disapproved. There were vertical joints there to four feet or more in depth existing. I found fault with the Resident Engineer for adopting a random rubble wall construction in such a place, and he informed me he had adopted it in the first instance from motives of economy, and promised that he would have no more of such walls.

149. Were you satisfied with his explanation, or did you remonstrate with him for departing from the plans provided with the contract? I remonstrated with him in the presence of the Contractor's Engineer and others, the words of my complaint being "that he had kicked his instructions as conveyed by standard drawings simply to the winds." As the wall had been built for most of its length, I asked him for particulars of strength. I was supplied with the same, the Contractor's foreman asserting that although a thin wall, it was practically a mere skin over a solid stone bank. I have since found that this was anything but the case. The filling in consisted of clay and stone rubbish in a pocket between the wall and the solid ground, in wedge shape.

150. Do the drawings in this paper correctly represent the wall as it was designed, and the wall as it was built? [Letter with coloured drawing handed to witness.] Upon my receiving a sketch of the dimensions, of which this is a copy, I asked Mr. Mault how he had fixed the strength, and he informed me that as he only intended the wall to be a face to a stone embankment, he started with a thickness of 18 inches at the top, setting off 6 inches to every 6 feet in depth.

151. Do you now think, with the experience which you have obtained as to the failure of the wall, that the alteration of the route at Back River was an economical one? I could not answer that without comparing the plans.

152. Would you be able to supply the Commissioners with information on this head when you examine the plans? I can do so.

153. Will you undertake to do so? Yes, I will.

154. Did you approve of the alteration—the diversion of the line at this point from the route shown on the Parliamentary plan to the present one? No, I did not. I did not examine the line after it was pegged beyond New Norfolk. I knew from the contract plans that it had been marked out.

155. Were you aware of the alteration? Yes, I might have been aware of the alteration.

156. Are you satisfied that proper provision has now been made to resist the action of the floods on the wall and the Railway embankment? Quite, Sir.

157. Do you think the form and description of the retaining wall now being built is the best form that could have been adopted? I should have preferred a slight batter, but we were fixed by the bridge and culvert over Back Creek and by the work that was previously in.

158. What batter would you have provided for? A batter of one in six.

159. That is two inches to the foot? Yes.

160. *To Mr. Stanley.*—What do you mean by the work already in? There was a portion of the Back Creek bridge designed with a vertical face, as most bridges usually are. As that was vertical we thought it better to run the wall vertical also, so as to leave nothing for the action of the floods.

161. Would there have been any very serious objection to a set-off equal to the batter of the wall? We thought it would look better to have one class of face, the present wall being vertical. The strength is amply sufficient.

162. *By the Chairman.*—Does this wall not take more to construct than one with a batter? Only a very little.

163. You would not have inclined the face, then? No, I should not. The only difference is in the concrete backing.

164. Compare the character of the two works—the old road bridge and the present railway bridge. The latter has nearly double the capacity of the other. Why did you increase the span of the railway bridge for additional waterway by providing vertical headway? I thought it advisable to keep the surface of the arch as high as possible, considering the floods likely to occur in the Derwent.

165. Can this additional waterway be utilised? It is only required for the back-water of the Derwent.

166. As to the Plenty Bridge,—are you now satisfied as to the carrying capacity in respect to extraordinary floods? Perfectly; it is more than double that of the road bridge, which has stood for seven or eight years. The whole floor of the railway bridge will be above the level of the highest known floods, as far as we can ascertain.

167. Do you think you have had reliable information? I believe so.

168. Coming generally to the railway works abutting on the River Derwent, are you satisfied that due precautions have been observed and provision made to protect the railway works from the action of extraordinary floods? I believe so. I don't know that there is any undue risk.

169. You do not anticipate any damage from floods? I do not, Sir.

170. *The Chairman.*—That is all I have to ask. My brother Commissioners will, no doubt, put some questions. We shall have to call you again, Mr. Fincham, in reference to other lines.

171. *By Mr. Stanley.*—In reference to surveys—how were the Parliamentary surveys carried out? Were they carried out directly by your staff, or by contract? They were carried out by such strangers as we could engage. Sometimes they were carried out on the contract system. We did the work of the Derwent Valley line by contract.

172. Do you think that a desirable way of carrying out a survey? I do not, now. I have entirely abandoned contract work.

173. You don't follow that method now? No: for these Parliamentary surveys were proposed the amount available was very little, and I could often keep within the limits by contract. Then I had no means of supervision, and such routes were adopted as the Engineer on the whole thought the better.

174. I think you said you made a preliminary examination of the country before the survey? Yes.

175. Then you gave, in the first instance, general instructions to the Engineers? Yes, I gave general instructions.

176. After the Parliamentary survey was made did you or any other officer of the Department inspect the survey before the plans were submitted to Parliament? No; there was no time for that.

177. Did the surveyors leave any marks on the ground,—pegs or otherwise? Not that I am aware of. It is possible the surveyors might have left a few rough marks, such as a peg here and there, but there are no marks as a rule left on a Parliamentary survey.

178. Who prepared the Parliamentary sections and graded them? They were done, in the case of the Derwent Valley Line, by Mr. Mault, and corrected by me on completion.

179. How were the permanent surveys carried out—by contract or by the official staff? In the case of the Derwent Valley Line, under contract by Mr. Mault.

180. Then at that time I presume you had no reason to be dissatisfied with Mr. Mault's method of making a survey? No, certainly not.

181. Was there any check exercised on the way the survey was carried out under the contract? No; I trusted the Contractor, who was a Civil Engineer.

182. At that time you had confidence in Mr. Mault? He came to us with very high testimonials from England, and I had every confidence in him. At the present time I am not required to supervise. A gentleman has been engaged as Inspecting Engineer, and we will now have all the work checked.

183. I think you said to the Commissioners that the Surveyors had instructions to explore and examine the country, and to obtain evidence as to the required waterways? Yes; they always do so.

184. Does that apply to all the waterways, bridges, and culverts? All the larger bridges and waterways I look into myself. As regards the minor culverts and waterways, I leave them all to the local Engineer, who has better opportunities of knowing the requirements.

185. Was it the Surveyor or the Resident Engineer's duty to determine the waterways on the Derwent Valley Line? The Surveyor and the Resident Engineer were the same man.

186. What is now your method in respect to the determination of waterways generally—are they fixed by the Surveyor or the Resident Engineer? Our Surveyors are not in all cases construction Engineers. I never employ a man to survey a Railway unless he has a knowledge of construction.

187. Did you allow the Resident Engineer to determine the minor waterways without submitting the same to you? In the first instance he determined them; he then submitted them to me and furnished the sections afterwards during construction. I believe several alterations were made without reference to me.

188. After the Resident Engineer submitted his proposed waterways, did you take steps to satisfy yourself before authority was given for the work? When the plans were first sent in, yes. I looked through them in the office and approved of them from my general knowledge of the district.

189. Did you go over the ground and judge for yourself? I did not; it would be impossible for me to do so.

190. I presume, as Engineer-in-Chief, you frequently make visits of inspection? Yes, as often as possible.

191. During these visits has your attention never been drawn to the question of waterways? did it never strike you in fact that many of these waterways were insufficient for the drainage area to be provided for? Excepting in the case of the culvert at 15 chains from the junction, no.

192. Our attention has been drawn to the case of a number of 18-inch earthen pipe drains which in some cases have been altered to two or three pile openings of 10 feet each. In going over the works did the insufficiency of those pipe drains come under your notice? Yes, in reference to the severe test of the late storm.

193. Not when you were inspecting the works before? They had never been found insufficient before. The contractor, and those in his interest, say they have spoken of the insufficiency of the culverts, but I cannot charge my memory to say positively.

194. What is the usual rainfall in this country?—I mean the maximum rainfall per hour? The yearly rainfall is about 24 inches.

195. I do not refer to an exceptional storm, but to the maximum steady rainfall.—What would you take it to be in the district? I should take the largest possible shower in one hour.

196. What is that? I should think an inch per hour. We have no very authentic records on the point.

197. Can you state approximately what is the largest area of watershed an 18-inch pipe drain will be sufficient for with that rainfall, taking a current through the channel of four miles an hour? I could not, without calculation.

198. Could you not say approximately within a few acres? No, I could not do it without calculation.

199. *Mr. Stanley.*—I may state my usual practice is to allow an 18-inch pipe drain for an average area of eight acres only. Now many of those we inspected the other day must have exceeded a hundred acres; I am sure it was over 100 acres in one case. There is one case at 3 miles 2 chains of an 18-inch pipe drain. From what I could see of that watershed I should say it was nearly, if not quite, 100 acres. There were many other cases to which my attention was drawn. Do you not think it very evident that a discrepancy such as that should have attracted your attention? It might have done so. I can't say now whether I called attention to the fact that the culverts were not sufficient; when I saw them I believe I did.

200. What general instructions do you give your Resident Engineers as to the alterations in works provided for in the contract? To submit them for my approval.

201. Were you not aware that Mr. Mault, as Resident Engineer, was making extensive alterations in the Derwent Valley Line? In respect of waterways, no. In regard to alterations in the line, short deviations were submitted to me; there was one at Boyer's land. Other things were not submitted to me.

The route at one part of the line has been altered from a marshy flat and thrown up and down along the hill sides,—a most dangerous and inconvenient road; that was done without my knowledge.

202. Who made the alteration in the case of the culvert at Om. 15c. 60l.?—that was originally a 4 ft. by 3 ft. culvert, and altered to three 15-foot pile openings. Who is responsible for that alteration? Mr. Sheard, the Resident Engineer, knew the culvert was condemned, and consulted me as to the new openings, of which I approved.

203. By whom was the culvert condemned? By myself, as soon as I saw it.

204. Then the alteration in that case was made with your approval? Distinctly; one 15-foot span with timber-lined abutments and wings; but as I disliked the use of timber-sheeted wings and abutments, I decided, when the other alterations due to the flood were under consideration, to put three spans, leaving the two end spans to be filled up with earth in lieu of wings, as the cost would be, if anything, less.

205. Did you ever make enquiry of the Surveyor or Resident Engineer as to the method followed in determining the size of the waterways where there were no existing bridges to guide him? No.

206. You cannot then say whether the watersheds were traversed or not? I do not suppose they were, as the work was done by contract.

207. In your agreement with the Contract Surveyor, did you not include provision for traversing the watersheds? No.

208. Was it understood that he had to examine them? It was understood that he should examine the country so as to enable him to determine the waterway required for each culvert.

209. In the case of road diversions, would you be good enough to explain to the Commissioners how you determined the width and grade of these diversions? By that existing in the immediate locality.

210. You were guided by the original road? Yes, by the width of the road at their end of the diversion.

211. Does the Railway Act make any provision as to the character of road diversions? No, it does not.

212. Were the Road Trustees consulted, and their consent obtained as to the alteration of roads? No.

213. Then you used your own discretion in dealing with them? Yes, I used my own discretion.

214. Can you give the Commissioners any information as to the cost of Parliamentary and permanent surveys.—Can you state what the Parliamentary survey cost? The Parliamentary survey of that line extended many miles before the line was adopted. I suppose it cost about £10 a mile.

215. Was that the contract rate? I could not tell from memory. I can supply that information.

216. Can you state from memory the cost of the permanent survey? Yes.

217. In that case was it by contract at a stated price? My first arrangement was at £15 per mile, but subsequently I recommended an increase of £5 per mile, on the assurance of the contractor, Mr. Mault, that for that sum he would take every possible trouble, and make any alterations which I might desire.

218. In entering into a contract for this survey, did you agree subsequently with the Surveyor as to the work he was to do for the payment mentioned? Yes, and as to the method of pegging, and fixing bench marks, and scales for plans and sections, and so on, I gave general instructions as to marking the line, and so forth.

219. Can you furnish the Commissioners with a copy of these instructions? Yes, I will try. They were not written instructions. The contract plans were shown the Engineer, and he agreed, for a certain price, to do the work required. That price was submitted to the Minister and approved, and the Engineer was notified accordingly. There was no formal agreement.

220. Did you not furnish him with written directions as to the work to be done for the money paid? I don't think that was done at the time; certainly not in writing.

221. Did you include any provision in your estimate for the cost of the surveys? I might have included it under the head "supervision." You will see if you refer to the estimates. [Witness refers to Parliamentary Paper 5, Sess. II., 1883.] No, there is no provision in the estimate. I remember the cost of the surveys came out of the construction vote. In the case of the Derwent Valley line it was so. In many other cases we had a special grant for the surveys.

222. I understand you to say that in the other cases there was a special vote? Yes; in the same session we had so many Parliamentary surveys provided for, and so many contract surveys. That applies to the Fingal and Scottsdale lines; all the rest came out of the construction vote.

223. Referring to the alterations made in the direction of the line in the vicinity of Back River, did you make any comparative estimate between the line as originally shown on the Parliamentary plans and that afterwards marked out on the permanent survey? I compared the two plans, but I did not make any comparative estimate.

224. *By Mr. Landor.*—Then to what extent did you make the comparison? The Parliamentary survey and estimate are distinctly understood to be never more than distinctly approximate. The line is not even marked on the ground. After the line was marked out I should compare the plans, but in a general way only.

225. But, in this case, if any additions were made to the length, or deviations were involved, you must have made some comparison? The only addition to the length was going round by North Bridgewater.

226. Then, are such alterations binding? I should have to carry out the plans generally.

227. *By Mr. Stanley.*—My reason for asking is to ascertain what determined you in adopting the working survey instead of the Parliamentary plans? It was economy merely. The section Mr. Mault gave me did not show any retaining wall at Back River. It merely showed some pitching. I therefore concluded it would be more economical to take the Back River route.

228. You did not prepare any plans and comparative estimates, then, in reference to that route? No, certainly not.

229. With the knowledge you now have, Mr. Fincham, do you not think it would have been more economical to have adhered to the Parliamentary survey? [Witness refers to plan.] No. If the work had been properly constructed the advantage from an economical point of view is in favor of the contract line.

230. In saying that, do you refer to the retaining wall? Yes; if it had been properly constructed I am of opinion that the comparison was in favour of the contract line. The Parliamentary plans show some very heavy cutting which would have been needed, and a bridge over the Back River, which is avoided on the present plan.

231. Can you give the Commissioners any idea as to the probable cost of the bridge and retaining wall over Back River now being carried out? Not from memory. I will supply that information.

232. I think you stated to the Commissioners that the line on the north side of the Derwent had been adopted at the request of Members of Parliament? Yes, that is the case. I was pressed to make a survey in the first instance there.

233. Then it was not on your recommendation that the north side was adopted? After the survey was obtained I recommended its adoption, but it was initiated at the request of several Members of Parliament. I selected the south route first of all.

234. Had you much pressure brought to bear on the Department by Members of Parliament—or was it merely an expression of opinion in the House? Merely an expression of opinion in the House.

235. What has been your practice in regard to side cuttings?—do you take an additional width of land where side cuttings are required? Yes, where I know that it is required.

236. I observed in several places that the cess between the toe of the slope and the edge of the side cutting was much within the limits of the specification? Yes, it is so.

237. At these places has extra width been taken to provide for the side cutting? No, it has not.

238. Did not you consider it necessary to do so? I should have done so had I been aware of it; but in many cases, to suit the contractor's own purposes, it has been taken beyond limits.

239. *To Mr. Lawder.*—Is it the custom to show the contractor where the slopes should be taken off? Yes; but you can't regulate this where the contractor acts in defiance of his instructions.

The Commission adjourned at 1 o'clock until 2 P.M.

AFTERNOON SITTING.

The Commission reassembled at 2 P.M. Present—All the Members and the Secretary.

MR. FINCHAM'S *examination continued.*

240. *By Mr. Stanley.*—When the Commission adjourned we were referring to side cuttings. Should the Resident Engineer not have taken steps to have got the necessary width at these places? Yes, if applied to. It is for the contractor to say where he wants to get the stuff out.

241. I presume the Resident Engineer must have seen what the contractor was doing, because these side cuttings occur at several places along the line? Yes, but it does not follow that he saw them in time to stop them along the line.

242. I can understand that if it had been only an isolated case or two, but there are several of these places? The Resident Engineer will be able to tell you about these.

243. I notice that the inlets and outlets to culverts have in most cases been left unpitched: is there any provision in the schedule for the rejection of such work? Yes; you will find a provision in the specification.

244. Do you refer to section 26 of the specification? No, to section 25, "Inverts and pitching."

245. Can you say whether instructions were given to the contractor to pitch these inlets and outlets? On this point I must refer you to the Resident Engineer; he can give you full information. He complained that he could not get the work done.

246. Are your instructions to the Resident Engineer to have them pitched? Certainly.

247. Is it the practice in your Department to require the contractor to request the Resident Engineer to inspect the foundations before proceeding to put in masonry or concrete? As a matter of fact the Resident Engineer is advised by his Inspectors when foundations are ready, and advantage is taken of that to inspect them.

248. I observe in a statement you have furnished the Commissioners with, that some exception was taken to the foundations of pier No. 7 at bridge No. 1 over the Derwent River, and it is stated that the foundations were put in on a Sunday morning, when neither the Resident Engineer nor the Government Inspector were present: what steps were taken by the Department in that matter? I proceeded to the work on the Monday morning and met Mr. Climie and the other officers of the Contractor's staff there. I informed Mr. Climie and the Resident Engineer that I should support the latter's claim, and have the whole foundation cleared out to the solid, no matter what it might cost. I believe, as a matter of fact, Mr. Sheard found that it was only necessary to take out a part of the concrete to where some five to fifteen inches of sand and clay were left in as part of the foundation.

249. Are you satisfied that a good foundation was secured in the end for these piers? I am perfectly satisfied as to the integrity of Mr. Sheard, and he is perfectly satisfied with the foundations now.

250. When passing along the line on the occasion of our visit there was some pitching pointed out as having been objected to by the Department: on what grounds was that pitching objected to? It is all through the line. We object to pay the price because the pitching is not up to specification. The Contractor does not deny this; but he says it is good enough.

251. Under the contract you have power to arrange a reduced price, have you not? Yes, I have offered to do that.

252. In the case of the faulty pipe drains, pointed out by the Resident Engineer, are you aware if these were included in the monthly certificate, or struck out after the damage by floods? I believe they were so included by the first Resident Engineer.

253. Have they since been struck out? No; but I have compromised the matter with the Contractor in this manner: when I inspected the pipes and other works on the present Resident Engineer taking charge of the line, the faulty pipes and method of laying were pointed out to the Contractor. He at first denied both, until we came to a place where the men were engaged in laying the pipes without the slightest attempt at compliance with the specification. I then required the Contractor to open out the pipes throughout the line, and engaged to pay the cost if it could be shown that the Department was in fault; and I required that he should pay the cost if it could be shown that the fault lay with the Contractor. Repeated promises were made to have this done, but without effect, and, as a last resource, I instructed the Resident Engineer to strike a certain sum out of the certificate until the examination was made. This sum still remains to the credit of the Department.

254. What was the principal fault found with the pipes as laid? They were not sunk in a bed, as they should be; the joints were not luted with clay, and in places they were actually supported on a mound of loose earth.

255. Your specification contains provision for sinking them in the solid ground, does it not? Yes, to the extent of half their depth.

256. What is your practice in cases where the Contractor disregards the instructions of the Resident Engineer in respect to the manner of carrying out works, or the quality of material, and so forth? My practice is to stop payment, and, in extreme cases, to stop the whole certificate.

257. Immediately the Resident Engineer refuses to pay for work not approved of? Yes.

258. Was this done in the case of the retaining wall at Back River objected to? It had been already paid for; I am not sure if to the full extent, but the wall had been paid for by Mr. Mault.

259. On its falling, was the item struck out of the next certificate? I cannot tell from memory?

260. I suppose Mr. Sheard would know? Yes, he would know.

261. You informed us that you determined the width of the piers of No. 1 bridge by making them a tenth of the span when to be built in lime mortar, and afterwards reduced them to 5 ft. 3 in. when in cement mortar: would the height of the pier not affect this question? Yes, no doubt it would.

262. Did you take this into consideration in dealing with the matter? Yes.

263. And you are satisfied that the width of the piers as now being carried out is sufficient, taking into consideration all such matters—the height of the piers, the height of the floods, and so on? I have the fullest confidence in them.

264. In considering the strength of the piers of No. 2 bridge, which are concrete piers with wrought iron casings, have you considered the lateral and longitudinal vibration on these piers? The lateral I have, and allowed for it in No. 2 by the width of the piers. In those of No. 3, owing to the skew, the normal width of the piers is increased.

265. How have you provided for the longitudinal vibration? There is the expansion due to the girders.

266. There would be a certain amount of vibration caused by a passing load? You mean by the passage of the trains?

267. Yes? Yes, there would be vibration to a certain extent, but not enough to affect a pier which, in the mass, is 215 tons.

268. What height are the piers of No. 2 bridge? Above the finished foundation, about 45 ft. The base is to be enclosed in a footing of concrete.

269. Would the strain caused by a passing load not induce tensive strains in the concrete in certain parts of the pier? I think it would be hardly possible, as I should have a loose road over the bridge.

270. Still, the effect of a rolling load is to produce such strains? Yes; but the case is vastly different in a fixed and a loose road.

271. Do you think it would take up the strains that I refer to? Yes, I think so.

272. Have you made any actual calculations as to the stability of the piers under every description of strain to which they will be subjected? Yes; I have made calculations as to wind pressure on the girders, and the weight of a combined dead and live load on the piers.

273. Would the wind pressure on the piers not have the effect of producing tensive and compressive strains on the concrete? I don't think it would be appreciable at all, because the piers would stand, roughly, in the direction of the prevailing wind.

274. Do you think it is a good practice to design piers of this kind without some reliable data? I think so, seeing that the case is tied together in all directions by braces. I consider, for the small size of the spans, that the piers are enormously strong. The plates enclosing the caissons of the bridges over the Tay and Forth are only $\frac{3}{8}$ of an inch thick.

275. Those piers are a considerable width, are they not?—here we have to deal with piers only four feet in thickness and 45 feet in height? Yes, and comparing those with 5 feet cylinders you find an enormous difference in my favour with regard to the area of the piers and the pressure.

276. Is it the usual practice to design piers such as those of No. 1 bridge without any batter? It is as often done one way as the other. That is the case in this country.

277. Of such a height? No, not so high. In the case of any lateral thrust, as of an arch, I should consider it necessary. As these piers have to bear the mere pressure of vertical weight it is not of so much importance.

278. As a matter of fact, is it not the usual practice to batter piers both on the cross section of the piers and the longitudinal section? Both plans are adopted.

279. Can you refer to any example of a bridge so high as those of No. 1 bridge built without a batter? No, I cannot do so at the moment.

280. I think you stated that you had satisfied yourself by calculation, that the girders being constructed for these bridges are of sufficient strength to meet all requirements? Yes, Sir.

281. In making these calculations what did you take the dead and rolling load at? I combined the dead and rolling load at $1\frac{1}{2}$ tons to the foot run.

282. I observed in the case of the girders being constructed to carry the road on top that the T iron stiffeners are only placed 12 feet apart. Do you think this is according to usual practice? The T iron stiffeners are 12 feet apart outside, but only 4 feet apart inside. [The witness here described the stiffeners on the plan.] These T irons are intended to stiffen the plates.

283. Do I understand the T irons are not constructed so as to transmit the strain on to the flanges? No, it is not required, they are only to stiffen the plates.

284. Then you think in the designs of these girders, the question of stiffening the web has been sufficiently considered and provided for? I think so.

285. You stated in conversation that instructions had been given to construct these girders with a camber? Yes, a camber of $1\frac{1}{2}$ inches.

286. Have you satisfied yourself that this camber has been provided? In the case of some of the girders I have.

287. Would you consider it safe to allow such girders to be erected without a camber being provided? I should consider girders of this description perfectly safe without any camber. I consider them specially stiff.

288. But under a rolling load such as you provided these girders should be tested with, do you not anticipate there would be some deflection? No doubt there is more or less deflection with every girder under a heavy load.

289. Then in the event of any of these girders being built without camber it would sag? The deflection would be very slight, and the girders are so stiff that it would immediately recover itself.

290. But while the load was passing over the girder would deflect? Under a very heavy load it might deflect for a quarter of an inch.

291. Do you not think this would injure the girder by buckling the web plates? I cannot suppose such a case, as the girders are being built with a camber.

292. Did you observe any camber in the girders at the Plenty Bridge on the occasion of our visit on Thursday? Yes, Sir.

293. Did you not observe that these girders were absolutely horizontal and without any camber at all? No, I did not see that. I don't think any one could detect a slight camber, who had not seen it before the girder was up. It would go down, of course.

294. What, under the weight of the girder? Yes, during building I should expect it would. The Inspector, Mr. Jowett, has remarked to me upon the stiffness of these girders, and that they did not lose the camber with which they were built.

295. Do you require the girders to be tested at the works before being sent on to the line? No, I do not. There are no appliances for doing so.

297. Is it not usual in English practice to require that to be done? I believe it is, but this is not the same case.

298. Would there be any insurmountable difficulty in having the same practice pursued here? I don't know where I could have got the appliances.

299. Could you not have tested them by loading them with rails? I don't know whether I could have got some seventy or eighty tons of rails on to them.

300. *To Mr. Lander.*—What do your rails weigh,—40 lbs. to the yard? No, 42 lbs., 24-ft. rails.

301. *By Mr. Stanley.*—I notice in clause 74 of the specification you provide a test for wrought iron, and I think that this test has to be made at the expense of the contractor? That is so.

302. Were any steps taken to enforce this condition? No.

303. Did you not think it practicable to do so? I don't think it would be practicable here. It was put in to meet the event of an order being sent Home for the girders. The metal is tested from time to time by examination, bending, and so on.

304. But you do not test for tensile strength? No.

305. Do you think there would be any difficulty in getting a rough testing apparatus rigged up for the purpose? I think there would be a great difficulty in getting any satisfactory machine rigged up.

305*. Of course I should not expect, in a place like this, to find appliances that would give an accurate test; but do not you think it would have been possible to have got some test that would have enabled you to judge as to strength? I preferred to judge for myself, by the aspect of the metal when broken, and so on, instead of by a rough appliance which could give no reliable result.

306. You can't say, then, if the iron has the required strength for resisting the weight of the girder? No; I could have done so if at home in England.

307. Did you object to the construction of the girders in the Colony? Yes, I did, on the score of extra cost, and also on the score of the absence of means for testing the quality of the iron.

308. *By Mr. Lawder.*—Can you let us have a copy of the letters in which you made that protest? No, I only objected verbally, as far as I can remember.

309. To whom did you object? To the Minister.

310. *By Mr. Stanley.*—Reverting to the masonry in No. 1 bridge, take the abutments; do you not think you would have saved considerably by adopting the usual system of building voids in those abutments? No, not in such a narrow abutment. I should not have felt justified with walls of a less thickness than four feet, and the amount of the voids would not have been worth saving.

311. What is the width of the abutment? Nine feet throughout inside the piers.

312. I thought it was 14 feet. No, the piers are 14 feet, the abutment 9 feet.

313. Don't you think if you had built the walls with a batter it would have been quite safe to have left a void in the centre? Yes, I suppose it would have been safe, but 1 foot or 18 inches of such masonry is scarcely worth saving in such a work. I should have sacrificed a vast amount of stability for a small saving. Besides, it would have necessitated an arch above the void, which is saved by the present plan.

314. Are such voids not often closed with covers on the top? Yes, they are.

315. Do you not think it necessary to protect the toe of the bank on the New Norfolk side of the No. 2 Bridge against the possible effects of a flood in the Derwent? No, I think not. It is all of stone, and it is protected above the bridge by a rock jutting out, which will cover it.

316. What is the height of the retaining wall now being built at Back River? The drawing will tell; I think about 25 feet.

317. Its thickness without the counterforts is 5 ft. 3 in.? No, it is 4 feet, I think, and 5 ft. 3 in. the counterforts. The whole thickness is nine feet, including the counterforts.

318. Is it built vertically back and front? Yes, back and front.

319. In the case of such a retaining wall, does not the pressure increase from the top of the wall to the foundations? I suppose it is greatest about a third of the way up. It would, of course, increase from the top to the bottom.

320. Is it not usual to design such walls with a battered face? Yes, a battered face is the more common method.

321. As a matter of fact does it not save material? I think it does in many cases.

322. Do you not think you could have saved a good deal of material in this case by adopting that design? No; in this case we were pressed for room for the curve, and advantage was taken of the absence of batter in giving us more room on the top.

323. Can you tell us what the cost per foot of iron was in the piers of the No. 2 bridge,—I mean per foot of height? You mean the amount due to the cases (refers to notes). I think the amount due to the iron cases is £9 17s. 3d. per foot; to the concrete, 30s. per cubic yard, that is, £2 18s. 6d. per foot of height. We pay 30s. per yard for concrete in cylinders.

324. Then taking concrete at 30s. per yard, the price of the iron cases at £9 17s. 3d. per foot would allow of 6½ yards additional concrete to every foot of height. Suppose you had constructed the whole piers of concrete instead of combined concrete and iron, do you not think this additional concrete could have been so placed in the pier as to have made a much stronger and even cheaper pier? I mean, do you not think you could have designed a pier entirely of concrete that would have been stronger than the present pier? It would have made a thicker pier, certainly, but I should not have cared to leave a comparatively green concreted pier exposed to the floods of this river. I would not have risked them unless of great extra thickness, and in that case I should have built them of masonry.

325. How long does concrete take to set? It should have set in a few days, and, of course, it hardens year by year.

326. But how long, according to your usual practice, does it take for concrete to set to take weight? Well, I would not like to put weight on it under a month in such a place.

327. Take the case of concrete culverts: is the time allowed not 48 hours? I should never allow such a short time as that. I would certainly not have any weight on the top of a pier under a month.

328. Don't you think in a river like the Derwent it would be a saving to erect a pier entirely of concrete? I should not have liked to have done it. Had I abandoned iron I should have done it of stone work. I think your comparison is not equal, because the price the Contractor would have demanded to build in concrete only would have been different and higher than when merely thrown down iron cases.

329. Suppose you had adopted cast iron caissons for that part of the piers which is below the water, do you not think it would have been safe? Yes, it would have been safe. And a cheaper pier? Certainly not.

330. Don't misunderstand me—I only mean the caissons to be carried up to the level of the water? The extra cost of cast iron would have been more than you would have saved up above. You must have had a larger pier on the top, and the whole cost would have been materially increased.

331. What is the contract price? £22 per ton.

332. I think you stated this morning that when you first inspected the original retaining wall at Back River you were informed it had been backed up with stone. Yes, I was told that it had been backed with stone; that was the justification offered for this wall.

333. Do you think that if it had been so it would have stood the pressure of the bank? I should have made no difference. I should not have been satisfied.

334. Is it intended to take any measures to protect the toe of the bank at the Plenty Bridge? Yes, it will be pitched.

335. It is well under the influence of the floods? Yes, it is to be pitched.

336. *By Mr. Lawder.*—Did I understand you to say that the estimates submitted to Parliament were made up on the bills of quantities submitted for tender? No, pardon me. When I made that answer I was being questioned about the contract particulars. The reference was this. I think the Commissioner who asked the question wanted to know whether I explained to the Minister or the Government the excesses over the estimates made originally, before the tender was accepted. I said the tenderer's prices were checked on an estimate of mine based on the bills of quantities on which the tender was made.

337. Are the quantities shown in the schedule those made from measurements made in the field or on the plans? The quantities are calculated on the plans.

338. From the plans, not on the field? No, certainly not.

339. Would the Minister in sanctioning the contract, when over and above the vote made by Parliament, do so on your recommendation? Yes, I would be required to make my recommendation on anything which affected the cost of the line.

340. I presume your recommendation would be accompanied by some explanations as to the discrepancies between the estimate and the tenders? Yes, it would be. But a fair comparison cannot be made between a Parliamentary survey, which is only approximate, and an estimate based on detailed quantities.

341. I think I understand you to say that you have a more detailed and accurate survey than the Parliamentary survey? Well, no, that comes long after, when the line is beginning to be constructed.

342. In that case do you accept a tender before you make detailed estimates? No; but the Parliamentary estimate is essentially approximate, and must be so, for the line is never marked out under it.

343. What is the difference between your detailed estimate and the estimate for tenders for the contract? My estimate is made merely for the purpose of checking the tenders, and is based in the same way as for conditions of tender.

344. Does it go to Parliament or the Minister? No, it does not. The Parliamentary estimate goes to the Minister and is submitted by him to Parliament. The Contract estimate is only for one part of the line. It does not deal with the probable price of rails, the amounts to be paid for land compensation, and other items which may vary.

345. But it includes items on which excesses might be made. The difference in the price of rails would not have a serious effect on the total of an estimate? If I am clear, now you speak of the difference of my estimate at the time the tenders are received; my estimate is made for one portion of the work only.

346. I understand you do prepare detailed estimates for your own satisfaction: well, in what respect do you compare with that estimate the tenders received from the various individuals? Generally. That detailed estimate is made long after the Parliament has sanctioned the line.

347. And you do not think it necessary to send that up to the Parliament for its sanction? I am never required to do that. If there is any difference the Minister has always been made acquainted with it. I do not recommend any railway line without acquainting him with the amount of my estimates.

348. Do you make him acquainted with the amount of your estimates before receipt of the tenders? No.

349. Does your estimate then made differ and vary from the original Parliamentary estimate? Yes, it would.

350. In the case of any considerable variation, would you not think it necessary to inform the Minister? No, I have not thought it necessary, because Parliamentary estimates have always been understood as approximate estimates. The two estimates cannot be compared. The quantities would vary, and the lines would run in different places.

351. I understand from you that you first proceed over the country in which it is proposed to carry a line of Railway, and make a flying survey. Of what does this flying survey consist? Generally an examination of the country proposed to be traversed.

352. By your eye or by instruments? By the eye. In doubtful places I would use instruments.

353. Then you merely prospect, in fact? Yes, I merely prospect so as to give general directions for a survey.

354. Then you don't go over the line again to point out your survey to the contractor surveyor, to show him the exact ground or the alignment you have selected on which he is to make his measurements? In some cases I have done this, but not always.

355. Do you go over it after the surveyor has completed his detailed survey and check his calculations, or ascertain whether it could be more economically constructed? I do that, as far as possible, while the line is in course of construction.

356. During the Parliamentary survey? I do that constantly, as far as my duties will allow.

357. What kind of data do you require from the Resident Engineer, in reference to waterways for instance? I require him to mark them in the section the waterways which he deems will be sufficient.

358. By traversing, calculation of areas, or approximation? Chiefly by approximation. I check the data afterwards by knowledge of existing local waterways, bridges over roads, and so on.

359. But how do you estimate that which is required over and above what these waterways require? We allow for any variation.

360. That is left to the Resident Engineer, is it? Yes, but it is submitted to me and checked over in the office.

361. Do you consider the Resident Engineer responsible, or yourself? I consider that, as the head of the Department, I should be responsible for these calculations.

362. Are your specifications drawn out for each important work specially shown on the detailed estimates, or do you give general instructions? For the several descriptions of work I give general instructions.

363. Then in case of a work like the No. 2 Bridge over the Derwent, do you give any particular detailed instructions as to carrying it out? No; the particulars of bridges and culverts are included in the general specification.

364. And do you consider that specification provides amply for such a large and important work? I do, Sir.

365. Were all the exact measurements ascertained, and the cost of each item of the work taken out? I mean was each class of work estimated for with regard to the sum mentioned in your specification? The quantities were taken out for me, and I priced the work.

366. In your office? Yes, in the office. I went through the quantities and priced the work with regard to the specification.

367. Is it part of your duty to estimate the financial prospects of these railways, the probable amount of traffic, cost of working when opened, and so on? No.

368. Do you not, in getting out the surveys, take the grades and curves into consideration, and make a survey of several of the most apparently advantageous alignments at first, by which you may be able to see which is the most economical to adopt, the first cost and the capitalised cost of after operation of each alignment being duly considered? Yes, we make various trial sections of those parts of the country where we think the line should be taken.

369. But do you equate? do you consider the first cost of the line and the capitalised cost of after operation in the case of each alignment, and then do you compare the probable economic results? Yes, I should do that if I had an opportunity of taking several lines. Wherever it was possible for me to take an alternative line, I should consider these matters.

370. Do you do this in regard to all surveys? I should not require to do it in all surveys. It is possible to get a line with easy grades and curves without considering an alternative route.

371. Have you done so hitherto? No, I have generally taken the easiest grades.

372. The easiest or shortest? Well, in the case of the Scottsdale line, the shortest and, I think, the easiest also.

373. Have you any comparative calculations in your possession with which you could favour the Commissioners as to these points? No, not on any of these matters.

374. Do you prepare any report on the lines by which the merits of the proposed alignment may be compared with those of others—any comparative reports for the information of the Minister or Parliament? No, these matters are left to my consideration and decision.

375. That is, practically, you can take the line where you think best? Practically, yes.

376. What was the thickness of the wrought-iron cylinders which you quoted as having seen in the bridge over the Ouse river in England? About three-eighths of an inch.

377. You don't know what the dimensions of these cylinders were? They were 5 feet. They were secured, several of them in a row.

378. What was the span placed between these piers formed of? A good-sized arch each side.

379. Brick arches, I suppose? Yes, brick arches.

380. You don't remember the distance? Yes, about 40 feet.

381. *To Mr. Stanley.*—What was the distance between the caissons? From 4 to 5 feet. They were jack-arches.

382. *By Mr. Lawder.*—Were these arches segmental? Yes; about 120 degrees, I suppose.

383. And what was the height of the piers from the foundations? Possibly 20 feet.

384. What is the weight of the locomotives you propose to run over the bridges on the Derwent Valley line? They will be 22 tons in running order.

385. With their fuel? No; the fuel and water are carried in a tender separate.

386. What is the weight of the tender, then? About 10 tons.

387. That is 32 tons in all. Do you know the length over all? Yes; it is 33 feet.

388. What plan of testing the girders do you adopt,—how do you test them? In the same way as the Board of Trade test girders in England, by running a locomotive over them at different speeds and taking the deflection by level.

389. By a pencil attached to the girder? Yes.

390. What deflection in a sixty-feet girder do you consider sufficient for a standing load? From one quarter to half an inch.

391. Would it not be more than that with an engine running at twenty miles an hour? Yes, it would be.

392. How much more? It would vary much, according to the shape of the girder, whether it was the box shape or the lattice girder. The thrust on the bridge from an engine going at fast speed would increase it, there is no doubt about it.

393. Would it also increase the oscillation on the girders you have adopted? Should you not consider the amount of lateral oscillation in a bridge of that kind? I do not think there should be any, as the road is a loose road.

394. You think a loose road should prevent lateral oscillation? I think it likely.

395. How do you test these girders with a single engine? I should test them with a load of one ton to the running foot. If a running load, I should have three single engines on the bridge at the same time. My calculations would allow for that.

396. *To Mr. Stanley.*—The specification provides for $1\frac{1}{2}$ tons to the running foot at 20 miles an hour? Yes.

397. *To Mr. Landner.*—How do you purpose to apply it? By getting a heavier type of engine, trucks loaded with rails, or in other ways. We can borrow heavy engines from the Main Line Railway for this purpose.

398. Do you not think it would have been advisable to make provision on these lines for heavier engines for your requirements, considering the steep grades? We have enough strength for heavier engines. These bridges are much stiffer and stronger than similar bridges in the other Colonies.

399. But do you mean they would hold a heavier engine, or are they merely strong enough for the rolling stock now proposed? Strong enough for a larger engine. I can allow for three engines being on the bridge at once.

400. How would a forty ton engine and tender affect the bridges? I have to deal with the standard type of engine used here; the engines on all our lines are of that type.

401. Would it not have been better to provide for the future by constructing the work for heavier engines? If in the far future it should be necessary to use heavier engines, it will be easy to strengthen these girders.

402. Would you not find that difficult to do and keep up a running line. I think it might be done.

403. Is it not customary for you, as Chief Engineer, to supervise and approve of the quality and class of work to suit a particular locality taking into consideration the nature of the ground, or do you leave that to the Resident Engineer? No; I select generally the style of work required for each particular Railway.

404. I mean the style of work suited to each locality; for instance, such work as that at Back River. Do you approve of the style of work and the quality? Yes, I agree to it.

405. But you did not agree to it in the case of the Back River wall? I approve of the present work. The former work I never should have approved of.

406. Has the road bridge over Back River easily fulfilled the conditions required of it?—Has the water ever been up to the floor by the flooding of the Derwent? I can't say if the water has ever been over the roadway itself, but it must have been nearly up to it.

407. And what is the difference in level between your formation and the road over the road bridge? Judging by the eye I should think they were nearly on a level.

408. Do you intend to take down the injured road bridge? No, I understand it will be repaired shortly.

409. You anticipate no injury to the Railway works should the road bridge fall into the channel? I don't think there is much to fear; we have considerably strengthened it by the building of the Railway bridge.

410. Would it not injure the Railway culvert? It might be blocked up, but I do not anticipate such a thing is likely to happen.

411. Has any request been made to the road authorities to remove the bridge? No, that road is under the Department now. It is under the charge of the Engineer of Roads. Had funds been available the bridge would have been repaired before this. It is intended to repair it shortly.

412. You do intend to repair the bridge? Yes, as soon as we have funds. Attention has been called to it.

413. Do you propose to adopt any protective measures to secure the toe of the slope at the south-eastern corner of No. 1 bridge over the Derwent. Mr. Stanley asked you, but you said it was protected by an arm of rock? You mean on the New Norfolk side?

414. Yes, on the New Norfolk side? The whole of the embankment is formed of rock from the adjoining cutting. On the other side is a point of rock jutting out into the river; it is therefore protected, and I do not think there is any danger from the backwash, as the embankment is of stone.

415. Could you not easily have eliminated the curves in the approaches to No. 1 bridge? I think not.

416. Not by cutting through the high ground on this side? Yes, at an extra cost, no doubt, I could have done so.

417. Do you not think the cost would have been justified by the extra safety? No, I think not, seeing that our engines are constructed and fitted to go round curves of 5 chains radius at fast speeds.

418. Are the local residents consulted in any way as to the stations, and where they would like to have them built? No, the stations are fixed by myself, and afterwards submitted to the Minister. Attention would always be paid to the representations of the local residents.

419. Are they in any way invited to express an opinion? No, but they generally do that freely enough if they do not approve of the site.

420. Have you adopted any particular type of station-yard and buildings thereon? I have adopted a type of station buildings now, and I have pretty well considered a type of yard, but it is not fixed as yet.

421. Then each station and yards may vary in detail? Yes; it is difficult to fix on a type of yard, because sometimes the necessary goods-sheds may be required on one side and sometimes on the other.

422. At the road diversion at the Derbyshire Rocks there is only a width of from 9 to 10 feet left from the end of the sleepers to the edge of the bank: how is the traffic to be arranged? We shall separate the railway by fencing off the road, and then they will have a greater width of road than they had before. At one part of that diversion the railway and road will be common.

423. Well, where it will be common,—I suppose you mean immediately under the cliff, that is, at 9 miles 78 chains,—how do you propose to regulate the traffic? By means of a gate in charge of a gate-keeper, who will not allow any traffic on the road for a short time before the arrival of the trains. The traffic is really so limited that no public inconvenience can result.

424. What is your stated width for these, taking your measurement from the line of railway? I think 14 feet, that is, 7 feet from the centre of the line: that is the distance I have fixed for the gates.

425. A clearance of 14 feet? Yes, a 14 feet clearance.

426. And all signals are erected with a due regard to that? Yes, I think so.

427. In the case of water columns and semaphores, do you keep to the same rule? I always allow a liberal distance for that. We have no semaphores on our lines, only warning posts at the cattle guards.

428. No semaphores at all? No, only at junctions. They have been adopted on the Mersey line, but it is contrary to my orders.

429. Then the distance allowed is sufficient for all purposes, and allows for opening the doors of carriages? Oh, it more than allows for that.

430. How often do you visit your railway lines annually when under construction? I suppose about three or four times yearly.

431. Do you then go over the whole of the works constructed? Yes, as a rule.

432. After you ordered the substitution of the larger waterways for pipe drains on the Derwent Valley Line, on what data or calculations were your decisions then based? I merely wanted to have enough waterway, or more than enough where possible.

433. But from what data did you arrive at your conclusions? Well, I fixed it without reference to any calculations, because I knew it would just be as cheap to put in a 10-foot span as a 6-foot span.

434. But what calculations did you arrive at in regard to the masonry wall at Back River? The drawings made by the Resident Engineer were submitted for my approval, and I approved of them.

435. You made no calculations? No. I saw they were quite sufficient at once.

436. What description of foundations had you? The drawings will show you. The whole is carried down to the solid rock.

437. Hard rock or soft? A soft rock on the river side.

438. Why was concrete backing required? So as to give extra weight and strength combined with economy.

439. You did not consider the wall strong enough without the concrete? If the concrete had been omitted the masonry would have been thicker. It is a common mode of construction to back up a wall with concrete between the counterforts.

440. In considering your decision in reference to No. 2 bridge, did you consider the question of lateral stiffness in those high piers, 45 feet high, I think? Yes, I did.

441. You will observe the width is an eleventh, or less than an eleventh, of the height? Yes, an eleventh of the height.

442. And you consider they would be stiff enough under a vibratory load at an eleventh of the height? I am confident they will, with the wrought iron cases round them.

The Commission adjourned at 4-15 o'clock until 10 o'clock on the following day.



TUESDAY, MARCH 2, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

Mr. THOS. C. JUST, Secretary.

Mr. FINCHAM'S examination continued.

443. *By Mr. Lawder.*—What is the size of the timber or trees likely to be carried down the Derwent between bridges Nos. 1, 2, and 3, giving length and thickness? I have never seen any trees come down the river there, and I do not think I could give you any information as to the size of the trees that are likely to come down the river.

444. Have you ever made any enquiries as to the size of the trees which might come down? No; but I know the country all the way up to the Ouse, and there are no trees there that would be likely to come down and cause any block.

445. Have you never seen any trees of any size carried down? No; I made enquiries from people in the district as to the sufficiency of the width of span for timber likely to come down.

446. With reference to trees? Yes.

447. With branches standing? With reference generally to trees that might come down the river; and the opinion of people who had resided in the district for years was that the spans were ample.

448. How do you account for the presence of such bad mortar as we observed in the culvert at 4 miles 34 chains, on our inspection the other day? I think it is partly due to the sand.

449. But this mortar had neither cohesive nor adhesive properties,—it was friable, and absolutely worthless as mortar? That had been pointed out to the Contractors by the Resident Engineer and myself.

450. In such a case do you not usually condemn inferior work of this kind? We have done so, and Mr. Sheard, the Resident Engineer, has required, in some cases, the culverts to be taken down and rebuilt.

451. Was that the case with regard to this three-foot culvert? The present Resident Engineer and myself examined the whole of the line as far as it had been constructed soon after we took charge.

452. But with regard to this particular culvert, what would you consider necessary to be done? I should consider it necessary to rebuild it where the mortar was bad.

453. Would you take it down as far as the mortar was found to be bad and replace the superstructure? Yes.

454. Even to the foundation? As far as I found the work bad.

455. I do not observe anything laid down in the specifications as to wetting stones on their being built into the masonry: do you not consider that necessary? In very hot weather I consider it necessary.

456. Do you not consider it necessary at other times when dry stone is being used, particularly sandstone? I think it depends upon the season during which the building is going on.

457. Allowing the sandstone used to have the same absorbing power as brick, would you consider it necessary to wet it? I should prefer to wet it.

458. Would you consider it absolutely necessary to wet bricks? I should prefer to wet them, and stone too.

459. There is no stipulation to that effect? No; details of that kind we leave to the practical judgment of the Inspectors.

460. In this case, as far as we observed, there is no trace of the stone having been wetted, and the sandstone was very soft? It is good hard sandstone.

461. It was also of a very absorbent nature? Not more, I think, than any ordinary sandstone would be.

462. Do you not consider it necessary to have stops in the side cuttings which would prevent the rush of water you fear in the cuttings on either side of the Plenty? I object to the side cuttings altogether there. They were done without instructions.

463. Do you not consider it necessary to specify that stops should always be left in side cuttings in any position? Not unless there is a run of water.

464. With a view of guarding against a run of water in unexpected situations, do you not consider it would be advisable to have such a stipulation? In every case that I am aware of where a run of water is anticipated I have ordered stops to be made.

465. There is no mention whatever of it in your specifications? As a rule we prefer not to make side cuttings where there is any chance of a run of water.

466. Then it is dependent entirely upon the inspecting officer's discretion? The contractor is not allowed to make side cuttings except where pointed out, and the Resident Engineer takes the responsibility of ordering it in a dangerous place.

467. It is left to the responsibility of the Resident Engineer? Certainly.

468. Regarding No. 7 pier of No. 1 bridge, did the Contractor protest against his responsibility for the stability of the work after the examination was made as stated by you? There was a general protest as to

the stability of the work before this occurrence took place,—a general protest that followed my repeated refusals to allow extra claims in connection with the bridge.

469. Not after? No, not after. I refer to a general protest made in writing.

470. Can you give me dates for that? I can supply them.

471. Did any one pass the founds for the Back River wall before it was built? I cannot say whether the first Resident Engineer passed them or not. I presume that he did, because he paid for the work that was done there.

472. Did you not make any enquiry at the time as to the depth the wall was to be carried? I had no reason at that time to doubt its sufficiency.

473. Do you consider sand a better bottom ballast than slate or broken stone of a slaty nature? Yes; slate and clay-slates would soon crush to powder and mud.

474. Have you signed the revised plans for Nos. 2 and 3 bridges? No; but I sent them to the Resident Engineer with instructions to forward them to the Contractor.

475. Do not plans of such importance as these usually bear your signature? We have no rule to that effect. The plans are signed by me in the contract book, and I consider that is sufficient. I do not sign every drawing that comes out afterwards.

476. If you make an alteration in plans, is it not customary to initial the alteration, and, in the case of a drawing, to sign the drawing, in order to authenticate it? I should do so if required.

477. You have no objection to sign, then? None whatever.

478. *By Mr. Stanley.*—Is it customary to send plans out of your office without your signature being attached? Yes. In plans sent from the Architectural Branch or the Roads Branch, we invariably require the draftsman making the plans to initial them that I may be able to refer to the right man in the event of any error having occurred in the plans, but I do not sign them myself.

479. Do you not think, as Engineer-in-Chief, that it would be better if they bore your signature, so as to authenticate them? I should have no objection to doing so.

480. *By Mr. Lawder.*—You stated that your engines are capable of going round curves of small radii, but have you considered the danger of sharp curves in the approaches to large bridges such as these in the event of any small obstacle being placed on the outer rail, or if the requisite super-elevation of the outer rail is not maintained? That is a contingency that may occur at any place.

481. But in such a dangerous situation is it not most desirable to have a margin of safety? I consider that with the speed at which the trains will probably be run on these lines, and the description of road used, there is ample margin of safety already allowed.

482. I am talking about any depression in the outer rail on a sharp curve? With a train going at high speed that might cause an accident.

483. Do you not think it would be wiser in such dangerous situations, where an accident might cause the death of a large number of passengers, to have straight approaches to a bridge, and gradients as level as possible? If I could ignore excessive cost I should certainly do so, but I do not consider there is any special danger attaching to the curves in question. The bridges would naturally always be approached carefully by the engine-driver.

484. But you cannot always be certain of the carefulness of the engine driver. Looking at it from a financial point of view, do you not consider the result of any serious accident would cause far greater loss to the Government, in the shape of damages, than the extra cost of making a straight approach in a cutting? It is quite possible that the compensation awarded in consequence of an accident of a serious character might more than make up the cost of straight approaches.

485. Would it not, then, be better to secure those straight approaches in the first instance, and so avoid the danger and the resultant extra expense? I do not consider there is any exceptional danger here. Now there are plenty of examples of bridges being approached by equally sharp curves in the other Colonies, and in England and America.

486. What are the corrected grades of the approach to Nos. 1, 2, and 3 bridges as now adopted? I have arranged for the details to be supplied to the Commissioners.

487. Do you consider a loose ballast road over large bridges preferable to a fixed timber road? I do.

488. Is it not liable to shift, particularly from the effect of sharp curves in the passing of trains? No; in all such cases broken metal ballast, as bottom ballast, is better.

489. Do you consider that any metal, however good, will prevent the tendency of rails and sleepers to shift at curves under a heavy load? Yes.

490. Then you consider that having good ballast will prevent any lateral shifting of the rails and sleepers? I consider there is far less danger in that direction with ballast, than there would be from the warping caused by the shrinking and twisting of our timber; the effect of that I have observed in many cases.

491. The timber in this Colony does not seem to me to be worse—indeed, I think it is considerably better—than the timber found in many other countries. Allowing it to be well seasoned, do you consider that there would be any objection to adopting it? I consider a loose road infinitely preferable, and it is now being adopted gradually on the Main Line Railway.

492. Will you be good enough to hand the Commissioners the estimate you have prepared, in which you have taken out your quantities, and your detailed report on the cost of the Derwent Valley Railway? There was a Parliamentary estimate first of all, which the Commissioners have.

493. I am alluding to the estimate which you referred to yesterday, with reference to quantities? That was done simply to check the tenders, so that I should be in a position to deal with them.

494. Have you made any separate calculations for any of the large works on the line? A general bill of quantities was made for the whole of the work that we estimated to be required for the railways.

495. How did you get out your estimate for, say, the ironwork for No. 1 bridge? That was got out for me so that the Government might be in a position to get the work done either in the Colony or in England.

496. By whom was that information made out? By the contractor for the railway office work generally, Mr. Edwards.

497. Then the estimate you have prepared was based partly on the estimates submitted to you by Mr. Mault and Mr. Edwards? No, distinctly not. It was made from the signed contract drawings which have been submitted to the Commissioners.

498. I thought I understood you to say yesterday that Mr. Mault prepared the contract survey and estimate? No; he prepared the quantities for the Parliamentary estimate.

499. Did he not prepare the contract survey and estimate? Mr. Mault prepared the contract survey, and then the work was plotted and the type drawings were made. The quantities were taken out by Mr. Edwards.

500. For the whole line? For the whole line. Those quantities were submitted to tenderers, and my estimate was merely a check upon the prices at which the tenders might come in.

501. Are the quantities entered on the schedule attached to the contract those got out by Mr. Edwards? Distinctly so. He was employed, at a percentage, to do the whole of the office work, including plotting, preparation of plans, and taking out quantities.

502. Did you check these quantities in any way? No; it was not possible for me to check the quantities of three or four lines in detail personally.

503. Do you not consider yourself responsible for those quantities? I must take the responsibility indirectly.

504. You are responsible to Parliament, I presume? I am responsible to the Government.

505. Have you any fixed maxima or minima dimensions for station-yards and structures therein, having regard to limits of safety?—I refer to engine sheds, width of openings, distance between centre of lines of rails, crossings, safe heights of openings for the passage of trains, and matters of that kind? Yes, we have standards for all those things. The width between the roads in station-yards, whenever practicable, I make 10 ft., the height of platform 2ft. 3 in. above the rails, bringing the platform on a level with the upper step of the carriages. The crossings vary on the straight, and have nothing worse than 1 in 8, but on curves, of course, come as sharp as 1 in 5 and 1 in 6 occasionally.

506. What is the distance between the nearest edge of the carriage and engine steps and the outer edge of the platform? Six inches.

507. Can you give me all these dimensions if I give you a list, to save time? I can get it prepared for you.

508. With reference to surveys, do you not consider it your duty to satisfy yourself that surveys, plans, and estimates are accurately prepared by the engineer employed to carry them out by contract before he has received final payment? In the one case that the question refers to, I trusted to the competency of the engineer.

509. Have you provided, and do you not think it necessary to provide, any other penalty than suspension of certificate in cases where the specifications or your directions are repeatedly ignored or disobeyed by the contractor? I think the total suspension of the certificate is a sufficient punishment.

510. I speak of repeated and persistent disobedience of orders, or ignoring the specifications? In that case the contract provides for the immediate dismissal of the officer offending, and I have lately put in force that portion of the contract.

511. I speak of a contractor? In that case the difficulty would be met by the suspension of his certificate, rather than involve the Government in the cost of possible litigation from the cancelling of his contract.

512. You consider that the cancelling of his contract would be more to the disadvantage of the Government than faulty construction and neglect of specifications? No; but it would be a serious step, that I should hesitate in taking.

513. In your contract there is no clause to that effect, as far as I can observe? We have it in our other similar contracts, and I supposed it was included in this. Clause 33 would meet it.

514. That clause does not refer to cases of repeated disobedience? The case would be fully met by the suspension of the certificate. It is equivalent to cancelling the contract if you stop the supplies.

515. In the case of No. 2 bridge, in which the piers are of some height, have you considered any alternative design with larger openings, with a view to avoid expense? Yes, and I am quite satisfied that the present design is efficient, and the most economical that could have been prepared.

516. More economical than a larger span without any expensive water foundations? Yes.

517. Would you be good enough to draw up for the Commissioners, at your earliest convenience, a report on the system upon which the expenditure on railway works is estimated, and the method of accounting therefor? I will.

518. I should be glad if you would also show in the statement, how, if plans of works are altered by you or by the Resident Engineer during the progress of the line, the expenditure therein is checked against the estimates? I will.

519. Does the power to sanction any extra expenditure involved in such alterations rest with you, and if so, within what limits, if any? It rests with me entirely, within the limits of the general contract.

520. I am speaking of excesses over estimates? It rests with me.

521. Up to what limits? Except in the case of some exceptionally large expenditure, I should order the alterations on my own responsibility.

522. Can you not fix the limit beyond which you consider your responsibility would not go? An alteration costing several thousand pounds I should consider one which it would be necessary for me to refer to the Minister.

523. *By Mr. Stanley.*—Has the culvert to which Mr. Lawder referred been condemned on account of faulty mortar or any other cause? I should have to refer to the list of condemned work prepared by the Resident Engineer, but we have been over the whole line.

524. Perhaps you will furnish that information? I will do so.

525. With regard to the use of sand for bottom ballast, are you of opinion that it affords as good drainage to the road-bed as broken stone? If clean, yes.

526. You might furnish the Commissioners with the probable cost at schedule rates of the three spans as designed for No. 2 bridge, as compared with the cost of one span on masonry piers? I can do so.

527. I understood you to say to Mr. Lawder that you had been guided by economical considerations in adopting the three-span design instead of one span across the river? I was guided primarily by the least opening that would suffice for the passage of timber coming down the river, and in connection with that I also considered the cost of a larger span. We fixed upon a span of 128 feet from the two openings. The extra work required for the middle pier, if done away with, would necessarily have to be added to the two end piers to support the large span. The cost of girders would be more than double, and the piers would require to be of a greater width.

528. Did you make any estimate of the probable difference of cost between a bridge of one large span across the river, and one of three spans? I made rough calculations at the time.

529. You made no actual estimate as to the difference of the cost? I made rough calculations when I had to approve or otherwise of the plans.

530. I will ask you to furnish the probable cost of the three central span including the two piers for the No. 2 bridge. The span may be put down at £700 and the piers at about £260 each.

531. *By Mr. Lawder.*—That is for iron piers? Yes; they cost £12 15s. 9d. per foot of depth, including the concrete.

532. But if the piers are 45 feet deep, that, at £13 a foot, would be £585? I will furnish the exact figures.

533. *By Mr. Stanley.*—The Commissioners have had certain Parliamentary papers laid before them, from which we find that you supplied an estimate of the Derwent Valley Railway in December, 1883, amounting to £140,000. That, I understand, was based upon the original Parliamentary survey? It was.

534. In another Paper, No. 126, of date 21st September, 1885, you gave an estimate of the total final cost of that railway at from £155,000 to £160,000. We have been informed that this second estimate was based upon quantities after the permanent survey had been made. Is that so? It was based on quantities supplied to me by the present Resident Engineer immediately preceding the date of the report.

535. Was that after the contract had been let? Yes; during the progress of the work.

536. I presume that estimate was based upon actual quantities? Yes; for that for which payment had been made, and as closely as possible for the work still remaining to be done.

537. It was not, then, based on the contract? Yes, as far as we could, but it also included several other elements which may be termed uncertain, such as cost of land, accommodation works, and so on.

538. Can you state whether this estimate is likely to be exceeded or not? My estimate of total liabilities up to the 28th February is about £164,000.

539. Does that include the amount which the Department will probably have to pay the Contractor in final settlement of his contract, as well as provision for rails, stations, sleepers, and other materials? Yes, it includes the entire cost of the work, including supervision, clerical assistance, and so on.

540. *By Mr. Lawder.*—Does your estimate for the Derwent Valley Line include supervision exclusively spent upon it, and also a percentage of the cost of the establishment employed for railway work generally? Almost the whole of it is for supervision exclusively spent upon the line. Only a very small percentage is charged to railway works generally.

541. *By Mr. Stanley.*—What amount is included in your estimate for compensation for land resumed? £4663 for compensation for land, exclusive of accommodation works.

542. Are those accommodation works provided for in the contract amount? No, they are not.

543. What provision have you made for them? They are provided for by the schedule of rates in the contract. They cannot be fixed until some time after the contract plans have been prepared.

544. In your estimate of the probable ultimate cost of the line, have you made any provision to meet the expenditure on such works? Yes, in the estimate of £164,000.

545. What amount is put down to expenditure on rolling stock in that estimate? £6697 for locomotives, and £8500 for carriages and waggons.

546. Comparing the amounts which you have just given us with your first Parliamentary estimate, it would appear that the charges for land compensation are considerably within that estimate? Yes.

547. And that of the rolling stock will probably be exceeded by about £1000? Probably.

548. In preparing your estimate for rolling stock, upon what data did you do so? Distinctly upon information from the Traffic Department as to its requirements.

549. Can you furnish the particulars you received from the Traffic Manager to guide you in this estimate? I believe I can.

550. Is the provision made by you in your preliminary estimate for stations and sidings likely to be exceeded in the actual cost? I do not think so.

551. In such instances as the Derwent Valley Railway, where the ultimate cost of the line will probably exceed the original estimate, do you obtain the authority of the Minister for the increased expenditure after explaining to him the causes thereof? No special authority is obtained.

552. Then the increased expenditure is incurred on your own responsibility as Engineer-in-Chief? To a great extent it is.

553. Has that been the usual practice in the Department? Yes, during the short time that the Department has been constructing railways.

554. I wish to ask you a question or two with respect to the proposed new railway bridge over the Derwent at Bridgewater. I think I understood you to say that the present railway bridge is in an unsound condition? The railway bridge is in a sound condition; the road bridge is in an unsound condition. I have gone over the bridge during the last month in detail, and it is in better condition now than it has ever been.

555. Is the substructure sound? Yes; I have tested the piles throughout from time to time. The abutment on the South Bridgewater side sank slightly some years ago, owing to the nature of the ground upon which it was built, but, although I have closely watched this particular part of the bridge, I see no special danger from it.

556. Then the bridge is likely to be in a serviceable condition for some years to come? Possibly for another ten or twelve years, or longer if it had been built of properly selected timber.

557. Have you made any estimate of the probable cost of a combined road and railway bridge over the Derwent at that place? The estimate was made by the Engineer of Roads, and the amount was about £24,000.

558. Can you say how much that estimate was increased by provision being made for the railway as well as the road—in fact, how much of that amount is due to the railway bridge? I am unable to tell without calculation what the extra amount due to the railway would be.

559. Can you give any idea of it? Not without calculation; but my proposal was, that as the work was required for joint purposes the cost should be practically equally divided.

560. On that basis you would charge £12,000 to the railway? Yes, and the rest to the road.

561. Do you think it is a desirable thing to have a railway and a road crossing a bridge together? I see no objection to it. It has been done on a large scale in other places. I believe the great bridge over the Murray has both a road and a rail over it.

562. Is the traffic across the bridge considerable? There is not so much traffic since the Main Line Railway has been opened, and the number of trains on the Derwent Valley Railway would probably be very limited for some time to come.

563. Then you do not think it is likely to cause accidents to the road traffic? The bridge would be put in charge of gatekeepers at each end. I do not think there would be any danger of accident.

564. Am I to understand that it was your intention only to allow the bridge to be used for road purposes when not required for railway purposes? Yes, within such time as might be fixed upon by the traffic department. On trains being due, the bridge would be closed.

565. Then you have not provided sufficient width for road traffic in addition to that required for the railway? No.

566. You utilise the space required by the Railway for road traffic? Yes, as is the case of the Murray bridge.

567. Do you not think that instead of incurring this large outlay for a new bridge for Railway purposes it would be better to make some arrangement with the Main Line Company to use the existing bridge? I think for many reasons it would be advisable to have an independent bridge. The tollage likely to be asked by the Main Line Company for the use of the bridge at Bridgewater would be very high. Certain correspondence I believe has already passed between the Manager of the Main Line Company and either the Minister or the late Manager of the Government railways with regard to the charge for this bridge. But, independently of the question of cost, I think the separate bridge is a great advantage. The new bridge, if erected as laid out, will be so erected as to enable the Main Line Company, in the event of any failure or important repairs being required to their bridge, to use the Government bridge, and *vice versa*.

568. Can you state what the probable amount of toll required by the Main Line Company would be for using their bridge? I cannot; but, as far as my memory serves, Mr. Grant claimed an amount equal to the value of three or four miles of road.

569. What would that be? I could not say, without the correspondence.

570. Can you ascertain for the Commissioners what it would probably amount to on that basis? I will do so, but I should strongly advocate the erection of a separate bridge.

571. *By Mr Lawder.*—What are your steepest grades on the Derwent Valley Line? I do not think here is anything steeper than 1 in 50.

572. There are several of them, I notice? Yes, for short distances, to save cost.

573. That is to say, it is a "give and take" line, a line that rises and falls? It is generally a fairly level road, with gradients of 1 in 50 to 1 in 66, to save cost. I do not think 1 in 66 is too steep a grade for this country.

574. Have you calculated what the nature of the haulage power of each of your engines on these grades would be? I have not gone into that calculation, but I have consulted with the Locomotive Superintendent, and supplied him with copies of the contract plans and diagrams of the gradients, so that he can judge for himself as to the line he has to work over.

575. Do you remember what is the resistance on the level to an engine, going at the rate of 20 miles an hour, in pounds per ton? I cannot carry all those things in my head. All matters connected with locomotives are left entirely with the locomotive superintendent.

576. I am speaking about the effect of gradients upon locomotives. A locomotive may be made so as to go round sharp curves, but the resistance of gravity is the same. Are you aware that a grade of 24 feet in the mile will double that resistance? I dare say it would. I am quite aware that the resistance is increased.

577. Your grade is 1 in 50 in places? For very short distances. But I do not consider that too great on the Derwent Valley Line. Our ruling grade is 1 in 40, and there is a grade of 1 in 50 on the Mersey Railway for six miles on end. An occasional grade of 1 in 50 is of no moment on an ordinarily level line.

578. Do you not consider those steep grades for long distances are very detrimental, and that it would be more economical if, by judicious expenditure, you could, at the outset, obtain more level grades within certain limits? Not for such short distances.

579. But some of your grades on the Derwent Valley line of 1 in 50 are half a mile or upwards in length? I can tell by reference to the plans; not from memory.

580. Is not that a serious length to be surmounted by a heavy train? I do not think so.

581. You are, of course, aware that the resistance of a train on a curve increases in an inverse ratio to the radius of the curve. From calculations made out by competent and accepted authorities, the resistance on a curve of 575 feet radius is exactly double what it is on the straight; therefore it is advisable to get rid of sharp curves? It is impossible to avoid them in this country without enormous expense.

582. Do you not consider that a moderate expenditure in this direction would be more than compensated for by the saving in cost of working the line afterwards and the probable profits to be derived therefrom? I do not think the probable profits for many a year to come would justify the enormous expense that would be involved in eliminating the sharp curves from our lines.

583. Practically, then, you consider the extra expenditure in working, capitalised at the current rate of interest, would not be sufficient to make the extra excavations or other works requisite to give you more easy grades and curves? I do not think it at all likely. In our rough country there would be more than excavation required; there would be repeated heavy tunnels and viaducts.

584. What rate of interest does the Colony pay for money obtained for railways? Four per cent., I believe.

585. With reference to your reply to Mr. Stanley about a common road and railway bridge, would you consider it necessary, in the event of such a bridge being constructed, to have any special signalling arrangements to protect it? Yes, especially for the swing bridge; I should recommend the semaphore arrangements.

586. What precautions do you consider necessary to be taken in the way of signals? I should consider an up-and-down signal necessary, and a gatekeeper or caretaker at either end.

587. What do you mean by an "up and down" signal? A signal at each end of the bridge, to be used before the train passes up or down.

588. Immediately at the end of the bridge? No; the one at South Bridgewater, 20 or 25 chains from the crossing. On the north side so great a distance would not be necessary, as the signal would be more readily seen. A distance of 200 yards would be enough, on that side would be more than enough.

589. From whom, and by whom, would these signals be worked? They would be worked by the gatekeepers in charge.

590. How would they be aware of the approach of trains, say, on a foggy night? Both by time and whistle. It would also be easy to put them in electric communication with the nearest station.

591. Are there any provisions in the Main Line Company's contract giving the Government running powers over their line and bridge should it become desirable? I could not say without reference. There is a provision in the Act for the construction of the Derwent Valley and Fingal railways for certain running powers over the Main Line, but I do not know of anything in the Main Line contract to that effect.

592. *By Mr. Stanley.*—I understood you to say, Mr. Fincham, that with regard to the failure of the retaining wall at Back River, and the insufficiency of the waterways on the first part of the line, you considered Mr. Mault, as resident engineer, was chiefly responsible? Primarily responsible. He was on the ground for weeks and months, and had ample opportunity of examining every watershed.

593. Was he furnished with a copy of those "Instructions to the Resident Engineer," which you handed to the Commissioners yesterday? He had a copy of those instructions.

594. I notice from instruction No. 5, that no deviation is allowed from the contract terms without authority in writing from the Engineer-in-Chief. Did Mr. Mault make those alterations without referring to you for authority? As I said yesterday, he asked my authority to alter the brick culvert at 15 chains to a pile culvert, on account of the absence of bottom; but, speaking generally, he acted without reference to me. In the case of the Back River wall I was surprised when I saw it, as, according to the cross sections supplied by Mr. Mault, I did not expect a wall at all would be required there. Had I known that

a wall would have been required, I should have taken more care to see that some check was put upon his work.

595. In the 8th clause of these instructions I notice that it is part of the duty of the resident engineer, previous to the commencement of the works, or as soon afterwards as practicable, carefully to examine the general features of the country and the watercourses by which it is intersected, and to submit to the Engineer-in-Chief a report on the drainage of the section of the line about to be proceeded with. Did Mr. Mault, as resident engineer, make any such report to you? No.

596. Did you not call upon him to furnish such a report in accordance with No. 1 clause? I did not.

597. In fact, he acted contrary to your general instructions? He acted largely on his own responsibility in the matter of the alterations he made.

598. *By the Chairman.*—With reference to the powers transferred from yourself to the officers under your charge, if you look at clause 1, folio 4, clause 22, folio 9, and clause 39, folio 18, you will see that unless the Engineer-in-Chief confirms in writing any alteration that varies from the contract, such alterations are not valid? No, those are provisions more for the protection of the contractor, and he has not required it until lately. He has only asked it in the case of the order for the increased waterway between Bridgewater and New Norfolk, and in the case of the No. 2 bridge.

599. But would it not be advisable—in the event of any accident happening to you, for instance—that they should receive your confirmation? Certainly, and my sanction is now given to Mr. Sheard, the present resident engineer, for all alterations that are made. I do the same with regard to the Fingal and Scottsdale lines.

600. With reference to the breaches of contract, provision I see is made in clause 12, folio 6, clause 13, folio 7, clause 14, folio 7, and clause 22, folio 14. Do you not think, considering the competent powers that those clauses give you, that you have power to deal with a contractor for breach of contract? Yes, but before exercising that power I think I should ask permission to consult the Crown law officers.

601. I am only speaking in a general way—do you not think those clauses give you that power? I think that combined they would give me sufficient power.

602. There is one other matter with reference to waterways. When we were at New Norfolk the other day we noticed a bridge spanning the Derwent at New Norfolk. Can you tell the Commissioners what length of time that has been built? Five years, I believe.

603. Is that bridge a larger bridge than the one that previously existed there? It is of precisely the same span.

604. What is the amount of the total waterway provided by that bridge? 600 feet, I believe. It was built under my supervision.

605. How long did the previous bridge stand? It stood for about 40 years, with the same number of spans.

606. Has the bridge ever been overflowed by the Derwent? Never.

607. Then that would give the Commissioners a tolerably reliable estimate of the rise and fall of the waters of the Derwent? At that place. Other tributaries enter the Derwent below the bridge and swell the volume of water. I should be better satisfied to take the height of flood waters as defined by marks that have been ascertained on the banks.

608. Have you any idea how your bridges compare with the one at New Norfolk? I think No. 1 bridge must be of very nearly the same extent.

AFTERNOON SITTING.

Present—All the Members and the Secretary.

GEORGE HAY EDWARDS, *Esq.*, called in and examined.

609. *By the Chairman.*—What is your name? George Hay Edwards.

610. What is your occupation? Civil Engineer.

611. What experience have you had in the construction of iron bridges and girders? Twenty-four years' experience.

612. Has your experience been obtained in England or the Colonies, or both? In both.

613. Would you, for the information of the Commissioners, mention any bridges in the construction of which you were actually engaged? The most important bridge whose construction I have been engaged upon in the Colonies was the Echuca bridge. That was for the Victorian Government. I made the designs, and afterwards superintended the work.

614. That is the bridge which connects the Deniliquin line with the Sandhurst and Echuca Railway? Yes.

615. Have you ever built any bridges of a somewhat similar character to those proposed to be erected on the Derwent Valley Line? Yes, but I have never used wrought iron caisson piers.

616. Have you been engaged in the preparation of plans for bridges, and so on, in the different railways here? I was engaged by the Government about two years ago to prepare all the contract documents for the Fingal and Scottsdale lines. The Engineer-in-Chief represented to me when I first came over that he could not give me the Derwent Valley line, because he had already made arrangements for that with Mr. Mault.

617. That is, the former Resident Engineer? Yes, he was then, I believe; I cannot give the exact date. About that time we were very busy, working from 12 to 16 hours a day on the Fingal and Scottsdale lines, and Mr. Fincham instructed me then to put Mr. Mault's into shape for lithographing; and he asked

me to put in the earthworks, the retaining walls, the fencing, gates, bridges, and culverts; but we were very much hurried through the pressure of work. There was very little time to give for the work on the Derwent Valley line,—we were probably not a fortnight or three weeks.

618. Will you state what plans for bridges on the Derwent Valley line were prepared by you alone, and what bridges were modified from the designs of Mr. Mault? The only bridge that I have been connected with on the Derwent Valley line was the No. 2 bridge. I did not modify Mr. Mault's plans.

619. Are you aware who made the plans for Nos. 1 and 3 bridges on the Derwent Valley line? Working drawings for No. 1 bridge were probably made in the field, unless it was built from a very small diagram shown in the contract book.

620. What work, then, were you instructed to do? The Engineer-in-Chief instructed me to have the plans lithographed, to accord with the other contracts. The plans were on continuous sheets of paper, and we had to put them into shape. They were all lithographed in my own office. We had to arrange them in sheets, to suit all the other lines. It was merely mechanical work.

621. That was what you had to do? I was requested by the Engineer-in-Chief to take Mr. Mault's plans of the line, and have them lithographed to accord with the other contracts—the Fingal and the Scottsdale contracts, I mean. This I did. It was merely mechanical work, as I have said. The sections were all graded, and the size of culverts given. I had nothing to do with the original plans. The Engineer-in-Chief asked me to make out detailed drawings,—for these I am responsible. We had very little time to prepare them, as we were rushed at the time with other contracts, and had to get them out expeditiously. The principal part was the iron-work, and we had a fortnight or three weeks in which to do that. There were four kinds of piers given—cast-iron piers, wrought-iron piers, cast-iron cylinders, and masonry or concrete piers. Virtually there were five different designs.

622. Which was adopted? The wrought-iron piers, for Nos. 2 and 3 bridges.

623. By whom? By the Engineer-in-Chief, I believe.

624. You only carried out the detailed drawings of No. 2 bridge? Only the detailed drawings of No. 2 bridge. There was no drawing given for this work, except a diagram to show the length and height of the bridge.

625. Did you, in revising Mr. Mault's drawings, make any extensive alterations, or did you carry out his original plans? Are you speaking of the bridges?

626. Yes, the bridges? Mr. Mault made no designs for the bridge, I believe.

627. I think you said he designed No. 1 or No. 3 bridge? I don't know whether they were working drawings for No. 1 bridge, prepared by Mr. Mault or Mr. Sheard.

628. Then you had nothing to do with either No. 1 bridge or with No. 3 bridge? I began to make drawings of No. 3 bridge, but my health becoming very bad, the Engineer-in-Chief took the work into his own office.

629. As far as the girders are concerned, these bridges are identical in design? Yes, the only difference is that in No. 1 the piers and abutments are wholly of masonry, and in Nos. 2 and 3 the piers are in concrete with wrought-iron caissons.

630. As you have told the Commissioners that you had nothing to do with Nos. 1 and 3 bridges, we should like you to confine yourself to No. 2. I understood that you did not prepare that; you made only a copy of some of the drawings? The working drawings of No. 2 bridge were prepared by me.

631. You are better acquainted with what was done than we are: can you give us a sort of narrative of the whole of the business,—I mean of the part which you took in it? I had all Mr. Mault's plans lithographed, and I then prepared detailed drawings showing earthworks, retaining walls, fencing and gates, and culverts. There were no working drawings given in for any of the bridges.

632. *By Mr. Stanley.*—You look upon those as the type drawings? Yes. It was left to the discretion of the Engineer-in-Chief to adopt any of the piers. Masonry piers were adopted for No. 1 bridge, which, I have been told, were reduced from 6 feet to 5 ft. 3 in.

633. You consider yourself responsible for their stability under the conditions given to you? I am responsible for the drawings, but not for the adoption of any particular design of pier.

634. In so far as calculating the expense is concerned, you are responsible for having designed them? Yes.

635. *By the Chairman.*—Were the girders which you designed for No. 2 bridge adopted for the other bridges? As a matter of fact, the girders for the No. 2 bridge were being constructed when I received instructions to make working drawings.

636. Then they had been determined upon before you did your work? They had been adopted by the Government before I made the working drawings for the bridge.

637. Did you find it necessary to make any alterations? No, not in the girders.

638. Did you closely examine the girders and the details to see the different parts and their relation to each other, and so on? I applied Colonel Yolland's formula. My principal assistant made drawings and applied Colonel Yolland's test to the sections, and found them ample.

639. *By Mr. Lavder.*—To what sections? The same sections and girders.

640. I understand you to say that they were actually in course of construction, and you were asked to get out drawings? They were finished and actually at work.

641. *By the Chairman.*—We want to get from you what you know exactly and what part you have taken in constructing and designing this work—what were you responsible for? The drawings which are embodied here, and which are called detailed drawings, I am responsible for.

642. That is hardly what we want to get. Did you make the design, and are you satisfied that the design was a good one?—what we want to know is, who is responsible for those drawings, and for working them out into a definite shape? I understood from the Engineer-in-Chief that economy was the order of the day, and that he was in favour of small spans. I think I heard something about 40-foot spans being mentioned; but I would not be certain about that. I found that about 64 feet would be the most economical.

643. Did you make out the designs in accordance with his idea? Yes, by his instructions.

644. And you say they are properly designed, and are calculated to bear all the weights and the strains they may be called upon to bear? I feel certain of that.

645. And you say the spans of those bridges are 60 feet? Sixty-four feet is the length of the girder from centre to centre. This would nearly give 60 feet of span.

646. Can you describe the details of the ironwork composing the girders? Something was said about having the work done in the Colony. The specification says:—"Should the Contractor be required to provide ironwork for river bridges and decide to import the cylinders, girders, and other ironwork from England, he must produce the certificate of the Inspecting Engineer of the Government of Tasmania in London." I understood from the Engineer-in-Chief that the girders were, if possible, to be made in the Colony. They were designed for 6×4 plates, which are usual sizes.

647. Are the plates which are now being used in these girders the same which you recommended should be adopted? I think so; I don't think there is any variation.

648. And the other parts of the girders are the same? I believe so. I have not inspected the girders on the wharf, and have not compared the plates; but I believe they are according to the plans.

649. It has been alleged that at times there are unusually violent storms which pass over the Derwent Valley: are you satisfied that the girders, as designed and now being carried out, are of sufficient strength and stability to resist any storm or wind pressure? I am. I don't think that the wind pressure would exceed 56.

650. *By Mr. Lawder.*—56 lbs. to the square foot? Yes.

651. *By the Chairman.*—Are they calculated to bear that pressure? Yes. I was only up there once, when I went over the line with Mr. Mault and saw the sites of the three bridges. The banks are very high.

652. You have seen the design of the bridges and of the work now being executed on the wharf, and have probably heard the allegations which have been made against the stability of the design: Do you think, taking into consideration all the circumstances, that a train could safely pass over the bridge in these unusual conditions of violent storm? I do, with safety.

653. Without any railing or guard-rail? You are now referring to No. 2 bridge.

654. No. 2 and No. 3 bridges; No. 1 is different? I don't know whether you are aware that it is proposed to make two of the bridges for road and rail traffic.

655. No. 1 bridge, I was told was so? The design contemplates a bridge being erected over which a railway is to run. Apparently, there is no provision in the drawing for any guard-rail or hand-railing, or any other necessary precaution for viaducts of that exposed and elevated condition? I presume a railing would be merely for the platelayers; No. 2 bridge is for a railway alone.

656. Would you not recommend that in a bridge so much exposed as that is, the train should have some protection from storm? I don't think a railing would be any protection.

657. Or any other protection? I did recommend to the Engineer-in-Chief that a guard-rail should be placed on No. 2 bridge.

658. Do you think that that would be desirable? Yes, on No. 2 bridge.

659. If a train were overtaken by a violent storm in traversing a bridge, the only protection to the lives of the passengers in the train would be the resistance offered by the flange of the wheels. Do you think that sufficient? It is just as good protection as you have on the embankments. They are greatly exposed.

659A. But, as a rule, embankments are generally made open in larger tracts of country where the wind is not confined within the walls of a valley: do you think the conditions are similar when a train is passing over an embankment as they are when it is passing over an elevated structure like that? I think so.

660. You would not recommend that the bridges should be so arranged that the train would run between the girders rather than on the top of them? I should myself (if I had *carte blanche*) make a sunk platform—not a raised platform—there. I had got out a sketch for a 200-foot span, but the Engineer-in-Chief was in favour of smaller spans.

661. As the bridges are designed, you are satisfied with their stability? Yes, I am satisfied with No. 2; I believe it is efficient.

662. What is the approximate weight of each span? I think each span weighs 24 tons. That would be the weight of one complete span.

663. *By Mr. Stanley.*—Does that include cross girders? There are no cross girders. They are raised 6-inch planing at the top. They weigh about 72 tons.

664. *By Mr. Lawder.*—That is, 24 tons for each span? Yes. I made out a sketch for a 200-foot span, but the Engineer-in-Chief did not approve of that; that would weigh about 140 tons.

665. *By the Chairman.*—That would be much more costly? Yes. The girders would be about 20 feet high, and the railway would run between the girders.

666. But, coming back to No. 2 bridge, it is proposed to build the intermediate piers of concrete, with wrought iron casings? Is that the form of construction which you designed, or was that the plan which was recommended to you by the Department? I don't think that it was recommended by the Depart-

ment. The type drawings show five different piers. The wrought iron piers were, I presume, adopted by the Engineer-in-Chief. They are the cheapest, and were, I suppose, adopted from motives of economy.

667. Do you consider them sufficiently stable for that work? I do.

668. Are you aware whether the same form of the design is being used? I do not know.

669. What made you adopt that particular plan? I think the Engineer-in-Chief had an idea that the caisson piers would be better than cylinders, on account of timber and so on coming down the river. I thought it just as economical to make it in that form.

670. I understood you to prefer that design? Did you allow the Engineer-in-Chief's judgment to over-ride your own, or did you assume the full responsibility? We had different piers shown to get a price from the Contractor. There were five alternate descriptions.

671. Yes, I understand that. But was that the form of contract which you approved and recommended to the Engineer-in-Chief, and one which you thought it desirable to adopt? I don't think I recommended any one pier in particular. We had four kinds shown. I don't think I was in favour of any particular one.

672. I presume, however, it was adopted; and, as it was your design, I want you to give the Commissioners the reasons why you suggested that particular form? The wrought iron piers were suggested for economy sake, and on the ground of easier carriage. This is a difficult place to bring material. We thought the wrought iron would be much easier for carriage.

673. Would it not have been better to have had cast iron cylinders for the foundations, and made a substantial concrete superstructure, and to spend the extra money the casings would cost in concrete of better quality? It is necessary for me to explain that these drawings were got up hurriedly; we were doing two other lines at this time. On looking up the contract I think the schedule will be found to contain a list of prices for different kinds of piers; that gave the Engineer-in-Chief an opportunity of adopting any one of them which are mentioned in the schedule.

674. Then who is responsible? I presume the Public Works Department.

675. Having heard what it was proposed by the department to do in the way of building these composite piers, and having seen the drawings, do you think that this is a desirable form of pier to build, and are you satisfied that in every way they are perfectly stable? I think the bridges, and particularly No. 2, are quite efficient for what they will have to do.

676. But with regard to the piers—the concrete piers? Yes, I consider that they would be quite safe, provided that concrete of good quality be used.

677. The quality of the concrete is, I think, eight parts of foreign matter to one part of cement. Do you think that a sufficiently rich concrete to provide for the very heavy strains to which it would be liable? The specifications provided for a double quantity of cement in passing through water; and I presume that the Engineer-in-Chief has a discretionary power.

678. That is what I want to know? If the concrete is placed in the water there is to be a proportion of four parts of stone and sand to one of cement.

679. Do you consider cement mortar above the water-line, if composed of eight parts of foreign matter, would be sufficiently strong? Yes; if properly mixed. For my own part I would rather have eight parts than four parts.

680. Supposing that there was earth or loamy matter mixed up with the cement? That would alter the conditions. I assume that the cement would be first class.

681. But where you are using the minimum amount of material and everything depends on the kind of material used, do you think it desirable to risk the stability of a bridge by using such a small quantity of cement in the concrete? Yes, if I were satisfied with the quality of the concrete and the quality of the sand and metal used. The Kyneton bridge in Victoria has concrete piers and abutments, 14 to 1, faced with stone.

682. But there the casing is of a substantial character to keep the concrete in place. You have seen the girders on the wharf: are you of opinion that they have been built as they were provided for in the specifications? No: I should not consider that the girders have been built in accordance with the specifications. I don't think the workmanship is equal to that for which the specifications provided.

683. You are referring to the girders on the wharf? Yes.

684. Will you explain in what, in your judgment, they are deficient? Beginning with the web-plates, (I had an opportunity of seeing only one joint), I think that if they are all as good as that one, they might pass. I do not think some of the rivets are first-class.

685. Did you notice the way in which the rivets have been driven?—are they irregular in line? I did not examine them very closely. I think, generally, that the girders are roughly finished.

686. Would the girders on the wharf assume a level line had they been built to a camber? They would if the joints of the webs were not close.

687. Having seen the girders on the wharf, do you think that they were built to a camber, or, if not that the set they have taken show the vertical joints are not close as they were designed to be? I think that that would be a fault.

688. In present circumstances, do you think they are sufficiently strong for the work they would be called upon to do? Taking them as they are at present, I think they are amply so.

689. Are the parts proportionally equal to the standard, or are they above the standard? They are above the standard. The Board of Trade Regulations provide for five tons to the square inch. The strain on all the girders for the Derwent Valley Railway does not exceed 4 tons per square inch, according to my calculation.

690. *By Mr. Stanley.*—Have the calculations which you have made satisfied you of the strength of these girders? Yes; I checked them by Colonel Yolland's formula.

691. Are you aware by whom the girders were designed? They were designed by myself.

692. I understood you to tell the Commissioners that those girders had already been partly constructed at the time you were asked to prepare the working drawings for the Derwent Valley Line? Yes.

693. Are they according to your design? I believe they are in accord with my drawings.

694. These girders have, you believe, been constructed in accordance with the type drawings which were previously prepared? I believe so. There were three bridges being built, but I ascertained that No. 2 bridge was being made in Launceston and Nos. 1 and 3 were being made here.

695. In making your calculations of strength of these girders, what dead-weight and rolling-load did you allow for? I took a ton and half per foot for the dead and live load,—that is, the weight of the girder itself and half the platform added to the weight of Tasmanian engines fully loaded, according to information supplied by the Public Works Department.

696. Are the plates on the top and bottom flanges of the same dimensions as marked on the drawing? I believe so. The webs could be reduced, but the plates were made all the same thickness.

697. Then you made no difference in the bottom plates on account of the rivet-holes? No, I made the top and bottom just the same.

698. That being the case, the top flanges will be stronger than the others? Not sufficient to make much variation in the thickness of the plates.

699. Do you take into consideration, in making these calculations, the fact that these girders are being constructed as continuous girders? My calculations are based on the girders being single girders, and not continuous.

700. Then are you satisfied that the dimensions of those parts are sufficiently strong to withstand the altered conditions of strain due to the fact of their being continuous girders? I am.

701. I think you stated that you had prepared a design for a single span across the site of No. 2 bridge? Yes, in accordance with the sketch laid on the table.

702. Did you make any comparative estimate as compared with the bridge now designed? Yes; I found that the three sixty-fours would amount to 72, and the 200ft. span would amount to about 140 tons.

703. But, for purposes of comparison, suppose you take these spans as 200, and assume it to be so? What you have to assume would be the weight of 80 tons plus the two wrought-iron piers, and then against that you would have two masonry piers just double the thickness to take the 200-ft. span, that is to say, masonry piers, provided that No. 2 bridge was 60 ft. wide. You would want double the masonry piers. That would be 140 tons plus the quantity in masonry piers, as against 80 tons plus two wrought-iron piers. A 64ft. span compares very favourably with a 200-ft. span.

704. Have you the comparative cost? No; to ascertain the cost I should have to take out the concrete and masonry piers and its foundations, and double that for 200-ft. span, and then take the two wrought-iron piers. But then the contractor would not build a 200-ft. span at the same price per ton as he would build the ordinary plate girder. It would amount to from £16 to £20 per ton more, I should think.

705. Can you now give a comparative estimate to the Commissioners? No, I cannot.

706. *By Mr. Lawder.*—Take the No. 2 bridge and substitute a 200-ft. span, with piers founded upon a rocky bed above low water, and getting a clear waterway over the water space during the dry season? A 200-ft. span would mean a corresponding increase in the piers. [The normal height of the river would necessitate three or four feet of water. I presume the contractor's prices for wrought-iron piers would make provision for getting through the water.]

707. *By Mr. Stanley.*—Were the alternative designs for the piers for No. 2 bridge proposed by the Engineer-in-Chief, as shown in the drawings, or did you use your own discretion? I think I used my own discretion in giving these types. I am not certain.

708. At whose suggestion was the design adopted? I may have suggested something about wrought iron. The Engineer-in-Chief asked me to go up with Mr. Mault on one occasion. I was up there only a very short time (it is nearly two years ago now); but whether Mr. Mault suggested wrought iron piers at the time I don't remember. I think I did speak to the Engineer-in-Chief about wrought iron piers, but I cannot remember whether I suggested it myself or whether it was suggested to me. I understand that wrought iron piers are the cheapest in accordance with the schedule of prices, and I suppose they were adopted by the Engineer-in-Chief for that reason.

709. Would these wrought iron caissons, as designed and carried out, be sufficiently stiff to carry the weight of the bridge without the concrete filling? I do not know the weight.

710. Are they designed in such a way that they would carry the weight as a pier so far as their stiffness is concerned, without the concrete filling? I do not know whether they would even stand a pressure of water without the concrete filling.

711. I am not referring to that. I am referring merely to the capacity of the piers to carry the weight immediately supported by them? I have not gone into the matter, but I should think them more than ample to carry the bridges,—that is, as far as my impression is concerned.

712. I observe that the piers are stiffened transversely with internal bracing, but they have no bracing longitudinally? The idea of bracing them is merely to prevent them spreading out. They were never intended to act as piers without the concrete filling.

713. And you think the bracing between the T iron stiffeners would be able to withstand the pressure of the concrete filling without buckling? Yes, I think so.

714. They are only quarter inch plates—would they be sufficient to stand the pressure of concrete being rammed into the piers without buckling? The piers are stiffened, four feet apart.

715. Did you make any calculations as to the stability of those piers—as to the strains they would be subjected to, from the superincumbent weight, and the wind pressure? My assistant checked them at the time, and afterwards they were checked by another assistant, and they made out that the piers were ample. I was away in Melbourne at the time.

716. Can you furnish us with those calculations? I am afraid not—my assistant has left me now. The fact is, the work has not paid me and I had to reduce my staff.

717. Had you anything to do with preparing the specifications? Yes; I wrote the specifications for the Fingal line and the Scottsdale line, and also for the Derwent Valley line; but I was supplied with the specifications for the Mersey and Deloraine line by the Engineer-in-Chief.

718. However, you prepared the specifications for the Derwent Valley line? Yes. I think the Engineer-in-Chief asked for certain things to be embodied from the Mersey and Deloraine contract.

719. *By Mr. Lawder.*—Are those specifications, then, adopted in the contract? Yes.

720. They were prepared by you in their entirety? Yes.

721. *By Mr. Stanley.*—With regard to the specifications for the ironwork, more particularly for the iron girders—are you satisfied that the provisions included in those specifications are necessary to ensure satisfactory and efficient work? I think those general provisions are necessary to ensure good workmanship, provided that the supervision be good. I may mention that I suggested to the Engineer-in-Chief some months ago something about supervising the ironwork, but I understood him to say that he had appointed a very good inspector, and that there was no necessity to do that, consequently I have not troubled to inspect that work at all. I sent down one of my assistants frequently when detail drawings for No. 2 bridge were being prepared.

722. As to the tests which you provided for the iron work, do you consider that to insure good and faithful work, it is necessary that they should be rigidly enforced? I should not if I was satisfied with the quality of the iron. I don't know whether this was branded iron; but I should say that from a glance at some of the piers, they were of a poor quality of iron.

723. Then you would not consider it necessary to apply the test to try the strength of the iron? If I had any doubt I should be guided by the quality of the iron.

724. Do you not think when an important test of this kind is inserted in the specifications, it is very desirable to carry it out? Yes, if I had any doubt about the contractor or the quality of the iron.

725. I suppose, as a matter of fact, that you cannot be so sure of the quality of the iron here as you can at home? No; perhaps not, although I think that sometimes the colonial is superior to the imported.

726. If in a manufactory in England it is considered necessary by the engineer to apply tests, don't you think that it is all the more necessary to apply them here? Undoubtedly; besides you cannot as a rule ensure good workmanship.

727. *By Mr. Lawder.*—Would it not be very easy to test the girders with a fixed load in the yard? I don't think that this test would be very satisfactory in a yard. I would rather have them on the site to test them.

728. *By Mr. Stanley.*—Is it not the practice in England to have them tested in the manufacturer's yard before they are sent away? Not in all cases, but in many cases it is so. Sometimes they are tested by hydraulic pressure.

729. Is it not usual to put them together and to provide that they should be so tested? I don't know whether it is so in the contractor's yard, but I never saw a contract of any importance where something of the kind was not provided.

730. Do you not think that in the construction of iron girders that the joints, especially in the compressive members, should be planed? I think that the end of the girders and the abutting members should be planed, as provided for in specifications; but you cannot get this done in Tasmania, as there are not the necessary appliances.

731. Were the specifications drawn out with a view of the work being done in Tasmania? I think that before I wrote the specifications I understood the Engineer-in-Chief to say that the Government wished the work to be done in the island.

732. The risk of having the work done in the colony appears to have been that you cannot insist on such good thorough work as if it was prepared by English manufacturers? I don't see how you could, because you have not the appliances here. I am now speaking from hearsay. I have not been inside the foundries here, but from what I hear I believe there are not the appliances in the colony. I should not pass the girders myself as I saw them this morning.

733. What would the effect be in a girder without camber, in the case of a passing load. Supposing it was built in this way and you loaded it with the maximum load, what would the effect be? To camber it the other way.

734. That would be the result; but how would it affect the different parts of the girder—I mean that if the girder were built horizontally it would deflect, would it not: what effect would that deflection have—would it not have a tendency to buckle the web plates? Yes, if the workmanship was not very good.

735. Would you not consider it a serious fault if there was no camber to allow for deflection? Yes.

736. What margin is allowed for expansion and contraction in No. 2 girder? I think it was proposed to have a lattice-girder,—that would be £15 more but it would be better to have the other girders rather than inferior lattice-work girders.

737. Don't you think that is an exorbitant price? They want from £10 to £15 in Victoria.

738. Are railway materials such as girders and other work liable to duty if imported into the colony in the manufactured state? I have always understood that they were exempt. I know this, for in regard to the proposed tramway here some time ago, I wanted some information on the point, and I found that railway plant was exempt.

67, Macquarie-street, Hobart, 10th April, 1886.

SIR,

HEREWITH I return proof of my evidence revised, as requested.

With regard to questions 617, 663, 706, and 735, a portion of my answers is evidently in reply to some questions which have been omitted.

With regard to question 736, my answer is omitted and an answer to some other question substituted.

I should desire to explain my answers to questions 638, 639, and 640, as such answers do not clearly express my meaning, and, consequently, might convey an erroneous impression.

With regard to question 720, I think it but fair to say that after I had prepared the drafts they were submitted to and revised by the Engineer-in-Chief.

I am, Sir,

Your obedient Servant,

T. C. JUST, Esq., Secretary Royal Commission on Railways and Public Works.

G. H. EDWARDS.

WEDNESDAY, MARCH 3, 1886.

The Commission sat at the *Bush Hotel*, New Norfolk.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

JONATHAN FALKINGHAM called in and examined.

739. *By the Chairman.*—What is your occupation, Mr. Falkingham? I am a contractor.

740. Are you the contractor for what is known as the Derwent Valley Railway? Yes.

741. At what point on the Main Line Railway does this railway commence, and where does your contract end? It junctions with the Main Line Railway at North Bridgewater, and ends at 24 miles 26 chains at Glenora.

742. That is a point some miles short from the town of Hamilton, is it not? About eight or nine miles short of Hamilton.

743. When you took this contract from the Government, what plans and drawings were then submitted to you? I have them here now.

744. Are they the same drawings as those which bore his signature in the office of the Chief Engineer? Yes, I have got the originals.

745. Has any departure from those plans and drawings been made by the Government, and what is the nature of the departure, if any, commencing at the lower end of the line and proceeding upwards? The first alteration was at Om. 15c. The contract provided for a four-foot culvert there. It did not say what material it was to be built of, and I got the order from Mr. Mault to build it in brick. I bought the bricks at New Town, but, I think, before they arrived, Mr. Mault discovered that he could not get a foundation, and he ordered me to build of timber with flat top.

746. Do you remember the date of that alteration? The date on the order is 28. 1. 1885. Here is the original design [exhibit].

747. This shows a culvert with upright walls and a semi-circular arch, 4 feet in diameter and 4 ft. 9 in. in extreme height. Was that the one you were first instructed to build? Yes.

748. What was the alteration in this? It is shown in the next plan, which I put in [exhibit].

749. This shows a culvert of 3 ft. 3 in. in breadth by 4 ft. in clear height; was that so? Yes.

750. Did you build that culvert? I did.

751. What happened next at this place? On the 25th September I got a note to build a 15 ft. opening.

752. For what reason? I do not know; he did not say.

753. This was after you had completed the square box culvert? Yes.

754. Have you got the plan for it? I do not think so. We have a general plan for 15 feet and 20 feet openings, and we build them according to the general plan. They give me the order to build according to the general plan.

755. *By Mr. Stanley.*—That is one of the contract type drawings? Yes.

756. *By the Chairman.*—Mr. Sheard says: "Enclosed please find tracing, with complete working drawing, for the 15 feet culvert at 15 chains." Have you received that drawing? I did receive it on the 25th September, 1886.

757. If it is in your possession Mr. Parker will have it? Yes.

758. What next happened? I gave orders at the saw-mill for the timber, but before the work was completed there came a flood and washed away the embankment.

759. What did the Government Engineer then do? He gave me a plan to build three 15-foot openings. I produce the plan [exhibit.]
760. What was the date of that flood? The 30th November, 1885.
761. Have you built this culvert, the drawings for which you received, I see, on the 8th December, 1885? We are now building it.
762. Have you any other observations to make about this particular alteration? A great rush of water comes through there, and with a flood the embankments are likely to go.
763. Why do you anticipate that the embankments will give way? Because in the event of a great rush of water it will wash the stones out like marbles.
764. That is a matter of opinion. What we want to know is what alterations were made in the original contract plans? Another alteration at this spot was that the embankment was raised four or five feet, and the cuttings adjoining it were raised considerably.
765. What was the date of that order? The date is 1-4-85. Here are the details [exhibit.] It was afterwards altered by Mr. Sheard.
766. Why was it altered by Mr. Sheard? He did not approve of Mr. Mault's alteration, I suppose; but he did not tell me.
767. What was the nature of his alteration—did he raise or lower the formation? He raised the formation and altered the gradient.
768. What is the next alteration? Mr. Mault altered the levels from 0m. 23c. to 1m. 14c.
769. What reason did he assign for that alteration? He did not assign any reason.
770. Had you completed the formation of the line between those points? I believe so; but I am not quite certain on that point.
771. What is the next thing you have to comment upon? At 1m. 41c. we found the levels nearly 3 feet wrong in the formation.
772. What happened? We called Mr. Mault's attention to it, and he told us to put it right. We had done the work before we found it out. We discovered by the eye that there was something wrong, and we found there was an error of 2·76 feet.
773. What is the next alteration you wish to refer to? The levels were again found wrong at 3 miles 52 chains. They were 5·69 feet instead of 2·81 feet, or a difference of 2·88 feet. The levels were corrected.
774. Then the banks were lowered at that place? Yes, lowered 2 feet 10 inches. This work had been constructed.
775. When did you make the alteration? Immediately after the error was found out.
776. What was the next alteration? At 1m. 14c. 50l. I had to make a series of alterations in culverts. There was a 2 feet 6 inch culvert at that place, and we were ordered to put in a culvert of three openings of 10 feet span.
777. You are certain of that? Yes.
778. Have you commenced the work? We are building it now. The next alteration was at 1m. 41c., where there was a 1 foot 6 inch earthenware pipe culvert. It has now to be two 10 feet pile openings.
779. Have you commenced that work? Not yet.
780. What next? The next alteration was at 1m. 62c. There is no provision in the contract for a culvert there, and we were ordered to build one with two openings of 2 feet 7½ inches each by 1 foot 6 inches.
781. Have you commenced that work? No; but I have the materials ready.
782. What is the next point? At 1m. 63c., where the water broke over the line, I had to put up a similar culvert to the last. There was no provision for it on the contract. This was an additional culvert.
783. It was shown to be necessary by the damage from the last flood? Yes.
784. What is the next? At 2m. 38c., where we had put in a 1 ft. 6 in. pipe culvert, we had to put in a box culvert 2 ft. 7½ in. by 1 ft. 6 in.
785. Had you put in the 1 ft. 6 in. pipe culvert? Yes.
786. What was the reason for the alteration? It was found that the waterway was not large enough. At 2m. 76c. the plan shows a 1 ft. 6 in. pipe culvert; I have now to build there two 10 ft. pile openings.
787. Why was that culvert required? The water washed the bank away and the ballast, and it was shown to be a place where a culvert was wanted.
788. What next? At 3m. 4c. provision is made for a 1 ft. 6 in. earthenware pipe, and I have to put down a 10 ft. pile opening.
789. Why was that necessary? The other was not sufficient to take the water away.
790. Was that a spot at which the earthworks were affected by the flood? Yes; it came over the embankment, and washed bank and ballast away.
791. The next? At 3m. 6c. there was nothing provided, and I have an order to put in a 15 ft. pile opening. This was also found necessary from the water breaking over the bank. At 3m. 34c. the plan shows a 3-foot culvert. I have now to build three 15-foot pile openings.
792. Why is that additional provision required there? The culvert was not large enough. The embankment there is 9 feet high, and the water came right over the top of it, and washed it away for about three-quarters of a chain. In two other places a break was made in the embankment. At 7m. 62c. I had to put in another square culvert.

793. Provision is made in the contract for one culvert there? The extra provision is for a culvert twice the original size. At 8m. 28c. 26l., where there is no provision made, I have to put in some boxes and rubble drains.

794. Were all those culverts that you have mentioned, commencing at 0m. 15c. and ending at 7m. 62c., affected by the flood in November last? Every one of them.

795. And all these additional provisions were rendered necessary on that account? Yes.

796. Now you can go on to other parts of the line? I want to tell you how my pipe culverts were built. The pipes stand on the ground, and are not let into the surface, and when the embankment subsided it thrust out the framing and drew the pipes out of position. The specification provides for concrete ends, "if ordered;" but they were not ordered.

797. Do you say that, although the specification provides that concrete may be used, they were ordered to be built of hardwood frames? Yes; the piles were not driven in, but set upon the ground.

798. You built them in that way according to the specifications? Yes.

799. It has been alleged that these culverts are designed to be let into the solid ground to the depth of half their diameter. It has also been alleged that you did not let them into the ground, but placed them on the surface. Is that the case or not? The ground is so irregular that if we had followed that rule in all cases they would have been up and down like the waves of the sea. Some have been put on the surface and others let into the ground in order to make them level.

800. It makes all the difference whether you did this according to instructions, or whether you did it in defiance of instructions? I did it according to instructions.

801. Then whenever you have departed from the manner shown on the drawings, it was done in accordance with the instructions of the Engineer-in-Chief? Certainly. No objection was then raised to it.

802. It says here that although the ends of the pipes, if ordered in writing, must be set in concrete, it is obligatory upon you to bed the lower end of the culvert round with concrete. Was that done? No.

803. Why was it not done? Because they did not want it doing, and would not pay for it.

804. Was that provision struck out by order of the Government, or was it left unexecuted through your neglect? No; they ordered me not to set it in concrete.

805. Go on to the next alteration? The next alteration was at 9m. 16c. 30l. The contract provides nothing there, and I have been ordered to put in a culvert 2 ft. 7½ in. by 1 ft. 6 in.

806. Has that culvert been built? Yes.

807. Why was it rendered necessary? Because the floods proved that a waterway was wanted there. At 9m. 20c., where no provision is made in the contract, it is proposed to put in a similar culvert to the last, as it was found that the water there came over the embankment. The next alteration is at Johnny's Creek, at 14m. 27c. The original provision there was for a 4 ft. 6 in. culvert, with stone semi-circular arch, and I have been ordered to put in an additional one with two openings of 3 feet by 2 feet.

808. Why was that wanted? The waterway was found to be insufficient.

809. Was the original culvert built? It has been built nine months. Notwithstanding that, the Government have found it necessary to put in an additional one. I find I have omitted a very important alteration at 12m. 76c., called the Back River. The line was diverted from 12m. 69c. to 13m. 33c.

810. What was the nature of the diversion? It was diverted further away to the right into the paddock away from the river into some very heavy ground.

811. What was the reason for the diversion? It was found to be too near the river. The embankment burst out the retaining wall.

812. Had you done any work on the original line? Yes, we had completed it, with the exception of about 200 yards.

813. Had a flood taken place? No, the wall fell down.

814. What caused the wall to fall down? The settling of the embankment burst the wall out.

815. It is described and shown in the drawings that this retaining wall is to be built in a certain form and at a certain inclination. Of what was the wall built? It was a dry rubble wall.

816. How many feet was the line diverted? About 20 feet.

817. You say the wall was built of dry rubble. How was it built? The first portion of the wall, for about 7 chains, was built at an inclination of about 1 in 4 to within 9 feet of the top of the embankment, and after that nearly 1 to 1.

818. You had instructions to build the wall, in the first instance, with a batter of 1 in 4—that is, 3 inches to the foot, and then you went into a new slope of 1 to 1? Yes, 9 feet from the top.

819. What proportion of this wall would be built according to the batter of 1 in 4, and what proportion according to the batter of 1 to 1? About 15 feet in depth, I think, at 1 in 4, for about 7 chains, and the top portion of 9 feet was about the same.

820. What was the width of this wall? 18 inches all the way up.

821. The wall, then, had an average width of 18 inches. Yes.

822. What happened to this wall? It is standing all right. There the wall is differently designed—it is 1 in 8, or inch and a half to the foot.

823. Has that wall been built? Yes.

824. What kind of wall, and what length? It is a rubble wall, but I cannot say what length. It is standing now, but covered up.

825. Who gave you instructions to build this wall? Mr. Mault.
826. Was it in accordance with the contract drawings? No; they show wall of that height to be 9ft. at bottom, 2ft. at top.
827. What was the thickness of it? 3 feet 6 inches at the bottom and 18 inches on the top, with a batter of an inch and a half to the foot; but it varies.
828. A portion of it was built vertically, was it not? Yes.
829. Were the dimensions of the vertical wall the same as the batter wall? Yes.
830. Do you think the vertical wall was reduced in width from 3 feet 6 inches to 1 foot 6 inches? No, it was carried out at those dimensions. This wall, about 3 inches from the culvert, was forced out, and fell down, owing to the settling of the embankment.
831. When did it fall down? My engineer, Mr. Parker, can give you the date.
832. What kind of backing had the wall? Earth backing. I asked Mr. Mault to put in stone backing to help to carry the weight of the embankment, but he refused to do so, saying, "You have got such a good price for the stone-backing that we cannot afford it."
833. Did the contract provide for dry backing? It does for abutments of all bridges, but not for retaining walls. The culvert itself did not tumble down, but gave way, and when the wall was thrust out Mr. Mault pulled it down.
834. How was the culvert built? The walls were up to the top on one side, and partly so on the other. The specification stated that the culvert should have stone-backing, but Mr. Mault would not allow me to put stone-backing in. When the soil settled it forced the thin wall out, and away it went.
835. What was the thickness of this wall? Mr. Parker can speak to that.
836. Did you obtain proper foundations for this work? Yes, we went down to the rock.
837. Did the engineer examine the foundation? Yes.
838. Who provided the drawings for the altered work? Mr. Mault.
839. Have you a copy of them? I will produce it.
840. What else have you to say about this culvert? I do not know that I can say anything else.
841. Tell the Commissioners what is being done now at the Back River? When the wall fell we got orders to pull it all down and build a squared masonry wall, which we are now building. We first got an order to build two or three chains, then two or three more, and then, again, two or three more. The wall is backed with 6 feet of concrete mixed with large spawls.
842. How near the top of the wall does the concrete come? I am not certain as to the distance. Mr. Parker will be able to tell that the concrete behind the culvert will come up to the spring of the arch, or nearly so.
843. Can you produce the original drawings for the Back River, and the altered drawings? We never had a contract drawing.
844. Can you show the drawing which you are now building from? Mr. Parker will produce that.
845. When you took the contract for this railway did the Department follow the course of the line at Back River in the first instance, or did they make any deviation? They followed the course of the line.
846. What is the next alteration? I omitted to mention the material alterations at the Derbyshire Rocks. There were five or six alterations in the survey, first one way and then the other; they first raised the level and then lowered it. I had made the line altogether, and they went and altered it.
847. Are you clear about that? Quite clear.
848. Will you state what the alteration was? Mr. Parker can give you the details about it. Mr. Mault before he went away pointed out that he wanted a lot of rocks down that were not safe. He asked me for an estimate for the work, and I gave him an estimate for £500. That was not accepted, and he told me to do the work by day-work; I did so, and it has cost nearly £5000.
849. Do you mean to say that the work you offered to do for £500 has cost nearly £5000? Yes. When Mr. Sheard succeeded Mr. Mault, he made these alterations by wholesale. The actual cost is £4266.
850. Have you been paid that? Yes.
851. Give us the net cost, so that we may make a comparison between what you offered to do for £500, and what it has cost the Government? I cannot do that, but my engineer, Mr. Parker, can. I will undertake to produce it.
852. What is the next alteration? At 10m. 57c., we put in an 18-inch earthenware pipe culvert and it was found to be insufficient. That was ordered to be taken up, and we have built a 7 by 5 masonry wall with a timber top.
853. What was the reason for that alteration? The culvert was not large enough.
854. Was it affected by the late flood? The rains we had before the late flood showed that it was not large enough.
855. What is the next? Two more culverts were pulled up at about 11m. and done away with, and two more which had been put in by Mr. Mault were taken up by Mr. Sheard.
856. Why was that done? He conveyed the water to what he thought was a better outlet.
857. What is the next alteration? There is an alteration between 14m. 27c. and 14m. 64c. I cannot explain it, but Mr. Parker can. Then there is a diversion of route between 15m. 5c. and 16m. 2c.
858. Why was that diversion made? Mr. Mault, I suppose, thought it was advisable.
859. What is there between those two points? Nothing but a paddock.

860. Is there no bridge or culvert or anything? Yes: there is the No. 1 bridge commencing at 15m. 43c.

861. What does the alterations consist of? An altered route and altered levels.

862. Does it make the length longer or shorter? Shortens a little, I think.

863. How has it altered the formation—is it raised or lowered? I do not know that.

864. In the original drawing it shows that the approaches to No. 1 bridge had descending grades on both sides of the bridge, and Mr. Fincham, in his evidence, stated that the approaches had been altered and made level: has the alteration of which you speak any reference to that? I do not know; Mr. Parker can explain that.

865. What is the next alteration? At 16m. 34c. a deviation begins, ending at 18m. 33c.

866. Are you sure of that? Yes.

867. Had any of the original line been made previous to this deviation? I cannot answer that question.

868. Who can speak to it? Mr. Parker.

869. What does the alteration consist of? Altering the route and the levels.

870. Does it make the gradients more or less severe? They are pretty easy in both cases.

871. What was the alteration made for? That we do not know.

872. Is there any large work occurring between 16m. 34ch. and 18m. 33ch.? Between those two points is the Plenty bridge.

873. Were there any alterations in the culverts between those points? Yes, but I cannot tell you the nature of them.

874. What is the next alteration? At 19m. there was another deviation, over which we were stopped a long while. It commences at 19m. and ends at 21m.

875. Are there any works between those two points? There is the No. 2 bridge.

876. Were any alterations made in culverts then? Alterations were made at various times, but I cannot tell how many. Mr. Parker can inform you on that point.

877. Is there anything else with reference to the embankments and culverts on this line between the Bridgewater junction and Glenora which you wish to speak about? I omitted to mention a deviation of over a mile, commencing at 8m. 19ch., and ending at 9m. 20ch.

878. Was that deviation made after the line had been formed? It was cleared, but no excavating had been done.

879. Are you aware why the alteration was made? No.

880. Were the levels raised or lowered? I cannot tell. Mr. Parker can speak about that.

881. Is there anything else you wish to say with respect to earthworks and culverts? These pipe culverts, for 8m., or 10m., or 12m., were put in with earth coverings. It was found that the earthenware pipe culverts did not stand, got out of shape, and of course the blame was laid on me. I was then ordered to put 12 inches of concrete, 3 feet wide, under the pipe, and to cover the pipe with 9 inches of concrete.

882. Has that been done? Yes.

883. Then for the first nine miles pipes have not been concreted? For the first ten miles.

884. Where does the concrete commence? At 10m. 40ch.; but there are some intervening places where it was not done. We only started cementing at about 19 miles, but we went back and put in some extra ones. The wooden box culverts at the Bridgewater end were covered with large spawls 18 inches in thickness, and the sides as well. This was done for about 6 or 7 miles.

885. Why was that done? I cannot say. To let the water through, I think.

886. Are they shown in the drawings? I think not. There is only a general drawing.

887. You were required to carry out this work? I did it for so far, and then I stopped because they would not pay me for it. It was a scheduled price, and I said, "If you will not pay me I will not go on."

888. What has been the result? The water has gone through and wasted the earth away.

889. Did the water trickle through the stone casing at the sides of the culverts? I think so.

890. Do you attribute the damage to some of those culverts to that cause? Partly, because the banks would not have given if the water had not got through those stones.

891. What have you to say with regard to No. 1 bridge? No. 1 bridge consisted of six 24 ft. openings, and eight 64ft. openings. Three of the 24ft. openings have been done away with at the east end, and one 24ft. opening at the west end. The piers were designed to be 6ft. wide, and they are now 5ft. 3in.

892. Were any reasons given for the reduction in size? Yes, they wanted to reduce the cost.

893. Was that stated so to you? Yes, by Mr. Mault. He said that 5ft. 3in. piers were just as good as 6ft., and that the reduction would save money.

894. Was it proposed originally that the piers should be built of ordinary lime mortar? It does not say how they are to be built.

895. Is it not stated in the specifications? No. It is described as roughly squared masonry, two stones to a course.

896. The last paragraph of clause 22, folio 33, states that "the rates for squared masonry in cement and in mortar are for materials and workmanship as specified." What was your contract? I have a price for building either in lime or in cement.

897. Of what were the 6ft. piers intended to be built? I cannot say.
898. In the schedule of quantities at page 50, it is stated—item 43—“ squared masonry in bridges, culverts, &c., in mortar, 200 cubic yards,” and then goes on to say, “ ditto, when ordered, in cement mortar, 50 cubic yards.” That is for Nos. 1, 2, and 3 bridges. Are those 200 cubic yards all the provision made in that respect? Yes, and for all the culverts on the line built of the same material.
899. Then it appears it was contemplated by the contract to build this principally in lime mortar? Yes; but it can be altered, if ordered.
900. Were you to build the piers in lime mortar, or partly in lime mortar and partly in cement? We are building all the piers in cement, from top to bottom.
901. Then the alteration was accompanied with an order to build all the piers in cement instead of lime mortar? Yes.
902. Has that been done? Yes.
903. What other alterations were made in No. 1 bridge? The piers were lowered in height about 4ft.
904. Why? I suggested to Mr. Fincham that to reduce the height of the piers would strengthen the bridge, and he lowered them 4ft.
905. Why did he lower the piers? Because I suggested to him to do so.
906. But he did not do that at your request without some reason for it? He did.
907. Probably that would be in connection with the altered gradients in the formations on either side of the bridge? I think the alteration in the gradients were made first, and he altered the bridge to agree with that idea.
908. Are there any other alterations in No. 1 bridge that you wish to speak of? There have been half a dozen.
909. Have the abutments been altered? Yes; at least ten times.
910. It has been pointed out to us that the abutments were originally proposed to be built with wings? There was nothing to show how they were to be built at first.
911. Are there no drawings? No.
912. Mr. Fincham pointed out to us on the ground that he had altered the drawings, and made the masonry solid for the abutments? There have been nine different alterations in the abutments, and I can show you ten plans for them.
913. What else have you to say in reference to this bridge? I do not know that I have anything more to say about it, except that the entrance of the east abutment on the superstructure is too narrow for the long carriages. They are 9ft. 5in. instead of 10ft., and is on a radius of 1 in $5\frac{1}{2}$, and not safe.
914. Who can explain this clearly? Mr. Anderson, the foreman mason.
915. Cannot Mr. Parker or Mr. Climie? They can explain the radius.
916. What other alterations, if any, are here? I do not know that there is any other. The top of the bridge, I consider, is insufficiently fastened, and unsafe. The joints are not fixed, and it is just the same as the permanent way with the fish-plates off. Neither is the decking fastened on the top of the bridge.
917. What do you mean by the joints? The two ends of the girders. The decking is not bolted to the girders.
918. Do not the drawings show that the decking is bolted down to the top flange? No.
919. Are you certain of that? Yes. No. 2 was the same, but since I have taken exception to it they have given me an altered plan which shows the decking to be bolted at No. 2.
920. Are there any directions in the specifications or supplementary specifications dealing with this? No.

AFTERNOON SITTING.

Present—All the Members and the Secretary.

MR. JONATHAN FALKINGHAM'S *examination continued.*

The witness asked permission to make an explanation; which being accorded,

Mr. Falkingham said: I desire to make an explanation about a few of the alterations between New Norfolk and Bridgewater referred to by me this morning. I intended to mention these matters, but I omitted them. All the plans shown here show the small culverts in the detail plans with footings. At a later period all the footings were done away with, and the result is that nearly all these culverts and small bridges are going down because they are built on mud.

921. *By Mr. Landver.*—Do you mean the footing of the abutments? Yes. All the original foundations of those small bridges were 12-inch footings; these have been all cut away, and this has been approved of. Then the road diversions at 5m. 10c. to 5m. 43c. At this place I cannot put up the fence. The road diversion runs parallel to the railway, and so awfully close to it that if I put the fence up it must be on the road diversion. This is the case not only here but at lots of other places. My contract plans show the width of the fencing all along the line, invariably at half a chain each side from the centre of the railway. At many places it is cut so deep that the tops of the slopes go a long way beyond this; therefore I cannot put the fence up, and I cannot get the position shown me.

922. Would it not be possible to put it up on the slopes? Oh, if they tell me I will do it. I have frequently called Mr. Mault's attention to this matter, and have asked him to show me the position for the

fence. He has always said it was the contractor's place to set out the work. That I admit; but where a line has been altered, I think they ought to show me the position. The fact now is that I cannot put up the fences in many places without encroaching upon the farmer's land, and rendering myself liable to an action for damages.

923. *By the Chairman.*—Do I understand you to say that the side slope of the cutting goes outside the width of the land taken up for the railway? Yes, it goes outside of it, Sir.

924. Can you fix these places by the chainage in any way? Not the exact chainage.

925. But speaking generally, can you indicate the places to which you refer? Yes; the first place would be from 5m. 10c. to 5m. 43c. The road diversion made here runs parallel with the railway, and I cannot put up the fence between the two for want of room. Another place is at Back River, where the line has been diverted away out of its original position. At the site of the Back River bridge it is the same; but Mr. Parker will be able to explain that better. Again, I have to complain that the side and table drains have not been cut in many places. I have had frequent complaints as to the works being sloppy,—that was in winter. I had got permission to lay some parts of the road in sand ballast, and there being no drains, of course the foundations were sloppy. They were complaining of this, and I spoke to the Engineer-in-Chief about it, and told him if he would not cut the side and table drains I could not keep the road dry. I never saw a railway yet in course of construction without drains being cut on the upper side of the line. There are several places on this line where the side ditches have not been cut to this day. I can give you two or three of them. The witness enumerated the following places specially:—

m.	c.	m.	c.	c.	m.	c.	m.	c.	c.
From 1	57	to 2	8	= 31	From 3	72	to 3	75	= 3
From 5	53	to 6	5	= 33	From 8	7	to 8	23	= 16

A total of 83 chains of side drains not cut.

926. *By the Chairman.*—Have you been instructed to omit them at these places? No, but I only cut them where ordered. After writing to the Engineer-in-Chief, in some cases I have been permitted to cut the drains, but until they are all cut the works will always be liable to be wet. The grades are so easy that the water won't run down the water-tables. Then cross drains have to be cut and filled with rubble. I started to do this, at least my son did, but Mr. Sheard came and got in a rage about it, and said he would be put off the works if he did not desist, and, of course, he did not do it. He then started to see the Engineer-in-Chief, but was persuaded to come back. My son said he would put in the drains, as we could not get the water off without, and Mr. Sheard, after some bother, gave permission to do it, which went to show that we were right. I forgot to mention one thing—that is, the taking off of about a mile of stone ballast at the Bridgewater end, to which Mr. Sheard called attention. According to the specification, this should be sand ballast. I saw Mr. Mault, and called his attention to a locality in the hill side, and to a certain rock. I asked him if he would take this rock in lieu of sand. He agreed to do so, and gave me his permission, and stated that it was better than sand. I put this on, and Mr. Mault took no exception to it. He said I could put it on and he would allow for it afterwards. Just at the month's end, when the certificate was due, Mr. Mault was sent away and Mr. Sheard arrived to take charge. He objected to this ballast, and compelled me to take it off. Of course, I took it off. I may mention that I wanted the Engineer-in-Chief to leave this stone ballast on for my own trucks to run on, as it was better for the line than running without ballast. I offered to take the stone off afterwards, but he would have it taken off then. I left it a short time, and then Mr. Sheard went to the Engineer-in-Chief and stated that the contractor had refused to take off the bottom ballast. Mr. Fincham showed me his letter, and I was astonished, and said I would call upon him to substantiate his statement, which was altogether false. I wanted the Engineer-in-Chief to cause enquiry to be made not later than the Saturday, as I had to leave for Melbourne on the Monday. I got a telegram the day after to meet the Engineer-in-Chief at South Bridgewater, as he was coming up by the express. I believed the Engineer-in-Chief was coming up to investigate the lie told by Mr. Sheard, but when I arrived he entered into some conversation with Mr. Sheard. I said I had received his telegram, and I had come to have an investigation of the statement made by Mr. Sheard. The Engineer-in-Chief merely said I must have misunderstood his telegram, and he refused to go into the matter. I ask you, gentlemen, to look into it, and see if the statement was true. I asked him to fix the Saturday for the enquiry; he agreed and came, and when I went to meet him he refused to go into it. It is a false statement, and only one of many. On another occasion I went to report what Mr. Sheard had said of me after I had engaged Mr. Climie. They said I had taken Mr. Climie away, and the Engineer-in-Chief said that a gentleman in Hobart had told him I was not satisfied with having taken Mr. Climie, but that I wanted to take Mr. Sheard also.

927. *The Chairman.*—You cannot speak on hearsay, Mr. Falkingham; tell us what you know yourself. *Mr. Falkingham.*—Very well. Then the Engineer-in-Chief said some one told him I wanted to take away Mr. Sheard. I asked him to substantiate the charge, and I wrote three letters asking him to enquire into the matter, but he would have nothing to do with it. I merely refer to these matters to show the false statements that have been made about me, and the way I have been treated when I sought for enquiry respecting them. There is one of the disputes, gentlemen, about extras, now. I was removing some ballast down at the Derbyshire Rocks, at about 10 miles. We were removing some stone rubble for ballast, and my son had charge of the engine. One of the inspectors came along and ordered him to desist. My son told him he had his orders, and he had better go to Mr. Climie. Complaint was made about this, and my certificate was stopped for removing the bottom ballast. Well, now, in mentioning these alterations I omitted to name those at the No. 1 bridge.

928. *By the Chairman.*—Yes; come to that. As to the alterations in the abutments: is it now built solid? Yes, it is now solid. I said this morning there had been ten altered plans for No. 1 bridge, but there have been nineteen different plans for No. 1 bridge. I wish to correct my evidence in that respect.

929. But those plans would be only small alterations in detail: I presume they would not affect the design? They are alterations in the entire character of the work in many instances. In one instance the

design was practically carried out and then the whole thing altered. The foundations of the abutment wall were put in on one design, and we used £97 10s. worth of cement concrete. That was all ordered to come down, and was buried up. It is in that abutment now.

930. Why was it covered up? Because they changed their minds and altered the design, and built the large massive thing you see now.

931. Was this a portion of the abutment? Yes, I suppose so. There were to be two wing-walls spread out, but this was altered and is now covered up:

932. Is that work to be seen now? No; it is all covered up by the abutment.

933. Is there any record of it in the shape of measurement that Mr. Parker can show: can he explain where it took place? Yes.

934. Anything else to tell us about this abutment? No, I think not.

935. *Mr. Falkingham.*—Now about this No. 1 bridge, I should like to give the Commissioners an explanation as to the dispute about the No. 7 pier. It has been said that I did not obey instructions, and that the work was filled in and built with clay and gravel instead of rock. My engineer, Mr. Climie, will be able fully to explain all that. There was some dispute, I believe, but it was all put right between Mr. Climie, my Engineer, and Mr. Sheard.

936. *By the Chairman.*—Anything else to say about the No. 1 bridge? Yes. There is a clause in the specification that the contractor being responsible for maintenance, must satisfy himself as to the stability of the foundations, therefore the Government and their engineers have not got exactly all the say in it. I should like to know if I should not have a voice in the matter.

937. It says in the contract, clause 18, page 31, that no masonry or brickwork, &c. shall be commenced upon any foundation without the inspection and approval of the superintending officer—(section read). What more as to No. 1 bridge? Well the superstructure that is to carry the line on the top is not fixed as it ought to be: I believe it will give way, and some serious accident will happen.

938. What is your idea about that? My idea is simply that every joint of the girders should be made fast and connected with each other.

939. But they propose to have the girders continuous? Yes,—only for 128 feet; then there is a break, and there will be quite three inches expansion and contraction.

940. But I understand it is proposed to have all the girders continuous? It has never been proposed to me. I will show you what I have got to build.

941. You have no authority for it? No.

942. Did you raise any objection to building the girders as they now are? Yes, I raised an objection some time ago, and they have made an alteration within the last fortnight. My objection was that the girders were not fastened to the bed-plates. The bed-plates are fastened to the masonry by four lewis bolts, but the girders themselves are quite loose in the bed-plates and not fastened to anything. Since my objection we have got notice to alter this. I have now got notice to bolt the bed-plates to the girders. [The witness described the first design.] That design was abandoned, and I have now to put in screw bolts to hold the girders down to the piers. That is an alteration made a fortnight ago, after I complained about it.

943. We understand these alterations are additional works to the original design? Yes.

944. And they are provided mainly at your instance? Yes, I suppose so. I only got the instruction on the 8th February. Now the top of this bridge is defective still. Every joint is loose; there is nothing to bind it to the work of the pier. If I lay the rails without fixed plates it will oscillate about. Then the deck of the bridge is to be left loose on the top of the girders. In the case of the No. 2 bridge, which is supposed to be the same design as this, they have now given me fresh plans, which shows that the deck is to be bolted to the girders. It is not so in No. 1 bridge. I can't say why they made the alteration.

945. But No. 2 bridge is the same construction as No. 1, is it not, except that it is a composite bridge? Yes. I heard it was stated that the reason the newels had to come down was that they had lately arranged to make it a joint occupation road at this place. I have had a plan in my possession some nine or ten months which shows that this was decided on then. I got the plan before the alteration of the road was decided, and I was to consult the Engineer-in-Chief about it; so that his statement is not correct. I got the plan about nine months ago.

946. We understand from the Engineer-in-Chief that the girders are to be strengthened by T irons which are to be bolted down, so as to enable them to make the bridge a road bridge as well as a railway bridge? I have had no notice of it.

947. Were ever any side-brackets provided for in this bridge? No; some gusset irons were provided on the side portion.

948. Then you have no orders for side-brackets at present? No; no orders at present.

949. Anything else in reference to No. 1 bridge? No, except that if you will allow me to show it, I have brought a model made of zinc to show the loose joint of the girders.

(Permission being given, the witness produced a plan of the piers, with a model of the continuous girders, and explained the same.)

Witness continued: This joint is supposed to provide for expansion and contraction. It is a loose joint, but the bottom is fixed. Now, you see this joint: is it reasonable to run a train over it at 20 miles an hour? I do not think so. She will grind on the outside rail for a distance of two or three chains before she gets to the centre, and they will be curved out of position. True, they are bolting these bottom plates now, but the road is loose. As it is, there is nothing to prevent the wind from carrying it over, because the total width is only 6 ft. 3 in., and the whole length of the girder is 128 ft.

950. *To Mr. Stanley.*—Are any braces provided under the deck of the bridge? None at all.

951. You said the deck was loose? Yes, a loose deck, and I can show it on the plan.

952. *By the Chairman.*—But Mr. Fincham said this would be bolted down? Well, he may have found that out to be necessary since, but I produce the plan to show that this decking is not designed to be fastened. (Plan produced).

953. *By Mr. Stanley.*—But that is not a detail plan? No; but it is the only plan that we have got.

954. Is there nothing in the specification as to the decking being fastened to the girders? No, nothing.

955. What is the thickness of the top flange of the girder? Concerning this, at the joints is five-eighths. The design for the Plenty Bridge does not show that the deck should be bolted down, but that has a cross girder, while the deck is longitudinal, and should be bolted down. It has to shift 4in., and it will be in the river.

956. *By the Chairman.*—Well, now you have described what the drawings show with reference to the road on the top of the girders, have you any other remark to make in reference to the design of the girder or of the No. 1 bridge generally? Yes; I wish to state my opinion that when the train comes on the top of that girder, with the wind pressure so severe as it is on this river, it will blow the whole thing over. The wind pressure on the carriages alone as they grind on the rail will shift the decking, it being laid loose.

957. Have you anything to say in regard to No. 2 bridge? No; Mr. Climie has all the measurements and will tell you about that.

958. I understand the alterations in No. 2 bridge are entirely in the piers, which are combined structures having iron cases filled in with concrete. Have you any remarks to make about that? Yes; I believe that this bridge will not stand. The piers are 52 feet in height, and not more than 4 feet wide from the top to the bottom; the caissons are 14 feet long. In the first place they were 14ft. 6in., but an altered plan was sent up showing them 19 feet up to water level, and then they die in again up to the height. I believe that the wrought iron will rust away in about four or five years. The iron bars with which they are braced inside will expand or contract, and the whole of the concrete will be cut into pieces. Even if the iron plates of the piers did not rust away, the concrete is not of sufficient strength to carry the railway, and, as I say, the iron bars will cut it up and the concrete will not be in a solid body, but cut up into five or six pieces; that is, under the existing plans. Supposing the girders would stand, the proportions of the concrete are not strong enough. The proportions are 1 in 9. It is customary in Victoria to make the concrete 1 in 6, that is, 2 parts of metal, 3 of sand, and 1 of cement; here it is made 5 of metal or large gravel, 3 of sand, and 1 of cement, as in the existing contract. That will not be a good pier; I believe if it is not soon carried away by the floods, the iron casing will rust away in a short period, and the whole will come down.

959. Did you object to the proposed mode of construction of this pier at the time the contract was signed? No, I did not know at that time exactly what sort of pier they were going to have.

960. Have you ever had any discussion with the Engineer-in-Chief respecting this pier? No, none. I wrote him.

961. Have these piers been altered in any other way than as you describe? They have been, but the plans have been suppressed. You will see to-morrow a plan showing an outer caisson that was proposed,—that is, an additional one outside that now provided, making the pier more than double. The Engineer-in-Chief gave me a plan showing another design for an outer caisson, but more complicated. I said it altered the character of the work; and, if carried out, he must pay me more money. He asked me for time to consider and he would let me know. He kept the plan I sent in, and I have never seen it from that day to this.

962. Can you supply the Commissioners with this? Yes; but unfortunately I cannot give you the data.

963. Will you undertake to produce this plan? Yes, I undertake to produce the plan.

964. With reference to this bridge, how does its girder contrast with that of No. 1 bridge? I am not quite sure. I have a letter showing that each girder is to be 1½ inches short; that allows for 1½ inches of expansion.

965. Has there been any alteration of the road? Yes. I take the altered plan I have got showing that the road is to be bolted down from without every 4 ft. or 6 ft.; that, I know, will have to be bolted through the girders.

966. Well, do your objections as to No. 1 bridge apply equally to No. 2 bridge? Yes.

967. Then you take exception to these composite piers? Yes, designed as they are.

968. What is the character of No. 3 bridge? There are to be wrought iron piers terrifically on the skew. There are nine of these wrought iron piers—the original plan shows them to be cylinders.

969. Are all these on the skew? Yes, considerably. I am not sure if they are more so than in the case of No. 1 bridge, but there are more of them. There are five in the water and four out of the water.

970. Now, in reference to the construction of the girders of this bridge, are they duplicates of those in No. 1 or No. 2 bridge? They are duplicates of No. 2 bridge.

971. They propose to have intermediate piers of a composite character? Yes.

972. Then your objections to No. 3 bridge are the same as the objections you have made to No. 1 bridge generally? Yes. The objections I have made to the piers and girders of No. 1 bridge and No. 2 will hold good in regard to No. 3 bridge.

973. Have you anything to state as to the bridge over the River Plenty? No, I think not; it is a very good bridge. It has been altered, of course. It only needs the decking bolting.

974. What was it originally? It was three 24-foot openings altered to one of 64 feet.

975. There is a land arch? Yes, there is under the altered plan two 24ft. and 1 64ft. span.

976. And that has been shortened? Yes, and many others the same.
977. But you have no complaint to make of the Plenty Bridge? No, save the decking being loose.
978. Have you any knowledge as to the height of the flood of 1863 at the Plenty River? Yes, from what I have heard from the neighbours. An old resident named Martin told me he never saw the flood reach within 10 feet of the original height of piers.
979. Does that take into account the back-water of the Derwent? I think so.
980. Are you satisfied, then, that the flood of 1863 was considerably below the level of the girders of that bridge? Yes.
981. Have you any other remarks in reference to the line generally? Yes; an important matter in reference to the alterations in quantities. If you refer to item 43, you will see the specification shows 200 yards only; and there are about 1700 yards in No. 1, and it is less than the original plan.
982. That is the squared masonry item in your contract? Yes.
983. What quantity is done now? 6000 yards, about.
984. What do you suppose will be the quantity required to complete the work? About 3000 yards more.
985. Then what the Department estimated as requiring 200 yards of squared masonry will now require 8000 yards. Are you positively sure of this? Well, not quite positive, but I shall not be far out. I have 1000 yards at Back River to do, and have a bridge to build besides.
986. Are there any other large excess items? Yes.
987. Will you point out where they are? Yes, there is a large excess in ashlar.
988. How much of that have you done? I can't tell exactly. In nearly everything there is an excess.
989. Now, as to the dry stone-walling or backing? Does that allude to the retaining walls? The schedule for these three classes is about 150 yards; I have built about 2000 yards.
990. I observe an item of 100 yards provided for it? Well, I have already built nearly 2000 yards.
991. Then, for item 54 of the schedule of quantities, where 100 cubic yards is set down you have already built 2000 yards? Yes; about that.
992. Will that be increased? Yes, I have orders now for 1000 yards more, but that will be squared masonry.
993. In the different items in the schedule are there likely to be any great diminutions that will act as a set-off against these excesses? No, there is not. In the woodwork schedule there are some items corrected, and I think they have been done away with, but in masonry there is a great excess. In the iron and metal you will see the quantities scheduled. I reckon I have to put up 500 tons of iron. I have ordered 400 tons from Hobart, and about 86 tons from Launceston. You will see the weights scheduled. About 600 tons of iron.
994. Well, taking the schedule, are the quantities therein estimated generally used? Yes. There may be some odd trifling things not used.
995. In reference to the construction of the girders, we saw some girders which, it was alleged, were being built for Nos. 1 and 3 bridges, on the wharf at Hobart. It was stated that the girders for the No. 2 bridge were being built at Launceston. Is that the case? Yes.
996. In a large work of this kind it is necessary to have strict terms. What conditions were imposed by the Government specifications? The Contractors were to do the work to the satisfaction of the Engineer-in-Chief. I have written to the Engineer-in-Chief in reference to some of the ironwork. I have examined the girders on the works.
997. Have any complaints been made about these girders to the Contractors? No. I think Mr. Fincham called attention to the quality of some of the iron in Launceston, which was not admitted to be bad.
998. Has any complaint been made to you as to the manner in which these girders have been finished there? I may say the Inspector went to inspect those being built by Mr. Knight, and he found that they, as well as those being built by the Messrs. Kennedy in Hobart, were as good as they should be; and he was told they would be done to his satisfaction.
999. Did you see the girders now being put together in the shop and on the wharf at Hobart? Yes.
1000. Can you state if they are built to a camber? I can't say; there is an inspector to look after that, and he should inspect them.
1001. Any complaints made as to their construction? No, never a word. I now want to call attention to the pitching of the slopes at Back River. I pitched those slopes to a certain height up the embankment while Mr. Mault was here. Mr. Mault considered the pitching was done to his satisfaction, and he paid for some of it. There was so much more done then. When Mr. Sheard came to measure up this quantity he objected to the work, and refused to pass it, because it was not according to specification, including that part which Mr. Mault had already paid for. After that the Engineer-in-Chief agreed to pay me 3s. 6d. a square yard as laid, but I did not agree. There is some pitching down the road that I don't complain about, because the tide carried it away. The stone was not so good, and the back water washed it away. But the pitching here is first-class, and I have a right to complain at Mr. Sheard refusing to pay for it. They gave me half price, and I cannot get any redress. Mr. Sheard called your attention to the fencing the other day. I don't know his object. True, Mr. Sheard, when he came, took exception to some of the fencing; but it was put up on Mr. Mault's specification and paid for. I was paid for it on the certificate at the end of the month. I took it at a reduced price, and I thought it was settled and there would be no more about it; yet Mr. Sheard called attention to this fencing after it had been paid for. Mr. Sheard also called attention to the masonry culverts—well, they were built under Mr. Mault's direction and to his satisfaction. The data of the specification show what it should be; if the mortar is no good it

is not my fault,—it is according to specification. It is the same quality as all that about Bridgewater, and it was put in on the special recommendation of the Engineer-in-Chief. Mr. Sheard comes since, and wants to pick holes in somebody's coat, and so he says the mortar would not set to please him.

1002. Have you the letter asking you to get the lime from this particular firm? Yes, I suppose so. The Engineer-in-Chief specially asked me to buy the lime from the Bridgewater Company, and I did so.

1003. Did they ever call your attention to those culverts? No; not the ones you looked at. I always altered any works of which they complained as soon as they informed me. There was an old man from Hobart who built some of the culverts, which they did not like, and they asked me to turn him away. I did so; I sent him away. I have done all I could to oblige them.

1004. *By Mr. Stanley.*—Before tendering for the contract I presume you made a personal inspection of the ground? No, I did not.

1005. Did you have it inspected for you? Oh yes, by two gentlemen whom I could well rely upon. I had tendered for the Fingal line unsuccessfully. Two gentlemen whom I know, from South Australia, had tendered for this line also without success. They gave me their notes on Derwent Valley Railway, so that I knew exactly what I had to do.

1006. Was the attention of those gentlemen who inspected the line drawn to the probable insufficiency of the waterways? No. It had nothing to do with me, it was my duty to build according to plan.

1007. During the construction of the line, did you see reason to call attention to the insufficiency of the waterways? Yes; when the very first culvert was built, myself and Mr. Parker called the attention of the Resident Engineer to the state of the culverts generally.

1008. Did you call the attention of the Engineer-in-Chief to any of the waterways? I don't remember, but I don't think so.

1009. Regarding the various alterations made in the culvert plans and drawings, were these altered plans furnished to you by the Resident Engineer or the Engineer-in-Chief? By the Resident Engineer.

1010. Were the alterations ordered by the Resident Engineer at any time confirmed by the Engineer-in-Chief? Yes, in his letters to me; I have his letters to show—17 March.

1011. Did the Engineer-in-Chief confirm the orders of the Resident Engineer as to the dry stone retaining wall at Back River? Yes.

1012. Can you produce the letter? Yes, I have the letter.

1013. Can you produce it for the information of the Commissioners? Yes. The letter is dated 17th March, 1885, and is as follows:—

*Derwent Valley Railway, Tasmania, Contractor's Office,
New Norfolk, 17th March, 1885.*

SIR,—Clause 22, general conditions, says no alterations are to be made, nor will they be recognised or paid for, unless such alterations have been made in writing by the Engineer-in-Chief.

Seeing that Mr. Mault is making alterations wholesale and verbally, permit me to ask you does this meet with your approval?

I do not wish to be understood I object to Mr. Mault making the alterations, but simply wish to put myself right in the matter.

I have the honour to be,
Your obedient Servant,
J. FALKINGHAM, *per* H. A.

JAMES FINCHAM, *Esq.*, *Engineer-in-Chief Tasmanian Railways, Hobart.*

The reply received from Mr. Fincham to that letter was as follows:—

Public Works Office, Hobart, 21st March, 1885.

DERWENT VALLEY LINE.

SIR,—I have the honor to inform you, in reply to your letter of 17th instant, with reference to alterations being made by the Resident Engineer, that all alterations so far have been submitted to and approved by me; but should you wish, I am quite willing to endorse any written orders of Mr. Mault when approved.

I have the honor to be,

Sir,
Your obedient Servant,
JAMES FINCHAM, *Engineer-in-Chief.*

J. FALKINGHAM, *Esq.*, *Contractor Derwent Line, New Norfolk.*

1014. *By Mr. Stanley.*—At what date did you receive your instructions as to the Back River retaining wall? I can't tell; it was three or four months before that. I could only tell by referring to the pay lists.

1015. I think you said you were ordered to build this retaining wall of random rubble? Yes.

1016. Is there provision in the specification for this work? No.

1017. Did you receive any supplementary specifications from the Resident Engineer in regard to it? No, none.

1018. Nor directions as to the character of the work? No; the Inspector was there, and had it built as he wanted it. I did not know what the character of the work would be. It was built under inspection, and measured and paid for.

1019. I presume, in reference to the various alterations that you have drawn the attention of the Commissioners to, in the formation levels, and line, that you have been paid for the extra work involved by those alterations? Yes.

1020. I think you have stated that it was originally provided that the faces of the pipe drains should be built in concrete? That is, if not required to be built in timber. I believed they should be built in concrete, or nothing at all.

1021. Was there any provision for timber facing? None at all; at least I don't think so. The plans show that these drains are to be faced in concrete if ordered. If timber is put in it must be because concrete is not ordered. (Witness refers to plan).

1022. Timber faces are provided for, then, in the contract drawings? Yes, for earthenware pipes, if concrete is not ordered.

1023. Can you give the Commissioners any idea of the probable cost of the alterations at the Back river retaining wall? No, but my engineer can supply it. It is more than hundreds a good bit.

1024. When you received the first design of the retaining wall to be built in random rubble—? I did not receive any design.

1025. Well then, the first instructions—were you satisfied that the dimensions given would make a sufficiently stable wall? No, I did not.

1026. Did you make a protest against it? I did.

1027. In writing? No; I called the attention of the engineer to the instability of the wall. It is not my place to criticise plans.

1028. You are surely responsible for the stability of the works, seeing you have to maintain them for a certain time? But I must make any alterations they require.

1029. For your own protection you are bound to protest against any work that would affect the stability of the line. If the works are affected it would be at your cost for maintenance, would it not? As soon as I saw the plan I objected to it, and wrote to the Engineer-in-Chief. I will show you my letters, and you will see it was not Mr. Mault, but the Engineer-in-Chief, who was in fault. The wall was put up by his orders.

1030. What do you mean?—can you produce that letter?—that is the letter which I have read? The approval of Mr. Mault's alteration, and it became his act.

1031. Did he know what was going on? I suppose so. They were taking the eyes out of the work. He wrote to Mr. Mault when it was done, and approved of the Back River wall distinctly, and it fell down after.

1032. When the contract was signed, was it understood that the ironwork should be done in the Colony? Yes; it was this way:—Two people had thrown the contract up; they then telegraphed and wanted me to come over. They said they would give me the contract if I got the ironwork in the Colony. I said it would be £4000 more than it would cost by going to England, but I said nevertheless I will take it. There was an alternative price in schedule,—a price for supplying and a price for erecting. A price was fixed for erecting only in case the Government should want to supply the iron. I called attention to this, and said I thought it would be better for Government to supply the ironwork and let me put it up. I said it would save them about £4000.

1033. Then you based your prices on the idea of getting your ironwork from England and not in the Colony? I did, and I was £4000 out of pocket by it, but I accepted it rather than throw up the contract. I can get the same sort of ironwork from England at £15 10s. per ton, and I am paying £24 to £30 per ton in Hobart; but I could not better myself. I am not paying quite so much in Launceston,—that makes it a little more easy for me.

1034. I observe by the contract drawing that a lin. camber is provided for in the 64ft. girders? I cannot say. (Witness refers to plan).

1035. Can you say if those girders at the Plenty River bridge have been built to that? No, I cannot say. The Government Inspector is there to see to that.

1036. Attention was drawn during our visit to the line to the insufficiency of the cess between the toe of the slope and the edge of the side-cutting? Yes, we varied the width by permission. I objected that I could not take extra ground where the owner did not give permission.

1037. Did you make any application? I can't say. We obtained enough by going to the edge of the cutting.

1038. Have those been carried out to the satisfaction of the Resident Engineer? Yes, and been paid for. He paid for it a time or two, and now because I won't do certain work he will not pass it. The Engineer-in-Chief was quite satisfied before and paid it, but now Mr. Sheard has taken exception to it.

1039. I think I understood you to say that the fence lines on the plans are at a uniform distance from the centre of the line? Yes.

1040. Did you call the attention of the Department to the necessity of increasing the width where the cutting was deep? I can't remember it. I wrote several times to Mr. Mault about it. He said it was my duty to set out the work. I asked him to come and show me where the fences were to be put, but he would not do so.

1041. Do you know if the Department tried to take additional land? No, I do not. They sent a man named Frodsham to put in the fence pegs. He commenced at Glenora and worked down the line, but nobody followed his pegs; in fact we were told to take no notice of them.

1042. Did you know that he provided for additional land by the fence lines? I am not aware if he did. Mr. Parker can answer that if you put the question to him to-morrow.

1043. Were the floods which occurred in November of last year of unusually high character? No, it was not half a flood—just a little fresh in the Derwent.

1044. Was the rain that fell heavy in particular localities? No, it was light, but it lasted three days.

1045. There was no sudden fall of rain that would cause a sudden rise in the creeks? No; if it had been a severe rain for an hour and a half it would have swept the whole thing away, I believe.

1046. Can you state what the probable amount of your contract will be, including the additional works ordered? Well, I cannot, but I should say not less than £100,000.

1047. The contract amount is £80,614, but you don't expect the total will be less than £100,000? No, I do not.

1048. Could you enquire, and furnish a rough estimate of it? I don't know; Mr. Parker could do it better than I could; he could do so.

1049. But you are satisfied it will not be less than £100,000? No, it will not be less.

1050. *By Mr. Lawder.*—Can you give us any idea of the height of the flood level at Back River wall? how far would it be below the formation? No, I can't.

1051. Did you never enquire? No, I never have. I asked the Engineer-in-Chief to keep the culvert 4 feet lower and increase the width.

1052. The Engineer-in-Chief told us that the floods had never been up to the floor of the wooden road bridge at New Norfolk: do you know if they have? I could not say.

1053. Could you get information as to their greatest height there? I think I can. Where I am living is on the same level as the bridge almost, and the water has been over the road where I am living.

1054. You will get the information to-morrow? Yes. Mr. Sharland would know the lines at the bridge.

1055. Are there any specifications in connection with the contract for the construction of the coffer-dams that you are to apply to the sinking of the foundations of the piers at Nos. 2 and 3 bridges? Yes, my price includes it.

1056. But are there any specifications for the coffer-dams you are to erect? No.

1057. What style of coffer dam do you intend erecting? I shall not want one. I shall just bolt the caissons together in 4 feet lengths and lower it to water level, sink it, and then rivet another on top of it.

1058. Yes—but how do you level the foundations? I shall send a diver down with a rock-borer.

1059. How are you to satisfy yourself that the foundations are sound? The Government will have to satisfy themselves. I shall be satisfied easy enough; I shall satisfy myself, because I am responsible for the stability of the work for 6 months after completion.

1060. If dirt got into the foundation, or chips got into the interstices, would the diver have to clear away to the surface of the rock? Yes, in that case, certainly.

1061. Would your diver remove all friable stuff and inequalities? The inequalities would be levelled up by concrete I suppose.

1062. How do you propose to put the concrete down in the water? The concrete would be put down in bags.

1063. Have any instructions been given to you as to how these caissons are to be got into the bed of the river? No, never.

1064. Do you intend to demand from them any special instructions? No.

1065. Have you any reason to believe that it is their intention to give instructions? No; I know my duty and will perform it.

1066. You have no idea of the water head at this bridge? No, but I should say the water runs very rapidly.

1067. Can you tell us the thickness of the original abutment designed for the Back River culvert, and that of the one that is completed? No, I can't tell; the first was about half the thickness of this one.

1068. Did the wall fall, or did it bulge and have to be taken down? It bulged, and was taken down.

1069. To the foundations? Yes, to the foundations, and fresh plans were given.

1070. Did the filling of concrete stand, or has any new been put in? No, none has been put in now. It was altered. It was to be a stone backing, and he would not let me put it in; he said I had too good a price, and he made me put in earth. The rain came, and of course the wall bulged.

1071. You stated that the deck over the girders at No. 1 bridge was to be fitted loose: what is it to be at the Plenty Bridge? It is carried on over the cross girders, but the deck is longitudinal. (The witness pointed out the girders on the plan.)

1072. I understood you to say that the line was diverted from its original alignment at the Back River, owing to the paddock through which it ran? I said it was carried through a paddock further back from the river.

1073. Had you ever solicited orders in reference to the cutting of those side and table drains? Yes, I fought hard to get them done.

1074. In every instance? Yes.

1075. Then do you consider yourself as not responsible for the overflow owing to these drains not being cut. Was that overflow caused because these drains were not fit to take the water? Yes.

1076. Do you consider it has any reference to these side or table drains? Yes.

1077. Has damage been done to the banks? Yes, all the way along where these drains were not cut: the water got into the formation and did damage to the banks.

1078. Can you give any rough estimate of the damage sustained? No, not now.

1079. You attribute it to noncompliance as to the issue of orders by the Resident Engineer? I cannot cut these drains without orders, and none were issued. Mr. Sheard asked me to tell him when the water came on the line so that he could come down and see about it.

1080. You say there were nineteen different drawings for No. 1 bridge : were any of these relating to details merely, or were they all alterations? Yes, they were all alterations.

1081. Are we to understand that of all those nineteen plans some were not detail plans, but that all were connected with alterations? I would not like to swear exactly, but I think they are.

1082. Does the work said to be covered up at the abutment of No. 1 bridge form part of the present abutment? No, it is not part of the abutment.

1083. It is covered up by the abutment? No, but with end of embankment.

1084. Is it part of the measurement of the abutment? No, it is merely doing duty as earth; that is, the earth was taken out and the concrete was put in, and then the plan was altered and the whole was covered up. I was paid for the concrete £97 10s.

1085. Can you inform us as to the size of the logs which come down the Derwent? No.

1086. Can you find out for us the size of the largest trees carried down the river? Yes, I will try to-morrow to get you this information from some reliable witness.

1087. Can you give the Commissioners any idea of the probable excess on the squared masonry along the line, not including the Back River wall. No. We have built perhaps about 4300 yards in the bridges and in the culverts, not including the Back River wall. I know we have built nearly 5000 yards, and I think there may be 500 or 600 yards in the Back River wall; so that would leave about 4300 yards in the bridges and other culverts of squared masonry.

1088. Can you give an idea of the discrepancy in the work executed at the Derbyshire rocks in comparison with the amount estimated by you—£500 was what you intended for it? No, I don't think so.

1089. Can you give us a copy of your estimate? No.

1090. *By Mr. Stanley.*—In respect to the probable total amount of the contract, which you have given as £100,000, does this mean the work done at schedule rates, or does it include any claim you may have against the Department outside of actual measurements? No, it does not include any outside claim.

Mr. Falkingham was asked to give a statement of the cost of works included in the alterations which have caused the excess.

The witness then withdrew.

THURSDAY, MARCH 4, 1886.

The Commission sat at the *Bush Hotel*, New Norfolk.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

CHARLIE KILNER SHEARD, *Associate Member Institute of Civil Engineers, examined.*

1091. *By the Chairman.*—What are you, Mr. Sheard? Resident Engineer of the Derwent Valley Railway.

1092. When were you appointed to that position? On the 3rd June, 1885.

1093. Will you state what experience you have previously had in the construction of railway works? I was a pupil of R. M. Brereton, a Member of the Institute, and during that time he had a great deal to do with railway work. I was on the Petalumah Railway, and also connected with the Southern Pacific, and I did a great many surveys in California under Mr. Brereton. When he retired, I took his place on the irrigation works, and after that I went into dock work, and was engaged on the Lima, Callao, and Oroya R. R., Peru. I did not do any railway work after that until the Barrow Dock scheme came on. I was engaged on that for a short time, and then came out here for the benefit of my health.

1094. Was the Mr. Brereton you mention of the firm of Brereton & Lewis, of Great George-street, Westminster? Yes.

1095. What are your present duties? To carry on the construction of the line according to designs that have been furnished and to be furnished. I was appointed to get the line put straight. When I came here everything was in a very bad state. The work was not right, and there had been a great deal of unpleasantness in consequence. I was told I was to get everything straight, and I had to get all the existing plans altered that required altering.

1096. When did you commence work on the line? Although I was appointed on the 3rd June, it took me nearly a fortnight before I could get into the full swing of the work. I sent in my report on the 18th June, and by that time I knew what the works were.

1097. When was the contract let? In January, 1885. Six months' work had been done when I came here.

1098. Who was your predecessor from the commencement of the work up to the time you took charge? Mr. Mault.

1099. Had he the undivided charge during the whole of that time? Yes.

1100. Then your responsibility dates from about the middle of June up to the present time? Yes.

1101. For what are you supposed by the Engineer-in-Chief to be responsible? For the works being carried out according to the specifications, and the plans being carried out according to the designs that are accepted, and that are furnished to me. Drawings got out by myself have been submitted to the Engineer-in-Chief, and, on being accepted by him, have been furnished to the contractor. I found the works in such a state when I came that I was bound to cancel all the new drawings that had been issued by Mr. Mault to the contractor. I cancelled every drawing on the works except the contract standard drawings. Until I could get other drawings out and submit them to the Engineer-in-Chief, I carried the work out by sketches.

1102. In case of a conflict of opinion between the contractor and yourself as to the reading of the specifications, what is your course of procedure? I appeal to the Engineer-in-Chief.

1103. And what does the Engineer-in-Chief do? He decides whether my reading of the specifications, or the contractor's, is the right one.

1104. Some evidence was given yesterday as to the failure of certain works between North Bridge-water and New-Norfolk: have you had any share in the responsibility for those works? Decidedly not.

1105. The whole of them were undertaken by your predecessor? The work was all completed when I took charge, and the only thing I did between those points was to order additional culverts to be put in after the heavy rains.

1106. In reference to these works for the conveyance of water, what plan did you adopt to determine the requirements of any locality? I went over the ground to find the catchment area, and made an estimate of the quantity of water that would come through a given point in a certain time, and allowed sufficient space for the flow of water off the catchment area.

1107. Have you followed out that plan? Except in two cases, where nothing was required.

1108. Having determined the drainage area for a particular work, what do you do then, presuming that the work contemplated in the contract is not sufficient? I report it to the Engineer-in-Chief, and get his permission to increase the size of the waterway.

1109. What does he do? He gives me permission, and I issue instructions to the contractor.

1110. Does the Engineer-in-Chief, according to the instructions, sign the drawings for any new works issued to the contractor? Not if they are in accordance with the standard drawings. If I were to alter the design of a standard drawing he would have to sign it.

1111. Supposing he withdraws a drawing, and another is substituted for it, does he not authorise that document by signing it, as contemplated by the specifications? If the contractor wishes it.

1112. Is it not obligatory on him to do so? If he is asked.

1113. But if he is not asked? I do not think so. So long as he does not alter the standard drawings, my signature is quite sufficient.

1114. That, as between you and the contractor, is a matter of administration: as a matter of procedure, is it not the duty of the Engineer-in-Chief, when one drawing is substituted for another, to ratify the new drawing by signing it? I should not think so.

1115. It says here that the Engineer-in-Chief "shall" do so and so. Is it not, in your opinion, desirable and necessary that he should comply with the terms of the contract? I look at it as only an alteration of detail.

1116. As a matter of administration you are right in the view you take, but how are you to guarantee under what authority the provisions of the contract are fulfilled? The contractor gets his instructions from the Engineer-in-Chief, and my signature to the drawings is sufficient.

1117. Clause 22, with reference to extras and additions, says clearly that, "unless the same shall have been ordered and directed by the Engineer-in-Chief in writing as aforesaid, or unless the claims thereto by the contractor shall have been made in writing within 30 days from the date of completion," those works will not be paid for? It is understood by the contractor that so long as I follow the standard drawings, and he gets a letter of instructions from the Engineer-in-Chief, my signature to the altered drawings is binding upon him.

1118. The contract is a document under seal, and no written instructions except under seal and as provided for will cancel it. That being the case, do you not think it is the duty of the Engineer-in-Chief to comply with Clause 22? In that case it is.

1119. Has that been the usual practice? There has been no departure from the standard drawings. When there has been the slightest departure from the contract drawings it has been signed by the Engineer-in-Chief.

1120. The contractor has stated that certain works have failed on the line: have any works failed that you have put up? Not one.

1121. Who commenced the works on the Back River? Mr. Mault. I stopped the work. It was after the failure of the wall that I was appointed. It was really on account of this wall and some other failures that Mr. Mault was suspended.

1122. Who suggested the present works at the Back River? The dry rubble backing and the masonry retaining wall were ordered by the Engineer-in-Chief.

1123. Then those works were determined upon before you came? Yes.

1124. Has any portion of the work now being carried on there been designed according to your suggestions, or had the whole of it been designed by the Engineer-in-Chief and your predecessor? The work determined upon would have cost more than the work I have put up.

1125. Was any portion of the present design a suggestion of your own?—On the failure of the work I made certain recommendations to the Engineer-in-Chief.

1126. Will you tell the Commissioners what you recommended? Did you pull down the old work in the abutment? No, I strengthened that, and carried the wing-walls further, with a backing of lime-concrete and stone, instead of dry stone.

1127. Then the design for the arch was already there? That has been carried out.

1128. Was the form of the river wall altered? The wing-wall was extended.

1129. Was the form carried out? The original 4 ft. wing-wall was carried clean back, and is run back parallel with the railway bridge to the old wall.

1130. Those works were all from the original design? Only strengthened.

1131. To what extent were they strengthened? The drawings will show.

1132. Were they widened and raised? Only the thickness of the walls strengthened.

1133. Was the character of the design for the river wall strictly adhered to? It is now being built in a vertical manner.

1134. Was that the original design? According to the original design it was to be a batter wall of 1 in 4.

1135. Had you anything to do with the alteration of that design? Instead of building a 1 in 4 batter wall I built it vertically right along.

1136. Are you responsible for building the wall vertically—altering it from the contract sketch—or was that adopted by your predecessor? By me, on account of the work that had already been done.

1137. I want to divide, if possible, the responsibility attached to the execution of these works. You say that your predecessor undertook them, and that they were adopted by the Engineer-in-Chief. I want you to state clearly to the Commissioners what you did, and what you have done since? The wing-wall built to a certain extent vertically. I adopted the same design.

1138. Then that plan originated with your predecessor, and has been carried out by you? Yes, the vertical wall was already partly built.

1139. To what extent? Some 20 odd feet.

1140. That was not pulled down? No.

1141. Then you followed out his original design? Yes. It was stated to me that the bank at the back of the wall was a rock bank, but when the winter rains came on the whole of the wall gave way, and we found that it was not a rock bank, but a clay bank. That is the reason for the further extension of the retaining wall.

1142. It has been stated in evidence that you placed concrete at the back of the abutment of the wall. Is that the case? Yes, lime concrete.

1143. What is the thickness of that? It varies according to the depth.

1144. Do you consider that necessary? Yes, on account of the very bad position of the work.

1145. Supposing the contract provision, giving a batter of 3 inches to the foot had been adhered to, and carefully selected earth and stone had been piled behind the wall, would it then have been necessary? It would have cost more than the present work.

1146. That is, adhering strictly to the thickness of the wall? Yes.

1147. But supposing you had adopted what is the ordinary practice of building a wall of a certain thickness at the bottom, gradually tapering to the top, by a batter of 3 inches to the foot, would then this concrete have been necessary? No, but there would have been more masonry, and it would have cost more.

1148. In carrying on these works you are now fully acquainted with the specifications and drawings. Can you suggest, for the information of the Commissioners, any plan by which a simpler and more effectual mode of carrying on the railway works might be adopted? The specifications might be made clearer, certainly.

1149. I am speaking of the administration particularly? If the specifications were plainer it would be easier to carry on the work.

1150. In what respect are they deficient? Two or three of the clauses are conflicting. For instance, in regard to dry stone work, it is provided on page 27 that it shall be done at schedule rates for cuttings, and on page 34 that it shall be done at so much per cubic yard.

1151. Are there any other conflicting clauses? Those are the only really bad ones.

1152. My question refers to simplicity of procedure—can you suggest any improvements? It would certainly be an improvement to make the specifications clearer.

1153. As I understand, the Engineer-in-Chief adopts any reasonable and beneficial suggestions of yours, and they are carried out? Yes.

1154. Knowing, as you do now, all the difficulties which surround this contract, can you suggest any plan by which such difficulties may be avoided in the future—I am speaking chiefly with reference to the construction of future railway works? The only suggestion I can make is that the Chief has not been allowed a sufficient staff of assistants to do the work. The Engineer-in-Chief has had to be in his office to attend to all the work of the island, and he has had no assistance, excepting that of Mr. Edwards, in getting out the drawings, and of the engineers who are on the works. He had no one to check the work out in the field. That, however, is being altered.

1155. What would you then suggest for the future? I would suggest that there should be an inspecting engineer for the lines under construction, and an inspecting engineer in charge of surveys.

1156. Do you think that if that plan had been adopted on the Derwent Valley Railway, all these failures and disputes that have taken place might not have happened? I am quite certain of it. Such officers as I have mentioned would of course be conversant with their work, and the onus would not have been thrown on the shoulders of the Engineer-in-Chief. The Engineer-in-Chief has to look after all the railways and other works in the colony, and it is impossible for him to spare the time to go over every line and check the work, and have everything at his fingers' ends.

1157. Is there any other statement you would like to make with reference to this particular subject? Only that I think it is vitally necessary that such officers should be appointed. An engineer has been appointed to look after the surveys, but there should be one appointed to look after construction as well.

1158. *By Mr. Stanley.*—I think you stated that you had prepared designs for many of the altered works as now being carried out? Yes, you have the drawings for the altered culverts by you.

1159. The contractor, Mr. Falkingham, pointed out yesterday several places on the line where the grades and centre line had been altered—are you responsible for those alterations? Yes, they have been made at my suggestion.

1160. Were those alterations submitted for the approval of the Engineer-in-Chief? Yes, and received his sanction.

1161. Would you mention the various alterations in formation and line which were made at your suggestion? From 9m. 68ch. to 10m. 50ch., but that is very slight; from 12m. 68ch. to 13m. 20ch., and from 19m. to 20m. 54ch.

1162. Were the whole of those approved by the Engineer-in-Chief? Yes.

1163. Was that approval signified by his signing the altered plans, or in what manner? He signed the originals, I think, and he also wrote the contractor a letter. You have the letter in which he sanctions the alterations being made.

1164. Did he sign the altered plans and sections? I think he signed the originals, which the Commissioners have in Hobart.

1165. We were informed by the contractor that he had received several different plans for the masonry of No. 1 bridge. Were those plans prepared by you? Only one.

1166. Who were the previous ones prepared by? Mr. Mault.

1167. Can you show that drawing to the Commissioners? I produce it. It refers only to the abutments.

1168. That is an alteration, I understand, from the original contract drawing? Yes, it was all altered before I came here.

1169. Has your plan received the approval of the Engineer-in-Chief? Yes.

1170. Has he signed it? I am not certain. I think he did, and sent it on to the contractor.

1171. Is it usual, in a case of that kind, for the Engineer-in-Chief to sign the altered plan and forward a copy of it to the contractor? No, I forward to the contractor his tracing.

1172. Does that tracing bear the signature of the Engineer-in-Chief? Not necessarily. It has always borne my signature.

1173. How is the contractor to know that the Engineer-in-Chief acknowledges that plan as forming part of the contract work? By the Engineer-in-Chief's letter.

1174. But he does not identify the plan as having been approved by his signature: do you not think it necessary, when one of the contract plans is altered in that way, that the alteration should be identified by the signature of the Engineer-in-Chief? I have the Engineer-in-Chief's sanction.

1175. Clause 22 of the general conditions provides that whenever important alterations of this kind are made they must be approved of by the Engineer-in-Chief in writing: has that condition been acted upon or not? I could not say.

1176. Should not such altered plans, when sent to the contractor, bear the Engineer-in-Chief's signature? Certainly they should.

1177. *By Mr. Lawder.*—Who was responsible for obtaining the signature of the Engineer-in-Chief—you or the contractor? The contractor. I look at it in that light. I took it that the letter of the Engineer-in-Chief was sufficient authority.

1178. *By Mr. Stanley.*—But the letter will not identify the plans? No, but my signature does.

1179. You are not the person authorised by the contract to sign? But I am authorised by the Engineer-in-Chief to sign, and I think that is sufficient authority.

1180. I doubt whether the Engineer-in-Chief can depute such authority to anyone? That is what I understood—that the letter given by him was quite sufficient.

1181. Did you prepare the drawings for No. 2 bridge? No; they were prepared by Mr. Edwards and forwarded to me.

1182. You stated that the plans for a portion of the retaining wall at Back River, as now being built, were prepared by you. Did you submit your designs to the Engineer-in-Chief for his approval? Yes.

1183. Did he signify his approval by signing the plans? I think he signed them, but I am not certain.

1184. Can you furnish the Commissioners with a list of the altered work for which you are responsible and state whether the plans have been signed, or not, by the Engineer-in-Chief? I will do so.

1185. Who appointed the subordinate staff on the line—the inspectors? The Engineer-in-Chief.

1186. Have you found the inspectors and other subordinate officers efficient in the discharge of their duties? Yes.

1187. Have you had sufficient assistance in that way? Sometimes I require the assistance of another engineer. I have no one to help me but a young man, who is very accurate in instrumental work; but when I apply for competent assistance I always get it.

1188. The assistant to whom you refer, I suppose, is chiefly employed in your office? He is running cross sections.

1189. Does he assist you in making out the monthly certificate? I always make out my own certificates. He is doing it now for the first time.

1190. Can you supply the Commissioners with an estimate of the cost of the additional works which have been ordered since you took charge of the line based upon the contract schedule of prices, and also an estimate of the probable total amount of the contract as now being carried out? I will do so.

1191. It was stated in evidence by the contractor that he applied some time ago to be furnished with the position in which the side ditches were to be cut, and that up to the present time he has not received such information as would enable him to complete them: is that so? It is utterly untrue.

1192. Have you furnished him with the necessary information he requires for cutting the side ditches throughout the line? I have personally done so, and have shown his engineers on the ground on the whole length of the line. My letters will show that.

1193. Will you furnish any letters you have corroborating that statement? I will. The side ditches are cut all through the line. I can give you the exact length of the side ditches actually cut at the present time.

1194. Have you given the contractor the necessary instructions with respect to cutting mitre and table drains? Yes; there is a standing order that any grade that is not steeper than 1 in 99 shall have table and mitre drains cut.

1195. Have your instructions been carried out by the contractor with regard to table and mitre drains? No; they have left them blocked with rocks and stones, and will not take them out; neither will they clear or grade the side ditches.

1196. You stated, I think, that in determining the additional waterways to be provided, you have been guided by the areas of the watersheds: will you prepare, for the information of the Commissioners, a tabulated statement showing the area of the watersheds at such places as additional or altered waterways have been ordered? There are only two or three that I have ordered.

1197. But a large number were pointed out to us on the occasion of our visit to the works: could you not furnish such a statement as the one I have referred to? I will do so.

1198. Before deciding on those altered or additional waterways did you, in accordance with the provisions of the 8th clause, provide a report to the Engineer-in-Chief? I did.

1199. Can you furnish a copy of that report? It is in letter-book No. 2, page 62, which the Commissioners have in their possession.

1200. After the receipt of that report, did the Engineer-in-Chief go over the line with you and examine the different localities? Yes, for the purpose of ascertaining what quantity of water was likely to come down the gullies; and we also got information from old residents in the neighbourhood.

1201. I presume the Engineer-in-Chief is in the habit of making periodical visits of inspection to the line? Whenever I ask him.

1202. On this occasion did you point out to him any alterations that were being made, or any extra works that you had ordered? Yes; but I made no alterations until I had his permission to do so, and he had seen the locality.

1203. Was it at your suggestion that timber faces were substituted for concrete faces? Decidedly not.

1204. Then you have abandoned the use of timber for facings? Yes, for all pipe-work.

1205. I presume that that alteration was made by Mr. Mault? The timber faces were all put in by Mr. Mault, with the exception of one that was put in before I knew anything about it; then I stopped all timber faces and adhered to concrete.

1206. On the occasion of our visit to the works, our attention was drawn to some ballast that had been obtained by the contractor for bottom ballast, and condemned. From your knowledge of the material of which this ballast was composed, are you of opinion that it was unsuitable for bottom ballast? Yes; I tested it carefully, and found that under the influence of weather and water it would soon become one mass of clay and puddle.

1207. How long has this ballast been lying where we saw it? Two or three months, perhaps four.

1208. So far as we could judge, there was no appearance of that disintegration? In some places it could be seen, in others not.

1209. Not where we looked at it? Possibly not, in that particular place. All the small material is disintegrated.

1210. Are you of opinion that it is advisable to use sand for bottom ballast? I do not believe in it myself.

1211. *By Mr. Lawder.*—Do you consider yourself responsible, in so far as these instructions to you are concerned, for carrying them out in their integrity? Since I got the work into my hands I do, but not before. It took me at least six weeks to get everything straight.

1212. With reference to one of those instructions, do you invariably write the results of your inspection in your diary? Yes, I write every day a full account of everything that takes place.

1213. Including your instructions to the contractor? Yes, everything connected with the day's work.

1214. Do you also report monthly to the Engineer-in-Chief, in full, upon all the works, as is laid down in the instructions? Not monthly, but when I send the certificate in; but I report immediately anything that has taken place.

1215. Did you make any special report, after taking charge, showing clearly in detail any faulty construction from design or workmanship? I made a special report as soon as I got the work in my hands, which I produce.

1216. I see that in this letter to the Engineer-in-Chief, dated the 18th June, you allude to the bad quality of the mortar used: in what works was that mortar used? In the stone culverts that I drew your attention to.

1217. What fault did you find with the mortar? The sand was bad, and would not set.

1218. Have those works in which that mortar was used been reconstructed? No, but they will have to be.

1219. Can you give the Commissioners a list of the works which will have to be reconstructed owing to the use of this faulty mortar? They are mentioned in my letter to the Chief Engineer reporting on the works, on the 18th June.

1220. Did you point them out to the Engineer-in-Chief when he visited the works subsequent to that report? I did.

1221. I observe, in section 7 of the instructions to the resident engineer, that a discrepancy in any drawing is to be brought to the notice of the Engineer-in-Chief by the resident engineer. Do you always follow that instruction? If it is of any consequence I do. The only one to which I have not drawn attention was in one of Mr. Edwards's drawings, which showed 1 in. instead of $1\frac{1}{2}$ in., which I arranged with the contractor should be put right.

1222. What was the character of the original retaining wall at the Back river? A dry rubble wall, built of the very worst class of stone that could possibly be got, and in thickness it was nothing but pitching. In fact it was not a wall.

1223. What was the thickness of the wall? As near as I can remember, at the foundation about 2 ft. 9 in., but not so much at the top. The wall was 22 ft. high.

1224. Was the wall now taken down of the same character as the part remaining which was inspected by the Commissioners on their recent visit? No; the part the Commissioners saw was better than the part that fell down.

1225. How deep was that wall founded below the original surface? 9 or 10 inches.

1226. What was the character of that foundation? Alluvial deposits washed down by the river, and in one or two cases logs were taken out.

1227. Before the wall was taken down, or after? After.

1228. Were those logs observable before it was taken down? I should think so. The wall was built right round the logs.

1229. Has any portion of that wall been covered up? The patching from 12m. 78ch. to 13m. 0ch. 50lks. is all covered up, and from 13m. 2ch. to about 13m. 8ch. 50lks.

1230. Do you not consider that the line should have been originally placed where it has now been placed, and whether a retaining wall would have been required at all under those circumstances? It would have been better if the line had in the first instance been put back 25 feet.

1231. If the line had been originally put back where it is now, do you consider it would have effected a saving of money? Yes, and the saving would have been greater if it had been put back 25 feet.

1232. Would that have done away with the necessity for a retaining wall? Yes, the rock bank would have been sufficient.

1233. I see that in many places alterations in alignment and gradients have been made. In this particular case the alignment was originally placed, in the Parliamentary surveys, much higher up the bank. Can you tell the Commissioners why the original alignment was deviated from? I have no idea. The line was all constructed when I came here.

1234. Did you make any alterations in alignment or gradients on any portion of the line? I made a great many.

1235. What were they necessitated by? Danger to the line itself.

1236. What do you mean by danger to the line? There was no stability in the way the line had been constructed.

1237. Then the gradients were altered by you after construction? Yes.

1238. What were your reasons for making those alterations in the gradients? The reason for the alteration at the Derbyshire Rocks was to prevent the necessity of having to build a retaining wall. By going a little further into the hill I got sufficient material to make a good rock embankment. By spending £6000 in excavation at that place there was from £14,000 to £16,000 worth of walling saved.

1239. Is that the place where Mr. Falkingham informs us that he had tendered for £500 to perform work which ultimately cost £4200? The tender was not made to me, but to Mr. Mault. The work that was tendered for for £500 was a mere bagatelle to what was ultimately done—it was only to knock off the points of the rocks here and there.

1240. In the alignment by which the knocking off of a few points of rock could be done for £500, would any other protective works have been necessary involving a greater expense? A wall would have had to be built round the river face.

1241. Is that the place you allude to as requiring a wall which would cost £14,000? Yes.

1242. Do you consider that the expenditure there of £4200 was justified? More than justified, for it saved the expense of the wall, and so cheapened the cost of construction.

1243. Was that wall provided for in the original estimate? No; it was provided for in Mr. Mault's sections.

1244. Did this alteration receive official sanction from Mr. Fincham? Yes.

1245. Did he inspect it before approval? He inspected it several times.

1246. Since you became Resident Engineer, have you reduced any steep gradients as originally laid out, or improved them? I altered the grade at 19m. in order to avoid rock cutting and get a better run on to the bridge.

1247. I dare say that with a little more expense, the line could have been made somewhat more level as regards grade? Certainly, but at a great deal more expense.

1248. With reference to culverts, was it in your time that the footings were done away with? No.

1249. Do you approve of footings being done away with in culverts? I believe in cement concrete foundations in preference to footings.

1250. Do you consider the culverts that have footings only, between Bridgewater and New Norfolk, are sufficiently safe as they stand, irrespective of any imperfect mortar? Not in that material.

1251. With reference to No. 1 bridge, the contractor states that he has had 19 different designs for it. Is that so? I have seen only one and my own.

1252. Are you aware that there have been 19 different designs for that bridge? I have not seen them.

1253. There appears to be a considerable increase in quantity of squared masonry for culverts and bridges over the schedule. Can you explain that discrepancy? I know nothing about it; it was before my time.

1254. You are of course aware of the quantities contained in the schedule. Do you consider that that list of quantities represents approximately the quantities that will actually be required? By no means. The masonry, for instance, is entirely wrong. The quantity of squared masonry in the schedule is 203 cubic yards, and there will be 7000 cubic yards at the very least. Many of the items are very much underestimated. In the item of masonry in cement mortar 50 cubic yards are provided for, and from 1700 to 2000 cubic yards will be required.

1255. Perhaps, instead of going through all the details now, it would simplify matters if you were to prepare a statement setting forth the quantities that have been required up to the present time, as compared with those originally provided? I will do so. [*Vide Appendix*].

[The Secretary here intimated that there were three farmers present who had attended to give evidence as to flood levels and logs coming down the river. They were anxious to get away, and he asked to know if they would be examined at once. The Chairman said that under the circumstances they would take the evidence at once.]

JAMES GEORGE GODKIN, *examined.*

1256. *By the Chairman.*—Where do you reside, Mr. Godkin? At the Falls Farm.

1257. How long have you resided on the banks of the River Derwent? Since 1854.

1258. We want some information from you as to the height of flood waters in the Derwent, in so far as they are likely to affect the Derwent Valley Railway? I consider the most dangerous place is about Charlemont, about 8 miles up the river, but that is some distance from the railway.

1259. You must fix your attention on some point of the river which would affect the railway works. Let me direct your attention to what is called No. 1 bridge: what is the highest rise of the river that you have ever seen in that locality? I have not been much in that locality when the river was high.

1260. About what height were the highest floods you have seen in the Derwent? I have seen it as high as 5ft. or 6ft. over the road near the Falls.

1261. Do you think the river will ever be above the level of the Railway at the Falls? I do not think it will.

1262. Do you know of any place where, in your judgment, the highest flood in the Derwent will overflow the Railway line? If at any place, it might do so at Redlands or at Thompson's.

1263. To what depth? I do not know what height the line will be, but a high flood covers the hedges there.

1264. You must have seen the railway works then; can you not, from your extensive local knowledge, give us some opinion as to whether the highest floods in the river will come over the railway embankment? I consider they will come over it to the height of a couple of feet at Redlands, Thompson's, or Hayes' rocks.

1265. Anywhere else? I am not acquainted with the remaining part of the line.

1266. With reference to timber coming down the river, what have you seen? I have seen trees left on the top of my gate-posts, which took four bullocks to remove.

1267. Would that have been anywhere near the railway works? The railway does not go on that side, but the logs would have to pass through the bridge.

1268. Did any of these logs pass through the old bridge here at New Norfolk? There were from 20 to 40 men employed at New Norfolk bridge to prevent the trees coming crossways, and, when they were any size, to cut them before they could stop up the arches. Mr. Sharland and Sir Robert Officer rented

the bridge, and they had men and horses there for that purpose, and the moment they saw a log coming they turned it endways through the arches. Otherwise, the bridge would not have stood any time.

1269. Taking the present New Norfolk bridge, and also considering the fact that the proposed bridges will have still larger openings, how do you think they will be affected by logs coming down the river? There will have to be men there to see that the trees go straight through, otherwise the bridges will be carried away.

1270. Then you think it would be dangerous if provision is not made to fend off these logs coming down the river? If the bridge is not made strong enough to stand the force.

1271. Have you seen the piers at No. 1 bridge? I have.

1272. Do you think they are strong enough to withstand the force of the timber coming down? That is not for me to say.

1273. What is the largest sized tree you have seen coming down the river? I have seen enormous trees—roots, branches, and all.

1274. Have you seen them 50 ft. or 60 ft. long? More than that.

1275. Have you seen them 70 ft. or 80 ft. long? To the best of my opinion they were fully that size.

1276. *By Mr. Stanley.*—Can you give any idea as to the rate of the current in high flood? I cannot.

1277. As far as you can judge, do you think it is more than 5 or 6 miles an hour? I should say a great deal more.

1278. Does it run faster than a man can walk? Yes.

1279. *By Mr. Lawder.*—Do those trees come down with their branches standing on them? Some do; more do not. Most of what comes down is dead logs carried out of fences.

JOHN GODKIN, *examined.*

1280. *By the Chairman.*—Where do you reside, Mr. Godkin? At the Ballymoney Farm, on the River Derwent.

1281. Have you noticed the Derwent, at high flood, at any position in connection with the railway works? Yes; I should consider the most dangerous place is near the mouth of the Plenty.

1282. What have you seen near that point? The ground is flat there where the railway works are. In a great flood, like the one we had in 1863, the water would rise five feet.

1283. Would that be above or below the railway? I think in places it would wash very close to the rails. I cannot say whether it would wash the earthworks away or not.

1284. You think it will be nearly level with the rails? In some places I think it will.

1285. Have you seen the piers of No. 1 bridge as they are finished. Have you ever seen the river Derwent as high as they are? Never so high.

1286. Did you see the flood of 1863 in that locality? No.

1287. With reference to this timber coming down the river, what are the largest-sized trees you have seen? I have seen them about 3 ft. in diameter and about 50 ft. long.

1288. This room is about 20 ft. in length; how many times the length of this room have you seen them? About three times.

1289. Have you ever seen the Derwent in flood at New Norfolk, as described by your father? I have not had an opportunity of seeing it.

1290. *By Mr. Stanley.*—At the Back River, how high do you imagine a flood might reach? It would go very close to the rails.

1291. Did you ever see it go over the old road bridge? No.

1292. But that bridge is some 8 or 10 feet below the railway? The flood of 1863 was 7 or 8 feet higher than the flood five years ago.

1293. Can you form any idea of the speed of the current, at top of flood, at No. 1 bridge? I should say at least 10 miles an hour.

1294. Do you remember the rains in November last? Yes.

1295. Were they unusually heavy? We have had rains as heavy as those.

1296. Was it a steady rain, or heavy downpours? I think the showers were constant, but I am not quite certain.

1297. Were they such rains as would cause a sudden rise in the creeks and gullies? Yes.

1298. You would call them heavy rains? Yes.

1299. *By Mr. Lawder.*—Do you live far from New Norfolk? About $3\frac{1}{2}$ miles.

1300. You are often at New Norfolk? Yes.

1301. Do you remember to what height the water rose at the New Norfolk road bridge during any severe floods? I have not noticed.

1302. Did you ever hear it mentioned by anyone? If I have I paid no attention to it.

1303. Is it necessary now to keep up an establishment to direct the course of logs and trees through the openings of that bridge? In a heavy flood it would be quite necessary.

1304. Is that establishment actually kept up? They would have to enlist people on the township to do the work.

1305. Is that customary? I think so.

WALTER MATTHEWS *examined.*

1306. *By the Chairman.*—Are you a resident in this district? I live at the Falls on the river Derwent.

1307. Were you living there during the flood of 1863? Yes.

1308. Can you remember what the height of that flood was on any part of the river where the railway line runs? I do not think it would have reached the rails by a foot or more.

1309. How would it have affected the railway at the Back River? That is the place I am speaking of.

1310. You think the railway would have been above the 1863 flood-mark? Yes.

1311. Is there any other part of the river where, in your opinion, the floods would touch the railway? I do not think so.

1312. Did you notice the New Norfolk bridge during the 1863 flood? I crossed it on the night of the flood.

1313. How much was the water below the level of the bridge? I should think three or four feet.

1314. Did you see any large timber coming down? A great quantity.

1315. How was the bridge affected by it? Sometimes the timber got fast, and at others it got through; but it did not do any considerable damage to the bridge.

1316. *By Mr. Lawder.*—About what would be the length and thickness of those trees? Some of them would be 2 ft. or 3 ft. thick and 70 or 80 ft. in length.

1317. Were there any longer than 70 ft. or 80 ft.—the total length from the root to the top branch? Some of them would reach 100 ft.

1318. Do the branches on the trees ever reach out of the water? Sometimes 2 or 3 feet. Very often they are right under.

1319. *By Mr. Stanley.*—At what would you estimate the speed of the current at top of flood? I should think 14 or 15 miles an hour, but I speak only from recollection.

1320. Do you remember the rain of November last? Yes.

1321. Was it a steady rain or a heavy downpour? It was a very heavy rain.

1322. Was it a general rain, or was it heavier in some localities than in others? It was heavier in some places than in others. It must have been very heavy at the Back River to have filled the creek in the way it did.

1323. How high did that creek rise? It was higher than ever I saw it before.

1324. Was it above the arch of the culvert near the railway bridge? It was impossible to say, as there was a good deal of back water from the river.

MR. SHEARD'S *examination resumed.*

1325. *By Mr. Lawder.*—Do you consider the injury to the bank, caused by the floods of the 30th November, was owing to the insufficiency of the flood-way? In some places that was the cause; in others it was caused by the side-ditches not being properly graded, the drains not being properly clean, and the inlets and outlets of the culverts not being properly cut.

1326. What do you say is the high flood level at the Back River culvert? 1ft. 6in. below the formation level, and 2ft. 6in. below the rail level. These are from actual levels taken from the 1863 flood marks given to me.

1327. Have you ascertained yourself what the probable waterhead pressure on the piers of No. 2 bridge will be? No.

1328. How is the planking to be secured in the larger bridges? I have not got the designs yet. The original design for No. 1 was a loose road, but now that it is to be both a road and a railway bridge, it will have to be a fast road.

1329. Do you consider that a loose road would be at all affected by the curves in the approaches, as at No. 1 bridge? Not in the way it can be boxed in. There would be no disturbance.

1330. Is it to be shut in by side pieces? It will all be boxed in.

1331. Do you consider that effect would be better counteracted in a fixed road than in a loose one? That depends on the weight of the train and the speed at which it travels.

1332. Do you remember what the thickness of the abutments of the original culvert at the Back River was? No, I have not the drawings here.

1333. Have you got the special drawing for the Back River culvert as built by Mr. Mault? It is amongst the drawings in possession of the Commissioners.

1334. According to the specification wooden box culverts are to be surrounded with 18in. of spalls and loose stones. Is that a good plan? No.

1335. Have you stated your opinion on that point to the Engineer-in-Chief? Yes, and since then it has been stopped.

1336. Do you think that its having been done previously affected the culverts? I do not think it would if there had been sufficient waterway. But I do not believe in it.

1337. Are you aware that the piers of No. 1 bridge were lowered in height? Mr. Mault lowered them 4 feet before I came.

1338. Do you know his reason for that? I fancy it had something to do with the girders.

1339. When were the gradients and approaches to No. 1 bridge altered? Before I came here.

1340. Have you seen much girder work? Yes.

1341. Do you consider this satisfactory, and that better work could not have been procured from England? Better work could certainly have been procured from England, but some of this work is very good. There are a few small defects which the manufacturers have promised to put right. The rivetting is not first-class work, and some of the details are not so well carried out as they might be.

1342. Have you had any considerable experience in girder work before you came here? For two years before I came here I had charge of Young & Christie's works at Cardiff and Swansea, and we had the contract for making and erecting the girders for four different bridges on the Brazilian Railways.

1343. What is your opinion as to the strength of these girders and their probable stability? As to strength they are perfectly safe, and their stability is from 1.92 to 2.11 to 1. That is the American practice. As far as the stability of the work is concerned, there is not the least fear.

1344. Do you also consider the proposed cased piers for No. 2 bridge will be sufficiently stiff and stable to support the load? Yes, after they are well set.

1345. Although they are less than one-eleventh of their height in thickness? They are about one-twelfth. That is the American practice, although they have lately reduced the thickness to one-fourteenth.

1346. Do you consider it advisable to run within such narrow limits, and allow no margin for faulty construction? I certainly would not reduce the thickness to one-fourteenth myself, but I should consider it perfectly safe.

1347. *By Mr. Stanley.*—What was the character of the rains here in November last? They were exceptionally heavy. The quantity of rain that fell during the storm was greater, according to the register, than had occurred during the last five years.

1348. But not greater than the ordinary maximum rainfall? Not much.

1349. No greater than such rains as you should provide for in determining waterways? Only in one gully was the rainfall greater than it would be necessary to provide for.

1350. In determining the waterways you would, I presume, take the maximum rainfall per hour?

1351. I understood you to say that this rain did not exceed the ordinary maximum rainfall? Only in the gully at lm. 62ch. The people there had never seen so much rain come down.

1352. In all the other cases the rain was not heavier than what you consider should have been provided for under ordinary circumstances? I should not think so.

1353. You stated just now that you considered the piers at No. 2 bridge, as designed, would be thoroughly stable after the concrete had set. Do you think it likely, under the conditions of those piers, subject as they are to constant expansion and contraction, that the concrete would set in a satisfactory manner, and bearing in mind the large amount of internal pressure there is? I do.

1354. You do not think that the internal wrought-iron bracing would interfere with the concrete setting in one solid mass? No, because there is no more in these piers than there would be if you had brick and cement.

1355. Have you made any calculations in respect to the stability of these piers under the strain to which they will be subjected from wind pressure, flood waters, and the rolling load? I have made the calculations, but I have sent them to America, to Mr. Brereton, for his opinion. I hope to get them back in time to lay them before the Commission.

1356. *By the Chairman.*—With reference to the culverts, you were saying that the fronts of the culverts were intended to be of concrete? There are two designs in the contract drawings.

1357. What were they? One with timber fronts. I do not think there was one designed for concrete.

1358. We want to know what the contract is? Timber pile fronts.

1359. Is there any drawing showing the front to be constructed of concrete? No.

1360. Clause 32 deals with this, and provides that if any alteration of the contract is permitted it must be done by order of the Government officer who may order the fronts to be put in concrete? That is so.

1361. Looking at item 76 of the schedule, you will see that it does not provide for anything but timber fronts, so that it is quite evident the fronts of these culverts are to be in wood? That is a matter of direction by the Government officer, and has nothing to do with the contractor. If he carried out that officer's instructions he was only doing what his contract provided.

1362. With reference to the faulty mortar in culverts, is the complaint as to the quality of the lime or the quality of the sand? I cannot say; I was not here.

1363. But why do you complain? On account of both lime and sand.

1364. Is it not stated in the specification where the lime is to be obtained? I do not know.

AFTERNOON SITTING.

The Commission re-assembled at 2 P.M.

Present.—All the Commissioners and the Secretary.

Examination of MR. C. K. SHEARD, continued.

1365. *By the Chairman.*—Will you take that list of alterations that Mr. Parker handed in, and tell us what you know about them? Yes. The first alteration is from about 0m. 8ch. to 1m. 13ch. The section of the line has been altered here from one level grade to twenty-five grades. That is quite correct. The date was 1st April, 1885, when the altered section was received. Mr. Parker's second alteration is also correct. The next is at 0m. 55ch. to 1m. 17ch., plan and section of road ordered by Mr. Sheard, January 25th. That is not an alteration at all, it is only to make a proper road—it is not an addition. At 1m. 41ch. 50l. to 2m. 18ch., road diversion ordered by Mr. Sheard. That is another slight addition to the original plan—it is not an alteration. At 1m. 41ch., an error in the levels. I don't know anything about that; it was discovered and put right before my time. At 3m. 58ch. I believe there were other errors in the levels. At 2m. 33ch. to 2m. 47ch. the section was altered, also the levels at this point, I know, but I am not conversant with the extent of the alteration. 5m. 49ch. to 6m. 2ch. a section and cross-section and road diversion. That is not an alteration—it is only the original deviation of the road.

1366. But that is additional? Yes. At 8m. 20ch. to 9m. 15ch. there is a deviation made by Mr. Mault. That is quite correct—it was a deviation of part of the line. At 9m. 66ch. to 10m. 50ch. there was a deviation as stated, and several alterations. It is known as the "Rocks Deviation." I don't know whether Mr. Mault made these deviations or not.

1367. Has the formation been altered or raised? It has been raised about 1 foot. That was my alteration. At 12m. 69ch. to 13m. 33ch.—that is a deviation. I have pointed it out on the ground. It was made under my direction at the Back River.

1368. Was that raising or lowering the line? It was to throw the line more into the hill. At 14m. 36ch. to 14m. 38ch., the road diversion at Hayes' rocks, mentioned by Mr. Parker. That is according to the original drawing that the contract was signed on; there is no alteration. The deviation below, at 14m. 27ch. to 14m. 64ch., is a deviation made by Mr. Hargraves, and the work was stopped until the deviation was made. I raised the formation level at this point, and since the deviation was made I have also thrown the line 3 feet further in, that is to say, I kept it 3 feet further away from the bank. It made no difference whatever in the actual work of the line. It is not really an alteration.

1369. Did it not involve extra work to the contractor? No, not at all. At 15 to 16 miles a deviation made by Mr. Mault reducing the formation.

1370. Do you think that was not an alteration? Oh, yes, that was an alteration made at No. 1 bridge.

1371. I may tell you what Mr. Fincham stated when asked why the approaches to No. 1 bridge were made on a descending grade: he said that portion of the line had been altered and a more level approach substituted for the other.

1372. Witness continued: There have been alterations at from 15 to 16 miles. Mr. Parker next mentions a deviation at 16m. 40ch. to 18m. 24ch. That part of the line was altered to meet the views of the owners of the land. The owners of land were always making representations, and a great many of the deviations on the line were made by the Government to meet their views. This deviation was made to meet the requirements of Mr. Read. The line was originally run by Mr. Mault close to the river bank. I will show you. (The witness pointed out the line and deviation on the plan.)

1373. What was the reason of that? It was on account of getting a better crossing over the bridge.

1374. And what was the reason for the alteration at the Plenty Bridge? Much the same. Mr. Reid, the owner of the property, would not have the line brought where proposed except at an exorbitant charge for cutting him off from the river bank. He offered to take either a third or a fourth of the sum asked if the line was carried away from the river to a higher level, and we would allow him a right-of-way along the river frontage. Under those circumstances he charged £10 per acre for the land required instead of £30 or £40 an acre; besides by this deviation the line is also shortened and the cost decreased. Deviation by Mr. Hargraves from 19m. 60ch. to 20m. 60ch.: that is at the Ivanhoe road. That is an alteration and addition. The alteration was on account of the rocks. It was at my suggestion the deviation was made.

1375. Will it have to be made at a larger cost? No, at a smaller cost, I am sure of it. At 18m. 79c. to 20m. 60c. the original line ran down on to bridge, and instead of making a 6-chain curve on the gradient, what I did was to make one vertical curve and run on the altered gradient 1 in 50 here. That is coming on to No. 2 bridge.

1376. What is the difference involved by the alteration? I make it a vertical curve of 10 chains in length.

1377. For what length is it 1 in 50? The actual chainage is 20m. 70c. to 22 miles. There would be 32 chains of 1 in 50. The next and last alteration mentioned in the list is in the formation levels at Section 83. I rise instead of running down from that part from 21m. 70c. to 22m. 5c. The gradient was a fall of 1 in 132, with 2 chains of level. I rise to 1 in 132 and run the grade through to level, and then make the run into Macquarie Plains station siding from 21m. 66c. to 22m. 20c. level.

1378. *By Mr. Lawder.*—Could you not, by reducing the altitude of the level parts, reduce the grade descending to Bridge No. 3? Yes; but it would have had to be done after the work was done. The work had all been commenced when I came.

1379. Would it not be more advantageous to go more into cutting, instead of increasing the descent on to these bridges? Yes, I think so; the line could have been kept lower.

1380. Then that is a mistake in the alignment? It is a mistake in the survey—yes, in the alignment.

1381. *By the Chairman.*—Are these all the alterations? Yes.

1382. Then you agree with the list of alterations handed in by Mr. Parker, subject to the explanations offered by you? Yes. In some cases the alterations were made to meet the wishes of the owners of the land; in some cases they were made as an improvement on the line. The alteration from 8 chains to 1 mile 40 chains I do not approve of. Originally the section was level; instead of that, it is now altered to the grade shown by the black line on the plan; that is a mistake. I cannot say by whom it was altered. It was either by Mr. Mault or the Engineer-in-Chief.

1383. Mr. Falkingham handed in certain letters signed by you, dated December 8th and 15th, and these were countersigned by Mr. Fincham in red ink; they relate to alterations in waterways, &c.,—are these correct? (Letters handed to witness.) Oh yes, those refer to the general waterways and alterations on the works.

1384. That is correct, then? Yes.

1385. I have an additional communication handed in by Mr. Falkingham as to additional waterways and alterations,—is that correct? (List handed to witness). In some particulars.

1386. At 10 miles 57 chains an 18-inch pipe built by Mr. Mault was altered to a 7ft. by 5ft. flat top culvert by you. Is that correct? Yes.

1387. At 10 miles 79 chains a box culvert put in by Mr. Mault was removed by you? Yes, that is correct.

1388. At 11 miles 4 chains a box culvert built by Mr. Mault was removed by you. Is that right? Yes, it is moved to 11 miles 6 chains.

1389. At 14 miles 27 chains a 4ft. 6in. arched culvert built by Mr. Mault was altered to an extra double sleeper culvert by you? Yes, that is right. It is at Johnny's Creek, but it is included in the letters written by me on 4th December last. It is not an alteration exactly, but it is correct.

1390. At 15 miles 44 chains No. 1 bridge waterway has been reduced by four 24 feet openings by Mr. Mault, and the bridge afterwards lowered four feet by Mr. Fincham: what about that? That is correct.

1391. At 15 miles 60 chains a flat-top culvert was ordered, and then an 8ft. stone wall was ordered. Is that correct? No, that was not ordered. The first waterway at 15 miles 60 chains was a 3ft. flat-top culvert, but Mr. Read asked for a cattle-creep and a 20ft. timber opening. I adopted this, and it was ordered, but afterwards a request was made to allow Mr. Read a roadway between No. 9 pier and the west abutment of No. 1 bridge, and then a 5ft. arched culvert was ordered, which is now being built.

1392. I will read Mr. Falkingham's statement, will you say where it is not correct. First, a 3 feet flat-top ordered by Mr. Sheard was altered to an 8 feet stone wall, again altered to a concrete arch, again altered to a 3 feet flat-top on the 15th September, again altered to a 3 feet arch on 21st September, and then to a 5 feet arch, now being built: is that correct? No: Mr. Falkingham is entirely wrong as to the alterations made by me. I admit I made the alteration to a 5 feet arch, to suit Mr. Read's convenience.

1393. On 27th July did you order for this place a 20 feet cattle-creep on tressels? Yes, it was ordered, but it was never done.

1394. Then how many of these alleged alterations are correct and how many incorrect? There were only three alterations made here. First, a 3 feet flat-top masonry culvert, then a cattle-creep, and then after the cattle-creep had been ordered it was altered to a 5 feet arch.

1395. You should reflect well, Mr. Sheard, because if Mr. Parker produces the letters, any conflict of opinion will be determined by those letters? No, he has no letters to support his statement. My orders are all recorded in my book, and he has no letters.

1396. You admit you ordered a 20 feet cattle-creep, and you altered that to a 5 feet arch. How many designs did you give altogether? There were really only three.

1397. Then the only difference is that you don't admit the alteration to a 3 feet arch on 21st September? Yes, I do not admit either the 8 feet wall or the 3 feet arch.

1398. Then you object to this written statement? Yes, I object to it.

1399. Well, go on to 18 miles, that is, the Plenty Bridge. The waterway is said to have been reduced to a great extent by Mr. Mault and increased by Mr. Sheard. Did you increase the waterway here? Yes, I increased it on account of the foundations. It was requisite to build these foundations of masonry on piles, and instead of building the west abutment on pile foundations I built No. 2 pier and threw the abutment into the embankment.

1400. Well, at 20m. 55ch. there is an alteration in the iron piers of No. 2 bridge: what about these? In the first instance, owing to the difficulties, I got Mr. Fincham to sanction iron caisson piers with a coffer-dam, exactly as they are building the Queen's Ferry piers at the Forth Bridge.

1401. Then you proposed that you should build the foundations of the piers themselves? Yes, with double caissons as a coffer-dam. The contractor refused to carry this out unless the Government gave him extra money for the ironwork. He refused to do this and the original drawings were referred back to the Engineer-in-Chief.

1402. Then you wanted to make coffer-dams round these piers? Yes.

1403. Was that to be a permanent structure? Yes.

1404. He was to provide the labour and you the piers? No; we paid him additional under his contract, but he wanted more money.

1405. Was it on account of his claim that the plan was abandoned? Yes.

1406. At 22m. 45c. a masonry arch culvert was done away with? Yes; it was done away with on account of the owner of the property, Mr. Shoobridge, objecting that there was no flood water to contend with.

1407. Was that after the stone was on the ground? Yes, he had the stone right alongside. He had delivered a part of it, only about a third of the quantity, on the ground.

1408. Well, at 23m. 5c. you ordered a 3 ft. masonry culvert, afterwards altered to 18 inch pipes? The reason of that was that at 22m. 63c. there were two culverts going in for a cattle-guard, and the owner did not insist on this opening.

1409. At 23m. 51c. a 2ft. arch was ordered and altered to 18 inch pipes? Yes, that is right.

1410. At 23ft. 79c. you ordered a 2ft. flat-top culvert and altered it to 18in. pipes: is that so? I did not. There is no alteration here at all. Mr. Falkingham is wrong there. I never altered it to an 18in. pipe. The culvert is not built, and there has been no alteration.

1411. The question is not as to the alteration being done—have you ordered the change? No, I have not ordered it.

1412. At 23m. 79c. have you altered a 2ft. 6in. flat-top culvert to an 18 inch pipe? No: that remains a masonry flat-top culvert just the same as the original design. No order to alter it has been given.

1413. At 23m. 67c. has a similar alteration of a 2ft. 6in. culvert been ordered? That is built in an 18 inch pipe. I could not put a masonry culvert in there.

1414. Then, with the exceptions you have named, you agree with the particulars as to alterations in waterways given in this list? Yes.

1415. We were speaking, before commencing with that list, about the quality of the mortar used in the masonry. Mr. Falkingham informed the Commissioners that when he commenced the works he had a letter sent to him from the Engineer-in-chief instructing him to use a particular make of lime: is that the case? Yes, it is.

1416. Do you approve of that lime? I approve of it for works where it can be left a considerable time without being racked or any vibration passing over it. It takes from three to five months to set before it becomes hard or fit to run any traffic over it.

1417. If he did not use this lime, where would the contractor get his lime? I do not know. There is no other to be got.

1418. Then you mean you would allow this to be used? He cannot get any other lime.

1419. As to the sand—does he get his sand where you direct? No, he gets it where he likes, and if I do not approve, I condemn it when it comes on the works.

1420. Do you approve of or condemn the sand used generally? If I condemn it he does not bring any more.

1421. Are you satisfied that the contractor does the best he can to get the best sand? No, I don't consider the quality of the sand is the best that might be got. He leaves it to his men, and they get it where they can.

1422. Where is the best sand to be got? At the Plenty there is very good sand; also in the vicinity of No. 1 bridge. As for the Plenty, there is sand *ad libitum* there.

1423. You were at No. 1 bridge when we inspected the works, and saw the cement and mortar we examined. Was that the class of sand you get in the neighbourhood? Yes, that is the sort.

1424. Are you satisfied with it, or not? I am satisfied with it in some cases and not in others. I would not have it for concrete,—I should want coarser sand for concrete. I think for mortar it will do when thoroughly clean.

1425. Are you of opinion that the contractor and his Engineers do their best to get as good sand as can be obtained in the neighbourhood? No; the contractor may, but his men do not.

1426. What interest has the contractor in not doing right? I cannot say. I only know that the contractor's men do not exercise the care and caution necessary on a large work of this kind.

1427. Did you make any complaint in reference to the mortar? I did as to the mortar of which the culverts were built, for I will not pass the work.

1428. Now, as to the pitching at the river bank near Back River, why do you object to it? It is not in accordance with the specification, but it was done before I came here.

1429. *By Mr. Lawder.*—In what way is it not in accordance with the specification? All the pitching should be roughly squared to the full depth of the joints. This is only random pitching, the stones put in just as quarried.

1430. *By the Chairman.*—Do you not think it unfair to the contractor if he honestly tries to comply with the orders of the Government officer in charge of the work, and does so, that he should be asked to rebuild work because the officer happens to be removed and the officer who succeeds him does not approve of it? Not if the work is not up to the specification and contract.

1431. But he carried out the instructions of the officer of the day? No, I do not think so.

1432. Suppose you were to leave, Mr. Sheard, and your successor were to condemn work of which you had approved, would not that be unjust? No, not if the work was not in accordance with specification. (The witness read the section as to pitching.) That is what the pitching should be, and the contract price shows it was intended to be good work.

1433. The price is not in question—that is your statement? Yes, that the work is not up to specification.

1434. Now, with reference to the solid abutment at No. 1 bridge, why was that so built? Because the wing-walls originally designed would have taken more masonry to build, and would not have been so strong.

1435. These abutments would not have taken more masonry if built with wings? They are 40 feet high. I should think they ought to have taken more masonry.

1436. You have built an abutment in solid masonry: suppose you had left the interior spaces out? You would have received no benefit.

1437. That would have been the usual, yours is the unusual way? This is the way in America.

1438. I thought you said that in America they built their piers down to a fourteenth part of a span? Yes; but here you had a solid abutment already built, and it would have had to be pulled down. You would not have had room for the slopes.

1439. How are the slopes protected now?—are you satisfied they are safe? Yes, the point comes out there, and there is no flood-water to speak of, and it is a rock embankment in the back-water.

1440. *By Mr. Lawder.*—Is there no fear of a considerable eddy in the hollow here? The last flood there was nothing. The last flood was barely up to 7 feet of the flood level of 1863.

1441. Then you anticipate no disturbance from the eddy in the water between the point and pier? If the embankment was earth I should.

1442. It is a stone bank? Yes.

1443. And you think the bank will be all right, no fear from the eddy,—no fear of any disturbance? No fear whatever.

1444. Then you approve of it? Yes.

1445. *By Mr. Stanley.*—Is the projection such as you refer to sufficient protection in case of an eddy or swirl? Yes. I should not think so if it were not in such a position as it is. It is an extraordinary point, very nearly straight for the pier. If there is any danger to be apprehended it will be from the throw of the current between Nos. 1 and 2 piers. If there is any danger it will be from the water getting round, and then there would be the danger of whirlpool eddies.

1446. *By the Chairman.*—About the width of the piers—do you approve of the width of these piers?—You said that in America they have piers one fourteenth of the height? Yes, certainly.

1447. Are they under similar conditions? Yes, the bridge I refer to is over the San Joaquin on the Central Pacific Railway. I am instancing that.

1448. Is that bridge in a position where large logs can come down the stream?—do you think it prudent to adopt the narrowest margin of safety—would you not rather give an excess of strength? I should give the excess distinctly. I cannot inform you as to the conditions of the bridge referred to.

1449. Have you made any calculations as to the strength of this bridge? Yes; I made calculations in recommending the double caissons.

1450. And you still adhere to the composite form of pier? Yes.

1451. Can you give any instance of its use? Yes, the Queen's Ferry Bridge on the Forth, and the Maiccon Bridge on the Seine. That is one of the bridges from which this design is taken.

1452. I ask do you adhere to the plan of the Railway Department, namely, a composite pier such as that designed? It is a stable one, although it may not be a desirable one.

1453. If undesirable, can it be stable? Yes.

1454. I cannot follow you? Well, a bridge with one span would be better than a bridge like that.

1455. But there is no occasion for a Government engineer to depart from the usual and approved plan of construction unless he can get some benefit; he should be guided by well proved practice. Why should he go out of his way to introduce something that has not been subjected to the test of experience? I think this has had the test of experience by the bridges built by the Sainly Austin Company. I can get you a practical instance of it.

1456. That is the American practice. Why should you go to foreign countries when you have the well-known and acknowledged British practice to guide you? The American bridges are quite as good, and, as for experience, there are more bridges built in America in one year than there are anywhere else.

1457. That is merely proving two negatives. You have certain well-known rules and principles for regulating construction—why go out of your way to introduce novel designs? Oh, I have nothing to do with that.

1458. Yes, you have. You are the Resident Engineer of this railway and responsible for the work. You should not recommend these piers without certainty? These plans were all sent to me to carry out.

1459. But you recommended the double caissons, and they were willing to adopt them. Why should you not be listened to in other matters?

1460. *By Mr. Lawder.*—Had the contractor objected to it? No, the contractor did not object.

1461. You believe, then, in the form of construction, and uphold the stability of it? Yes, the stability.

1462. The concrete in the caissons is broken up into sections? Well, it is not solidity, but it is all joined together. It is only a narrow slip of iron that divides it.

1463. If I have a piece of masonry and cut it into pieces, as the iron binders in these piers do the concrete, do you mean to tell me that it is one section? There is three feet at least solid between the bars.

1464. Yes, but these solid pieces are cut in two by the bars dividing it into sections? It is not divided into sections. (The plan was here referred to, and the section pointed out to the witness.)

1465. *By the Chairman.*—Then do you mean to tell me that the concrete in these caissons with T iron binders between is a solid concretion?—how are the men to pound the concrete in the caissons?

Mr. Lawder: They are flat iron bars, not angle iron.

1467. *By the Chairman.*—But how are you to pound the concrete together with the bars there so as to get solidity? The concrete will do it. It will set solid.

1468. *By Mr. Stanley.*—Would there not be a certain amount of expansion and contraction in these iron bars? Yes, some.

1469. Will this not affect the setting of the concrete. Take for instance a hot day like this, and a cold night like the last,—will the expansion and contraction caused not affect the setting of the concrete into a solid and substantial mass? Certainly, if there is expansion and contraction it might disturb the concrete.

1470. Might there not be expansion and contraction? There might be, to a slight extent.

1471. *By Mr. Lawder.*—If you were designing a bridge, would you adopt an iron-cased composite pier in preference to any other design? I would rather have masonry by all means.

1472. If you approved of that design, why was it necessary for you to propose the double caissons? On account of the foundations, and on account of the trouble of getting a good and reliable bottom; also in order to avoid the trouble of getting a new design made by Mr. Edwards.

1473. Then did you propose that design to give additional stiffness? Yes, and strength as well.

1474. Do you think it advisable to give that additional stiffness? I think it would be advisable to adopt that in order to get a proper foundation.

1475. Did you take additional stiffness into account? I did not recommend it particularly in reference to that. All that was required was to give facilities for getting to a safe foundation.

1476. *By Mr. Stanley.*—You said, I think, that on economical considerations it was desirable to adopt these piers? No, I never went into the question of cost.

1477. Do you not think so? I presume this was the only reason why the design was adopted.

1478. Were you informed by Mr. Fincham what the cost of the wrought iron piers was? No; I don't know what is the amount of the cost.

1479. In view of that fact, suppose wrought iron casing cost £10 per foot of height, don't you think the money would have been much more desirably spent in constructing a masonry pier, with cast iron caissons for foundations to water level, and then masonry to the formation level? Well, my experience is American, and they do not adopt cast iron at all.

1480. That is a common mode of construction in England? It is not much adopted in England now, it is going out.

1481. *By the Chairman.*—I wish you to consider this—your piers are 14ft. in length? Yes.

1482. They are 6ft. in width. Now, if you take a pier 14ft. in length, 6ft. in width, and 1 ft. in height, and you work it out according to your conditions of contract as “ashlar set in mortar,” it will cost £8 11s. 6d. per foot in height. The Engineer-in-Chief said it would cost £9 17s. 6d. per foot in height for the iron. If you average the cost of masonry piers, allowing enough for the four quoins-stones, &c., I believe you will find that masonry is cheaper.

[A discussion followed, the Chairman and the witness making calculations, which showed that the piers would be 1s. 6d. per foot of height cheaper if in masonry. That is on the condition of the above question as to measurement and prices.]

1483. *By the Chairman.*—Do you think you should put up a structure which will be almost bound to fail when you can have substantial masonry for less? You should call the attention of the Engineer-in-Chief to it.

1484. *By Mr. Stanley.*—How is it proposed to fasten the piers or caissons to the foundation? We will sink them right on the solid.

1485. It is not so in the drawing. The Engineer-in-Chief said you would level up the bed of the river with concrete, and lower the caisson into it? That is not my intention.

1486. Is that according to the drawings that have been prepared? No; I have an altered drawing showing the caissons into the solid rock.

1487. What depth do you sink them? Not less than 4ft. into the solid rock. The depth is to be determined by the Resident Engineer. It is written on the plan,—my own addition.

1488. Do you consider it an economical way to build a solid masonry abutment such as you have?—do you not think the same material disposed in a different way would have made a better design? It is a fair structure for such a place. It is not as if you could put wing walls.

1489. I am not referring to wing walls, I refer to the abutment as designed and carried out. Could not that material have been disposed so as to get more stability and a much more satisfactory construction? Yes, of course it could, but the work was already done when I came, and I had to go on as it was.

1490. Could you not have put in a different construction, with a batter? It would have been unnecessary.

1491. Suppose you had altered the plan and put in battered walls and voids, would it not have been better? Yes, but you could not do that when I came, the wall built would have had to come down.

1492. I can't see that? It is a vertical face.

1493. *By Mr. Lawder.*—Would it not have been better to pull down the work done and secure a batter? The best way would perhaps have been to pull down the whole abutment and put another span.

1494. Mr. Sheard, have you formed any conclusions or drafted any directions to be submitted to the Engineer-in-Chief, or has the Engineer-in-Chief drafted any special instructions to you as to how you are to proceed with the works at No. 2 bridge? Not yet.

1495. Do you expect any instructions? Do you mean as to carrying out the construction?

1496. Yes, as to sinking the water tounds, &c.? No, I don't think so.

1497. Is it not usual for instructions to be given by the Head of the Department in detail? When he comes on the works, yes.

1498. None beforehand? No.

1499. In the instructions whereby the work is proceeded with, the contractor would have information as to the material required? Under the specification it is specified that a coffer-dam will be required, and we will require them.

1500. Do you make any specification for the coffer-dam? No; I have not done so yet.

1501. Who is supposed to do so? I presume the contractor, because it has to be done under the specification, in such a way that the water can be got out.

1502. Then the contractor designs the coffer-dam, and you approve? Yes, he designs the coffer-dam, and if it will keep the water out, I approve.

1503. Then if there are no instructions sent, you can go on without any? Yes; we will have them on the ground when we commence.

1504. By whom drawn out? By the Engineer-in-Chief.

1505. And you don't think it necessary to give any greater notice to the contractor? Under the contract you can't.

1506. No power under the contract! Is it not the custom for the Department to send special instructions for any class of difficult work? Yes.

1507. You always write specially to the Engineer-in-Chief if any danger appears should the work not be carried out properly? Yes.

1508. To what effect do you write to him? As to how the work is to be done.

1509. You make, probably, suggestions? Yes; my letters are all there, and speak for themselves.

MR. ALFRED MAULT, C.E., *examined.*

1510. *By the Chairman.*—What is your name? Alfred Mault.

1511. Are you a civil engineer? I am.

1512. When were you appointed by the Government of Tasmania to undertake the survey and sections of the Derwent Valley Railway? I was appointed to undertake the first survey about two and a half years ago—the Parliamentary survey. Subsequently I was appointed to undertake the engineering survey. And in the month of November, 1884, I was asked to undertake the superintendence of the works, and commenced my duties on the 1st December.

1513. You made the Parliamentary and engineering surveys in due course, and submitted them to the Engineer-in-Chief: what was the next step? After the engineering survey, I was asked to undertake the superintendence of the construction of the line, and was appointed on 1st December, 1884.

1514. That was when the contract was let to Mr. Falkingham? A little before that time.

1515. Previous to your engagement, I presume, the Engineer-in-Chief had satisfied himself as to your experience in railway construction. Will you state what your experience has been? In railway construction I was engaged in Scotland, many years ago, in superintending part of the construction of the Glasgow and South-Western Railway, in the immediate neighbourhood of Kilmarnock. I had also work on the Neilston and Barrhead Railway, and on part of the Caledonian Railway, in the neighbourhood of Rutherglen. After that I had no railway construction for some time, but was engaged principally in water-works until I went to France. There I designed and constructed some railways for the Compagnie Anglaise, that had the concession of the Sewerage of Paris, to join their works to the railways, the Northern on one side, and the Eastern on the other. That has been my experience as far as railways are concerned.

1516. That appears to have satisfied the Engineer-in-Chief? I suppose that it did.

1517. Then you commenced the actual work of the contract? Yes.

1518. What steps were taken in the preparation of the plans? I prepared the plans and sections of the engineering survey; the details were prepared by Mr. Edwards. I am not sure that the details were all prepared by him, but I saw the plans in his office.

1519. Then Mr. Edwards, in the preparation of the detailed plans, was in communication with the Engineer-in-Chief as to the style and mode of work adopted? I suppose so. At one time there was some intention that I should prepare them, but before this was settled the Government had made a general contract with Mr. Edwards, and I was told off for superintending construction. I believe I was asked to design the ironwork for the bridges over the railway. I can't remember exactly how it came to be differently arranged. I was told to see Mr. Edwards about it, and the result was I made a draft design for one of the girders. In submitting it to Mr. Edwards I saw we should not get on satisfactorily together, and I declined to have anything more to do with the matter unless all the designs for the ironwork were placed in my hands.

1520. Then that resulted in Mr. Edwards preparing all the working drawings? Yes.

1521. When you prepared an engineering survey did you supply the Department with data to enable them to decide what class of bridges and culverts would be required on the railway? I gave large scale-sections of the most important parts.

1522. Who determined the size and the position where the culverts should be? On the engineering plan I marked the sizes and the positions where the culverts should be as a rule.

1523. How did you obtain your information? In the best way I could, by enquiring the extent of the watershed and by observation.

1524. Did you inspect any of these watersheds? Not any further than the Government charts enabled me to do.

1524A. Where did you get your information? From the Government charts.

1525. Did they show the position of the ranges? No, they would not be much use in that respect, except to a person who had been over the country previously. They were indicated sufficiently to enable me to form a general idea.

1526. Then, to the best of your information you did indicate this? Yes, to the best of my information. I should state that the Parliamentary survey was made by me by day work. As the Minister had a Parliamentary grant of £1000 for that survey, and as I saved £400 of this, they were satisfied to let me the next survey on contract, and I undertook the engineering survey at the rate of £20 a mile; consequently, you see, that for £20 a mile it would not be expected that I should make a very minute examination of the whole of the surrounding country.

1527. In reference to the whole of the bridges over the River Derwent, what information did you give? I obtained all I could to enable them to decide. I enquired as to such floods as that of 1863 wherever I went, especially as to its effect on the River Derwent. I enquired of persons who had lived on the banks at the time if they could point out places where the water was highest, or where they remembered having seen logs deposited. I should think I obtained information from 30 or 40 different residents, and I checked it by making a longitudinal section of the river, and crossing the river four or five times as I did, I could make a section enabling me to check the information given to me. If I found, for instance, that at a given point the water was said to have risen 24 feet above the ordinary flow, I could check that all the way up, and where I found there were discrepancies, I should either find something to account for those discrepancies, or be satisfied there was some mistake in my information. In addition to that, on 23rd September, 1884, there was another great flood. I had asked the residents all up the valley to telegraph to me if there was anything like a flood comparable to that of 1863. I received telegrams from several, and, going up, I saw for myself how the river behaved in a very great flood, and I got levels which enabled me to compare the flood of 1863 with that of two years ago, or that enabled me, rather, to check the information obtained regarding the 1863 flood. I found small discrepancies in one case as in the other, but on the whole I think the information I gave to the Government was to be thoroughly depended on, and upon the plans I marked the levels attained by the floods.

1528. In sending that in, did you compare it with the height of the floods at the bridge at New Norfolk? Yes.

1529. It has been stated that the bridge at the site of the present one at New Norfolk township, existing in 1863, afforded ample waterway for that year's flood; was that in accordance with the information you obtained? Yes.

1530. Come to the line itself. Your first survey was on the south side of the river? Yes.

1531. And the line adopted is that on the north side of the river? Yes.

1532. Can you tell us why it was altered? I really cannot.

1533. Were the reasons given to you economical reasons or otherwise,—for instance, that it might save your having a bridge at New Norfolk? No reasons were given to me.

1534. Put to the test of estimation, how would the figures come out? I did not make any estimate either on one side or the other. I furnished a plan of the alignment and the height of the bridges required. The estimates were made in the Engineer-in-Chief's office. In one estimate they made the bridge was set down at £10,000. In the line on the south side as surveyed for Parliamentary purposes there were a great many road diversions that were estimated as costly, and they were saved. Some stone lining and other works were also saved. The saving for earthworks, road diversions, and bridges was held to more than compensate for the extra length of line on the other side.

1535. What is the extra length of the line? Under a mile.

1536. Suppose this bridge had to be built, how might the estimate compare, assuming the Government have now to put a new bridge across the Derwent at Bridgewater? The present line would then be the more expensive of the two. I am judging of the two lines from the data in my possession, but they are not comparable one with the other. The survey on the south side was a Parliamentary survey only, whereas the survey on the other side was the result of a double examination—a Parliamentary and engineering survey. As you are aware, an engineering survey always lightens the works as much as possible. If I had to make an engineering survey this side, as on the other side, I should have saved much on the Parliamentary survey, but the opportunity was never given.

1537. Did you examine the country alongside the south bank of the river towards the Plenty? Yes, I walked up and down several times on both sides before I decided on my preliminary report to the Government. I should mention also that one reason for abandoning the line on the south side was the existence of a public road which would be interfered with.

1538. Were you satisfied that it would be practicable to keep on this side of the river? I was satisfied that it was impracticable, that is, that the expense of carrying the line along the road to the Plenty on this side would be far more than enough to compensate for the increased length on the other side.

1539. In the Parliamentary survey you prepared for the Government of Tasmania, the line in the neighbourhood of the Back River keeps more inland than the line adopted; why was this altered? On account of the levels. When we crossed by a bridge at New Norfolk I had to keep very high on the south side, which made me keep high on the other side also. I was then 30 to 35 feet higher than the ordinary run of the country on the other side; that enabled me to keep well up on the bank and get on the high ground there. I got over the Back River by a heavy bridge. When I was down to the level of the low ground on the other side I put it where it is now.

1540. With the knowledge of the country you have now, would you again keep so close to the Derwent as the line goes now? I would say yes, if I thought that the line would have been carried out on a set of quantities and a schedule fairly prepared; but if I had to carry out a contract on the prices in Mr. Falkingham's schedule, I would not go near the river.

1541. Don't you think, looking at the work now, if this line had kept inside the road bridge with a deep cutting on either side of the Back River, it would have enabled you to do away altogether with the bridge and wall? It need not have been an expensive bridge and wall, if the wall had been fairly priced. Will you allow me to say that I have prepared a memorandum of my general services connected with the railway; I ask your consideration of it. I should now like to read it and leave it in your hands.

The Chairman.—Certainly we shall be glad to hear it.

Mr. Mault then read the following:—

ROYAL COMMISSION ON RAILWAYS IN TASMANIA.
MEMORANDUM FOR THE COMMISSIONERS.

When I was appointed to superintend the works on the Derwent Valley Railway I was asked to effect, if possible, on the contract sum of £80,000, a saving of £10,000, to be devoted in aid of the vote for the bridge at Bridgewater. I had accordingly to carefully examine every part of the work to see where any saving could be made, and soon found that the only portion that could be modified so as to cost less than provided for, was the excavation in cuttings. In almost all other work it became evident that on account of grave errors in the schedule of quantities, not only could no saving be effected, but that much more would have to be spent than would counterbalance any sum saved on the earthwork. The detail drawings, specification, and quantities were prepared by the same persons, but in the quantities no proper provisions were made for carrying out the detailed and specified work. I pointed this out while there was still time to have corrected it. When I obtained a copy of the contractor's schedule, I found, shown by the following note, that the errors in the quantities would result, as far as I could then foresee, in adding £20,792 15s. to the cost of the Railway, against which there was a provision of £7328 10s. 11d. for contingencies, leaving £13,464 4s. 1d. unprovided for.

	£	s.	d.	£	s.	d.
I anticipated that under item 18 of the schedule 92 more gates would be required at £7	644	0	0			
But in items 4—9 there are 6000 yards in excess at 1s. 4d.	400	0	0			
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Leaving to be provided	244	0	0			
Item 19a, 2600 yards more of guard rail required, at 3s.	390	0	0			
Item 21, 18,000 yards more of side cutting at 1s.	900	0	0			
Item 30, 4500 yards more of benching at 1s. 3d.	281	5	0			
Items } 2550 yards more masonry or concrete at 50s.	6375	0	0			
34 } 5000 feet more ashlar in abutments, &c. at 4s. 6d.	1125	0	0			
to } 2400 feet more ashlar in quoins, &c. at 5s.	600	0	0			
52 } 400 yards more lime concrete in backings at 30s.	600	0	0			
Item 54, 1400 yards more dry rubble walling at 30s.	2100	0	0			
Item 85, 5500 yards more pitching to slopes, at 7s.	1925	0	0			
Item 92, 4800 yards more metalling, at 6s.	1440	0	0			
Item 98, 1250 yards more guardrails, at 4s.	250	0	0			
Item 102, 10,000 yards more painting, at 1s. 6d.	750	0	0			
Item 104—124, materials and day labour, say 5 per cent on contract amount—therefore more required	3812	10	0			
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TOTAL	£20,792	15	0			
Less provision for contingencies	7328	10	11			
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Leaving unprovided for	£13,464	4	1			

And this did not represent the whole difficulty of my position. The contract was based upon quantities that were partly real and partly nominal. On the whole the real quantities were pretty fairly priced, and as they formed the bulk of the large items they influenced the amount of the total, and thus secured the acceptance of the tender. But many of the nominal quantities, when of such small amounts as not to greatly affect the total, were exorbitantly priced, and unfortunately some of these were for work in large quantities specified or shewn in the details, but not sufficiently provided for in the schedule. For instance, of drystone backing to walls only 25 yards are provided for; and it is priced at 30s. a yard—at least five or six times its fair price; and of drystone walling, 25 yards are also provided, and priced at 38s. a yard as compared with 40s. a yard for squared masonry in mortar in bridges, &c. In fact under this ill-drawn schedule for any work that I could deduct the contractor had only to allow me a fair price, while for any of this work its omissions forced me to add, I was compelled to pay exorbitantly. In the presence of such facts I did not hesitate to modify the detail drawings whenever the circumstances permitted.

The first failure occurred at the Back River culvert. In designing this I was misled by a discrepancy in the specification. Clause 10, on page 27, provides that in rock embankments the backing of abutments and retaining walls is to be "carefully packed for such distance on each side as the Superintending Officer may direct, the cost of this work to be included in the schedule rate of the excavation from which the bank is formed." I accordingly set out the abutments as if to be backed up with carefully packed stone, and directed the work to be so done, and it was so commenced. On my refusing to pay for the stone, earth was substituted for it. When I was aware of this I stopped the work; but the mischief was done. I found that the contractor was right in claiming payment, as he is entitled to it under clause 28, on page 35, and the item in the schedule above referred to. But I should never have so designed the work had I known that 30s. a yard would have to be paid for work not worth a quarter of the price.

The other failure occurred in the retaining wall adjoining the Back River culvert. The embankment here was designed to be entirely of rock, and at first all the stone taken from the adjoining cuttings was packed in layers so

that carts continually passed over it; I therefore contented myself with putting a facing of dry rubble walling to it. Part of the wall was completed in these conditions, and was passed by the Engineer-in-Chief. On approaching the Back River culvert the question of payment for backing was raised, and on my declining to pay 30s. a yard for it, the contractor began to cart earth for backing. While this was being done the Engineer-in-Chief inspected it, and being told that the lower part of the wall was backed with stone allowed the work to go on, expressing an opinion that this part of the wall was better built than that further back. It was this part of the wall that fell, and the Engineer-in-Chief ordered it to be rebuilt according to the lithographed detail drawing. I understand that this has not been done. I am also told that it has been found that in this part the stone backing was not done as above described, and, consequently, that both the Engineer-in-Chief and myself were misled. If this be so I can hardly blame my inspector, who had about five miles of works to inspect, some of it of equal or more importance than this part. Unfortunately I was unwell when this particular part was being done. But altogether an unwise economy was exercised in regard to inspection. While this and other work was being done, and changes of line being surveyed, spread over more than twenty miles of country on both sides of the river, with only one bridge, I had part of the time only one inspector, and part of the time two,—a third being sent after the Back River failure and I had only one horse. The length of time an inspector would be absent from any given place could be counted upon, and at each monthly measurement it was well known that I should be necessarily absent from the works, being fully occupied for some days in the office.

If I had adhered to the detail drawings and specification, this retaining wall would have cost £3800 in dry stone walling without backing, or about £5000 with backing as specified and at schedule prices, while the actual worth of the work so done would not have been more than £1500 in the one case, or £1900 in the other. I naturally tried to avoid committing the Government to having work done under such conditions. The work I had done had cost £1070 for the wall, and £100 for the culvert. If the part condemned by the Engineer-in-Chief had been rebuilt in squared masonry it would not have cost more than £2200, making a total cost of £3370, as against £3800 or £5000. So I hold that I was justified in trying to save the public purse by the result, even such as it was.

Since my resignation the Public Works Department has so far recognised the condition of things as to demand a further credit of £15,000 or £20,000 on this contract, so that my successor, instead of being set to carry out an £80,000 contract for £70,000 is to be allowed to spend £95,000 or £100,000 to carry it out. If any such prospect had been held out to me I should not have been subjected to obloquy in Parliament and in the public press—obloquy that was undeserved, and that ought not to have been silently allowed by those I had done my best to serve at a cost of hard work and bitter anxiety, if not of something worse, to myself.

In resigning the direction of works here, I stipulated that my letters on this matter should be recorded, and should be given equal publicity to that given to the Engineer-in-Chief's reports. I therefore refer the Commissioners to them, to my letter to the Minister of Lands and Works, dated 13th November, 1885, and to my memorandum on the schedule of quantities, dated 5th December, 1884.

A. MAULT, *Ancien Ingénieur-en-Chef de la Compagnie Anglaise de Paris, and late Resident Engineer of the Derwent Valley Railway.*

At the conclusion of this paper the Commissioners adjourned until 10 o'clock on the following day.

FRIDAY, MARCH 5, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, M.L.C., Chairman.

HENRY CHAS. STANLEY, Esq., C.E.

ARTHUR WILLIAM LAWDER, Esq., C.E.

THOS. C. JUST, Esq., Secretary.

MR. A. MAULT'S *examination continued.*

1542. *By the Chairman.*—We have received your statement, which the Commissioners presume gives a concise record of your connection with the works from the beginning to the finish? Yes.

1543. If there is anything which you remember, and which is based upon your supervision of these works, you might either state it now, or we will proceed at once to ask you a few questions? Very probably the questions which you would ask me in connection with that would cover all the ground. But I think the last question which you asked me before I read that memorandum would show that it would be better for me to read the memorandum than to allow such a line of examination to go on. For I think the last question you asked me was whether I now thought that the line of railway as taken was a preferable one to that indicated by the Parliamentary survey, and I answered both "yes" and "no." If I had then known what I know now,—for instance, if I had then known that there would have been only a single price for all excavations in the contract, that is,—that the earthwork would not be separate from the rock-work,—I should of course in many places have designed the line differently, because I tried as far as I could to avoid all rock cuttings on the ground of expense, whereas I now know that it was no matter whether there were rock cuttings or not. I also then thought that the rough stone walling would be priced at an ordinary and fair rate, instead of at the exorbitant rate in the schedule.

1544. I hardly think you could take that line of argument. The contractor took only work as submitted to him. There is no evidence before me that you know anything of the line on the south of the river? I am talking about that particular part of the line that runs parallel with the river above New Norfolk.

1545. That is perfectly right? I understood that that was the question you asked me, and that now you were referring simply to the two lines which were surveyed above New Norfolk.

1546. *By Mr. Stanley.*—Did you anticipate that there would be more rock cuttings above New Norfolk on the south side or on the north? If I had known at the time, and when laying out the line there, that it would make no difference whether a cutting was in rock or in earth, I should certainly have kept my line through that part further from the river than I did keep it.

1547. *By the Chairman.*—That is, the Back River? All through there there would have been an average cutting of 18ft., that is, that is, 6 yds. of rock. Well, 6 yds. in depth of rock cutting along there would have cost a great deal more per yard than an embankment faced with stone, if the stone facing had been at all properly priced—even at the price given, 7s. per square yard,—do you not see that a 15ft. embankment would not cost more than 45s. or 50s. per yard for facing? whereas if I had gone through 6 yds. of rock cutting it would have cost more—in fact, about £5 per yard.

1548. Taking this view, supposing you took a point 10chs. from the centre of the Back River bridge at the present site, and left the railway at a point and diverged at Back River, say a chain eastward of that river, and come back from that point to the present railway 10chs. to the north of that river? Just let me look at the plan. (Plan examined.) I don't think it would have made any improvement.

1549. It would have kept you away from the river? Yes, it would, perhaps; but I don't think there would have been much gained. (Plan again referred to.)

1550. But suppose we go back and start from the beginning. Now, in those conditions which I have indicated, leaving the present line of road at a point ten chains south of the present railway at Back river, and coming into a line ten chains north of that river, and having examined the cross sections on the plan, are you now still of opinion that you should not have made a deviation there? I am of opinion that we should not have saved any money.

1551. Why? Under the impression that I was under at the time that the work was laid out—

1552. If you took your cross sections ———? Then I should have been running through rock cutting all the way there.

1553. It would have been indicated by extending the length twenty chains, the major portion cutting, and the minor embankment. What would then be the cost in addition to the present cost? No doubt the average cost per yard run would have been £1 more at least to have changed the line from what it was now, including both cuttings and embankments.

1554. A cubic yard or running yard? A running yard.

1555. It would be £400, then? Yes, at least.

1556. What would be the cost of the retaining wall? I calculate, including the cost of a retaining wall, that the cost of running through rock cutting would have made the line £1 per yard more at least.

1557. How do you make that out? I am only making a rough calculation on the spur of the moment.

1558. Do you state that as a fact, or are you making only an assertion? I should have calculated that the facing more in rough stone along the embankment would have cost me 50s., and the rock cutting £5 a lineal yard.

1559. In making that estimate, what do you consider the cost of a chain of cutting would be? I estimate that such a cutting as I should have had would have cost me at the rate I have stated. I estimated that I should have rock cutting if I kept the line back. I should have had 30 yards of excavation per lineal yard, and that I could not do for less than £5.

1560. That would cover the whole of that? The average of the whole.

1561. It would give 13,200 yards of excavation? Not all in excavation.

1562. How much would you take off? A quarter of it.

1563. That would be 9900 yards, say 10,000 additional yards? Not 10,000 additional yards—10,000 altogether. That I should have reckoned at 4s. 6d. or 4s. per yard.

1564. Is that the present contract price? I could not anticipate that. The present contract price is 2s. 3d. for all cuttings.

1565. You could not estimate the sandstone cutting at 4s. per yard? The estimates that were put on by the Department upon the quantities of the Parliamentary survey were shown to me, and in those estimates the earthworks were taken as at 1s. 6d.; sandstone 5s. per yard.

1566. Per cubic yard? Yes. The cuttings in trap rock were taken at 10s. per yard.

1567. Do you know that even during the early times of the gold fields in Victoria, when wages were three times what they are at the present day, that cuttings of basaltic rock were let by tender at less prices than those indicated by you? I thought it a most exorbitant price. But you must remember that I had just come into the colony, and had only the Department's prices to guide me.

1568. It appears that these 10,000 yards additional of rock cutting would be necessitated if this deviation was made—what has been the cost of the retaining wall, and other works? The cost of the retaining wall, which failed, was £1070.

1569. Do you know the exact cost of the works now? I don't know at all.

1570. *By Mr. Stanley.*—Can you form any idea? I have no idea either of what has been done or of its cost.

1572. *By the Chairman.*—Taking that work at 4s. per yard—which is a most exorbitant and unheard-of price for sandstone—this cost of the wall that failed would have paid the addition of the cutting? Yes.

1572. And then you would have no risk with the river? I don't believe that there was any risk from the river if it had been properly put up.

1573. But why run into danger? To save £1000.

1574. You say you could have made that deviation for £2000? But then you will consider that the deviation of the present route at Back River involves an alteration of 10chs. on either side of the river. Will you give us the cost of that deviation. Very well.

1575. Alter the deviation to 15chs. on the one side, and 15chs. on the other side of Back Creek? That would have carried us into ground where we were distinctly told not to go.

1576. But don't you see that you were the resident engineer of the line, and if you, as resident engineer, made a suggestion that was not carried out, the responsibility is shifted from your shoulders to those of the officer who refuses to carry out your suggestion, based as it probably would be on local experience and knowledge? Then I might reply to that, that the responsibility was already shifted.

1577. In what way? The engineering plans which I sent in were approved by the Department—not the Parliamentary line only, but these plans and all the cross-sections were approved of.

1578. On information which you supplied to the Department? Precisely so, and also after inspection.

1579. This originated with you? Yes. I don't want to shirk my responsibility, but, putting it in the way you did, I can put it in that way now. You see after I made certain suggestions what was the result. I knew at the time that such suggestions would not be carried out. If I had suggested that they would have had to buy Matthews' property and buildings, the suggestion would not have been listened to.

1580. What would have been the cost of adopting your suggestion in that particular? I cannot say. Ever since I have been here I have spoken of the folly of paying such attention to property, and have urged that miles of heavy work in this country would cost more than buying land out and out at once.

1581. Then you have counted the cost of maintenance? Yes; but that is not the only point in dispute. Elsewhere engineers are invariably trying to get as good grades as possible; they know the heavy cost of maintenance of permanent way and working the traffic on heavy grades. They seem to think nothing about that here; the first cost of the line is everything. For instance, through the Ivanhoe Estate, I understand, they have now shifted the line farther inland from where I put it, to avoid part of the river bank subject to floods. I say that is done simply because the contractor has given a very high price for the retaining wall. They are going to incur greater expense for working than by my line just to avoid giving the contractor his price. (Plans referred to.)

1582. Evidence has been given before the Commissioners by preceding witnesses that certain culverts between North Bridgewater and a point a few miles south of New Norfolk have been found insufficient. The first one which occurred was at 15 chains. The provision made, if I am correct, was an earthenware pipe or box drain. That has been found insufficient, and after various changes, the Department has arrived at the conclusion that a culvert of one central opening of 15 feet and two spans in the embankment, each of 10 feet, have been found necessary to carry off the water. What explanation have you to give of that? That particular culvert was a large box culvert as I designed it.

1583. Of what size? I cannot exactly say, but I think it was a 3ft. 3in. opening and 4ft. above the surface of the ground.

1584. That gives 15 superficial feet of waterway? But there was a depth of 6 feet at least of waterway. However, I can tell you what my calculations were. I was told that there was an area of about 1500 acres draining there. I estimated that two inches of rain might fall within 12 hours, and I made provision for that to pass. At the time the culvert failed, the rain-gauge at Hobart showed that 7 inches of rain had fallen.

1585. In what time? Within a day, or at most, 30 hours. Of course I did not anticipate any such rainfall as that.

1586. Surely there must be some mistake about that? No person here ever saw such rain. I never heard of any such rain anywhere else. The rain-gauge on Mount Wellington showed a little over 5 inches, and the rain-gauge at the Royal Society's,—the Botanical—Gardens, showed 7 inches.

1587. During what time? During 30 hours; within two days.

1588. Is there any proof of that, or is that a mere statement? The proof of that is that culverts on the main line and on private property—old culverts—were washed away.

1589. It has been admitted that the flood of 1885 did not approach in volume that of 1863? But it was in totally different country.

1590. But the 7 inches of rain fell, you say? In 1863 there was a large rainfall, accompanied by the melting of snow in the Lake country, and accompanied further by wind that blew the water out of the lakes. The wind here will often make a very great difference; and in that case it blew the water out of the lake and flooded the river.

1591. The evidence we obtained from all preceding witnesses went to show that there was a constant rain, but that it was not of a great character? Then I refer you to the meteorological records, which show that in the lower parts where this occurred the rain fell in unheard of quantities.

1592. But what proof have you that 7 inches of rain fell there, when 2.6 inches did not fall in other parts of the country? I refer you to the records of the Meteorological Department of Tasmania.

1593. Can you produce them,—can you show that 7 inches of rain fell in two days in North Bridgewater? Not in North Bridgewater, but in the immediate neighbourhood. You will see that it fell within 10 miles of North Bridgewater—in the Botanical Gardens—and that it had an increasing rather than a decreasing tendency in going in that direction. Up at Bushy Park, I am told by the gentleman who keeps the records there, that only 3 inches of rain fell during that period. Well, in addition to the fact of this great quantity of rain, I am sure that a mistake was made in the method in which the box drains were constructed; that is, they were surrounded by a loose packing of stones, which formed a drainage outside. In case of any rise of water drainage would go through the stone packing in immediate contact with the newly formed earth banks.

1594. Did you disapprove of that form of construction? Is there any evidence to show that you protested against its adoption? There is evidence to show that I would not do it; but the Engineer-in-Chief said that I must do it.

1595. Can you show me where I can get the letter or communication containing that? You ought to have copies of all those letters from the Department; but if you would let your reporter make a memorandum of what you require I might be able to get them.

1596. Can you not tell us? No, I can hardly do that. I think it is in the correspondence which took place in regard to the first and second monthly reports, where the Engineer-in-Chief said that I was omitting those surroundings of the culverts, you will see that I gave my opinion, and that he insisted on his.

1597. But do you think that that sized culvert was sufficient? As far as I could possibly judge, before that rain fell. It was of six times the capacity of the road culvert in that neighbourhood.

1598. What road culvert? The road from North Bridgewater to New Norfolk passes by a culvert over the same little rivulet that this culvert crosses.

1599. I thought that there was no road on that side? There is a road, but not a main road.

1600. Following the stream up on the main road to Launceston, what is the size of the culvert there? I cannot say.

1601. That would be a test? It would not be so good a test as the road culvert there, for my culvert was in exactly the same condition.

1602. If you only allow for this you omit the influence of the tide? I am aware of that. The smaller culvert would do.

1603. What size is that on the Main Line Railway? I don't know. I do not think the Main Line crosses this rivulet.

1604. Did you seek that information? No.

1605. Was it not your duty to do so? Well, I did seek it on the main road.

1606. You took an insignificant road culvert? I very much doubt whether the main road crosses it. I do not think the Main Line Railway crosses it, but I don't know.

1607. Did you see what had been done—did you not look for any culvert? I went up the Main Line Railway for some distance, but I came to no culvert.

1608. But was that the same valley—did you look at the Main Line? I went some distance up the Main Line Railway, but I found no culvert.

1609. Then the only information which you sought was that afforded in the precise locality? I made the calculation that a twelfth part of the whole average rainfall would fall in 12 hours.

1610. Did you think that a culvert 4 ft. by 3 ft. would take off the two inches of water falling over an area of 1500 acres? Yes, I know it would. You will remember that it was virtually a culvert of 3 ft. 3 in. by 10 ft.

1611. But where is the excavation below the surface? I had a trench excavated right down.

1612. There is no evidence of that? There ought to be. I dare say that what has destroyed that evidence completely was that very flood.

1613. That would not be a satisfactory way of constructing a culvert. I should have supposed that if you had provided a flat top culvert, of a large span, built up to the level of the formation, it would not have carried it away? I did that as part of the waterway. Directly there was a head of water on the landward side the whole of the water down below would have come that way.

1614. Down between the level of the surface? Certainly.

1615. How far did you cut the outlet? Right down to the tideway.

1616. Is there any evidence of that? I am not sure whether the instructions were fulfilled.

1617. If they were not fulfilled, what use would this cutting down below the surface be? I did not leave the work complete. I cannot charge my memory as to whether the drain from that was made or not.

1618. You give as a justification for the use of this small culvert that you provided additional waterway of ten feet under the floor of the culvert? Six feet.

1619. That would be 6ft. below the culvert itself. Unless you cut a deep outlet, what use would that cutting be? None whatever; but I say that at the time the orders were given with regard to the culvert the order was given for cutting the drain. All I say is that I am not aware whether that order was fulfilled at the time I left.

1620. I now pass on to 1 mile 14 chains 50 links,—my information is that there was a box drain built there 2 ft. 3 in. \times 3 ft. 6 in.? Yes.

1621. The Government has now provided three openings of 10 ft. span? I say it is utterly unnecessary.

1622. Going now to 1 mile 35 chains 50 links, what do you find there? There is an 18 in. earthenware pipe.

1623. There has been also a square culvert provided,—what do you say to that? I say that that is utterly unnecessary. I should explain to you that when I saw that box culverts were provided, I made it a rule—a standing rule—with the contractor that where there was not a certain quantity of earthwork and ballast between the top of the drain and the rails, that the earthenware pipes should be replaced by box culverts. All my books are given up, and I cannot see in that particular place whether it was a box drain. I fancy that it was, but, if so, the fact of putting stonework around it would account for anything in the way of washing it away.

1624. Now go on to 1 mile 1 chains 6 links. The original provision consisted of a double sleeper box drain, 2 ft. 8 in. by 1 ft. 6 in. Now it is intended to substitute for it two 10 ft. openings, as the banks have been carried away, and the previous provision has proved insufficient to carry off the water? That the previous provision was sufficient I am quite satisfied. The banks would not have been carried away if the stone was not put round. In all these explanations I take it for granted that it is understood that I still insist upon the unprecedented quantity of rain that fell.

1625. A double box drain was originally provided at 1m. 63ch. : it is now intended to construct two openings each of 10 feet. Do you consider this additional provision necessary or otherwise? I consider it unnecessary.

1626. We will give you a complete record of the provisions and the alterations in the culverts between New Norfolk and Bridgewater—the original provisions and the substitutions which Mr. Sheard made—and you can give us evidence thereon. You are aware of the original provisions for the discharge of water on the line between the junction at North Bridgewater and the Derbyshire rocks: are you still of opinion that the provisions made were sufficient for all ordinary floods? Yes.

1627. Do you consider them sufficient for extraordinary floods? Not perhaps for such an one as that we had not long since; but if the railway had been consolidated, and if the wooden culverts had not been surrounded by loose packing of stones, this injury to the embankment, which I understand has occurred, would not have occurred.

1628. Well, the Commissioners will give you a list of the culverts which the Resident Engineer says have been provided, and also a list showing the original provision for the waterway constructed under your charge. Will you look over that list and give the Commissioners, as soon as convenient, your views with regard to those provisions, including any remarks you wish to make, and remark upon each in detail? Exactly.

1629. Is there anything else you wish to say with regard to the Back River? No, I don't think so.

1630. Now we come to the bridges. You are aware of the design which has been adopted for the crossing of the Derwent at what is called the No. 1 bridge. Did you approve of that design? No, I did not.

1631. With regard to that—the No. 1—bridge, it was first designed to comprise a number of land arches, in addition to the spans crossing the river? I think it was in six 24 feet openings first on the south bank, then eight 64 feet? Let me look at the plan (plan referred to). Yes, that is correct.

1632. It has apparently been altered in this manner: the Department have abolished the land opening on the south side of the river and substituted for it a solid abutment, and provided on the north side of the river two land openings of 24 ft. span, bridging the river with several openings of 64 feet each—was that done before you left? It was hardly what I recommended. The Engineer-in-Chief and myself talked over what we could save on this bridge, and no doubt I suggested that three of the land openings on this side of the river, and one of the land openings on the other side, might be saved.

1633. The land openings on the south side of the river are to be done away with, and the land openings on the north side reduced to two. Now there are two openings on the north side and eight openings of 64 ft. crossing the river? Yes.

1634. Then in addition to that the Department built the south abutment of solid masonry? That has been done since I left the work.

1635. Regarded as a whole, do you think that sufficient waterway has now been provided—do I understand that they have left a 24ft. opening on the far side, and that they have closed it entirely on the south side by making a solid abutment? Will you allow me to suggest that you are making a mistake. I have seen the place and I know that there is one 24 ft. opening.

1636. Are you of opinion that this provision is sufficient? Yes; based on the local knowledge I have obtained, and from my knowledge of a portion of the locality where that bridge is. Immediately above the bridge on this side there is a great projecting rock which cuts off a great deal more of the waterway than is cut off by all those piers.

1637. Do you approve of constructing the abutment on the south side of solid masonry? Without seeing the plan, I cannot say.

1638. Do you remember that the original plan comprised abutments and wing walls, but it is built of solid masonry—do you approve of this? It is quite strong enough, but I should say that it is rather a waste of money.

1639. The piers were originally designed to be 6 ft. in thickness, and they are now reduced to a thickness of 5 ft. 3 in.? Yes.

1640. Do you consider, from the information which you obtained of the flood in 1863, and from the enormous quantities of timber floated down the river, that the piers of 5 ft. 3 in. are sufficiently thick? Quite sufficient; built in cement I think there are even better. They give more waterway and are stronger.

1641. Coming to the design of the bridge—do you approve of the plan? I would rather not answer that. If you remember, I was once asked to design these bridges.

1642. The position of the Commissioners, Mr. Mault, is this. The evidence disclosed may lead to certain recommendations being made to the department: it is therefore necessary this information should be obtained? As a whole, I do not approve, and I never did approve, of the arrangement.

1643. What would you have proposed? A slight modification in the form of the girders themselves, and that they should be placed much farther apart.

1644. Transversely, so as to have given a broader base? Yes.

1645. What breadth of base would you have proposed? Eight feet.

1646. Eight feet clearance between the girders? Yes.

1647. Are those all the remarks that you have to make about No. 1 bridge? I don't want to volunteer any remarks. I might have modified the cross section itself, making the webs a little wider.

1648. Coming to bridge No. 2, this plan shows a somewhat similar form of construction, but with composite piers in the waterway. These piers are of a certain height, and are to be 3ft. in thickness internally, with an outside casing of wrought iron. Do you approve of that form of construction? I cannot say that I do.

1649. What would you have proposed? What I proposed all along to the Government was to get rid of having piers in such a rocky channel as that. By the word "such" I mean the rocky channel that there is there. I proposed to put one span right across.

1650. Of what width? 200 ft., and I offered to design composite girders on the American plan, but the offer was declined.

1651. Do you think a pier of 4 feet external thickness, less the thickness of the iron casing, is sufficiently strong to carry the load? Sufficiently strong in itself, but then, you consider, it would have been 56 ft. or 60 ft. high.

1652. I am taking it with those conditions? I should, certainly, have not recommended that.

1653. What would you recommend? In the peculiar circumstances, and everything considered, it would be far cheaper and far better to have had one span across the deep water. I should have had masonry piers each side and one span across.

1654. And what proportion to span is adopted for piers for this class of bridge? The average, I think, is one-seventh,—I have known one-ninth and one-tenth. It depends so much on the nature and height, but I don't think for any less than one-seventh.

1655. Do you recommend a pier 8 ft. in thickness there, based on the mode of construction adopted? If I had to put a pier in a narrow waterway where the flood was confined in one deep channel, I certainly should have had it about 8 ft. thick.

1656. The form of girder is, I believe, similar to that of No. 1 bridge, therefore the same remarks as to its mode of construction would apply? Yes.

1657. With regard to the locality of No. 3 bridge, have you any knowledge of that? I particularly examined the whole of these crossings. I should think, taking it at the low summer level, that there would have been no difficulty in making coffer-dams so that the piers would be well founded on solid rock. I don't think that four feet of gravel would have had to be removed to come upon solid rock.

1658. Assuming the same description of girder in No. 3 to be like those in bridges Nos. 1 and 2, the same remarks you made about them would apply to No. 3? Partly; I should not have recommended such strong piers as for No. 2.

1659. You mean of less thickness? Yes, about 6 feet, unless I could have done them in masonry and cement, and then I should have had them 5ft. 3in., like No. 1 bridge.

1660. Speaking of the general height of the railway above flood level, are you satisfied that the level of the railway from North Bridgewater to Glenora is above the level of the highest flood—that of 1863? Quite. It would be nearest to that about the Plenty, and there the rail level would have been 3 feet or 3 ft. 6 in. above the highest known.

1661. But are you satisfied that that would be sufficient for the safety and protection of the public? Yes; I paid particular attention to the 1863 flood.

1662. *By Mr. Stanley.*—You stated that in estimating the necessary areas for the waterways you assumed a rainfall of 2 in. in 12 hours? Yes.

1663. Do you consider that that is sufficient to provide for the maximum rainfall in this Colony? Not now, but I did then. At that time I had no idea of the exceptional rainfall which occurred when these works were washed away.

1664. We have had in evidence that the maximum rainfall in this Colony is generally taken at one inch to the hour. Do you think that in these circumstances your allowance was a sufficient one? Quite so, because it cannot be supposed that one inch to the hour would continue hour after hour.

1665. Still, if it continued for several hours your waterways must be of sufficient size to provide for that fall? Not for passing it in one hour. If over 500 acres an inch of rain fell, it would never arrive at any outlet till many hours after. In no country in the world, even in the worst part of India, do they ever make provision for passing an inch of water per hour. I can appeal to Mr. Lawder on that point.

1666. *Mr. Lawder:* As you have appealed to me, I can assure you that in some places in India provision is made for passing 24 inches in 24 hours.

1667. *By Mr. Stanley.*—The practice in Queensland is to make provision for an inch an hour, and in addition to that there is from 25 to 50 per cent. added to the area for waterways, to provide for sudden thunderstorms? That is all news to me.

1668. Before you determined those waterways, what information did you obtain as to the rainfall in the Colony? I consulted the records of the Meteorological Department, and from these I arrived at the conclusion that the average annual rainfall was 25 inches.

1669. But I take it that it is not the average yearly rainfall which you would have to take, but the maximum? I took the maximum in any ordinary round year, and I made provision in case that a month's rain would fall in twelve hours.

1670. But do you think that sufficient to provide for the thunderstorms which take place in this Colony? Yes; for if the work is well done your railway ought not to be washed away; then the water could rise over the headway of the culverts. That was one of my great objections to putting the stone there.

1671. If in one hour you have sometimes as great a fall of rain as in 12 hours, as you have estimated, is it reasonable to think that the waterways would provide for that fall? Yes, perfectly, because the whole of that can never fall at once.

1672. What authority did you receive from the Engineer-in-Chief for making alterations or ordering additional works while you were Resident Engineer? I don't know that I received any written orders. The general understanding was that I was to be so allowed, and on one occasion in my presence Mr. Falkingham asked the Engineer-in-Chief whether he was to take my orders in these matters, and the Engineer-in-Chief said "yes."

1673. In making these alterations, did you do so without reporting—without having written to the Engineer-in-Chief for his approval? I invariably reported to him anything that I did in the monthly reports.

1674. Have you received the general instructions issued by the Engineer-in-Chief to Resident Engineers. (Document exhibited)?—Yes, but not until sometime after the works were begun.

1675. When did you receive them? Some time after I came here.

1676. These instructions are dated January, 1885. When were you placed in charge of the line? I was appointed in November, 1884. I began my duties on the 1st of December.

1677. And that was about a month before the instructions were issued? More than that. I got them some time during the month of January, but the work was begun before I received them.

1678. Still, within a month, or say two months' time, considerable progress could not have been made with the works? No, I suppose not.

1679. When was the work of construction begun? On January 12, I think.

1680. Then you received your instructions within a month from the time of the works having been begun? Yes.

1681. Under clause 5 of these instructions it is provided that "no deviation from the contract forms, conditions, dimensions, materials, or prices without authority in writing from the Engineer-in-Chief shall be allowed." Did you obtain that authority before making any deviations? I didn't understand that, and I don't understand it now. And you must remember that, as I have said, I was asked to save as much money as I possibly could; and it was distinctly understood by the contractor that the schedule would be reckoned only as a schedule of prices; that the earthworks and other things would be exactly as I chose; and the Engineer-in-Chief was perfectly aware that I was making alterations in the works.

1682. Then did you look upon the instructions as a dead letter? Yes, to a great extent I did; that is, a part of them.

1683. Under clause 8 it is provided that "the Resident Engineer shall, previous to the commencement of any works, or as soon after as practicable, examine the general features of the country and the water-courses by which it is intersected, and submit to the Engineer-in-Chief a report on the drainage of those sections of the line about to be proceeded with, suggesting therein such alterations as may appear to him desirable in the position of the bridges and culverts, or the dimensions of the waterways provided in the contract drawings." Did you furnish such a report to the Engineer-in-Chief? I received that too late; the whole of the works had been set out before I received that document. In the district you speak of it was too late,—the work was actually set out and begun.

1684. But you stated in evidence that the work was begun on the 12th of January, and you received these instructions within the same month? Just so.

1685. The progress, then, could not have been so much as to have prevented you from forwarding that report? The progress was such that all the work had been begun, so I should have had to stop all work. I believed that the Engineer-in-Chief had already noticed the work, and was satisfied with it.

1686. But from the information which you had obtained in carrying out the survey, and during your residence in the district, how long would it have taken you to have prepared a report such as that referred to here? If I had had to do it over again, I think it would have taken me a month.

1687. But had you not such information at your disposal at the time as would have enabled you to give such a report? Such information as would have satisfied me, but not such as would have enabled me to draw up a formal report on the subject.

1688. Then you did not consider it necessary to carry out the instructions conveyed in this clause? It was utterly impossible, without stopping the work.

1689. In what way was the permanent survey carried out?—were you employed as Staff Surveyor, or did you do the work under contract? Under contract.

1690. Can you furnish the Commissioners with the terms of your agreement for this contract? I have told the Commissioners the terms of the agreement, but there was no formal agreement. The only information which I can give is to furnish them with the terms paid to me. There are also general instructions given to surveyors.

1691. At what rate per mile were you paid for this contract survey? £20.

1692. And for that £20 per mile what information were you supposed to furnish to the Department? I was supposed to set out the railway and the survey of the country on each side of it, furnish the names of the owners and occupiers of the land through which it passed, and make notes as to the nature of the country passed through. I am not sure whether I was supposed to give the sizes of the culverts that would be necessary, but whether I was supposed to do so or not, I did so.

1693. Were you supposed to furnish any information as to the area of the watersheds crossed? No.

1694. Then, no written agreement or statement as to the extent of the works you were to do was entered into? I think not.

1695. Did you grade the sections? Yes.

1696. Did you estimate the earthworks—the quantities, and so on? Yes, but that was not as part of the contract.

1697. That was additional? Yes, and was paid for as day work, though the grading was not.

1698. That information was furnished previous to tenders being called? Yes.

1699. You stated, I think, that you were of opinion that if the line had been kept on the south side of the river from Bridgewater to No. 2 bridge the cost of the works would have been greater than the line as it is now being carried out? Yes, between here and No. 2 bridge.

1700. Between New Norfolk and No. 2 bridge? Yes; but as between North Bridgewater and New Norfolk I am not in a position to say.

1701. In forming this opinion, have you taken into account the fact that two bridges—one across the Derwent at Bridgewater, estimated to cost £24,000, and the other at site of No. 1 bridge—would be saved? No; I made no reference whatever to Bridgewater bridge, about which I knew nothing, except that it was intended to put a road traffic bridge there, and that it was absolutely necessary to put it there whether the railway was constructed or not. I knew that that was the intention—in fact I furnished the plan necessary to furnish the design. I knew then that it was intended to adapt the road bridge to railway purposes; but in speaking as I have spoken, I made no allowance for the Bridgewater bridge.

1702. With such information as you now possess of the intentions of the Department with regard to Bridgewater bridge, do you consider that the present line is a more economical one than that on the southern route if that had been adopted. In this include the bridge that I spoke of, supposing that it was taken altogether for railway purposes? I very much doubt whether the other line would not have been the cheaper; but the works between here and the No. 1 bridge would have been very much heavier on this side than on the other side.

1703. Still you think that the cost of the bridge as now proposed to be erected at Bridgewater would have counterbalanced the extra cost? Yes.

1704. You stated, in reply to a question by the Chairman, that you were specially instructed to avoid interfering with house property near the Back River? Not specially. I was generally instructed to avoid house property altogether.

1705. What would you consider the value of the property or of the buildings interfered with had the line been deviated in the manner in which the Chairman suggested? Well, I dare say the Government would have been asked—but I can't really say; I can only guess.

1706. What do you consider them to be worth? About £600, including the land.

1707. Had you anything to do with the preparation of the quantities upon which tenders for this line were based? Except what I have said—nothing.

1708. With the earthworks? Nothing but the earthworks. But after the quantities were drafted the Engineer-in-Chief asked me to look over the large items. I did so, and I sent him in a report on the large items. The misfortune of it was that I ought to have looked at the small items too, for some of the small items ought to have been large ones.

1709. Apart from the earthworks, did you consider that the quantities in that schedule even approximately represented the works to be carried out under the contract? Oh, no; they bore no proportion to it. As I have said in my memorandum, there were omissions which I could foresee, when I was on the line, to the amount of £20,000.

1710. Had you made an estimate of the probable cost of the work under the contract? No; not further than what is stated in my memorandum.

1711. Will you state, for the information of the Commissioners, what, if any, alterations you made in the line or grades on this contract? At the Bridgewater end I lightened the earthworks.

1712. Will you state the mileages (plan examined). Having examined the statement of alteration in the grades and line furnished to the Commissioners by Mr. Falkingham, the contractor, can you state generally whether those are correct as far as you are responsible for them? Yes.

1713. *By Mr. Lawder.*—Was yours only a Parliamentary survey of this line, or did you make one or two surveys? Two.

4714. One being a Parliamentary survey? Two Parliamentary surveys; one on one side of the river and one on the other side.

1715. I am alluding now to the north side. You made the Parliamentary survey of the north side? Yes; two surveys. I made a permanent survey afterwards.

1716. When did you do that and submit it to the Engineer-in-Chief? The Parliamentary survey of the part between Bridgewater and New Norfolk was made between the months of September and October of 1883. It was at New Norfolk joined to the Parliamentary survey which had been made at the early part of the same year between New Norfolk and Glenora.

1717. By yourself? By myself; or rather between New Norfolk and the Ouse by myself.

1718. What were you paid for that survey? By day work for the first part. I was paid by day work for the entire survey from South Bridgewater to the Ouse. I was paid, I think, £15 a mile for the survey from North Bridgewater to New Norfolk.

1719. For the Parliamentary survey? Yes.

1720. Can you tell the Commissioners what you were paid in the first instance? I was paid £2 2s. a day.

1721. Did that cover cost of the staff? The staff was paid extra.

1722. When did you begin the permanent survey? The permanent survey I began on the 30th of January, 1884.

1723. When did you submit that survey? Speaking as far as I can recollect, it was towards the end of July, but it was sent in in sections. The Engineer-in-Chief wanted to have the detailed drawings and the quantities got out by Mr. Edwards, so he asked me to have it in in sections, and I think that they were all completed within the time I mentioned. The first, I fancy, was sent in about the beginning of April.

1724. When you sent that survey in did you mark thereon the sizes of the culverts which now appear on the sections? Yes.

1725. Did you then inform the Engineer-in-Chief that you assumed the rainfall to be 2 inches in 12 hours? I don't think I did.

1726. Did he make any enquiries from you as to the rainfall assumed by you? No.

1727. Did he make any enquiries as to the general suitability of the waterways prepared by you? Except in general questions.

1728. And did you state in reply that they would be sufficient? Yes.

1729. Do I understand that the Engineer-in-Chief did not inspect the ground to check your approximations? He did. From time to time he came and walked over the ground where I told him that I intended to go.

1730. He approved of your provisions? He did not disapprove of them. He did not formally say "I approve."

1731. You say that you were requested to cut down the estimate, or to keep the estimated cost sufficiently low to save £10,000 for the proposed new bridge at Bridgewater, and you found that you could not do so? No.

1732. Then do you consider yourself responsible for the estimate which was made out of the cost of the line? No.

1733. What did you consider yourself responsible for? I considered myself bound to carry out the line as cheaply as possible.

1734. Then was any request made to you to avoid rock cuttings in order to cheapen the line? No, not at that time. The general instruction was in designing the line to choose as cheap country as possible.

1735. Was any request made to you to avoid taking up expensive land even where by so doing you might add to the stability of the line? No, nothing of that sort; everything was left to myself.

1736. Then I understand you to say that you received no instructions whatever with regard to the survey, but that the alignment and the proposed works, or proposals for works, were left to your discretion? Precisely so, on the understanding that I should choose the cheapest line that I could find.

1737. Why did you alter the original alignment after the estimate had been prepared, and the contract had been made—I mean of the permanent line? Simply to save money; thus, in the first of the items that you submitted to me just now, the engineering survey showed a level line, and I undulated it to avoid deep cuttings and high embankments.

1738. Did you allow for the extra width of land where such was required for deep cuttings or for high banks? Yes.

1739. Then the land was not taken up at a constant width throughout? No.

1740. In what places was it deviated from, as far as you can remember? I was not asked with regard to the first section of the line—the first four miles, that is—to set out the land width at all, and I believe that in that part a universal width of a chain was taken, but I modified the fence lines so as not invariably to keep the central line of railway in the centre of the ground taken, if you understand me.

1741. Yes, I understand. That is to say that on the side boundaries you were not always parallel to the alignment? Then after the first four miles I set out the width according to the nature of the ground, and after those first four miles the width continually varied according to the depth of the cuttings,—in orchards even less than the chain width being taken.

1742. It is in evidence that one equal width has been taken up throughout the line, and that no provision has been made for extra widths to carry the side slopes of deep cuttings? I am satisfied that that is entirely wrong; but I am not responsible for it if it is. The law here is that only District Surveyors can survey Government land in their districts, consequently the plans were handed over to the District Surveyor, and he set out the fence lines; but from the questions he put to me he was aware that through deep cuttings extra land was required.

1743. Do you mean to say that the extra width required as shown in your plans should have been taken up by the District Surveyor? Yes.

1744. Is it not usual for the Engineer to set out the side width? I thought that I should have to.

1745. You did not do so? No; because I was told that the District Surveyor would have to do it.

1746. How would the District Surveyor know where to set them out? From the plans and sections.

1747. With regard to that box culvert which you put in at 15 chains, how deep did you drive your piles for that culvert? I really cannot say from memory.

1748. How much do you think? I should think about 15 or 16 feet.

1749. Below what? Below the level of the ground. But the order given to the Inspector was, that he should drive till three blows of the monkey made no perceptible difference.

1750. There is an answer which you gave to a previous question. You said that you considered the thickness of the piers in cases $\frac{1}{7}$ th, $\frac{1}{8}$ th, even up to $\frac{1}{10}$ th of a span? I am speaking now on the spur of the moment. I dare say I ought to have begun at $\frac{1}{10}$ th, because I was having particular regard to the particular place that was referred to when I mentioned that, and that is in the place in the river where the channel is confined between rocks, and where in times of flood there is a tremendous sweep.

1757. But would the calculations for pressure and stiffness and other influences not come into operation in your conclusion? Certainly.

1752. What would you propose to make the thickness of the piers of a 200 feet span, with a height, say, of 20 feet? I am not prepared to say, without a calculation.

1753. Would you make them 20 feet or 1-10th of span? what thickness do you think you would give them, building with sandstone of good quality? I am really not prepared to say, but for that height I should think that at the top 9 feet would be sufficient.

1754. In checking the large items of the estimates, which you say you did when Mr. Fincham sent them to you for the purpose, did you observe any errors in the items for masonry? Yes.

1755. Did you bring them under his notice? Yes; I have a copy of my report on the subject.

1756. We should be glad to have a copy of your report on that point, and also the one in connection with the survey you sent in, or of any other matters which you might have thought it necessary to bring under special notice? I have said here generally that, with the exception of earthworks, fences, and permanent way, the whole of the items consist in round numbers, which have not been arrived at except by roughly guessing. They are quite useless for the purpose of obtaining a schedule of prices.

1757. When is that dated? December 15, 1884.

1758. Will you let the Commissioners have it for perusal? I will. You will see there is an error of 2550 cubic yards in the masonry. I see, though, that my draft was written on the 5th December, and that it was sent to the Engineer-in-Chief on the 6th of December. (Document handed in.)

1759. Have you any reports in connection with your surveys? I have no doubt that I have.

1760. *By the Chairman.*—I think if there is anything you wish to bring under the notice of the Commissioners in explanation of what you did on the works, and in explanation of any charges made against you, you might let us have them. We do not know of the existence of any documents; you do; we could then embody them in our report? In my memorandum I have referred to the documents which I should like you to see.

1761. Will that supply what you wish? That embodies what I wish. I have alluded to the document now handed in in the memorandum of the 5th of December, as to the quantities and estimates.

1761. *By Mr. Stanley.*—Upon the completion of the permanent survey which you carried out under contract with the Department, were any steps taken by the Engineer-in-Chief or any officer deputed by him to examine or check your survey work? Not that I am aware of.

1763. Then your survey was accepted without question? As far as I am aware. I should mention, as I have repeatedly mentioned to the Engineer-in-Chief, that I would not be answerable for the setting out of the work by the contractor. He did not wait for me to give him leave, but started work without ever informing me, pulling up the whole of the stakes, and putting them not upon any definite system—sometimes upon one side, sometimes on the other.

1764. I refer to the survey work at present. You state that as far as you are aware the work which was done by you was never examined or checked? As far as I am aware, it was not.

1765. According to the contract drawings the timber faces to the pipe drains are shown to be constructed with dwarf piles driven into the ground? Yes.

1766. Will you state why those piles have been omitted in carrying out the work? The whole of the culverts put down were either on rock bottoms or hard gravel bottoms.

1767. We have been informed that the retaining wall which was originally constructed at Back River was formed of random rubble? Of coursed rubble.

1768. The Engineer-in-Chief (I think it was) informed us that it was of random rubble? Coursed rubble. There was no specification for that part of the work at all. The work was not specified, and it was done in coursed rubble.

1769. I observe from the schedule that an item is entered as dry stone-walling—is that the class of work upon which that retaining wall was built? No.

1770. What item, then, in the schedule provides for the class of work of which that retaining wall was a part? I think three items further on; item 54, I fancy.

1771. Dry rubble retaining walls? The Commissioners have had an opportunity of inspecting a portion of the original retaining wall which still stands at that place, and while they consider that it has been carried out in accordance with the specification for item 54 in the schedule ———? I think you will find a difficulty in fixing that item 54 in the specifications.

1772. Do you mean that there is no clause in the specifications particularly referring to this item in the schedule? Yes. I took it that that dry stone-walling meant walling above the surface of the ground, to be used as facing for instance. I took it on that account because of the price.

1773. Is there no clause in the specifications defining the class of work used by you in the retaining wall to which I refer? No.

1774. Then do you understand by item 54 that this rubble was coursed work or random rubble? It was coursed.

1775. And do you consider that the wall, as erected, has been constructed properly? No; I was continually finding fault with it; it was not constructed as I wished.

1776. Because the Commissioners observed that in a considerable portion of this wall the stones have not been laid on their natural bed, but are frequently on end, and, in fact, are laid at almost any angle? All this work was marked when I left to be altered. I noticed a good deal of it too.

1777. Was that work examined by the Engineer-in-Chief. Yes.

1778. Did he approve or disapprove of it? Well, he approved of it so far as to pass it. He made the same remark that you have just made and that I have already made. In fact, I pointed out to him that it was intended that all stone not on the natural bed should be taken out; but that part which stood he passed, and he was present while the wall that failed was in course of construction, and he

expressed more approval of that part of the wall than of that farther back which was completed, and which has stood.

1779. What instructions did you give the contractor with respect to the dimensions and character of the retaining wall at this place? I instructed my inspector to have these walls put only where the entire embankment was formed of rock, and hand-packed rock, and that in these cases he was to give the wall a batter of 1 in 6 outside.

1780. Was the wall built in accordance with these instructions As far as I know, it was.

1781. Did you not see it? Whenever I saw it I took care that it was so. As I mentioned in my memorandum to you, during part of the time I was ill.

1782. The Engineer-in-Chief has stated that this wall was built with a perpendicular face, and of a less thickness than the dimensions shown in the contract drawings? Certainly; the contract drawings began with 2 ft. 3 in. But allow me to explain: it was not perpendicular, except at the point where it joined the wing-wall of the culvert. Thence it went straight out into its proper batter; that is, the actual line of junction between the retaining wall and the culvert was perpendicular; then it went out at once.

1783. Do you consider that a retaining wall of dry rubble, of the dimensions which you have given, is sufficiently strong for a position like that? Yes; the entire embankment was formed of rock below. With the exception of that one particular place, the wall had really only itself to support. It was on the face of not quite perpendicular rock, but the rock was so perpendicular that if I had given a batter of 1 in 4, instead of 1 in 6, three times the amount of work would have had to be done.

1784. Then you consider that, in the circumstances, there would have been no pressure from the bank at the back of the retaining wall? No.

1785. Then you regard that retaining wall, as originally designed, as merely a facing of the embankment? That is all.

1786. Can you state whether the embankment was formed of rock or soft earth? The upper part of it was formed of soft earth.

1787. Was that in accordance with your approval? Quite the contrary.

1788. Then why was the work not stopped? I was very disposed to stop it, but I was kept back from considerations of economy. If I had begun to put up a proper retaining wall I should have had to begin right down. It was of no use to put a thick wall to resist earth on top of a thin one which was only intended to resist the pressure of hand-packed stone.

1789. Before giving the contractor instructions as to the manner in which the work was to be done, did you consult the Engineer-in-Chief, or obtain his approval to the design? No; I believe that in my monthly report I called attention to the fact of what was being done.

1790. But did you explain in your report what was the character of the work that was being done? I was all at sea. I think the Commissioners should bear in mind that if I had had the work done as I should have liked to have had it done independent of considerations, I should have been called upon to pay the contractor at least five times the value of the work.

1791. *By Mr. Lawder.*—At the time you say that the earth and clay were found behind the wall at Back River, was it specified that the contractor should fill in the banks with stone refuse and spawls? Yes.

1792. Did you consider it a deliberate intention on the part of the contractor not filling in that stone rubble? My opinion is, that it was the deliberate design of the contractor to force me to pay him 30s. a yard for this work.

1793. Was it not within your competence to insist that the contractor should fill in these works with stone *débris*? Not unless I paid him 30s. a cubic yard for it.

1794. Did you not consider it better to stop the work until you had consulted the Engineer-in-Chief? The Engineer-in-Chief came exactly at the time.

1795. Did you not ask him to settle the matter then and there? The Engineer-in-Chief said that he was entitled to his payment.

1796. Did you agree that he should fill in with stone and receive payment as the Engineer-in-Chief had sanctioned? The Engineer-in-Chief said that if I had it done, I should have to pay for it.

1797. What did you understand him to sanction? The work going on, and the filling in with earth.

1798. Under the circumstances whom do you consider responsible for the falling of the wall—the contractor, yourself, or the Engineer-in-Chief? I don't want to shirk my responsibility. I always said that it was a mistake on my part not to have altered the works whatever the cost was. I take that responsibility, but that responsibility is shared by the Engineer-in-Chief, who actually saw the work being done, and knew as much about it as I did.

1799. Whom do you consider responsible for it, if you brought the matter under the notice of your Engineer-in-Chief, and he gave certain instructions, and he being your superior officer you followed those instructions,—would he not be responsible? As I have just said, I don't want to shirk any responsibility. As the facts are, it was a joint responsibility. It was a mistake; we were both parties to it, and we were both partly misled by the statements made by the contractor in the presence of the inspector.

1800. What statements do you refer to? I am told that the earth has been found to be much lower than we were told that it was. The contractor stated, before Mr. Fincham and myself, and in the presence of the inspector (who did not contradict it), that the whole embankment was, as it were, a solid wall.

1801. How did you discover that? Mr. Fincham has since told me that at the bottom earth was put in. That is all I know.

1802. *By the Chairman.*—We should like you to tell us where we can obtain any information with regard to the rainfall. From the Meteorological Office.

1803. From whom? Captain Shortt.

1804. I have a list showing the culverts designed for portions of the line, and of the substituted culverts, showing where the alterations were made. You can take this and write your remarks on the fly sheet respecting those under your control. It seems that Mr. Sheard had to do with some, while others were built by you? I have no documents to show mine. I don't think I shall be able to distinguish between them.

1805. Will you be able to say which are your culverts? Probably I may; probably I may not.

1806. Surely as a matter of personal knowledge you would know whether a particular culvert was yours or not? I can do so only from memory. I don't think that I should be able to distinguish them all for certain.

1807. *By Mr. Stanley.*—I presume the present resident engineer would allow you, Mr. Mault, access to his papers? Yes, I dare say he would.

1808. *By the Chairman.*—Certain culverts were built by you between the Pulpit Rock and North Bridgewater, and our attention has been called to the quality of the masonry and of the mortar. They are generally stone wall culverts? Yes.

1809. Were they built under your direction, or with your approval? Some of them were. I had some built once or twice over. The mortar everywhere, as far as I could find out, was very bad indeed; we found very often two kinds—one quality in the facings, and one in the backs that we could not see.

1810. Did you notify to the contractor where he could get his sand and lime from? I only satisfied myself of their quality; he got them himself.

1811. Did you direct him where he should get his lime? I had no power.

1812. But if an engineer objects to lime being obtained from one locality, do you not think that he should indicate another suitable one? The requirement was never made.

1813. The cement mortar is alleged to be bad. I ask did you take ordinary care, and were you satisfied with what was done? I was not satisfied with what was done, but I exercised all the care that I could, and I believe the inspector did likewise.

1814. Mr. Falkingham stated here that he was directed to get lime from a kiln near Bridgewater? Not by me; by the Engineer-in-Chief.

1815. Do you approve of that lime? I don't say that I know enough of it to distinguish it from the other lime.

1816. Where did you get the other lime? I know so little as to where lime comes from that I can't say.

1817. Do not you think it is the duty of an engineer to obtain that information? Precisely so; I got the best lime that I could in the neighbourhood.

1818. And were you satisfied? I was satisfied with the Bridgewater lime as being sufficiently good, but I found a great deal more fault with the quality of the sand mixed with it.

1819. Then, generally speaking, your objection to the mortar was as to the quality of the sand? With the quantity of the lime as well.

1820. Is that not a matter for the inspector?—did he ever complain? Yes.

1821. What steps did you take? We ordered more lime, and where a work was put up we ordered it to be pulled down.

1822. In consequence of complaints made by the inspector, did you allow work to pass which was afterwards altered to your satisfaction? Not up to the time I had left; I think I had left before that could be done.

1823. If you had excluded a work, would not its subsequent return show that it had been completed to your satisfaction? Yes.

1824. And supposing we found culverts returned before you left the works, would not those works have been done to your satisfaction? Yes.

1825. Then your objection does not hold good. Coming up the line certain culverts were pointed out to us as having been built with inferior mortar; if these culverts had been built and paid for upon your certificate you must have been satisfied? Precisely so; but I don't remember any such case.

1826. Are you satisfied with the work between New Norfolk and Bridgewater? No; it is unsatisfactory work.

1827. *By Mr. Stanley.*—At the date of the last certificate previous to your giving up charge of the works, were these masonry culverts included or not in that certificate? Some were, and some were not.

1828. Can you inform the Commissioners which culverts were excluded, by a reference to the office records? No doubt I can.

1829. Will you do so, then? I will.

AFTERNOON SITTING.

The Committee re-assembled at 2 P.M.

Present.—All the Commissioners and the Secretary.

JOHN CAMPBELL CLIMIE, *examined.*

1830. *By the Chairman.*—What are you, Mr. Climie? A civil engineer.
1831. What experience have you had in railway works? I may say 30 years.
1832. You have had considerable colonial experience as well? Very much. My experience in railway construction commenced when I was quite a boy, at the bridge over the Menai Straits. I was there by invitation of Sir William Fairbairn and Mr. Hodgkinson, the eminent engineers. That was in 1848.
1833. You have been engaged on this Derwent Valley Railway contract, have you not? Yes, by Mr. Falkingham, for the last five months. I commenced work here in October last.
1834. What position were the works in at the time—how much had been done? The earthworks were very well advanced.
1835. As to the culverts, how many had been built? The culverts generally were built throughout.
1836. I understand you have handed in to the Secretary a statement giving your views generally on the works? I have.

The statement was read at length by the Secretary, as follows:—

J. C. CLIMIE, Civil Engineer:—At the present time I am the contractor's representative for the construction of the Derwent Valley Railway; have had this position for the last five months. Remember the flood of November 30th, 1885; there was a considerable flood in the River Derwent, but not an extraordinary one. Walked over the line of railway from Bridgewater to 3m. 35ch. on the 1st of December, 1885; found the embankments in many places washed away and other damage done. I can say it was owing to the culverts in every case being too small to carry off the flood water. My opinion was much strengthened by the Government engineers ordering the contractors to put in timber openings of a much larger area, notably—at a distance of 0m. 15ch. and 3m. 34ch., where culverts 4ft. by 3ft. and 3ft. by 3ft. had been built. Altered designs were received by the contractor to build three 15ft. timber openings. Other portions of the line were more or less injured, and additional waterways have been ordered. Some difference has arisen between the Engineer-in-Chief and the contractor respecting making good the damage done by the flood referred to. The contractor wishes to have the earthworks, ballast, and relaying the road replaced, and made good as before the flood, and has submitted a price based on his schedule rates for this work. The Engineer-in-Chief will only allow one shilling (1s.) per cubic yard for the earthwork—a price which the contractor cannot accept without loss to himself; and as the damage was caused solely through insufficient waterways, which had been ordered or approved of by the Engineer-in-Chief, it is reasonable the contractor should claim schedule rates.

Back River.—Much unpleasantness has arisen through the abutment of an 8ft. culvert and river wall at this place having given way owing to faulty designs and character of work ordered. Reference to the plans will show that the work could not stand the pressure that it would be subjected to. The result was that the abutment of the culvert had to be removed and rebuilt. The river wall also became a total wreck, and had to be removed, and is being rebuilt for a distance of 404ft., the remaining portion being covered up by forming an embankment outside of it for a further distance of 982ft. The wall now being built is (vertical) of squared masonry 4ft. thick, with 5ft. 8in. of lime concrete backing. Although there is a great excess of material used this is not a strong section of wall, and may yet cause trouble. Another very objectionable part of this work is the 8ft. arch. Having been built 2ft. below flood level there is reason to fear that damage may result from pressure of the water, which in time of flood is over 20ft. deep. The contractor has objected, and pointed out the possible danger of this part of the work. For the safety of the line the river wall should have been built with a batter, and need not have had lime concrete backing.

Bridge No. 1.—The design of this bridge has been objected to by the Contractor for the following reasons:—The piers should have had a cutwater on down-stream side to protect the masonry from the current and scour that must necessarily occur from the piers having square ends; they are also too narrow, only 5ft. 3in., scarcely allowing width enough for fixing the Lewis bolts in the bed-plates. The girders, which have a raised platform, are of solid $\frac{3}{4}$ in. plate, and 6ft. deep, spaced 6ft. centre to centre with solid wrought iron $\frac{3}{4}$ in. plate, fixed 12 ft. apart, the full depth of girder. The top is covered with $\frac{1}{2}$ in. planking only. These girders, from this peculiar design, expose a large surface to be acted upon by the wind,—no less than 984 square feet. The pressure of the wind, taken at 50lbs. per square foot, I find not less than 22 tons to be the pressure against the girders; in addition to this strain there is the effect of a passing train to be considered. It will be seen, by referring to the plans, that a train running on top of these girders during a strong wind would act as a lever, and tend to overthrow the girders, or, from the oscillation, it is possible that the train may be thrown off the rails, when the most serious consequences must follow. The weight of the girders I reckon to be about ten tons each; how then can 20 tons of dead weight be expected to resist a pressure of 22 tons with the addition of a passing train, or even half that amount of tons, acting with a series of gusts at intervals. The oscillation would be such, with these girders, that it would be dangerous for any one to attempt to walk over the bridge in a strong gale; such a gale as visited the Derwent Valley on the 11th February, would, in my opinion, create such a disturbance to the girders that would cause certain destruction to life and property should it ever be attempted to run a locomotive train over it. It is the stiffness of a structure which prevents vibration, not weight, and upon this all hope of safety depends. I submit that these girders are not constructed to give the necessary stiffness to prevent oscillation, neither can they be without having a greater base, say, 12ft., and diagonal bracing at top; and this cannot now be done without pulling down the piers and solid abutments. It is provided in the specification that the bridge must be tested at the contractor's expense by running a train over it at the rate of 20 miles an hour,—this is a high rate of speed, seeing that the bridge is approached by a curve of $5\frac{1}{2}$ chains radius ending on the abutment of the bridge.

Bridge No. 2.—This bridge has also been objected to by the contractor. The site chosen is not a good one for iron caissons, the formation being hard rock of very irregular formation. The plan proposed is a wrought iron caisson 52 feet in height and only 4 feet wide from top to bottom, $\frac{1}{2}$ in. plate, braced and tied every four feet, and filled with cement concrete. Although I have not had any experience in building such piers for bridges (in fact I have never seen or heard of anything like it being built), I am of opinion that if built they would not stand long in such a river as the Derwent. The foundations could not be made secure, as shewn on plan, by placing bags of concrete around outside the caissons; the current at the bridge site, I have been told, runs at the rate of 10 miles an hour during flood; this would wash away concrete, bags, and all, as fast as they could be put in. These caissons being the same width the whole height of 52 feet, do not offer sufficient lateral strength to resist the shocks from floating timber which is carried down the river in flood time. Piers should not be less than $\frac{1}{10}$ their height, and when lateral pressure has to be provided for, increased base becomes a necessity. These conditions do not appear to have been attended to.

I do not consider they could be built according to plans with any degree of safety. Supposing the water to be an average depth of 30ft.; there would, from the weight of water, be a pressure on the caisson of 550 tons; would a plate-iron stand this pressure? Such a caisson, if built in a favourable position, its life would not be more than 5 years, when, from rust and other causes of decay, the whole fabric would fall to pieces, as the cement concrete could never become one solid mass; owing to the horizontal and diagonal bracing, the caisson above water would be subjected to expansion and contraction, which would effectually cut up the concrete into small pieces and be of no more use than dry rubble. The same objections raised to the girders of No. 1 bridge will apply to No. 2 bridge; but I would observe that since the contractor has refused to take the responsibility of maintaining these bridges, instructions have been given to make the girders continuous over the two caissons. This will make the girders 192 feet long. To meet these alterations special bed and bearing plates of cast iron have been given; this shows that cast iron upon cast iron is to act for the expansion and contraction of these 192-foot girders. This is so opposed to usual practice that I unhesitatingly say that should the bridge ever be erected serious consequences will be the result.

1837. That is your statement and comment upon the works of the Derwent Valley Railway during the time you have been connected with it? Yes. With regard to the bridge, I told the contractor that if he determined to build it I must resign,—that I would not take the responsibility of it. I did that from a humane point of view. I hand in a sketch of it.

1838. You are aware that alterations have had to be made in the culverts in consequence of the deficiency in their size? In going over the line on the 1st December, I noticed that the culverts appeared to have done their duty according to their size, but they were so totally insufficient that the banks burst and gave way.

1839. Are those the culverts built by Mr. Mault? Yes.

1840. I think I understood you to say that the culverts were built before you came on the works? Yes.

1841. Then the alterations have been done in your time? We are making the alterations now.

1842. Do you think these alterations are necessary or in excess of the requirements? I do not think they are equal to the requirements even now.

1843. I think it right to tell you that Mr. Mault, who was the Government Engineer formerly, takes exception to the increased size, and says the culverts as designed by him were quite large enough, and that it was the peculiar local circumstances that prevented their being efficient. Do you agree with that opinion? I do not. I do not think that with the alterations made by the present resident engineer they are quite sufficient.

1844. Were you here at the time of the flood in November last? I was.

1845. Was it an extraordinary flood? Not by any means.

1846. Mr. Mault states that more water fell during those two days than during any previous similar period; that, in fact, seven inches fell at one particular spot. Have you any means of verifying that statement? Thirteen years ago I was engaged in constructing the Main Line Railway, and intended taking the line over that very spot, but Mr. Grant, the present manager of the railway, altered the line to its present site. At that time I recommended three 20-ft. openings, knowing from careful measurements and observations that without such a large waterway the line would not be safe.

1847. Does the Main Line Railway cross that gully at all? No, it crosses below it. There is a most impetuous and troublesome stream, which flows for 3 or 3½ miles.

1848. Does it run parallel with the course of the railway towards Brighton? No; it runs more towards the Dromedary and the Crooked Billet.

1849. The Crooked Billet,—that is a public-house on the road? Yes.

1850. Do you know from your own local knowledge whether there is any existing bridge which spans that creek? I do not think there is one. There is a bridge which spans a portion of it at the Crooked Billet.

1851. As this information will be very valuable, are you in a position to say that it only crosses a portion of the stream at the Crooked Billet? I am.

1852. What is the size of it, as nearly as you can remember? About twelve feet opening.

1853. Then if the railway officers had gone up this creek and examined what it was, they would have seen the necessity of providing a more adequate waterway? If I had been doing the work, I would have put up six 15-ft. openings there.

1854. How far along the main road from Bridgewater is it before you come to this crossing near the Crooked Billet? I think 2½ or 3 miles.

1855. Does the bridge of which you speak lie on the north side of the road or towards the Main Line Railway? It is over the main road, near the Crooked Billet.

1856. With reference to the other culverts, are you of opinion that the provisions which are proposed to be made are adequate, or are they in excess of present requirements? I consider they are very much within the limits of what will be required.

1857. Have you anything to say with regard to the culverts above New Norfolk? At Hayes's Rocks there is a ridiculously small waterway allowed.

1858. Has not the resident engineer's attention been called to that? I called his attention to it. That culvert was built before I came here.

1859. Does he intend to make any extra provision there? We have added 12 superficial feet area, or two 3 × 2 culverts, within the last few days since the Commissioners were there. That is at 14m. 28c. Beyond No. 1 bridge we are also increasing the waterways.

1860. With regard to the Back River culvert, you know that locality intimately, I suppose? Very well indeed.

1861. Has proper judgment been exercised in laying out the line at that place? No judgment whatever. The line should never have been there. If it had been placed 14 chains away from where it is now it would have been better, and would have saved the country £10,000 or £12,000.

1862. The information given to us is to the effect that although it was originally intended to take the line further back, yet that the sum which the landowners would ask for compensation would make the line so expensive that it was deemed advisable to go along the bank of the river. Do you coincide in that opinion or not? By no means. They would have given the land freely. While dealing with this question I would point out, to clear myself from any blame in connection with it, that although I was Inspecting Engineer for Government railways when the Parliamentary survey was made, the Engineer-in-Chief specially asked me to forego visiting the Derwent Valley Line, because the Engineer in charge of it then was a man of such experience that it was quite unnecessary. Consequently I never visited it.

1863. Was that Mr. Mault? I presume so.

1864. Was it Mr. Sheard? Mr. Sheard was not here at the time.

1865. Then it was the predecessor of Mr. Sheard? I do not know who it was.

1866. It has been stated in evidence that only two Government Engineers have been connected with this railway, Mr. Mault and Mr. Sheard, who succeeded him. It must have been one of those two gentlemen? It could not have been Mr. Sheard.

1867. With reference to the Back River wall, did you see the original wall which was built there? Only a section of it; it fell before I came here.

1868. You deal, in the statement you have made, with the work going on there: have you any other remarks to make in connection with it—can you suggest how it should have been done? I could suggest, but I do not think it is necessary. If it is admissible, I can give you a section of a wall that in my opinion would be stronger and more efficient, with less masonry and no concrete banking whatever, and perhaps, save the country thousands of pounds.

1869. Coming now to Bridge No. 1, it has been stated in evidence that the waterway there has been altered from the original intention, and that it is now to consist of two 24 feet and eight 64 feet openings: is that correct? Yes.

1870. It is also stated that the Engineer-in-Chief has reduced the piers from their original size of 6 ft. to 5 ft. 3 in.: is that correct? Yes.

1871. Is that an alteration of which you approve? I am very much opposed to it.

1872. What, from your experience and knowledge would you consider a suitable section for adoption there? The piers should not have been less than 6 ft. on top, with a greater base. One of the Lewis bolts is placed so near the outside edge of the stone as to run great risk of splitting it.

1873. *By Mr. Lawder.*—But if you left out that particular Lewis bolt the remaining five would be quite sufficient to hold the bed-plate down? Yes; I do not think that particular bolt of any value where it is. It will simply burst the stone.

1874. *By the Chairman.*—The original plan, as we are informed, provided that the abutment should be constructed in a particular way, that is, with an ordinary wall, and with wing-wall with spaces between. How is the abutment being built? It has been built solid.

1875. Do you approve of that form of construction? I think it is a most extravagant waste of money.

1876. Would not the excess of masonry in the abutment have been better applied to thickening the piers? Much better; a more extravagant and foolish arrangement I never saw during the whole 33 years that I have been acquainted with railway construction.

1877. With regard to the piers, do you think 6 ft. will be thick enough to resist the force of floods and of timber that may be brought down the stream? Possibly, but I should have had a greater base; these piers have cutwaters only on up stream end. It is most important that the down stream side should also have cutwaters as a protection from the swirl of the current, which is very great during a fresh in the river. I would never have had squared ends on the down stream side.

1878. I think it right to call your attention to the fact that a charge was made that in the construction of No. 1 bridge the contractor did not carry out the orders of the engineer, and that he built or attempted to build a foundation on an uneven bottom? I should like to make an explanation on that point. In this particular case I happened to be absent for two days. We had put in a temporary dam in 6 or 7 ft. of water which was giving way. Our inspector of masonry said we must do one of two things, either save the dam or fill the bottom with concrete. When I saw that, I said he was perfectly justified in doing what he had done.

1879. What was that? He filled it with concrete.

1880. Had he previously obtained a good and secure foundation? After securing the dam by filling it up with solid concrete, we found it was a mere crevice in the rock, and was not of the slightest detriment to the foundation of the pier. Afterwards we opened it up, and the whole thing was then considered satisfactory.

1881. Has it been accepted by the Railway Department? Most completely. To save our dam we had to go to work on Sunday morning. I drove to Mr. Sheard's house in my own buggy, arriving there at about half-past seven, and asked him to come out with me. He agreed to do so. We started at a quarter past eight, and when we arrived at the scene of operations they had just commenced to put the concrete in.

1882. How long had the work been commenced, and what quantity of concrete had been put in when Mr. Sheard and you arrived? They were putting in the very first batch of concrete.

1883. Then your justification is that to save the dam you were obliged to commence the work and put in the concrete? Yes.

1884. Are you certain now that good substantial work has been put there? There never was a sounder foundation. In fact, Mr. Sheard will tell you so himself.

1884A. Is there any risk to the work from that foundation? Not the slightest.

1885. In reference to the superstructure, it has been alleged that the newels on the abutments are too near the centre of the line, and that the rolling stock will not pass: is that the case? The rolling stock they have here now is on the straight quite 4 ft. 6 in. from the centre, but on the curves they want 5 ft. The width of these newels is 9 ft. 6 in. or rather 9 ft. 5 in. Therefore on a curve of $5\frac{1}{2}$ ch. the rolling stock would not pass round them. But we have had instructions to pull them down.

1886. Is it the instruction now that the bridge is to carry road traffic as well as railway traffic? It was ten months ago.

1887. What is your opinion as to the strength of the girders? They are very well designed, and I have not the slightest objection to find to them.

1888. What is your opinion as to the open space between the girders, and the stability it will afford? It is out of all proportion. I do not hesitate to say that the whole thing must be overturned. When the wind blows with hurricane force the girders must go over.

1889. Can you suggest any means by which the necessary safety could be secured without abandoning the present plan? No; I should take down the piers and widen them.

1890. Would it not be possible to give them the requisite width now? It would be quite impossible now.

1890A. Would it not be possible to extend the base of the girders on the present masonry, so as to give greater stability? I do not think so, with any safety, but I have not gone into that question. I should simply pull the piers down, and give the girders at least 12 feet base.

1891. Coming to No. 2 bridge, the work on which has not yet been commenced, you are of course aware of the manner in which it is proposed by the Government to be built. What is the width and average height of the piers there? 4 feet in width, with an average height of 52 feet.

1892. Are those piers, in your opinion, sufficiently strong to carry the weight that will have to go over the bridge? I do not believe they will stand two days in a flood.

1893. Do you think it is an economical design? It is the worst thing I ever saw in my life.

1894. At contractor's prices for squared masonry, do you think it could have been built of masonry at a lesser or a greater cost? I think it would have cost less.

1895. What would have been the difference in the price? The price, according to the present design, is £42 a ton, and it could be built in masonry at £2 a yard.

1896. You are of opinion that a solid masonry pier could be built at a cheaper rate than the composite pier? Certainly. The price for masonry and mortar is £2 a yard, and for masonry and cement, 55s. I take great exception to putting wrought-iron caissons on a rock bottom. My experience in the West Indies, Portugal, and other parts of the world has taught me that to put these things down on a rock bottom is the height of madness. However deep you sink them, I do not see how you can secure them. It is intended to secure them by putting two or three bags of concrete outside them. I told the contractor I would not be a party to it.

1897. Has the contractor obtained any information as to what the bed of the river is composed of? It is the very hardest description of rock, without a particle of sand. The current is exceedingly strong, and it is strongest at the bottom of the river.

1898. That would be the place of all others in which to erect a sound masonry footing? Yes.

1899. *By Mr. Stanley.*—According to the plan it appears that a portion of the bottom is intended to be levelled with cement concrete, so that at that point the caisson will really not be sunk at all,—it will rest on the top of the concrete? Yes; the drawings show this very clearly.

1900. *By the Chairman.*—So far as No. 2 bridge is concerned, the work has not been progressed with, and the Government are not committed to anything? That is so, excepting the wrought-iron caissons and girders which are being constructed.

1901. Is it desirable, in the execution of such works, to introduce some novel principle of which we have had no experience? I should not do so.

1902. Would it not be the duty of the Engineer-in-Chief to accept the experience gained in other large works, and carry out his designs in accordance with that experience? I made bold to tell him so, but he ignored my advice.

1903. With reference to the planking on the top of the girders, the drawings show that the planking is to be placed there, but no means are shown by which it is to be fixed: have you received any instructions on that point? No, we simply fix it by the kerbing.

1904. Is it proposed to fasten the timber to the top flanges of the girders, or how? I should not think so.

1905. Then how do they propose to fix it? Only to the kerbing, as far as I am aware.

1906. But that does not fix the timber planking to the girder. Have you ever asked the Engineer any questions about it? They thought it quite sufficient to have a loose decking.

1907. The drawing shows no means of securing the decking. Have you had any instructions how it is to be secured? No.

1908. Have you asked for instructions? Yes, seven or eight times.

1909. Have they not intimated to the contractor how the decking is to be fixed? No.

1910. With reference to No. 3 bridge, that is a duplicate of No. 2 bridge as far as general principles

are concerned. Do the remarks you have made with reference to No. 2 bridge apply equally to No. 3 bridge? Not quite so much, because I believe the foundations are not so bad. I do not think it is a rock bottom.

1911. You do not object, then, to the principle of sinking cylinders filled with concrete, but to sinking them in an unsuitable locality? That is the special objection.

1912. You would not object to cast-iron cylinders with a good foundation? Not in the slightest.

1913. Can the work be made as solid with braces and ties as without? I do not think so. Concrete will shrink and iron will expand. It becomes dislocated. The combination is one that should never be attempted.

1914. Is it not an element of weakness in construction generally, when you apply two bodies of unequal contractive and expansive qualities? It is one of the most dangerous things possible.

1915. *By Mr. Stanley.*—You stated that the girders had bearing and bed plates of cast iron in No. 2 bridge. Is this not contrary to all recognised practice? It is totally opposed to it.

1916. Do you think it is likely, under those circumstances, that there will be any movement to provide for expansion in these girders? None whatever.

1917. Will not the two cast-iron surfaces bite? They will bite within three months of being fixed.

1918. You stated that you were for some time Inspecting Engineer in the Railway Department. What were your special duties while holding that office? To look after the railway surveys that were going on.

1919. Had you anything to do with inspecting the surveys? That was my special duty.

1920. In the case of the Derwent Valley line, I understand you received special instructions from the Engineer-in-Chief not to examine it? That is so.

1921. From what you have seen of the present contract, do you consider that a line on the south side of the river from Bridgewater to No. 2 bridge could have been constructed at more or less cost than the line now being carried out—bearing in mind that it is the intention of the Department to erect a new bridge to carry the railway over the Derwent at Bridgewater? Without the slightest hesitation I state that I could lay out a line of railway between those two points on the south side of the river at a less cost to the country of £40,000, and with greater safety. I should have gone on the south side of the river all the way from Bridgewater.

1922. Would not that have involved interference to a considerable extent with the existing Main road? Not in the slightest. I know the country well, and have given special consideration to the question.

1923. Have you examined the Parliamentary survey that was made on the south side of the river? Yes.

1924. Do you think that that survey has been made in a judicious manner? By no means.

1925. Then you do not think it affords any correct idea of the difference between a line on the two sides of the river? No.

1926. Can you form any idea of the probable total amount of the contract by the time the present line is completed? Speaking roughly, I should think it will be about £40,000 in excess of the estimate.

1927. Have you made any special estimate of the cost? An approximate estimate. The contractor does not know what to do. He is asked to tender a price for 200 cubic yards of masonry, and up to the present time he has done about 4000 yards.

1928. Then such a schedule as that attached to the contract would form no proper guide to the probable cost of the undertaking? Not in the slightest, and it is most misleading to the contractor.

1929. Have you ever, in your experience, seen a schedule prepared in the same way? Never; and I have had a long experience in seeing contracts carried out on the schedule principle.

1930. I understand you have resided in this Colony for a considerable time? I came here in 1872 to carry out the construction of the Main Line Railway, and I have been here ever since.

1931. As an engineer, you would of course have to determine the waterways necessary on any line of railway. Upon what maximum rainfall would you consider it necessary or advisable to calculate those waterways? I went to Mr. Abbott, of Hobart, who was an authority on the subject, and got his records upon it. Then we had parties out for weeks and months getting accurate accounts of all the possible rain that could fall in the gullies before we attempted to frame the maximum size of our culverts; and the result is that we have never had an accident.

1932. My question referred to the rainfall per hour or per day—what would you consider it necessary to allow for in making your calculations? I should take it at the heaviest rainfall for thunder showers, which might be one inch or two inches in the 12 hours, or sometimes more.

1933. Do you never have thunderstorms or heavy showers in excess of that? Sometimes, but very rarely.

1934. Would it not be necessary, in determining the waterways, to make provision for heavy showers of the latter kind? It would be; there may be exceptional cases.

1935. *By Mr. Lawder.*—Do you know what the revised roadway of No. 1 bridge is to be, supposing it is to be adapted for road as well as railway traffic? I cannot say.

1936. Have you any idea what its width is intended to be? No.

1937. What is the present intended width of platform? There is only 8 ft.

1938. Do you know if it is intended to carry the combined roadway upon the proposed girders, or are any additional girders to be introduced? Mr. Fincham, last Christmas, showed me a plan for joint occupation, and I remember telling him the thing would not bear the wind pressure. It was not intended by that plan to introduce any additional girders.

1939. Do you remember what the width of the proposed roadway was? About 14 ft. on the top of the present girders.

1940. Do you consider that the overhang of the roadway would affect the wind pressure? It would throw you right into the river, without doubt. The area of wind pressure on the girders I estimate at 984 square feet. It is unreasonable to suppose the girders as designed would stand the wind pressure.

1941. How do you arrive at those figures? It is not one girder, but two. I have made a model of them, which I have here. That is twice 64ft. by 6ft.; and there are 12 horizontal ties, of 6ft. 6in. That gives the quantity I have mentioned, to which the projection must be added.

1942. I hardly see how you can take the whole of the inner surface of the further girder into your calculations as to direct resistance of wind? The girders are open at the bottom, and the wind pressure will be just as great there as on the outside.

1943. Have you made any enquiries with regard to timber washed down in floods? Yes.

1944. Have you ascertained what the extreme length of such trees would be? From 100ft. to 200ft.

1945. Would they come down with the branches standing? Certainly.

1946. Would there be any danger of their getting entangled in coming through openings 65ft. in width? Very much.

1947. What would be the result in such a case? A tree 4ft. in diameter—and there are hundreds of them—would come down at the rate of 10 miles an hour. Its weight would be from 15 to 20 tons, which, multiplied by the velocity named, would strike the piers with a force equal to twice their weight; and destroy them.

1948. Can you inform me what provision has been made in No. 2 bridge by the revised plan for the union of those three 64ft. girders as one girder, at the end of that continuous girder, for expansion and contraction? About 3in.

1949. How is that proposed to be adjusted in the construction? By expansion plates.

1950. How are you supposed to adjust that in the roadway? They never would expand. They would buckle, owing to cast iron resting on cast iron, as shewn on drawings.

1951. With reference to the permanent way, how is it proposed to adjust that? The road or permanent way is laid loose, and will not be affected.

1952. Do you consider there will be any disturbance of the cased piers owing to the expansion and contraction of that long girder? I do.

1953. Do you consider that in that case the stiffness of the piers will be affected? The whole thing will be disturbed, and it would not be safe to run over it.

1954. Are you aware whether orders have been given to put any stops in the side cuttings at the Plenty bridge, where the side cuttings are continuous, and that if they have not been ordered they should have been by the engineer-in-charge? I cannot say.

1955. Was that side cutting taken out before you came here? Yes.

1956. Would you, as an engineer, adopt continuous stops in side cuttings of that length? Yes, where the incline is steep.

1957. Can you inform us when you consider this line will be finished by the contractor and open for traffic? I could not possibly form the slightest idea.

1958. Will it be open by the date of the expiration of the contract? That is impossible.

1959. Supposing you get within the next month sufficient orders to enable you to complete the work in the most expeditious manner possible, when do you consider the line might be completed and open for traffic? If they would give instructions to complete the railway according to certain designs I will guarantee to finish it in 10 months.

1960. But if you do not get those designs you cannot possibly finish it in 10 months? No.

1961. *By the Chairman.*—There is one question which it is only fair that I should put to you, which you can reply to if you please. It has been stated that probably you might be inclined to view these works unfavourably—I do not wish to put this in a personal way—through having been a candidate for the office of Engineer-in-Chief with Mr. Fincham. Has that consideration in any way influenced you in giving your evidence here to-day? Not in the slightest.

1962. I presume that, as a matter of pecuniary recompense, you can obtain quite as good an engagement outside any Government office as you could in it? I would not accept an office. I can do better outside than in.

1963. Have you any further remarks to offer? I merely wish to call your attention to the caissons in $\frac{1}{4}$ in. plate placed in 30ft. of water. If it should be required to empty those caissons for the purpose of getting at the foundation the pressure of water upon them would be so great that they would simply get torn to pieces.

EDWARD LEONARD PARKER *examined.*

1964. *By the Chairman.*—What is your occupation, Mr. Parker? I am a civil engineer.
1965. In whose employment are you? In the employment of Mr. Falkingham, the contractor for the Derwent Valley Railway.
1966. When did you commence service on this work with Mr. Falkingham? In January, 1885, at the commencement of the contract.
1967. Have you been engaged on the work uninterruptedly since that time? Yes.
1968. Did you see the culverts as they were built along the line from North Bridgewater towards Glenora? I saw them occasionally. I was frequently passing up and down the line.
1969. A list of culverts has been handed in to us by the contractor, showing where alterations and additions have been made to them. Without going into details for each culvert, can you say that that list of alterations, which the contractor says has been prepared by you, is correct? To the best of my belief, it is correct.
1970. Can you tell the Commissioners whether the size of the culverts was found to be inadequate, or did they fail from any other cause? They were found to be inadequate.
1971. From what you have seen of the rainfall on the railway, are you of opinion that the sizes of the culverts, as now designed, are adequate or inadequate? I think the waterways now provided, at any rate between Bridgewater and New Norfolk, are sufficient, although a little more might have been given in one or two places.
1972. It has been alleged by Mr. Mault that the contractor used mortar in the construction of these culverts not of quality equal to the specification, and that in some instances he had the work pulled down and replaced. Have you any knowledge of this? I remember a portion of one culvert that was pulled down and rebuilt. To my knowledge, in every case the contractor gave orders to all his workmen that the full quantities were to be put in, and I believe they were. If not, I should look upon it as the fault of the Government Inspector, who was up and down the line continually.
1973. Did the Government Inspectors ever complain to you or to any other officer in reference to the bad quality of the lime that was being used? Not to my knowledge.
1974. Did they ever complain as to the quality of the sand? At one culvert, at 10m. 17ch., they did make a complaint, but it was with respect to the concrete only.
1975. Did they ever indicate where you could get better lime or sand? No.
1976. Do you know whether the contractor had any instructions from the Government officer as to where he was to obtain his lime? Yes, I believe he was asked to get it from the Bridgewater Lime Company, near Bridgewater. I think there is a letter from the Engineer-in-Chief asking him to do so.
1977. Have you seen that letter? Yes, I think so.
1978. Can you produce it? I think I can produce it to-morrow.
1979. Allegations have been made that lime of an inferior quality has been used, but if it can be shown that the lime came from a source approved of by the Engineer, those allegations are very considerably weakened. Are you certain you can produce the letter of which you speak? I certainly believe I can produce it.
1980. With regard to the mortar, did you use a pug-mill, or did you mix it in the ordinary way? In the ordinary way.
1981. Has the mode you have adopted in preparing mortar been approved by the Government officers? It has never been objected to, and we take that as approval.
1982. With reference to the Back River culvert, do you remember the wall that was built there, and which fell? Perfectly well.
1983. It is alleged that a portion of that wall has been buried up in the bank? That is so.
1984. During the construction of this wall, and the construction of the culvert, have you been continually passing along that part of the line? Continually.
1985. Do you know if, in the first instance, the foundation on which the wall was built was approved of by the Inspector and Government Engineer? Yes. With regard to this foundation Mr. Mault simply ordered us to put the rough stones firmly in the earth. There was no arrangement about going to a rock or gravel foundation. We were to be paid at the rate of one cubic yard for every lineal yard of the foundation. That shows that we were not requested to go to the rock for a foundation.
1986. It is stated by the Engineer that the failure of the wall was owing to the contractor not having obtained proper foundations. Are you in a position to say whether or not the foundations which were obtained received the approval of the Engineer and the Inspector? Most decidedly. The Inspector was there all the time, and indicated when we were to lay the masonry.
1987. Was that done in every instance? Yes.
1988. From what you saw of the work, can you state why, in your opinion, the wall failed? It fell because it was not sufficiently strong to hold up the embankment. I pointed out to Mr. Mault and Mr. Fincham what would be likely to happen, and asked them to put stone backing behind it.
1989. Supposing the wall had had the batter indicated on the drawing, three inches to the foot, would it then have stood, do you think, presuming you had got a good foundation? Not, I think, without stone backing. We were not told to put any particular batter to the wall, and Mr. Mault ordered us to vary the batter. We were to keep as near the river as possible.

1990. *By Mr. Stanley.*—Have you written instructions to that effect? No; all the orders were verbal with regard to the Back River wall.

1991. Can you produce any notes in confirmation of the statement you make? I do not think I can; but if Anderson, the managing mason, is called, I think he can prove that what I say is correct. I have been slightly blamed for not objecting to do this work.

1992. Did you make any protest? I protested verbally, continually. Of the first wall we have no plans or sketches. On the 2nd February Mr. Mault ordered a dry wall from 12m. 73ch. to 13m. It was to be an 18in. wall, and the batter would be about 1 in 4. The whole of this wall was built, and 149 square yards of pitching was completed. The whole of that has been covered under the bank made by Mr. Sheard. The value of the retaining wall buried there is £919 18s. 5d.

1993. *By the Chairman.*—Is that what you were paid? Yes.

1994. And what were you paid for the pitching? £52 3s., making a total of £972 1s. 5d. The quantity of retaining wall pulled down is 638 cubic yards, and is now being rebuilt. The order we received for the rest of the wall, from 13m., was a verbal order, and the only instruction we have is a sketch in Anderson's book. This is the place [pointing to the plan] where I asked for a stone backing.

1995. What evidence have you to corroborate that? Anderson can corroborate that statement. On February 5th Mr. Mault agreed to pay for one cubic yard for every lineal yard of excavation.

1996. Was that an advantage to the Government or otherwise? It was a fair arrangement, but it shows that he did not intend us to go to any depth. About the 28th March the wing-wall showed signs of giving way. At that time there were 75 cubic yards of squared masonry built in that one abutment, and the wall itself was about 20ft. high. Inspector Sleightholme expressed himself satisfied with the quality of the work, but said the wall was too slight to support such a bank. That was on the 30th March.

1997. Will you state whether that design was in accordance with the contract drawings? We have no original drawings for that particular culvert, but I should certainly say it was not in accordance with the contract drawings. On the 18th April I received an altered plan of the culvert. Mr. Fincham inspected the work on the 14th April, and that was one of the days I asked him to get stone backing behind the retaining wall. He declined to do so. The next plan I have is No. 19. This is nearly the same culvert, but after my drawing attention to its want of strength, Mr. Fincham ordered Mr. Mault to make an arch.

1998. How did this arch come to be designed? I suggested it in order to strengthen the work. On the 17th April, Mr. Fincham, after making some few complaints about the retaining wall, and after sending a letter saying he thought it was not quite up to specification, came up and visited it. I pointed out that there was no specification for the retaining wall at all, and that the wall was built to the inspector's satisfaction. Mr. Fincham expressed himself as highly pleased with a portion of the wall that he saw, and that was the very portion of the wall that gave way not many days afterwards. In a letter I wrote to Mr. Fincham informing him of the accident, I called his attention to that fact; and Mr. Fincham addressed the following memorandum in reply to the contractor:—

Public Works Office, Hobart, 7th May, 1885.

DERWENT VALLEY LINE.

(Extract from letter dated 4th May, 1885, signed "J. Falkingham, per E. L. P.")

"The portion of the wall that has given way was examined and approved of by you, and you pointed it out as a *pattern* for the rest of the wall to be built by."

MEMO.

The above extract appears in your letter of 4th inst. Will you be good enough to say if this applies to the face appearance, or if you refer to the *thickness and strength of wall*. If the latter, I can only say that it is not correct, and I must ask you to order its withdrawal.

The approval was given *solely to a portion of the face-joints* that I found satisfactory, after condemning many that your agents admitted were bad. Both the bad joints and good joints were pointed out in the presence of several of your officers as well as mine, all of whom were eagerly listening.

I really cannot help regarding this paragraph as an attempt, on the part of your agent, to rid you of a responsibility for the fall of the wall that I never did, and never intended to throw upon you; and seeing that at the same meeting I actually told the resident engineer that the wall was too weak, I feel that an apology is due to me.

J. FINCHAM, *Engineer-in-Chief.*

After the visit referred to I again asked for stone backing, and at last Mr. Fincham tried to pass it off as a joke, saying "I had played that tune too long, and had better try something else." On the 5th May Mr. Fincham again visited the Back River, and it was on that occasion he said we ought to have refused to build the wall, and he ordered the line to be thrown further back from the river, and a dry rubble wall, 20 inches thick, to be built. At that time 148 yards of 10 inch pitching had already been completed. On the same day he gave the order to pull the wall down and build as per plan No. 40. That plan was never carried out. Mr. Sheard came before it was commenced, and gave us a different plan to work from. On the 13th May we had plan No. 34 for the culvert, in which the arch is used, and we were ordered to put in 10 feet of stone backing. That was after most of the damage had been done. Plan No. 40 was received on the 28th May. That is the last of Mr. Mault's plans, and on the 3rd June he was succeeded by Mr. Sheard. I pointed out to him, as I had done to Mr. Mault and Mr. Fincham, the spot I considered most dangerous, at 13 miles 6½ chains. A portion of the wall is there buried under the embankment, and I am afraid it will go into the river unless it is strengthened. The next plan is Mr. Sheard's.

[Mr. Parker put in plan, No. 63, received on 2nd July, 1885. This is the plan on which we are now building the Back River wall.]

1999. *By Mr. Stanley.*—Is there any batter here? No, it is a perpendicular wall (plan inspected). Instead of the stone backing originally ordered by Mr. Mault we are now putting in lime concrete, with lumps of stone thrown into it.

2000. That is the final plan received? Yes.

2001. What is proposed to be done with the walls of the culvert?—what are they? They are masonry.
2002. What thickness? This is the plan that succeeded that by Mr. Mault. This is a section through the abutment and through the arch. It is to be 4ft. 9in. in thickness—a solid abutment. We have no section of the counterforts. In reference to the wall between the culverts and the dry stone pitching, it is a 4ft. vertical wall, backed with 5ft. 8in. of concrete, as shewn in the plan.
2003. Are there any weepers? Yes, there are weep-holes; but only through the masonry.
2004. Then the water will be apt to head up behind the concrete? I can't say if they have altered the plan since; but I think they are putting pipes through the concrete. I would like to submit a sample of the mortar from there. I took this out of the wall that was pulled down (sample submitted.)
2005. *By Mr. Lawder.*—That seems good mortar; but the sand is rather too fine? I don't know if your attention has been called to it; but the contractor is limited as to the distance within which he has to get the sand; I think it is 2 miles.
2006. As to the quality of the sand. I presume you would refer to the Resident Engineer if you could not get good sand in the district? Yes; but no question can arise, as there is plenty of sand in the district all through. A slight exception was taken to the quality of the sand at 10m. 17ch.; but it set afterwards. (Quoted the contract, page 32, sec. 20.)
2007. *By the Chairman.*—In reference to the carrying on of the works at Back River, has there been any departure from the orders given by the Government engineers or inspectors at any time? None whatever.
2008. Has the contractor always endeavoured to carry out the orders of the Government Officers? Most certainly. He has done his utmost to give satisfaction.
2009. Has any written complaint or communication been sent from any of the Government Officers expressing dissatisfaction as to the way the work has been carried on? Yes, there have been a number of letters.
2010. What are these complaints? There are so many letters, and such extraordinary complaints, that I can't tell from memory.
2011. Were there any serious complaints from Mr. Mault? Very few. I don't know of one.
2012. What are the complaints made by Mr. Sheard? They are so numerous, and so trifling, that I can't say.
2013. We don't want the trifling ones? They are all trifling; I don't know a really serious complaint.
2014. Has he objected to the stone at all? Yes, at No. 1 bridge.
2015. At Back River? No. That is the best quarry we have.
2016. Has he objected to the mortar? No.
2017. Then the only complaints have been as to trifling details? All trifling.
2018. Anything more as to Back River? No, nothing else. I want to draw attention to the way in which the survey was made. Money might have been saved by avoiding the Back River wall altogether. With a very slight deviation, they might have crossed the Back River higher up.
2019. Would that have gone through private properties? Yes, I would have gone away from the present line and taken it further inland before coming to Back River, at a farm-house there. Unless there is some grave objection, I don't see why they should not have avoided Back River wall altogether.
2020. Mr. Mault stated, when asked, that the sum that would have been asked by the landholders would have been so great it would have increased the expenditure too much. I don't think it would have been much.
2021. Does not the railway now traverse private property in front of the river? As it goes at present it cuts up more valuable property than if it had been taken in the direction I speak of. With respect to the laying out of the line, it is necessary to draw attention to the way in which it was carried out. As regards the bench marks, nearly all in the centre of the line; and, when the clearers came, all the bench marks went. The pegs used for intersections were nearly all knocked out; and when we came to put in the centre of the line it was a most difficult thing. I also found a number of errors in the lines, and also in the position of the curves. I will hand in a letter from Mr. Mault in answer to mine in which I called attention to these errors, and inclosing the instructions he sent in reply to my letters. He said it was an error in the magnetic bearing, and he would have to check all through the work. The bearings in the plans were incorrect.
2022. Were the bearings so incorrect as to interfere with the working of the line? They were in some places. In one place I found the line 4 feet out. We have had to alter the radius of a number of the curves in order to get a line at all.
2023. The survey was carelessly laid out? Yes, the intersections and bench marks were badly laid out. Perhaps the most serious portion was the fence pegs. There were none put in. For the greater part of the line there were no figures at all to show where the line was to go. We wrote to Mr. Mault about it, and he said it was the contractor's duty to put in the pegs, and that we should have to set out the work ourselves.
2024. Mr. Mault stated to us that where the line intersected Crown land he had no authority to set out the work,—that duty lay with the district surveyor? But there was very little Crown land to go through.
2025. Then the bulk of the land is private land? Yes. I wish to tell you that a Mr. Frodsham was sent up by the Department to put in the fence pegs. I found errors in his pegs of as much as 2 or 3 feet. I pointed these out to Mr. Fincham, and he only told me to ignore Mr. Frodsham's fence pegs altogether.

That was a serious thing, because the Department can never find out what land is taken from the landholders without making a descriptive survey. In many cases Mr. Frodsham's pegs came right on the slopes of the cuttings. Such a thing might lead to a large amount of money being spent to prevent law suits in the future through our taking more land than was paid for.

2026. Have the Crown the conveyances of the land taken? I can't say; but I know we should have the land properly defined. I was three years in the plan-room of the Victorian Survey Office, and they were most careful in matters of this sort. In respect to the culvert at Om. 15ch. I drew the attention of both Mr. Mault and Mr. Fincham to it before the flood.

2027. Mr. Fincham said the contractor was responsible for the damage? On the 10th January we received a plan of a brick culvert, and on the 28th January it was done away with, and this sketch was sent. (Puts in plan.) I pointed out the defect, and that there was only 3ft. 3in. between the piles, and the beams were the same length (witness explained on the plan). I pointed out the insufficiency of the waterway. I then requested him to put in a 20ft. waterway, and the contractor did his best to get him to do it. All this was pointed out to Mr. Fincham and Mr. Mault long before the culvert was commenced, and when at last it did give way, three 15 feet opening were decided upon. (Tracing of the culvert submitted.)

2028. *By Mr. Lawder.*—Were the materials ordered for the 3 feet culvert shown on the plan? Yes, they were ordered.

2029. Were they actually provided? Yes, but not delivered on the ground.

2030. Can you give the dates of the ordering of the culvert of 3 feet and of 3 15 feet pile openings and the construction of the latter? The date on the plans is 9th December, 1885. We commenced the work of 3 feet culvert soon after, and the 15 feet was commenced last month.

2031. Did you receive orders to commence before that? Yes, the opening of 15 feet was ordered on 26th September.

2031A. And from the 26th September to the time of the flood, nearly two months, the contractor had made no arrangements to construct the work? Yes, the timber was ordered. The order was sent away immediately.

2032. Could you not have constructed this waterway within the two months? No, we could not get the timber. It was perhaps fortunate in one way, because had it been constructed as originally ordered it would have been washed away. No. 1 bridge is the next thing. I have an addition to the original plans,—19 new ones.

2033. *By the Chairman.*—Are those details only, or variations from the original plan? Yes, they are variations. They are details of course, but alterations of the designs. I wish to show the alterations made, and I can give the dates. There were nineteen plans and alterations of this bridge. (Mr. Parker was asked to hand in a list of the nineteen plans at a later period, and promised to do so.) The most important alteration was the alteration of the original wing-walls to the solid abutment now built. I should like to submit to you the first and last plans ordered. You need not see the various intermediate changes. (The witness here put in the first and last plans, and said there were nineteen drawings altogether for the bridge.)

2034. *By Mr. Stanley.*—And these nineteen drawings are not of separate details, but alterations one of the other? No, they are all alterations one of the other. The height of the bridge was reduced from 140 feet to 136 feet.

2035. *By Mr. Lawder.*—Can you say why this was done,—was it owing to a reduction in the formation level, or in the masonry levels? It was a reduction of the formation level. The lowering of the girders in any way reduced the masonry. I should now like to submit a document which is the most important of the lot. It is a list of the increases over and above the amount of the contract schedule which will have to be paid for when the work is finished, and shows that the contract will cost over the original schedule £44,562 13s. 8d. That is the amount in excess. The list was handed in as follows,—

DERWENT VALLEY LINE.
STATEMENT showing Quantities in excess of Schedule.

Item.	Description of work.	Schedule quantities.	Quantities completed to date.	Quantities required to complete Contract.	Quantities in excess of Schedule.	Rate.	Amount in excess of Schedule.
							£ s. d.
1	Clearing	24½ miles	24 miles	5½ miles	5 miles	30l.	150 0 0
4 to 9	Fencing	82,940 l. yds.	21,817 l. yds.	67,323 l. yds.	6200 l. yds.	1s. 6d.	465 0 0
10	Cills and struts	250 c. ft.	250 c. ft.	500 c. ft.	500 c. ft.	4s.	100 0 0
11	Round posts	250 No.	..	2650 No.	2400 No.	5s.	600 0 0
13	Taking down and re-erecting fences	440 l. yds.	1053 l. y.	..	613 l. y.	1s. 6d.	45 19 10
18	12-ft. occupation gates	20 No.	82 No.	50 No.	112 No.	7l.	784 0 0
20	Excavation in cuttings	171,718 c. y.	171,718 c. y.	10,000 c. y.	10,000 c. y.	2s. 3d.	1125 0 0
21	Side cutting	1000 c. y.	43,200 c. y.	15,000 c. y.	57,200 c. y.	1s.	2860 0 0
22	Excavation in station grounds	500 c. y.	3036 c. y.	20,000 c. y.	22,536 c. y.	1s.	1126 16 0
24	Excavation in road and creek diversions	1000 c. y.	19,071 c. y.	10,000 c. y.	28,071 c. y.	2s. 6d.	3508 17 6
27	Side ditches	10,000 c. y.	12,181 c. y.	500 c. y.	2681 c. y.	10d.	111 14 2
28A	Excavation in foundation	1000 c. y.	6850 c. y.	2000 c. y.	7850 c. y.	2s.	785 0 0
30	Benching to embankments	500 c. y.	4587 c. y.	413 c. y.	4500 c. y.	1s. 3d.	281 5 0
34	Cement concrete in foundation	200 c. y.	272·63 c. y.	200 c. y.	272·63 c. y.	50s.	681 11 6
35	Ditto under water	200 c. y.	208·75 c. y.	200 c. y.	208·75 c. y.	55s.	574 1 3
37	Lime concrete	200 c. y.	568·00 c. y.	600 c. y.	968 c. y.	30s.	1452 0 0
43	Squared masonry in lime	200 c. y.	2473 c. y.	6000 c. y.	3273 c. y.	40s.	6546 0 0
	Cement concrete in caissons	Nil.	Nil.	1500 c. y.	1500 c. y.	4l.	6000 0 0
44	Squared masonry in cement	50 c. y.	1176 c. y.	200 c. y.	1326 c. y.	55s.	3646 10 0
45	Ashlar in cement	1000 c. ft.	3818 c. ft.	12,000 c. ft.	14,818 c. ft.	4s. 6d.	3334 1 0
47	Angle drafts	500 l. ft.	4512 l. ft.	2000 l. ft.	6012 l. ft.	1s. 3d.	375 15 0
45*	Ashlar in lime	Nil.	1124·94 c. ft.	..	1124·94 c. ft.	4s. 3d.	239 0 11
50	Dry stone backing	25 c. y.	179 c. y.	1000 c. y.	1154 c. y.	30s.	1731 0 0
51	Flat stone covers	100 c. ft.	657·41 c. ft.	Nil.	557·41 c. ft.	3s. 6d.	97 10 11
54	Dry retaining walls	100 c. y.	1289·46 c. y.	Nil.	1189·46 c. y.	30s.	1784 4 0
61	15-inch earthenware pipes	50 l. ft.	489·50 l. ft.	100 l. ft.	539·50 l. ft.	7s. 6d.	202 6 3
62	18-inch earthenware pipes	1500 l. ft.	2050 l. ft.	100 l. ft.	650 l. ft.	10s.	325 0 0
76	Hardwood box drains	1500 c. ft.	4095 c. ft.	500 c. ft.	3095 c. ft.	3s.	464 5 0
70 & 80	Bridge ironwork—(about balances itself)						
92	Metalling and binding	1000 c. y.	1466 c. y.	6000 c. y.	6466 c. y.	6s.	1939 16 0
104	Cement	25 csks.	100 csks.	100 csks.	175 csks.	1l.	175 0 0
105*	Powder	Nil.	Nil.	Nil.	..	..	261 18 4
106	Excavator	50 hrs.	26,362 hrs.	..	26,312 hrs.	1s. 6d.	1972 3 0
108*	Ganger	Nil.	1220 hrs.	..	1220 hrs.	2s.	122 0 0
110	Boy	50 hrs.	17,945 hrs.	..	17,445 hrs.	6d.	43 2 3
116	Smith	50 hrs.	925 hrs.	..	875 hrs.	1s. 6d.	65 12 6
117	Striker	50 hrs.	889 hrs.	..	830 hrs.	1s.	41 19 0
121*	Carting at Rocks .....	..	..	..	15,324 loads	2s. 3d.	1724 4 3
	Cr.—Cement in cylinders	800 c. y.	Done away with.	30s.	45,762 13 8 1200 0 0
							44,562 13 8

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2036. *By Mr. Stanley.*—Does that list merely represent the amount of work executed in the terms of the contract, or claims other than matters of measurement? No, it is simply for measured work; not outside claims.

2037. *By Mr. Lawder.*—Is that for the work when finished or to date? It shows both the probable quantities and the work finished.

2038. *By Mr. Stanley.*—Have you made out any particulars as to any deductions there may be from the contract schedule as a set-off to this? I have not done so. I do not put this forward as a very accurate statement of the quantities required to complete contract. It is submitted merely as far as I could do so. I have left out of the list things that would counterbalance any deductions. I think this list shows what the amount will be over and above the contract.

2039. *By the Chairman.*—Now are you certain about that statement? To the best of my belief it is a fair statement of the extras. I have given the schedule quantities and quantities completed to date, and in a great many cases they are above the schedule quantities, so there is no doubt about it, the quantities required to complete the contract will be very near the mark. I think you will find it a tolerably accurate statement.

2040. *By Mr. Stanley.*—Can you state the probable cost of the retaining wall at Back River? I cannot state it at the moment.

(Witness was pressed on this point, and eventually said he would ascertain the cost and forward a statement to the Secretary.)

2041. You said that in the case of the first retaining wall no specification as to the class of work was provided? No, none.

2042. What instructions or directions did you get in respect to the building of it? We were merely told to build a dry rubble retaining wall.

2043. Did you see no specification—did you not get from the Resident Engineer instructions as to building it? We were told to build a dry rubble retaining wall, and, when it was nearly built, it was found there was no specification.

2044. Did not Mr. Mault give instructions as to random or coursed work? Random, yes. Coursed work, no.

2045. It has been stated in evidence that when Mr. Sheard took charge he had occasion to find fault with the construction of the works between Bridgewater and New Norfolk? Yes.

2046. And it has been stated that some of the work was struck out of the certificate? No, not struck out of the certificate, but reduced in price. Only one small piece of pitching was struck out of the certificate.

2047. *By Mr. Lawder.*—Can you tell the cause of the bad mortar which we saw in the course of our inspection the other day? No, I certainly cannot.

2048. You also must have observed that it showed neither cohesion nor adhesion? I cannot account for the failure.

2049. As far as we took down the masonry the mortar was bad? Well, I thought not after the second stone.

2050. We noticed that it was very inferior indeed? No doubt the first stone was in bad mortar. The greater part of the mortar is very good, but some is inferior owing to the want of sand. There is no good sand here for mortar.

2051. Do you then think that an exception. Do you not think the mortar is of the same nature all through? I think not. In respect of that particular culvert it would be.

2052. Would it not be desirable to take down that culvert? I think not.

2053. If the mortar is bad is it not desirable to take it down? The mortar is not of such inferior quality as to render it necessary to take it down.

2054. Is it customary to wet the stone in building? No, it has not been customary, not in all cases. I don't think it has been done generally.

2055. Can you have good masonry without wetting the stone, especially in dry weather? No doubt it is better to have it wetted, but I have seen a great amount of mortar used where the weather was particularly dry without wetting, and it has made good work.

2056. Do you consider the lime used was good lime? I don't think it the best of lime.

2057. What quality of lime is it? I can hardly say.

2058. Is it hydraulic lime? No.

2059. Is it fat lime? I cannot say. I have not examined it particularly, and cannot express an opinion.

2060. Have you ever called the attention of the Engineer-in-Chief to the quality of the lime? No.

2061. Has his attention ever been called to it? Not that I am aware of. The lime came from Bridgewater.

2062. Are there any particulars as to the tensile strength of the lime? Not that I am aware of.

2063. Were any experiments made on the works to test its strength? None that I am aware of.

2064. Is it not usual on works of such magnitude to test the quality of the lime used? Where it has been found defective, yes.

2065. Under any circumstances is it not usual to test the quality? No; I have seen large works carried out without testing.

2066. That was, I presume, where the lime was of known good quality? Yes, where the lime was known.

2067. Where there is a risk of using inferior lime or mortar, would it not be wise to test it? Yes, where there is a doubt I think it should be tested.

2068. Then do you think there was a serious doubt in this case owing to bad sand? Yes.

2069. With reference to the Back River wall again,—of what was the backing composed when Mr. Fincham inspected it? Of stone and earth.

2070. I think you observed it was a stone backing? Yes, to a particular point. Again, I think that Mr. Fincham asked the question when he inspected the work, "how much was backed with stone?" I pointed out to him where the stone backing came to.

2071. Did I understand you to say that Mr. Fincham did not approve of further backing with stone in consequence of the cost? No, I did not say that. I said the embankment was formed of rock from the cutting. The rock was put in without being hand-packed at all. I wanted to have it backed with hand-packed stone, but Mr. Fincham would not give the order because it was too expensive.

2072. On what score? That it was too expensive.

2073. Did Mr. Fincham endeavour to come to any terms with the contractor as to a special rate for the large amount of such packing required behind that wall? No, not to my knowledge.

2074. If he had done so, would the contractor have been willing to make fair special terms for it with Mr. Fincham? That is a question I cannot answer. I think the terms of the contract gave very fair prices.

2075. Mr. Fincham seems to think the contract rate a high rate for dry stone packing—do you think it high? It is a good price, no doubt.

2076. Is it too high a price? I cannot say that.—It was the price that was tendered for and accepted.

2077. That was, we are told, under the supposition that there would be only a small quantity. Is it not a very high price for a large quantity? It is a high price, no doubt; but I think it is unreasonable to ask a contractor to reduce his prices merely because the quantity of particular work is increased.

2078. Had the resident engineer power to give a special contract for any extra work? I never heard so.

2079. Do you think the contractor would have been willing, under the special circumstances, to agree to special terms? I don't think he would have been willing to agree to alter his prices.

2080. Do you consider that Mr. Sheard's objections to alleged bad stone delivered at No. 1 bridge were fair and reasonable or not? I cannot answer that unless the stone was pointed out. I have seen stone on the ground intended for two bridges—some at No. 1 bridge and some at the Plenty—that I do not consider it fair to condemn.

2081. There was a stone at the Plenty Bridge, pointed out at the time of our visit, which had been objected to. Do you consider the objection fair or not? I cannot say. Some of the objections made were fair and some were not. There were some stones with flaws in them where I think the objections were fair, but there were other stones where I don't think it was fair to object.

2082. Do you consider that the stone upon which we saw the man use the chisel was a good stone? Yes, that was a good stone, because it will harden by exposure to the weather.

The Commission adjourned at 6 P.M.

MONDAY, MARCH 8, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

MR. FINCHAM, *re-examined*.

2083. *By the Chairman*.—The Commissioners desire to give you an opportunity of replying to some statements which have been made by witnesses at New Norfolk; it appears you also wish to make some explanation in regard to certain questions put to you on your first examination? Yes; there are two or three questions in reference to which I should like to say something.

2084. The first matter that I should like you to explain is in regard to question 79. You were asked, "Then Mr. Sheard would entirely undertake the supervision and determination of the culverts from the New Norfolk township terminus of the line?" and your reply was, "He would." What additional explanation have you to make? I mean that beyond New Norfolk certain culverts had already been constructed, as well as the bulk of the culverts between Bridgewater and New Norfolk, before Mr. Sheard took charge.

2085. And below? My answer was correct as to the bulk of the culverts which were below New Norfolk, but I did not remember at the time that some of them above New Norfolk were constructed before Mr. Sheard took charge. My answer was correct generally, but I wished to make it more particular.

2086. The next question I ask you about is, "Did you approve of the alteration—the diversion of the line at this point, *i.e.*, Back River, from the route shown on the Parliamentary plan to the present one?" to which you replied, "No, I did not. I did not examine the line after it was pegged beyond New Norfolk. I knew from the contract plans that it had been marked out?" With respect to taking the line from the high ground at Back River, Mr. Mault informed me that he intended to take the survey there. Before the work was begun he informed me he intended to take the survey along the river bank.

2087. Then did you approve of that? As at the time it was merely a question of survey, I assented to it.

2088. I presume you knew what works required to be constructed on the banks of the river, supposing you gave your assent to the alterations? I expected that in accordance with my instructions to Mr. Mault I should have had an opportunity of going up there before it was too late.

2089. That is before it was finally determined upon. You then saw that after he had determined and pegged out the line, the levels of which he submitted to you as a proposed alternative plan? My instructions to him were to advise me from time to time when he had a section of work surveyed, that I might go up and inspect it, but beyond that first portion he did not do this.

2090. Then had he authority to determine these alterations of the line without informing you of what he was doing? When it was too late for me to alter the line, owing to the necessity of calling for contract, I examined the plans and sections and adopted the surveys.

2091. Without looking over the ground? There was no time for it, and there was nothing in the plans to lead me to believe for one moment that the work would become so costly as it has since become.

2092. Then, after he had made these alterations, when was the first time that you tested the work at the Back River deviation?—was it before or after the contract was taken? After.

2093. This contract was let adopting the deviation by way of Back River? Decidedly.

2094. So that you were committed to the route by the letting of the work? Yes; I was committed to it.

2095. Is that the explanation you offer? Yes; partly in justice to Mr. Mault, as he said he intended to take the survey along the river.

2096. The next question which I understand you wish to make some further explanation is No. 219? It is this—"Can you furnish the Commissioners with a copy of those instructions"—that is the general instructions for marking out the line—and your reply "Yes, I will try. They were not written instructions; sample contract plans were shown the Engineer, and he agreed for a certain price to do the work, &c."? I meant the latter part to correct the first. After having said "Yes, I will try," I remembered that there were no written instructions. I merely asked afterwards that that reply should be omitted.

2097. Then No. 222 question is—"I understand you to say that in other cases there was a special vote," and your reply is—"Yes; in one session we had so many Parliamentary surveys provided for; and so many contract surveys. This applies to the Fingal and Scottsdale Lines: all the rest came out of the construction vote"? My answer is not so clear as what I should like it to be. As a matter of fact the contract survey for the Derwent Valley, the Fingal, and the Scottsdale Lines came out of the vote for the construction of those lines.

2098. The whole of them? Yes. In special cases a special vote has been provided for the contract survey.

2099. Are there any other remarks which you wish to make with respect to that? No, I don't think so.

2100. *By Mr. Stanley.*—Was any estimate prepared of the cost—the probable cost—of the line as surveyed on the south side of the Derwent River on the basis of the Parliamentary plans first submitted? Yes, to compare it with the proposed northern line; and I believe the estimate was made by Mr. Mault.

2101. Can you furnish particulars of that estimate to the Commissioners? It is quite possible that I can find the details. It was gone into by Mr. Mault, and he reported that practically there was no difference, as the extra length was offset by the cost of the bridge on the Derwent at New Norfolk.

2102. As far as you can recollect, the estimated cost was about the same for both lines? Yes, I reckoned it was about the same.

2103. Can you recollect whether in that estimate any allowance was made for the proposed new bridge across the Derwent at Bridgewater? No; Parliament had fixed the junction at North Bridgewater.

2104. Have you any information as to the flood level at North Bridgewater, that is, of the flood of 1863? Not that I am aware of.

2105. Do you know whether the height of that flood has been recorded in any way? I don't.

2106. With regard to the schedule of quantities attached to the contract, I think you informed us the other day that the quantities were taken out by Mr. Edwards? In common with the rest of the contract work.

2107. We have been informed that, except in the items of fencing and earthworks, and a few other unimportant items, these quantities do not represent the actual amount as calculated from the drawings and sections. Were you aware of that at the time that Mr. Edwards furnished you with the quantities? I was aware that in the case of the girders the quantities were approximated, and I believe in the case of one or two minor items, but I cannot recollect which.

2108. In looking through the schedule of quantities, the quantities for concrete culverts and other works, such as drain pipes and woodwork, are merely assumed quantities. Was your attention drawn to that at the time they were furnished to you by Mr. Edwards? I was not aware of that.

2109. You observe that those to which I refer are all in round figures, evidently not taken from actual estimate? (Document referred to.) Yes, it would not be possible to get exact quantities, and I assumed that the nearest even figure was put down.

2110. Did you consider, then, that the quantities as furnished to you in this schedule were sufficiently near to be a guide to the probable cost of the contract? Yes, because deficiencies in some would be met by excesses in others. As a matter of fact I think the provision in the item ironwork will be much in excess of the actual cost to the Government.

2111. On the other hand, we are informed that most of the items under the head of masonry will be very largely exceeded, in some cases by ten times? I cannot state by what amount, but I believe that the masonry items will be exceeded.

2112. Then did you consider that these quantities would fairly represent the probable amount of work to be executed? I did, as Mr. Edwards was employed to get them out for me.

2113. Did you take any means of checking the correctness of those estimates? I could only have done it personally; and with two or three other lines in hand at the same time, it was impossible for me to go into calculations of details myself.

2114. Then you left the matter to his judgment? He was paid for proper schedules, and I left the matter to his judgment.

2115. Have you any information of the probable total amount of the contract, estimated at the schedule rate; that is, for the work as now being carried out? Yes, I have, in my office.

2116. Could you furnish it to the Commissioners? Yes.

2117. Will you also be good enough to furnish the probable cost of station buildings and other works let by separate contract? I can easily do that.

2118. Also a list of rails and other material as supplied by the Department, as well as the supervision. I may state that our object is to obtain as nearly as possible the total probable cost of the Derwent Valley Railway as it is now being carried out? I can supply that by the monthly estimate of liabilities to the Minister.

2119. *By Mr. Lawder.*—I think you said the original estimate was prepared in your own office? That is a private estimate. I made it for checking the tenders as they came in.

2120. It is, then, an official record,—hardly a private estimate,—although it was made for your own personal information? I mean by “private” that it was not meant for anybody outside the Department.

2121. *By Mr. Stanley.*—I take it that you looked upon it as a confidential estimate for the information and guidance of the Minister in deciding upon the tenders? For that purpose alone, since the tenders ranged from £80,000 to £130,000.

2122. Will you state the total amount of the estimate for work tendered for? £74,379. (Document handed in.)

2123. Mr. Mault has stated in evidence that the reason for his having skirted so near to the river bank in the vicinity of Back River was in consequence of his having received special instructions from you that he was not to interfere with the property at that place? I have not the slightest recollection.

2124. Were any general instructions of that nature given by you? I am quite unaware of any.

2125. Then he was not in any way tied by such instructions? He was absolutely free. I am quite unaware of any such instructions having been given in regard to any part of the line.

2126. Mr. Mault laid considerable stress on that point,—to the fact of his having received instructions from you to avoid interfering with private property? I think that he must be labouring under some mistake. I have no recollection whatever of any such instructions.

2127. What position did Mr. Climie occupy when he was connected with your Department? He was Resident Engineer on the Fingal Railway latterly.

2128. And previous to that? Previous to that he made the survey for the Fingal Railway, and previous to that, again, the Parliamentary survey of the Launceston and Scottsdale and Moorina line, and he has also been connected with the Department for some years past.

2129. Were his duties connected with the general construction of the different lines of railway? He did the general inspection of the Parliamentary survey for the Scottsdale line, and, subsequently, owing to the incompetency of the surveyor on the Brighton and Bothwell line, I employed Mr. Climie to spend a few days in overlooking his work. On the Fingal line a portion of the survey,—viz., that from Fingal to St. Mary's,—was given to Mr. Home, the present Resident Engineer, but it was supposed to be done under the general supervision of Mr. Climie.

2130. The Commissioners thought it only right that you should know that Mr. Climie stated that his general duties were to inspect the different lines being constructed under the Department, and that in the case of the Derwent Valley Railway he had special instructions from you not to visit or inspect these works? I am not aware of that.

2131. Then you don't recollect having given him instructions as to the survey of the Derwent Valley Railway? I must have recollected the matter if he had been in any such position as he describes. The only railway that he had full charge of in connection with the surveys was the Parliamentary survey for the Launceston, Scottsdale, and Moorina line. He was employed for a few days—it might have been a week—on the Green Ponds line. Although a portion of the Fingal survey was done by Mr. Home, it was generally put under Mr. Climie. The trial sections prepared by Mr. Home were forwarded through Mr. Climie, but as a matter of fact Mr. Climie, I think, had not much to do with it.

2132. Then did you, or did you not, give Mr. Climie instructions not to visit and inspect the survey of the Derwent Valley Railway? I have not slightest recollection of it; I don't believe that I could have done so.

2133. *By Mr. Lawder.*—Are you quite confident that you have allowed sufficient height above flood level on the line all along the Derwent Valley? Yes, from enquiries made from time to time.

2134. Are you satisfied that the formation is above that level? Yes.

2135. All along? Yes.

2136. And you are not afraid in any one locality of any wash or scour along the river? No, because in all such places there is a formation of stone-work.

2137. In all places? Yes.

2138. You have not given any directions for the alterations of the usual slope where there is a liability to flood but not to scour? Never.

2139. Then you think that the ordinary slope of $1\frac{1}{2}$ to 1 quite safe in cases where you may not have scour, but where the flood will rise to the banks? In places where the real banks are formed of hard rocky material.

2140. But where they are formed of clay or earthy material? Where the real bank is formed of clay or earth, or clay and earth mixed with stone, the provisions are, as far as I am aware, in all cases heavy pitching.

2141. And pitched all the way where you are liable to be affected by a flood? Yes; a casual observer might think that this was not the case near the Back River, but most of the slope that shows there is really spoil which covers an ordinary pitched slope.

2142. Take the approach to the Plenty Bridge. We find from enquiries, I think at the time of our inspection with you, that the bank was only about 3 feet above the flood level, whereas there is an embankment of 9 feet in some places. Have you made that bank the same? It is to be protected.

2143. Is that laid down in the plans connected with the works? I have agreed with Mr. Sheard that those banks are to be protected with pitching, and I would not allow it to pass without the pitching.

2144. Then there are no places where this is not properly provided for? As far as I am aware, every place is properly provided for.

2145. In the evidence which the Commissioners have received there is a complaint made by the con-

tractor that you forwarded to him 19 different plans for No. 1 bridge. Can you explain to us the reason for that, if this is the case, and if it is not the case will you kindly say so? No 19 drawings ever came from me.

2146. Are you not aware of the existence of 19 drawings? No; I am not aware what Mr. Mault may have sent to the contractor.

2147. Who is responsible for the design of the original culvert at Back River? Mr. Mault.

2148. Did he submit any design to you for your signature or approval? I saw no design at all at the first.

2149. And did he proceed with the work without having submitted the design to you? He had proceeded with the work, and it was to a large extent complete when the failure took place.

2150. Is there any type drawing similar to that at Back River culvert in the contract drawings? There is no culvert exactly similar, but there are standards quite sufficient for the guidance of an engineer.

2151. In the general drawings? In the general drawings.

2152. What do you mean by sufficient for the thickness of the abutments according to the height? There are standards for the thickness of the retaining walls, and I should adopt those for the thickness of the abutments, with a small arch over them, as the Back Creek is designed to be.

2153. Did you think that sufficient for the resident engineer to understand?—it seems to me that it was an exceptional case; it was 24 feet high and it had an 8 feet span? Yes; and the walls of the culverts in the squared masonry work were designed of the same slender construction as the random rubble wall that gave way. No engineer of ordinary railway experience would have expected the work as designed to stand.

2154. But, knowing the locality, did you not think it necessary to send him a special design with instructions? I did not think an 8 feet culvert of so much importance. The work consisted chiefly in large wings on either side, and the strength of these wings was amply provided for by the standards. The bulk of the work in these culverts was in the retaining walls, in one case parallel to the river, and in the other two cases parallel to the Back Creek.

2155. But the abutments are the most important part of the culvert, and they were erected insufficiently strong. They were of a clumsy description, and the mortar (of which I have preserved a specimen) was very bad. How do you account for the badness of the mortar, and who is responsible for that? The contractor is.

2156. Did you not impose a penalty on the contractor when the culvert failed? No, I did not impose any penalty, because the Department, through the resident engineer, was responsible for the design.

2157. With respect to No. 1 bridge, do the Commissioners understand that this design has been altered from a lower flange roadway to an upper flange roadway? Never.

2158. It was never intended to place the roadway on the lower flange? Never for one moment.

2159. Then why were the piers reduced in height from 4 feet? I am not aware that they ever were reduced.

2160. We have had it in evidence from Mr. Mault that the contract for No. 1 bridge—? I thought you were referring to No. 2 bridge. At No. 1 bridge I found, on looking over the sections, that the headway above the flood was enough to allow me to reduce the height of the bridge, and I accordingly did so by lowering the whole superstructure. Never for one moment has it been contemplated to move the roadway on the lower flange.

2161. Is it now proposed to construct all of the bridges, Nos. 1, 2, and 3, with a combined roadway? Only Nos. 1 and 3.

2162. And is it contemplated to carry a combined roadway on the present girders? It is.

2163. As it is proposed to erect them, that is to say, on the upper flange? On the upper flange.

2164. Do you consider that this would be a satisfactory plan? Quite as satisfactory as the Cataract bridge at Launceston. The width for traffic and passengers will be the same.

2165. The plan for double caissons was submitted by Mr. Sheard for the piers of No. 2 bridge? It was.

2166. Why did you not approve of it? I can explain the matter shortly. When the Messrs. Edwards were preparing the working drawings for the piers of No. 2 bridge I instructed them to lengthen the base of the pier, as now being carried out, without adding to the width.

2167. Or thickness? Or thickness. I supplied the sketch to that effect. The Messrs. Edwards drew out a plan with a double caisson and submitted the same to me. As at this place the water was deep I thought it would be a considerable assistance to the contractor, my intention being that after the caisson was lowered in place the concrete should be passed down through the water in the outer ring, thus forming a coffer-dam. It would have been a great help to the contractor and would have enabled him to pump and excavate the main caisson to the required depth. But the contractor refused to carry that out. I therefore ordered my original intention to be carried out.

2168. Then it was merely with a view of saving, or giving the contractor less difficulty to sink the inner piers, that you approved of the design for double caissons? It was, to a large extent; but, at the same time, I was not blind to the fact that I should be adding a still larger margin of stability to these piers.

2169. Then did you consider it desirable to add to the stability of the piers? I considered then that I had enough or I should not have stated to the Commissioners that the piers are sufficient. It was largely to assist the contractor in what I considered a difficult position, but he refused to carry it out.

2170. Did Mr. Mault send in any report with his survey and plans? No report of the contract plans.

2171. No descriptive report,—no remarks upon his alignment, or the natural features of the country? Not that I am aware of. The whole of the survey was very much hurried through.

2172. But did he not make any suggestions for the works of any locality suitable to the local circumstances? Yes, I remember one case at No. 2 bridge.

2173. Did he not make a comprehensive report on the whole line? Not that I am aware of. He suggested a combined iron and timber bridge with a large span at No. 2.

2174. Was Mr. Mault requested by you to keep down his estimate by £10,000 as a saving for the bridge at Bridgewater? Well, yes, in general conversation. He informed me that if I gave him the construction of the line he would let me see how very economically he could construct it, and in a general way I replied, "You save me £10,000 and I can use that for the Bridgewater Bridge." But it was merely a private conversation, and was not in any way in the shape of an official order. The remark was a half-jocular one.

2175. At about what sum did you estimate the cost of the bridge at New Norfolk in the alternative line? At that time, £10,000.

2176. And the bridge at Bridgewater, £24,000? The other day, yes.

2177. Did you not tell us the other day that you estimated the rainfall usually at one inch per hour, or am I mistaken? I thought that the greatest probable rainfall.

2178. Did you get out in the same way the schedules for any other railways? Yes, the Fingal and the Scottsdale lines.

2179. Did you find them satisfactory in the case of these lines, or did you find any serious errors? I have found no difficulty in the case of either Fingal or Scottsdale as yet. I was officially informed by Mr. Climie, the resident engineer, that the contract sum would not be exceeded.

2180. Has that been borne out by facts? I cannot tell until the whole work has been completed.

2181. As far as you know, have the quantities been exceeded? I can't speak from memory, but I can easily get the Commissioners the means to compare the last certificate with the contract quantities.

2182. I mean, do the errors imputed to Mr. Edwards refer to the Derwent Valley line only or to the other lines as well? I have not heard of any complaints with regard to the other lines.

2183. Mr. Mault, in his evidence, informed the Commissioners that after his protest against surrounding wooden culverts with loose stones, you sent him orders to proceed with them nevertheless. Is that so? did he enter any protest, and did you thereafter direct him to proceed with the culverts? I have no recollection of it; but, as a matter of fact, the stoning was only done in most cases, as I found out afterwards, near the end of the culvert. I put in the timber culverts at the special request of the contractor, when he first started the work; but this was conditionally that in no case the depth of the banks in which they were placed exceed 5 feet, and that he would adopt the same plan used in connection with all our timber bridges for the preservation of the timber from decay, viz., that the culverts should be tarred and the timber work protected from contact with the wet clay and earth.

2184. By loose stones? By loose broken stones.

2185. Is that being carried out now? Yes.

2186. *By the Chairman.*—I should like to ask you, Mr. Fincham, how you or Mr. Edwards determined the nature of the work necessary for particular localities, that is, as to waterways? The sizes of the waterways were marked upon the sections by the resident engineer in each case, Mr. Mault or Mr. Climie, for the Derwent Valley or the Fingal lines.

2187. Then, did you instruct Mr. Edwards to make certain provisions, or was it a mere general idea of his own that such and such a culvert would be required? As I have just stated, the sizes were fixed by Mr. Mault in the sections in order to ensure the work being complete. It was specially arranged for Mr. Mault to consult with Mr. Edwards while the contract plans were in course of preparation. The information was obtained from the engineer in charge of the survey.

2188. It has come out in evidence that a culvert 4ft. by 3ft. was originally placed in the bank at Om. 15ch.? The section states a 4ft. culvert.

2189. Was that information obtained by Mr. Mault? Yes.

2190. It has also been stated that this valley has a gathering ground of upwards of four square miles in extent up to the back of the Crooked Billet. Did you or Mr. Mault have any idea of the area of this watershed? I ordered one span of 15 feet before the wash-out took place: it was none too much. During the last week my official duties required me to examine the alternative line between Brighton and North Bridgewater Junction, and I then took the opportunity of examining the watershed delivering into this culvert at Om. 15ch.; and, as I have said, a 15ft. culvert would have been none too large.

2191. Is it a fact that over a part of the stream at Crooked Billet there is a large culvert of the size I have mentioned? The water passing through the railway viaduct near the road at the Crooked Billet is not connected with the water that comes through the culvert at Om. 15ch.

2192. We are informed that it is not the same watershed, but that it rises near to the Dromedary. Are your instructions to surveyors projecting the routes of new railways that they shall examine all existing bridges and culverts with a view of supplying the Chief Engineer with reliable information as to the waterways required? Yes.

2193. Would it not have been Mr. Mault's duty to explore for those? I am not aware that he did. It was his duty; he was employed for weeks in the neighbourhood.

2194. Can you say definitely whether he did or did not? I cannot. I trusted to him. I had no idea that the culverts at Om. 15ch. drained the extensive watershed that it does.

2195. With regard to the height of the 1863 flood—we had some information given to us by old residents at New Norfolk that the beams of the present road bridge over the river were fully two feet below the level of that flood. Are you aware whether the information obtained by Mr. Mault coincided with that, or what was the height of the flood which he obtained as that of 1863? I don't know that he took the 1863 flood.

2196. It is marked on the sections at Nos. 1, 2, and 3 bridges, where the flood-line is shown on the sections? He would get that from residents in the locality.

2197. Was there any information brought under your notice which enabled you to fix the height of the flood of 1863? I trusted to his levels.

2198. Were you satisfied yourself in looking over the levels, that the formations on the low places between New Norfolk and Bridgewater are above the 1863 flood? I don't know the levels of the 1863 flood at that portion of the line.

2199. Have you any idea of the level of that flood? Have you any information as to the height of that flood at the Bridgewater Causeway? Yes; I know that occasionally the Causeway has been awash.

2200. Have you any information as to the height of the rails of the Main Line Railway above the extraordinary flood level, taking the Causeway as being awash? The Main Line Railway is on a grade.

2201. But at the crossing of the river? I could not say from memory; possibly 10 ft. or 12 ft.

2202. But not above the flood level? I don't think it was under 10 ft.

2203. The formation at North Bridgewater, where you join the Main Line, is 105·28 feet above datum, while the formation at New Norfolk is 111·15 feet? Yes; it is 105·28 where we joined at North Bridgewater.

2204. How much would that be above the rails at the telescope bridge at Bridgewater? Several feet, as there is a falling grade.

2205. How many feet, do you think? From 6 to 8 feet possibly.

2206. Do you think it is as much as that?—would it be 6 feet? The grade, I believe, is 1 in 47 to 1 in 50; 6 feet would give 300. No, I don't think it would be as much as that.

2207. Do you join the Main Line on the Hobart or on the Launceston side of North Bridgewater Station? We join on the down grading in the Launceston side of North Bridgewater.

2208. What should you estimate the level to be, keeping within the mark? I am not quite sure where the grading ends; but I should not think it would be 5 ft.

2209. Assuming it at 5 ft., it would give the rail level at the telescope bridge as 100·28 feet. That would be so.

2210. What would be the level of the 1863 flood below that? As I have said, I have no record of the 1863 flood.

2211. But from the information which you have obtained, you say that the causeway was flooded? I can obtain information from the office as to the level of the causeway.

2212. Do you think that was near the Hobart end of it? The causeway is practically level from South Bridgewater to the beginning of the bridge—the road-bridge.

2213. Do you remember that the railway rises from the New Norfolk road until it gets 5 ft. or 6 ft. above the causeway? More than 5 or 6 ft. The rail level would be 10 ft. above the causeway.

2214. Would that enable you to fix the level of the line at the crossing of the bridge? Assuming the rails on the North Bridgewater bridge to be 10 ft. above the end of the causeway—and, speaking from memory, they are fully that—there would be another 5 ft. due to the rails at the Derwent Valley junction, making it 15 ft. above the level of the causeway on the main road.

2215. What height would that give? Reduced to the contract datum, about 90 ft. is the height of the causeway. If the Commission will allow me, I can produce exact levels, which will be more satisfactory.

2216. What would be the level of the flood there? 96 feet.

2217. *By Mr. Stanley.*—Do you mean the flood level of 1863? I have no knowledge of the flood level of 1863; but, judging from the work that I have seen, I should say that the height of the flood level there would be about 96.

2218. Do you think you have seen it at 96 feet above datum? Yes, I think so.

2219. How long have you been here? Since 1873, but I was here once before then.

2220. Was there a flood at Bridgewater in 1875? I was never at Bridgewater during floods in 1875. I judge from the remarks of the roadmen that the water had been over the road here and there. I have seen grass and rubbish washed upon it in places.

2221. *By the Chairman.*—That is what I want to call your attention to. You have seen the flood level at 96 at Bridgewater. Yet, at New Norfolk, the information that we obtained was that the highest flood was 2 ft. below the railway formation at New Norfolk station, and that is the highest level any old resident has seen it. Our rails would be 1 ft. 6 in. higher than those levels? I don't know exactly the level of the station.

2222. Assuming that the flood was considerably below that—supposing it was 2 ft. below the lowest part of the beams of the road bridge—that would be 103 ft.? Yes.

2223. The evidence showed that the flood of 1863 was 2 ft. below the old road bridge? I submit that that evidence should be taken with considerable caution. The new bridge is not of the same level as the old one.

2224. Would it be higher or lower? Four feet higher, to my knowledge, at one end.

2225. The present road bridge is 6 ft. higher on the New Norfolk side than on the railway station side. Mr. Calder, one of your assistants, stated that the level of the abutment on the New Norfolk side is 112.76ft., or a little more than 6 ft. above the east abutment? I could not speak as to that, because on one side some approach was made, I know. I couldn't speak positively of the reduced level of the under-sized of the old as compared with the under-sized of the new bridge.

2226. What was the flood level at the Pulpit rocks? Two to three feet below the formation.

2227. Supposing the flood level is 96 feet at Bridgewater, and 103 feet at New Norfolk, do you think that the lowest parts of the railway are safe? You have to allow a certain amount for the fall.

2228. But you adopt 96 feet at Bridgewater? And my railway is 9 feet above.

2229. In some places the railway is 15 feet above flood level; but the strength of a chain is its weakest link, and the most dangerous part of your railway is the lowest part. If you look at the sections from 1m. 55ch. to 2m. 5ch. you will see the formation level is 95 feet, which is a foot below the flood at Bridgewater? The formation level, yes, and is above it if you take the rails' level.

2230. From 2m. 40ch. to 3m. 5ch. the formation is the same height, and that is another half a mile below? Yes, if the grades have been carried out to original sections.

2231. Then from 3m. 55ch. and to 4m. 20ch. the formation level is only 2 feet above a flood level which you say you have seen at Bridgewater, and from 5m. 50ch. to 6m. 60ch. it is the same level as what you have seen at Bridgewater? That is so.

2232. From 7m. 40ch. to 7m. 50ch. the formation is 100 feet? Yes; but a great deal would have to be put against the causeway which might be built.

2233. Adopting the levels of the flood at New Norfolk, and assuming the maximum height at the Main Line bridge as 96 feet, you would find, as a matter of proportion, what the flood level would be at any intermediate point between Bridgewater and New Norfolk; so that if the section levels are correct a considerable portion of the line would be submerged during flood? Then you have to think of the heading up of water due to the wind, and so on.

2234. Yes; if you adopt the flood level as the height of the causeway the argument holds good; but if you assume the flood level in accordance with the sections, then it would mislead. The flood level must be determined at the causeway and at New Norfolk? But then you have to take account of the flood against the causeway from wind and other causes. The level would be reduced there, and make the railway higher by the difference.

2235. The section discloses that the 1863 flood is considerably above the level of the causeway at Bridgewater, but taking the level at New Norfolk as 100 feet, and the lower level at Bridgewater as 96 feet, it stands to reason that the level must be proportionate at different portions of the line between those points. Then do you think that these exposed portions of the railway—such as the Derbyshire and Pulpit Rocks, and between the Derbyshire Rocks and Bridgewater—are safe under these conditions? Even supposing that a very exceptional flood ever reached the formation level, there would be no risk from it.

2236. Would not the low portions of the line be damaged? It would not suffer any damage, as the whole of that work is of stone, the railway itself being on the solid.

2237. But the wash of the steamers now show that the water is eating into the banks do you still think that you have made all necessary provision at these places? The railway, as I have before said, is well built on the solid. It is protected by the spoil thrown out to form the extra width for the road traffic.

2238. Our attention was drawn, when coming down the river in the steamer, to the comparatively small height of the bank above ordinary high water. It appeared to be only 6ft. or 7ft. above that level? It is hardly right to assume even one continuous even fall. There would be more rapid fall at the upper portions of the river, and very much less as you got down to Bridgewater.

2239. But that would be rather against your argument, because the point where it is so very low is 6m. 60c. from Bridgewater.

TUESDAY, MARCH 9, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

MR. FINCHAM, C.E., recalled and further examined.

2240. *By the Chairman.*—Is there any mistake in the levels on the line between Bridgewater and New Norfolk, and where, as made by Mr. Mault? There is an error near Dromedary Creek.

2241. What is the mileage of Dromedary Creek? 4m. 60ch.
 2242. What is the error there? About 3ft.
 2243. What height of formation does the section give at 4m. 60ch.? It gives 98.
 2244. And what are the levels there now? About 3ft. higher, but Mr. Sheard is in a position to prove that the error goes all through.

MR. SHEARD, *recalled and further examined.*

2245. *By the Chairman.*—Mr. Fincham says you have some additional information to give about these levels: will you tell the Commissioners what it is—I refer to that portion of the line between Bridgewater and New Norfolk? At 1m. 41ch. there is an error of 3ft. in reduced levels.

2246. Tell us how far it extends, and then go on from point to point? I have not got the levels. I did not know that that was the information wanted, or I would have brought my level-books.

2247. How far does the 3ft. error at 1m. 41ch. extend? From 1m. 41ch. to 3m. 34ch., but it is not uniform right through.

2248. Evidence of this kind is of no use whatever, and is unfair to Mr. Mault; besides, we have Mr. Calder adopting the section formation as right. Can you furnish a detailed report showing where the errors are, whether they are continuous or isolated, together with such flood levels as have been taken? I will do so.

2249. Do you think the bank at the Pulpit Rock will be above water during such a flood as that of 1863? It will be 2ft. 3in. above flood mark. The 1863 flood was only 8in. higher than that of 1883.

WEDNESDAY, MARCH 10, 1886.

PRESENT:

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.
 HENRY CHARLES STANLEY, Esq.
 ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

JAMES FINCHAM, Esq., C.E., *re-examined.*

2251. *By the Chairman.*—Is there anything you wish to say about the flood-levels obtained by Mr. Sheard? I would ask you to be good enough to get that information which the resident engineer can give you as to the corrected levels, and if the Commissioners have any doubt about the levels of the railway at some particular spot—say the spot mentioned near the rocks—I would ask them to be good enough to examine witnesses of good local knowledge. They are to be obtained in the district.

2252. I will give you an instance of the information we obtained at New Norfolk. I asked Mr. Calder, in the absence of Mr. Sheard, to give the Commissioners the level of the under side of the beams of the New Norfolk River bridge. Mr. Calder handed in a document in which he determined the formation level of the railway at the prolongation of the centre line of the bridge as 111·15 ft., and he gave the Commissioners certain heights taken from that reduced level. He yesterday wrote on this plan that level as correct, and now it appears what Mr. Calder says is 111·15 Mr. Sheard says should be 112·13 feet? Mr. Sheard told me that.

2253. Mr. Calder gives me one point as 111·15 feet, but which Mr. Sheard states should be 112·13? I should prefer to take Mr. Sheard's figures.

2254. Practically, then, there must be confusion in the whole of the levels at those points? Mr. Sheard is prepared to send a plan showing the actual true levels in the construction of the line.

2255. What we require is the levels of those portions of the line between Bridgewater and New Norfolk where they differ from the levels shown in the contract sections? He promised to prepare that last night, and I expect to receive it by the coach in the course of to-day. My request referred to evidence as to the height of the flood over the old road at the "Rocks."

2256. Who can give us that information? Mr. Downie, I think; he has property in that portion of the line, I know, and will be well acquainted with it.

2257. Could not Mr. Riddoch, who lived at Government cottage, give good information? Mr. Downie is a much older resident. Mr. Riddoch might know.

2258. We want only reliable information to determine if the railway is safe from such floods as that of 1863. In all probability that is the maximum danger the department requires to guard against; but if the railway formation is below that flood there must come a time when great damage will be done to its works through their being submerged? I would submit that evidence be taken from people acquainted with the locality in question.

2259. Well, if you could suggest to the Commissioners the names of any parties who could give reliable evidence we could take them after we get Mr. Sheard's amended list of levels? I would suggest the Messrs. Downie as being likely to give most reliable evidence, as they own property at the spot.

2260. Could they describe the height of the flood, say at 3m. 6ch. and at 6 miles, and round the Derbyshire and Pulpit rocks? Round the Derbyshire rocks and the Pulpit rocks, as they own land there.

2261. But who could give us reliable information as to the lower portion? I could not tell without enquiry. Mr. Sheard informed me that he obtained local information, and that he was perfectly satisfied that the work was safe. In justice to the department, it is only fair that others beside Mr. Blockey should be asked.

2262. I was not speaking of Mr. Blockey; he has given no evidence; what he said was only a matter of conversation. We got information from three persons, Messrs. Godkins and Mr. Matthews, who live on the line, and their information is to the effect that the formation of the railway is above flood level. What we particularly want to know now is as to the flood levels of the line from Bridgewater up stream as to which we have indefinite evidence. I mentioned to you that Mr. Blockey stated that at the bottom of his garden he had seen the flood 4ft. deep,—then in that case the line at the Pulpit rock may be 4ft. below the flood? I find from enquiry that it would be 2 or 3 feet above the flood level. Mr. Downie's evidence would be reliable because he owns the spot referred to and lives there. Besides, the whole bank is rock and the ballast is all broken stone, and an exceptional flood once in 25 years would not be likely to have a very serious effect, even supposing that what is assumed to be correct is correct.

2263. Do you remember the effect which the flood had on the Launceston and Deloraine line—I mean that extraordinary flood which happened sometime between 1870 and 1875? I heard of it; but the damage there was owing to the want of waterways.

2264. The want of waterways and submergence of the line? I also know that the Launceston and Western line, near Hobler's Bridge, is submerged in times of even ordinary flood, and the traffic is never stopped.

2265. Those are the lowest portions of the line? By Hobler's Bridge the railway is to some extent under water at every flood time.

2266. Do you think the floods in the North Esk at Hobler's Bridge are as dangerous to the Western railway as the Derwent floods will be to the New Norfolk and Ouse line? No; because in one case the railway is crossing the flood and the other runs parallel to it.

2267. *By Mr. Stanley.*—Can you obtain for the Commissioners any authentic documents, Parliamentary or otherwise, as to the flood levels? I have never heard of the existence of any.

2268. I understood that there were some such documents in existence? Parliamentary documents?

2269. Yes? I don't think so.

2270. Will you make enquiries, and find out whether there are any or not? I will.

2271. *By Mr. Lawder.*—Do you remember whether a special grant was voted by Parliament for the Parliamentary survey of the Derwent Valley line? Yes, there was.

2272. Can you tell us the amount? I feel sure it was £1000.

2273. Was there any special grant for the permanent or contract survey? No.

2274. How is that paid for? Out of the votes for the construction and supervision.

MONDAY, MARCH 15, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

J. W. NORTON-SMITH, Esq., M.H.A., examined.

2275. *By the Chairman.*—What is your name? James William Norton-Smith.

2276. You are one of the Members of Parliament for this district? Yes.

2277. Also a resident in the district? Yes, for a number of years.

2278. Are you acquainted with the mode of conducting the affairs of the Public Works Department in this district? Yes, generally, from observation. I am not connected with them in any way.

2279. I mean as to how the business is transacted in detail? Yes, to some extent in detail.

2280. Are you aware how contracts are obtained for the construction of large works such as bridges and harbour works—on what principle? When main roads and bridges or harbour works are made, they are constructed from special votes passed in Parliament. Bye-roads and cross-roads are made principally from the funds of the Local Road Boards, but Parliament from time to time has given money to supplement that available for bye-roads. Then there is money available from the Land Fund under a special Act which provides that half the sale price of crown lands shall be expended in making roads to those lands; that is, if

the land in any district is sold for £1 an acre, as soon as a certain number of acres are taken up the Government gives back 10s. per acre for the purpose of making roads to and through that land.

2281. Then I understand moneys are granted by Government, and the works are made under the Public Works Department and then handed over to the Local Boards, and they have to provide for their future maintenance? Yes.

2282. Do you think that is the best plan under which Public Works should be constructed. Is there any improvement you could suggest? My own idea is that Government ought to take the sole control of the main roads, leaving the cross and bye-roads to the Local Boards. I may tell you that this is a plan which has been spoken of frequently, but I am not aware that it has been considered by the local bodies.

2283. Do you think if the money voted for roads was placed absolutely in the hands of the local bodies it would not be economically spent? That would depend on the character of the local bodies. In the country districts of Tasmania we have a great variety in the class of men constituting the local bodies. In some districts they are practical and economical and do the work cheaper than the Government do. In other districts it is different, and the local bodies do not take so much care.

2284. Would these bodies not be restricted by the system of supervision which the Government might adopt,—that if the works were not carried out in a certain way, the money would not be available? Then you fall back on the system in vogue at the present time.

2285. But I understand that at the present time the Government make the works and then hand them over to the local bodies to maintain: would it not be better to throw the whole responsibility on the local authorities and let them supervise the works throughout? Yes; no doubt the parties who have to maintain the works should be able to see that they are properly constructed according to contract.

2286. I want your opinion as to whether you do not think these works should be handed over from the first to the local bodies? No, what I think is that the parties who make the roads should have the responsibility of maintaining them afterwards. If the plans and specifications were sent to the chairmen of the Road Trusts and the roads were constructed by them through the road inspectors under Government supervision, subject to the head of the Public Works Department, then it would be fair to ask the Trusts to maintain the roads afterwards. At the present time there is no proper supervision; the work is scamped in many cases, and then it is thrown on the Boards or Trusts immediately afterwards to be maintained.

2287. Take the case of main roads under the present system, do you think the road works are constructed in the best and most approved manner? No, they could be improved in many directions.

2288. Can you indicate any particular change that you think could be made with advantage? Yes, I think our road bridges should be built with stone piers to save loss in reconstruction. We build our bridges with borrowed money, and we build them of timber. The piles soon decay, and then we throw more money away to replace the timber piles. If we had stone piers the tops only would have to be replaced.

2289. I presume this system is the existing one. Can you inform the Commission of any instance where it has been abused? Well, there is the Leven Bridge just finished last winter, all wooden piles. Of course, if the piers were of a permanent material, such as stone, it would be but a trivial expense to put on a new top. In these rivers we are troubled with marine worms, and they soon eat the wooden piles away.

2290. In the case of the Leven, what do you consider the life of the bridge?—how long before it would have to be renewed? Well, the bridge which it was put up to replace was finished, I think, in the year 1867 or 1868. The old bridge which was built then has now to be entirely renewed.

2291. That would be about 18 years. Don't you think that would rather favour the present system. Suppose it is cheap work, would not the interest on the increased cost of a permanent bridge more than cover the cost of replacing it by another timber bridge? It might in certain instances, but if cheap bridges be constructed an annual reserve should be made to provide for reconstruction. At present we have an accumulation of small expenditures, aggregating large amounts.

2292. I follow the thread of your remarks. You mean that if an inferior bridge would last, say, 20 years, it might be constructed of stone in the first instance for a less cost than it could be renewed? Yes. The system now is to make them of wood. The cost of stone abutments and piers would not be more than three times the cost of a wood bridge, and it would be permanent. In the other case, in the course of 40 years you would have to pay as much or more money and still only have a wooden bridge.

2293. In the case of the Leven Bridge, was there stone available in the district? Yes, they could have brought down any quantity of stone from the Dial range.

2294. Then, in the case of the Leven Bridge, you think it would have been better to make a permanent bridge at once? Yes, I do.

2295. Could it have been made available for railway communication? If necessary, it might have been.

2296. Would it be desirable? I think it is undesirable in the case of a long bridge to have locomotive and horse traffic over the same bridge. It is dangerous to the public.

2297. Yes, in a general way, no doubt it is so; but there are instances. There is the case of the bridge over the Murray at Echuca, the longest and most expensive bridge in Victoria, on the great high road to the Darling; that is on one alignment. Don't you think, under the system of shields and guards, the traffic by rail might be protected from that by road? It might be protected, but there is danger to the people using it. I don't think it is desirable where it can be avoided. Of course there may be exceptional cases. On the Derwent Valley extension to the Ouse we voted money for this description of bridge; but it was pointed out that the road traffic was very light, and it was sanctioned. Where the traffic is only small it might be advisable, but not on a main road.

2298. In the case I allude to the traffic is very heavy; all the stock from the northern Australian stations come down that road. Up to this time no danger or loss of life or accident has occurred. Are you prepared to say if the people here would accept or reject such a proposal? I don't think they would be likely to object. They are only too much in the habit here of taking what is given them, without making remarks about it.

2299. Is there any other case to which you wish to draw attention? Yes, the bridges generally along the coast. It is the custom here to build wooden bridges.

2300. *To Mr. Lawder.*—Do you object to wooden bridges and abutments? I object to wooden abutments on account of the cost from year to year. A wooden top can be renewed from time to time at small cost, and is legitimate; but where piles are put down instead of stone abutments and piers, I object.

2301. *By the Chairman.*—Suppose the Government of Tasmania imported really stable timber for their work, and built their harbour and road works of red gum, or jarrah timber from Western Australia,—timber which is impervious to the marine worm,—would it not be a good plan to import the piles, and leave the superstructure or top to be built of native timber? No. In this Leven bridge they used piles that came from the South, the very best timber we have. In Melbourne there is not so much trouble with the marine worm as we have here, in consequence of the fresh water coming down the Yarra.

2302. I may mention that at Warnambool and Portland, and also in Hobson's Bay, Victoria, where it is salt water, jarrah wood was found to be eminently satisfactory? Of course no timber is durable, like stone; but if we could get timber that would last 30 or 40 years in such situations, no doubt it would be advisable to do it.

2303. Anything else? Yes; there is another plan adopted here in building road bridges, about which I am hardly competent to give an opinion, but I should like to call attention to it. That is, the principle of loading the bridges. The wooden bridge is made, and then about a foot of metal and tar is put on the top, giving unnecessary weight without any advantage, to my mind. My idea is, that this loading keeps the water from running off. If the boards were left bare, just with a coating of sand and tar, it would be much better.

2304. To what instances do you refer? There is one over the Inglis, at Table Cape; another at Flowerdale, and, again, the case of the bridge over the Leven.

2305. How about the one at the Forth? That is not finished yet. I have not seen the specification.

2306. Are you acquainted with the road works at Circular Head and Table Cape? Yes.

2307. Anything more in reference to these bridges? Yes, the bridge at the Inglis is built the same way, with wood, and loaded; there is another new bridge at Flowerdale exactly similar.

2308. Is the system of supervision a good one?—do the officers look well after the interests of the public and the Department? Oh, we have any quantity of supervision.

2309. Is it practically and economically applied? Some question is always arising about that. I think there is a certain allowance to be made for the Department. Owing to the number of works now in progress it is difficult to get qualified men to take charge. Some of the inspectors are capable men, but some are of very little use.

2310. Is there any system of examination to determine the efficiency of these officers? No, none. I knew a case of an inspector being appointed who did not know the use of a set of boning-rods.

2311. What had he to do? He had charge of a large district for roads and bridge work.

2312. Is that a solitary example? Yes, it is the only instance I know of.

2313. Was he appointed at the instance of the inhabitants? No, it was purely a Government appointment.

2314. Was he forced on the Department, or was it a mistake? Well, I believe it was a sort of political appointment. I would like to remark here that this instance was not within the last three years—it was before.

2315. *By Mr. Lawder.*—What was the nature of the pressure brought to bear? There was no pressure.

2316. In what way was it, then? Well, I believe the man's brother had helped the Minister in some way.

2317. There was no political pressure? No, none. This happened a considerable time since. The present Minister had nothing to do with it.

2318. *By the Chairman.*—As you have been a long time in the district, Mr. Smith, would it be too much to ask you to put in writing your views as to the best way of carrying out the works in the interests of the Department and the public? Yes, I shall be very pleased to do so.

2319. *By Mr. Stanley.*—Does the Public Works Department exercise any control over the expenditure of the money granted by Parliament for these roads? Yes, they see to the whole expenditure of it. The other moneys are spent on the cross and by roads. The Road Trusts have to undertake to maintain the roads after construction. The Public Works Department construct a road on the guarantee of the Road Trust to keep it in repair.

2320. But I understood that only applied to the main roads? No, no; there are two bodies—the Road Boards keep the main roads in repair, and the Road Trusts have control of the cross and by-roads. The main roads are made by the Public Works Department, and maintained by the local body.

2321. Then, when a grant is made by Parliament for the construction of a line of road, it is expended by the Public Works Department entirely? Entirely; yes.

2322. Does the Department exercise any supervision over the way in which the main roads are

maintained by the Boards or Trusts? I don't think so. I presume it is the duty of the Inspector to report to the Government if any of the roads are allowed to get into disrepair. Our Act provides that if the Road Boards do not take the necessary steps to keep the main roads in good repair the Works Department steps in and does the work itself.

2323. Have the Road Trusts or Boards any voice in the construction of large works to be undertaken by the Department, such as bridges, for instance? No, the whole plans and specifications are made out in Hobart.

2324. Are they not consulted in the case of important works? I think not at all. Of course they have to undertake to keep the road in order.

2325. Then, in the event of a bridge being constructed in a way which the Road Trust did not approve of, would it be competent for them to enter any protest against the manner in which the work was constructed, seeing that afterwards they have to maintain it? Well, of course they could protest the same as any private individual, but they have no power to do anything. As a matter of fact they never see the plans or specifications. I have always thought the plans and specifications should in the first instance be sent to the Chairmen of the Road Trusts. Now these officers cannot see the plans unless they will go to the local post office, which is the usual place where they are displayed, so that they have no opportunity till the work is in progress of seeing how it is to be constructed. I don't think this right. The Trusts should have an opportunity to see the plans and specifications beforehand, and to approve or disapprove: certainly if the Trusts are expected to maintain the works afterwards they should have a voice in their construction, and this has been granted in instances where the Road Trusts have insisted on it. At Emu Bay it had been insisted on, and the Trust had had the plans and specifications.

2326. I notice in respect to the piles of the Leven bridge that no attempt is made to protect the piles by sheathing: is that never done here? No, it is never done.

2327. Don't you think if the piles were sheathed with Muntz metal, or some similar precaution taken, that the duration of the piers would be increased? I think it might be doubled. The only place where they would go then would be where exposed between wind and water. Now they are eaten away between high and low water.

2328. I understand you to say that the marine worm attacks the piles? Very much, and before the pier is up any time. The life of the piles is nothing.

2329. In Queensland we suffer very much from the marine worm, and we have to sheath all the timber up to high water-mark? That would nearly double their life.

2330. Then in that case there would not be the same argument in favour of expensive masonry piers? Not so much, no.

2331. In stating that you thought these bridges should be constructed on masonry piers, did you refer to the abutments in all cases, and the piers in the water as well? Yes, I meant right through.

2332. That would make expensive coffer-dams necessary in many instances? Yes, coffer-dams would be necessary.

2333. What does the bed of the rivers on the coast consist of chiefly, such rivers as the Leven and the Forth? Well, the rock is near the surface; but I don't quite know. I should prefer not to answer that question, as I am not sufficiently positive about it.

2334. My reason for asking was to ascertain whether it would be suitable to use cast iron screw piles,—they are less expensive than masonry, and make a durable structure? They would be infinitely superior to timber, and would not cost much more than double the piles.

2335. *Mr. Stanley.*—Do you think the system of covering up the roadway with metal does not have the effect of rotting the timber? The only instance that came under my observation was the old bridge at the mouth of the Emu. That bridge was re-decked during my residence here, and then covered with metal. The flooring went in five years, because the air could not get at it to dry the timber. The damp got in, and there it remained. I think the life of timber is shortened by this system of covering it up. My idea is that the timber is kept damp instead of dry, and it rots in a very short time. Then, again, the structure is asked to carry a considerable and unnecessary weight.

2336. Does the timber stand well if it is dry, where the wheel traffic is large? Oh, yes; but there is a great deal of carelessness in selecting the timber. But for that I think it would last longer. If the timber was felled in the middle of winter, when the sap is down, it would be better. Now they call for tenders at the wrong season, the contractors have no timber on hand, and green timber is put in.

2337. What sort of timber is the best? Stringy bark, I think, for this district. Blue gum is a favourite timber, but it does not grow on this side of the Island.

2338. From your knowledge of what the Public Works Department undertakes, and the nature of the work, are you of opinion that the staff is an unnecessarily large one? It is.

2339. You think the work should be done with a less number of inspectors? I think so.

2340. What is the system of carrying out supervision?—have you District Superintendents with inspectors under them, or how? The Island is divided into districts, and an inspector is appointed to each, then he appoints a lot more sub-inspectors, really to do his work; they mostly lay out his work.

2341. *By Mr. Lamder.*—Has he that power? That is it, Sir.

2342. *By Mr. Stanley.*—Does he engage these men, or is it done by the Works Department? He appoints them himself.

2343. Then he is responsible to the head of the Department for the efficiency of the men he appoints? Yes.

2344. *By Mr. Lawder.*—You said in answer to Mr. Stanley that a portion of the money contributed towards the cost of road works is given by Parliament, and a portion from the proceeds of land purchased? For road construction, yes.

2345. Is this contribution given from the proceeds of the annually settled lands, and spent on them only? Yes.

2346. Or does it come out of the Consolidated Fund? No, from the proceeds of land, and is only spent in the district where the land is taken up.

2347. Then these funds are not given back to the Road Trusts? No, they are expended through the Public Works Department for opening up the lands from which the funds have been derived.

2348. How are the various bye roads budgetted for—how are they selected for construction—and how is the distribution of the available funds carried out? To answer that I must start at the commencement. These bye roads are made into Crown lands as they are taken up, when a track is selected.

2349. Who prospects and selects the tracks? The system of selecting tracks and bye roads has been generally to follow the splitters' tracks. The man who takes up the land follows the splitters' track, and then he goes wherever he can get a piece of road; he follows that up by degrees, and as he selects it he points it out to the surveyors and it ultimately becomes the main road, much to the detriment of the road as far as the selection of grades is concerned. In many cases these roads go up and down steep hills, whereby with a little care a good level road might be got.

2350. Would it not be advisable to consult the neighbouring residents as to the laying out of these roads? I think the surveyors should be instructed to run roads into all good bush lands before any land is surveyed for sale. This, I believe, is now proposed to be done. I mentioned it in the House of Assembly last session, and urged it as a very necessary thing.

2351. In reference to the equitable distribution of the grants in aid all over the colony: how is that arranged for? Do the local trusts or boards submit proposals for the various works required in the different localities? No, they have nothing to do with it; it all rests entirely with the inspectors.

2352. Do they also select the bye-roads? The inspectors? yes.

2353. Do they select these roads at their own will and pleasure, or are they suggested to them by local residents who know the country? I think the inspectors select them entirely of their own accord. I don't know of any instance where the inspector has consulted the residents. This you can ask the inspectors about. I rather think the inspector is instructed not to consult anyone in the district.

2354. Then what guides him? His local knowledge. Of course in many instances where roads are selected by the inspector, the people get up a petition, which is sent to the Governor in Council, and sometimes to Parliament if it is sitting; and these cases are also frequently brought forward in Parliament by the member for the district.

2355. There is no other channel by or through which the residents in the locality can represent their views to the Government? No; except through the newspapers.

2356. Or by public petition and the action of their member? Yes.

2357. Don't you consider it would be advisable to give the local Boards the right to select the route of the proposed roads in the district? Undoubtedly they should be consulted. Of course we know that some districts and influential parties would ask for more than the Government could give; but the trusts should be consulted as to the road works required in the districts. I should send a tabulated list of proposed roads round so as to ascertain the opinion of the trusts, and with the understanding that those approved would come on for construction in the order in which they appear in the schedules, and as funds were provided by Parliament.

2358. Do you not consider it would be a better plan to place the construction of these roads under a competent engineer, under the control of those local Boards, but liable to inspection by the Public Works Department? I don't think we could afford that, Sir.

2359. But if those engineers were paid from Government grants, do you not consider it would be preferable to the present plan? You mean, to allow the Road Trusts to spend the moneys granted by Parliament?

2360. Yes, through their own engineer, who would be subject to inspection by the Public Works Department? That would be merely placing the inspectors under the control of the Boards.

2361. But if the local Boards did not construct the roads satisfactorily the Department would interfere? Of course, that is the thing, as to how far they would exercise their power. That proposal requires thinking over a good deal. There are no doubt reasons why it might be advantageous, and other reasons why it would be unadvisable to have anything like dual control over the engineer. Then the engineer would be under the control of the local Boards financially, but under the professional control of the Public Works Department. They would have the power of inspecting his work and reporting him to the local Boards and to the Government, while the Boards would have to see it carried out. I doubt if it would be desirable to go so far as that. It would not be satisfactory if the engineer had to deal with the local Boards in financial matters, and in construction had to report to the head of the department.

2362. But I mean that the engineer should be in the charge of works undertaken by the local boards, but might be paid through the Public Works Department. Yes, that is a good idea.

2363. The grants in aid might be made by the Government to the local boards, and the engineer would be responsible for their proper expenditure? That would be better. The present system, where one body constructs and the other maintains, must be detrimental to the stability of the works. My idea has been that the Public Works Department should maintain the whole of the main roads. I think in most instances if a competent engineer were appointed—I don't mean a man of great ability, but a practical man, who could take levels and lay out his work properly—it would be the best plan. Of course, the local board would have to be provided with funds to pay this engineer. They could not get such a man for less than from

£200 to £300 a year, and they could not afford to pay this out of their own funds; but if Government provided them with a man of that sort they might safely let them spend the money under him, the head of the Public Works Department overseeing him as occasion demands. At the present time the contractors are put to a great disadvantage. There are no sections taken of the works,—it is all a matter of rule of thumb or guesswork as to the value of any work about to be constructed. I do think the Commissioners should look into some of the plans and specifications; they can easily get some. I think sections should be made out in certain lengths, three or five chains or longer, and that the work should be set out so that the contractor should not have to go and do work that the engineer should do, or else give a mere guess as to the work to be done. Take earthworks,—in most cases they have no idea whatever as to the number of cubic yards of earth to be excavated, and they put on a large sum to cover themselves in consequence.

2364. Then you think the local boards would take enough interest in the progress of the works to secure economy in construction, together with a fair distribution of the benefits to be conferred, if the Government provided them with a public works engineer? There can be no doubt the Road Trusts are inimical as a rule to the Government system; but I think on this coast that they take a great interest in the works. There are some districts where the roads are naturally so good that the trustees take no trouble about them, and don't even rate themselves on account of them. I would like to remark about the rates raised locally that they are subsidised further by Government under the present Act of Parliament; that is, every district which rates itself at 1s. in the £ shall be subsidised to the full amount of the rate subscribed.

2365. Who has the expenditure and control of this money? The road trustees. Then the subsidy comes down in a descending scale. Districts rated at 9d. in the £ get 6d. in the £ subsidy, those at 6d. get only 3d.; but the Government thus subscribe to the general fund for cross and by roads under the road trusts. This money is granted towards the maintenance of the cross and by roads.

2366. How do they supervise that work now? The road Trustees do that entirely themselves.

2367. The members of the Road Trust? Yes; they appoint an inspector.

2368. They have an inspector, but not an engineer. I think you stated that the main roads are maintained by a vote of so much per mile? Yes, they are constructed by the Government, and then handed over to the local bodies; that is, the main roads. Local construction works are entirely looked after by the local bodies.

2369. It is in evidence that the expenditure of all moneys granted specially by Parliament is under the control of the Public Works Department? Yes, both for the by roads and main roads.

2370. For both? Yes.

2371. *By the Chairman.*—I understood that the local works were entirely under the local bodies? The by roads are; but where money is specially voted by Parliament for the by roads in a district, that amount is spent under the supervision of the Works Department; that is for the construction of by roads. Then the people rate themselves locally, and the Government add a subsidy to the rate which also comes in for maintenance. The local bodies can do what they like with any such moneys.

2372. *By Mr. Stanley.*—Including the subsidy? Yes, they can do as they like with those moneys.

2373. Then I understand the annual subsidy is entirely in the hands of the Road Trusts? Yes, entirely in the hands of the Trusts, and all special grants are spent entirely under the control of the Public Works Department.

2374. Who is responsible for the carrying out of the plans and specifications? The Department. Take the specifications which are advertised now. That, I think, you will hear of from Mr. Jones. There are specifications for tenders advertised now till the 17th March for works at Table Cape, and the plans, amongst other places, are advertised to be seen at the Post Office, Emu Bay; but up to Saturday, that was the 14th instant, no plans had arrived here. I don't believe they are here now: yet, as you see, the tenders are to close on the 17th March.

2375. *By Mr. Lawder.*—In what limit of time have the works to be completed? That depends on the amount of work to be done.

2376. Do you consider it would be more advisable to call for tenders early in the year? Yes, undoubtedly it would be better. The money for this work was voted six months ago, and instead of getting the plans out at once, and the work done while the summer is on, it is let so late that there will be nothing but winter to do it in. Of course the contractors ask a great deal more than they would in the summer, and then, besides, the work done in winter is not nearly as durable.

2377. Is there anything connected with the supply of funds in the way of these contracts being called for earlier? No; it is a want of system, I think. If the inspectors in the districts were capable of taking levels and making sections of the works, they would be able to give proper estimates of the works required for these sections, and they would send them on to the office at the time of making their reports as to the amount of money required. Then, as soon as the money was voted, they would have nothing to do but send in sections of the work to be contracted for, the plans and specifications could be out in a week, and the works could be done in summer when they would be much more valuable.

2378. When do they send in their reports? They are now making their reports for works required next year.

2379. And the money they ask in these reports will be granted, when? When Parliament next meets, I suppose about August or September.

2380. And tenders of these works will be called for, under the present system, when? Perhaps this time twelve months. You will observe that the system I have indicated as to the inspector making his

report is as liable to error as can be. They say merely that an expenditure of £1000 is required here, and £1500 there, but there is no calculation about it, it is all guess. If we had men who could make a section of the ground, we could tell to a nicety,—the matter is in a nutshell.

2381. *By Mr. Stanley.*—Then as a rule these inspectors are not competent to make sections or to lay out the works? No they are not.

2382. *By Mr. Lawder.*—But do not the local bodies appoint these men? No, the Government appoint them; the boards have nothing to do with it.

The witness withdrew.

Subsequently Mr. Smith forwarded the following addition to his evidence in writing :—

Burnie, 15th March, 1886.

GENTLEMEN,

HAVING already been examined by you on the construction of bridges by the Public Works Department, I shall not refer to them beyond drawing your attention to the road bridge at Sisters Creek, which I consider of the most temporary and unsafe character, a new bridge having been built on top of the original structure for the purpose of raising the levels.

Culverts.—I would draw the special attention of the Commission to the wooden culverts almost universally used on this Coast; the cost of glazed earthenware pipes suitable for culverts is so very slightly in excess of the prepared wood that the use of the latter material is entirely unjustifiable, and more especially as these ephemeral drains are constructed from borrowed money. It may be permissible for me to remark that in constructing the permanent way of the E. B. and M. B. Railway that I found the cost of wooden culverts, when I was forced to use them in consequence of there then being no means of getting pipes to the particular locality, greater than that of earthenware pipes.

On the road between Duck River and Montagu an especially bad form of wooden culvert has recently been adopted; the decking has been laid longitudinally with the road, the sand with which they were covered has been washed and blown off, leaving the covering slabs bare; the natural consequence must be that as soon as the slabs begin to decay the wheels of passing vehicles will go through them.

During the last Session of Parliament I drew attention to the absurdity of constructing such works from borrowed money, and the Minister of Lands informed the House that the use of wood for this work was a thing of the past.

Shortly afterwards I was informed that Contractor R. Dallas, of Rocky Cape, was placing wooden culverts in the main road between Rocky Cape and Circular Head at the very time, under the supervision of the Public Works Inspector. I did not see the specification, but, from what I could gather, pipes were specified as the material to be used, and wood substituted. The Commission will readily understand that I had no power to examine into the matter and ascertain which Officer of the Department was to blame.

Since the time referred to (during the present summer) an embankment has been thrown across a gully near the 122nd mile-post, some 15 to 30 feet in height; at the bottom there is a wooden culvert which was placed there when the road was opened, and this old culvert has been allowed to be covered with the new work, the only alterations made being the removal of two or three of the end planks since the embankment was finished, in consequence, I believe, of public remarks.

Roads Construction.—This system I consider to be extremely faulty in so far as there is very little, if any, judgment displayed in selecting the best routes available prior to the expenditure of public money: the principle adopted seems to be that of making the roads over any track which may have been hit upon by the pioneers of the district as the most convenient for foot traffic either to new selections or to beds of splitting timber.

A remarkable instance of this may be seen in the Flowerdale road in the Table Cape district, where the road between the Inglis and Flowerdale bridges traverses two sides of a triangle, near the apex of which the summit of a hill is crossed, whereas a nearly straight line between the two bridges would pass throughout over ground almost level.

A more recent instance of this plan of laying out roads may be seen on what is known as the West Coast road *via* Pieman Heads. Where this road passes through the Van Diemen's Land Company's Woolnorth block the route south of Mount Cameron has been selected over a heavily timbered hill, on which the land is very rich, the result being that clearing the track of the heavy timber growing upon it was an expensive work, and that the road, in consequence of the rich nature of the soil, is impassable, and all the traffic passes through another part of the Woolnorth block (at this point) right away from the road. There is not the slightest necessity for rising this hill, as along its base the country is nearly level, the ground of a sand loamy nature, the timber stunted and sparse, and a road, suitable for present requirements, could have been made there for a tenth part of the money spent on the impassable route referred to above.

I consider that it would be highly beneficial to the public interest to have longitudinal sections made of the roads to be constructed, and the quantities of cuttings and embankments taken out, as a guide both to the Department and intending contractors, as to the real value of the work. The present system of guessing at the value of the various proposed works is injurious. The Inspectors usually estimate the cost below the value, and the consequence is that repeated sums have to be asked for from Parliament to complete a work. The time of the Inspectors is occupied in setting the work out over and over again, and there is an increased cost in supervision to the Department, and in taking plant to the sites on two or three occasions instead of once, to contractors. The contractors, having no information as to the quantities in cuttings and embankments, naturally protect themselves from loss by tendering sufficiently high. A section with the quantities marked upon it would, in addition to providing the necessary information to inspectors and contractors, be valuable to the Chief Inspector, who could therefrom see if the proposed alterations of levels and grades were the best obtainable without leaving his office in Hobart, and the head of the Department could at once determine how much of any given road it was desirable to undertake immediately; and year by year, in the case of postponed works, there would be no difficulty in picking up the points of commencement and termination of the year's work. Further, these road sections would enable the Minister of Lands to call tenders for the work within a very short time from the money being voted, and the summer months would be devoted to the construction of the works instead of the pegging out by inspectors and tardy calling of tenders, thereby forcing the construction into winter months when work costs more per yard, and is not so good as that performed during the dry months; further, it frequently happens that contractors are forced to leave their work half finished, and all traffic has to plough through newly or half formed embankments through the winter months.

In all cases the spaces on one side of the macadamised road should be sufficiently formed to permit vehicles to travel thereon. If this were done the bulk of the traffic would pass on the unmacadamised portion during the summer months, a period in which much damage is done to the newly constructed roads by the picking up and kicking off of the metal.

I also consider that more attention should be paid to filling in ruts, and rolling newly made roads. Horse-rollers are used by the Department for consolidating the roads at the times of construction, but they are not available to the Road Trusts without payment of a fee which the Trusts consider excessive; the consequence is that the roads

remain unrolled, and the rollers, from exposure to sun, wind, and rain, suffer more injury than if they were at work with proper attention. Again, there is not a sufficient supply of horse-rollers, there being only one between the Blythe and Circular Head, and it is questionable whether steam-rollers would not do their work more efficiently and at less cost.

The material used for metal is not in all cases the best procurable, as witness the road through Cassidy's Forest, which has been metalled with a soft clay slate, while there is an abundant supply of gravelly quartzite in the neighbourhood, though at a rather greater distance from part of the road than the quarry whence the slate was taken.

In some instances contractors are paid for work not performed, a notable instance being on the South Road at Circular Head, where the metal in many places was only put on the depth of 5in., and work generally so slummed that the Road Trust absolutely refused to undertake its maintenance. The Works Department is now offering the Road Trust a considerable sum of money, voted for another portion of the road, to put the section referred to in order.

At another place on the same road, nearer to Stanley, a considerable sum was spent some two years since in forming and macadamising a road about two chains from high-water mark. It was known at the time that the sea was encroaching at this point, and that a small outlay at the time would prevent further encroachment, but the only effort made to stop it was the erection of a brush wattle fence, which would not have stopped a sheep;* the consequence is that the sea has gradually worked in until it has wasted away the road, and, so far, the metal which was placed on the road has, in falling, formed a protection against further damage.

As a further instance of general carelessness, I may mention the Hellyer Bridge, south of Table Cape. Tenders are invited in the newspapers until the 17th current, and contractors are informed in the advertisements that plans and specifications may be seen, amongst other places, at the Post Office, Burnie. On Saturday, a contractor on enquiring for them was informed that they had not yet arrived, and on enquiring there myself to day, I found that they were not even now in the office. As there is no means of getting plant to this bridge except by pack horse, the construction must be unnecessarily costly, and I fail to see the utility of a bridge in the middle of a forest before a road is made to the river.

I have the honor to be,

Gentlemen,

Your obedient Servant,

J. W. NORTON SMITH.

*The Chairman and Gentlemen of the Royal Commission
on Railways and Public Works.*

* N.B. At a subsequent period (forgotten when writing on this subject) a few loads of stones were placed along the bed in a rough line parallel to the coast line.—J.W.N.S.

The Hon. WM. MOORE, Esq., M.L.C., called in and examined.

2383. *By the Chairman*—What is your name? William Moore.

2384. You are a Member of the Executive and Legislative Councils, a resident of the North-western District, and have held office in the Ministry as Chief Secretary and Minister of Lands and Works for the Colony of Tasmania? Yes.

2385. Your experience extends over a large number of years, Mr. Moore? Yes, I have been in Tasmania since 1853.

2386. In the supervision and carrying out of public works, do you think the present system adopted by the Department the best? No, I do not.

2387. Could you from your experience tell the Commissioners where any improvement could be made in the way of the administration and more efficient control of the Department? That is a large question.

2388. I mean generally in regard to works in the country districts, for example? Well, one important improvement I would suggest is, that nearly all the works should be carried out in the summer instead of in the winter months. A great many of the principal works are now done in the winter. In the erection of bridges over rivers there is great difficulty in the winter, and the work is not satisfactory.

2389. How could that plan be adopted, considering that the necessary funds can only be obtained when the Parliament has voted them? Parliament generally sits in the winter and votes the supplies, but it is very seldom when an Act is passed that the Department tries to carry out the works in the summer following. It is seldom that any action is taken till the winter after that.

2390. Is that not a fault in the Parliamentary system?—if the money is not voted the works cannot be carried out till it is? The works immediately requiring attention could be done in the latter part of the summer, and what could not be done then should be done in the summer following.

2391. That is it. For instance, could not the sums voted in 1866 be spent in 1867? Yes, of course it could be done, but it is not. For instance, the votes taken last year will perhaps not be expended for two or three years.

2392. Would you spend the money available only during the summer, or would you hold it until the following winter, when the Parliament could vote additional sums? I would make a selection of the works, and where the money could be expended economically I would do so; but in such works as bridges, I should be careful to erect them in summer.

2393. Would the votes not be liable to lapse? No.

2394. Would the vote hold good until the next session of Parliament? Yes.

2395. Then the vote would not lapse if not spent in the financial year? No; the votes that are on the estimate for the year would lapse, of course, but for these votes for works you have special Acts of Parliament for special works which keep the vote alive.

2396. Are these works under Acts of Parliament? Some of them are.

2397. Would there not be a difficulty with money on the estimates—would you not have to get a special Act to make the money available? No.

2398. What would you suggest? I would have all these special works carried out without reference to the lapsing of the vote for audit purposes or for purposes of finance. For instance, votes for works like the breakwater here, and others, would not be allowed to lapse.

2399. Well, take the vote which Parliament passed for the construction of these breakwaters—would it not lapse if not spent during the financial year? Certainly not; the money would not be an object,—it would come to a Loans Bill.

2400. But suppose it did not, and as you have experience how the department works—how would you meet the difficulty? All these votes for special works are scheduled and put into an Act of Parliament; there is no such thing as lapsing at all in reference to them.

2401. Are they not included in the Appropriation Bill? Certainly not; they are not included in the Appropriation Bill at all. The maintenance of roads is a part of the Appropriation Bill, but special votes for works are sanctioned in an Act of Parliament, and would not lapse at all.

2402. For what reason, then, does not the department take a common sense view, and construct works in suitable season, and within a reasonable time? That is the point. That is what I find fault with. They are not driven by the lapsing of the votes to delay the construction of the works. Most of the works are under authority of Acts of Parliament, and would not lapse in ten years.

2403. I may say your complaint is not peculiar to Tasmania—it is likewise the case in Victoria, where money is not always spent at the proper time. You say, however, the votes would not lapse where your works are scheduled under an Act of Parliament? They would not.

2404. Now, as to the application of these moneys: would you suggest that the expenditure of the moneys be submitted to the local Boards, or continued under the present system? I don't think it is desirable to hand over the moneys voted by Parliament to the local Boards. They have not the requisite scientific knowledge, and they have not sufficient responsibility. I think the construction of the works should be under the Public Works Department; and the responsibility for the proper construction of the works should fall on the head of that Department, and not on the local bodies.

2405. Then you do not recommend anything like that? No, I do not advocate any change of responsibility. I complain of the want of practical constructive knowledge in carrying out works,—in fact, of the want of competence of the Department.

2406. Is that want of knowledge on the part of the officers of the Department, or is the fault in the system? I think it is partly both. I don't charge the officers particularly,—the fault lies with both.

2407. Do you think it is the fault of the Department that plans and specifications for tenders in this district, advertised to close on 17th March, are not now forthcoming where advertised? That must rest with the Department. They should never advertise a thing for tender until they are prepared with the plans and specifications.

2408. Yes, but would you blame the officers or the head of the Department? I have no idea of taking the blame from the head of the Department. The responsibility for the incompetency of the officers rests with the head of the Department.

2409. Is it not perhaps neglect rather than incompetence: should not the recommendation be made by the officers? The fault is with the head of the Department.

2410. Do you mean the ministerial or professional head? Both of them. The money for that work was voted long enough ago, and the plans and specifications should have been out.

2411. What time would be enough? I should say about a month.

2412. It has been pointed out by a previous witness that the local bodies are not consulted in reference to these works. Do you not think it desirable that they should be consulted? Well, it would perhaps be as well to consult them; but as far as the technical and scientific part of the work is concerned, you could not expect to get much information.

2413. But as to recommendations, for instance, as to bridges and traffic, whether they should not be wider or narrower, or to determine if the waterways were sufficient, would not local bodies, as to these matters, have every advantage, and be able to advise the Department, and give information that could not be got otherwise? Yes; but I consider all enquiry of that sort should stop before the vote is brought before Parliament. I think before Parliament votes the money for these works, it should be furnished with reliable plans and specifications based upon all available data.

2414. Then you agree that the local authorities should be consulted? Yes.

2415. Would that be one of your recommendations? I don't know. I have a better and more elaborate scheme of public works in my mind, but I am not going to show my hand now.

2416. Well, do you think it would be an advantageous plan to consult the local bodies? It would, to a certain extent.

2417. Is it not better to throw responsibility upon the local bodies, and extend the principle of local self-government? That is a question of policy.

2418. It is a question of local self-government? It is a question of policy. To my mind there can be no real responsibility unless there is financial responsibility. If the local body concerned find the finances then it should be for them to control the works. If the finances are found part by one authority and part by the other, then it is a joint responsibility. If the local bodies find the money for the works, or find it principally, then it is desirable to leave it to them.

2419. But I understand you throw the cost of maintenance on the local bodies? That is only with reference to branch roads. The main roads are constructed and maintained by the Government, assisted by the local boards. They are really boards of advice to the Government. The whole of the money is found, in regard to the construction of main roads, by the Government.

2420. Do these recommendations apply to the whole Colony or to the districts? To the whole Colony.

2421. If they have the power of taxing themselves? The ratepayers have the power of taxing themselves to the extent of 1s. in the pound, that is for cross and by roads. We have a large extent of cross and by roads as well as main roads. The finances for the main roads are furnished entirely by Parliament, that is for construction as well as maintenance. For the cross and by roads the money is furnished jointly by Parliament and the local bodies. The local bodies assess themselves to the extent of 1s. in the pound, and in that case Parliament subsidises them to an equal amount. Where the local bodies assess themselves to the extent of 9d. in the pound Parliament gives 6d.; where they assess to 6d. in the pound Parliament gives 3d. in the pound, and so on; so that where the districts rate themselves to raise money for the construction of roads Parliament assists them. As they increase the rates levied they are assisted in proportion; and to that extent the road works are carried out by the local bodies.

2422. Then, so far as you know, there is no instance where the local bodies provide the whole of the moneys required for public works? No; you must divide the roads into two classes. The main roads are made and maintained out of the moneys voted by Parliament.

2423. Have there been instances where the local authorities have expended the moneys voted for road works? Yes, there have been such cases where the local bodies have provided the moneys for roads, but that was under a past system.

2424. But under the present system have there been any cases where main roads have been constructed by the local authorities? Not since the passing of the present Act.

2425. Then, the Government undertake the construction of all roads? Yes; as nearly as I can recollect they have under them about seven hundred miles of roads. Then the branches or cross and by roads are under the Road Trusts.

2426. Do you think the description of these works as given by the Government, taken in connection with the specifications supplied for the information of contractors, is satisfactory, and permits the best results to be obtained? I believe that the descriptions are ample; more than that, they are sometimes too full, and almost frighten new contractors. Of course the knowing ones know that a great deal that is in the conditions don't mean anything; but others don't know that, not having the experience. Very often an honest contractor won't look at the work, owing to the description given; and then those who understand the system come and tender low, do the work, and slum it.

2427. We have been told the descriptions were so imperfect it was impossible for contractors who do not know the locality to tender for works? In some instances. The Boat Harbour works is a case in point. No one knew what was the meaning of it.

2428. Then, do you not think that the specifications should be submitted to the Chairmen of the local bodies for revision? The specification should show all the earthworks in detail, the cuttings on the roads, and so on,—in fact, a proper survey. Then, when the specification came down, there would be nothing to do but to go out and show the works required.

2429. *To Mr. Stanley.*—Do you mean that no section now accompanies the specification? No, none.

2430. *By the Chairman.*—Do you think we could obtain a specification and plans that would fairly represent a sample of ordinary procedure? Yes, you had better get one, and judge for yourselves. You can easily obtain that.

2431. Then, in reference to the particular works in your district to which you refer, do you think any failure of professional knowledge was shown? Well, you had better take a drive to Table Cape, and see for yourself.

2432. Is the road not graded to levels? Yes; but it goes round about where it might be straight: where they might go direct, they go round corners.

2433. Do they give any sufficient excuse for this? None at all.

2434. Do they save money? No, they expend.

2435. Is there any local difficulty? None in connection with these works that I am aware of. There might have been some land compensation asked for, about £2 or £3 an acre; but they might have saved on the specification far more than the price of the land. Such a consideration is not worth thinking about. They should always endeavour to get the best line of road, because it is a thing settled for ever.

2436. Who is responsible—the officers of the Department? Yes, of the Department.

2437. Not the political head? Not at all; it has been all pointed out to the political head.

2438. To come back to this question, do you not think, if the advice of the local bodies was taken, the difficulty to which you refer might be obviated? Yes, to a certain extent.

2439. Do you not think the members of the road boards should be consulted as to the general direction and style of the works? That would be a good thing; and also as to the plans and specifications.

2440. And lead to economy? Yes, I think a great deal of money might be saved.

2441. Is there any other case of a road that you think the Commissioners should see? Yes, you should see actually, and judge for yourselves.

2442. But can you point out any particular case? It is almost everywhere the same: I would mention the road up to Flowerdale, three or four miles beyond Table Cape. They have a hill there for a mile that could have been avoided.

2443. What is there to see there? The road is not in the proper place. It goes up hill and down again without any reason.

2444. Is there any other place? I have really seen so much of it that I don't care specially to draw attention to these cases. You will see for yourself. The road to Flowerdale has practically been made

twice. The Commissioners could hardly make a general recommendation unless they could see the works themselves.

2445. Can you indicate the places where we could examine with advantage? Yes, I could do so. Some of the roads have been almost built twice.

2446. How was that? Because rubbish was put on the road, shale and slate, and as soon as traffic was put on the road, under its action and that of the atmosphere it disintegrated and became mud.

2447. Whose fault was that? The fault of the professional officers of the department.

2448. Could you name the officer? No, I am not going to do that: it is for the head of the department to do that.

2449. But if there is a notorious case of this kind, do you not think the Commissioners should know who is to blame? Well, they won't know from me. I am not going to place myself in that position.

2450. Is there any information you wish to give the Commissioners in reference to the Mersey line? Yes, I might give you information on some points.

2451. It has been pointed out to us that one of the reasons why the cost of construction of the line from Deloraine to Formby was exceeded, was the fact that it deviated from the original survey. The line at first surveyed went by the west bank of the river, and avoided two bridges, but certain parliamentary and political pressure was brought to bear on the department which led to the line going by the present route and necessitated the construction of those two bridges? I doubt if the line on the west bank of the river was ever surveyed.

2452. Well, we are told there were three alternative routes, one on the west bank of the river, one by Stott's Plains, and one by Latrobe; the one by the west bank going as far as Horsehead Creek. How long is it since this line was projected? The line has been surveyed I don't know how many times, but I don't think they ever made a survey of the line by the west bank of the river. I should like to see it if it was.

2453. Were there any special circumstances which rendered it desirable that the line should go through the town of Latrobe? From beginning to end it was intended to go through the town of Latrobe. The department recommended that the line should go down, and that would have made a great saving. It is for the engineers to say if the estimates were affected by going down the west bank, or by Latrobe, as by the original estimate.

2454. In point of fact, had the Mersey and Deloraine Tramway Company possession of, and had they constructed any of the works? Yes, certainly. The line was originally constructed by the company. That was one reason which made the Government of the day construct the railway through Latrobe. The original tramway was built from Latrobe, the station buildings were in Latrobe, the locomotive sheds and all. That tramway ran 16½ miles from Latrobe to Coiler's Creek. That portion of the line was completed and working years and years before the Government thought of the completion of the line between Deloraine and Formby. Understanding that, I think the cuttings and all the principal works remain as they were before. The cuttings all the way from Deloraine to Whiteford Hills, and for 13 miles on the Latrobe side, were new.

2455. Had the tramway company acquired the freehold of the land on the present route? Yes, the freehold of the land was granted to it.

2456. Then, if the railway had gone on the west side of the river, the Government would have had to acquire land? Yes, certainly.

2457. Can you give an idea of the quantity of land likely to be required? No, I cannot.

2458. Would the cost of the present works exceed the cost of the land? Considerably. They have had to pay more than it would cost from Latrobe to where it would form a junction with the other line.

2459. Would the works be liable to be flooded? Yes, but that could be avoided by keeping on the table land; but then by keeping there you would destroy the traffic. If you are to accommodate Latrobe at all you would have to keep down on the flat.

2460. Then, if you had followed the line on the high ground, how far would you have been away from the town? From half to three-quarters of a mile.

2461. Would that have been acceptable to the inhabitants? Certainly not.

2461A. Would they not have had to bring pressure to bear on the Government to get this line? There was no pressure brought to bear on the Government, because the line was constructed originally by the Tramway Company, and the Government bought it. The Government never would have bought the line there if it had not been for the land. It was actually given to the company, and the line was originally built by the company. The company came to grief after having formed the railway to Kimberley's Ford. It was built up to Coiler's Creek. Then the Government afterwards bought the whole line from the company, with all the buildings, two locomotive engines, and everything, for £5000 or £6000. That was the 17 miles of railway and works. The line and land had, in fact, fallen into the hands of the late Messrs. John Foster and Askin Morrison, and they received some 21,000 acres of land as a bonus for the work constructed. In order to make their property more valuable, they sold the whole of the line, which was said to have cost £50,000, for £5000 or £6000. It was on that understanding that we built the line to Latrobe into the town. There were locomotives on the line then, and station buildings into Latrobe. Up to that point the line had not to be built—practically speaking there was only 20 miles of forming and making to be done. Of course they had to rebuild some parts and improve others, excepting that the whole of the works were completed for them excepting the bridge over the Mersey.

2462. *To Mr. Stanley.*—Was there a bridge over the Mersey built by the Tram Company? Yes, and over Kimberley's Ford too.

2462A. Could those bridges not be utilised by the present railway? No, they were not fit; they had to build a new bridge. I believe the piles of the old bridges were sound and good, but the trussing of the bridges was not good.

2463. What was the extra length incurred by taking the line through Latrobe? About half a mile; you will see from the plans.

2464. And you state that the cost of the line on the western side would be nearly as much as the present line? Yes; the cost of the line on the western side would be about equal to the cost of the short piece of line that had to be made in order to get to Latrobe.

2465. Then you think the cost of the bridge should be credited to the Department in considering the extra cost? Yes; I think the Department is entitled to reckon the cost of the two bridges and the excess in carrying the line that way, provided they intended to carry the western line. The idea of this line costing £40,000 more than the estimate, say £160,000, is absurd. There is a screw loose somewhere.

2466. You state that the Tramway Company had already provided the land necessary for station buildings at Latrobe? Yes.

2467. Then the Department, I presume, had to purchase land beyond that to the junction of the line on the west side? Yes; with the exception of a small portion of Government land which the line passes through, near the police station.

2468. How do you think the value of the land in question would compare with that of the land on the west side? The value of what would be necessary. Well, the land on the west side is not so much value as the land in Gilbert-street. The land up to Gilbert-street had already been purchased by the Company, but the land from Gilbert-street Station to the crossing, the whole way across, that had to be purchased.

2469. Do you know of any other material deviations in the line that would increase the cost to any extent? No, I do not. The deviation was made with a view to cheapen the construction of the line, that is, the deviation at Horsehead Creek. I thought it a mistake at the time, and I think so still.

2470. Do you know whether many additional stations had to be provided beyond those originally contemplated? I don't think so. There are no stations that would cost anything much. There might be one or two more than were contemplated, but they did not mean much. The purchase of ground and the construction and alterations of the station at Deloraine cost a great deal. There was a lot of money thrown away.

2471. In what direction? In the direction of making the stations suitable for the accommodation of two services, viz., the broad and narrow gauge. Deloraine is an intermediate station, and they want to make it a terminal station. If it had been taken as an intermediate station very little expense would have been needed,—but it is not so. Another thing I have taken exception to was the laying of the third rail, which was a useless expense. My contention was that it would have been far better to narrow the gauge at once, and not have a mixed system. I believe the country will lose by it.

2472. It has been explained to us that the object of that was to use up the broad gauge stock? For what benefit? It has been running now for sixteen years, and the life of the engines has now nearly come to an end. The cost of the third rail will be about £20,000.

2473. Mr. Batchelor informed us that as soon as he could make the alterations the broad gauge stock would be available for the narrow gauge? Would it not be better to put it all in a heap and put a fire-stick into it?—it is ridiculous when you come to calculate it. Why, the cost of the third rail would equip the whole of the line with new narrow gauge stock suitable to it.

2474. Referring again to the question of the use of timber on road bridges, don't you think if the piles were properly sheathed, as is done in other places, that it would make a permanent and durable structure? You mean with Muntz metal, yes; but where you want to go to that expense you had better use concrete or stone. In a river like the Leven you might have it, but there you have a great rise and fall of tide. I believe the bridge should have been put up at the Leven with stone piers and iron girders, that would have cost very little more than the bridge has cost now. About the Leven, the engineers submitted a plan to Parliament with such piers and with trestles of wood to carry up the pier higher. The estimate for that was £500 less than it has cost to put in the wooden ones. How do you get over that?

2475. Do you think that estimate was a sufficient one? It would be the fault of the department if it was not. They submitted the plans, and they were stone piers. Why they adopted piles I don't know, for when the old bridge piers were drawn they were found to be all cut off with the worms. The new bridge was £500 more than the cost of the bridge, plans of which were submitted to Parliament, with stone piers.

2476. What is the nature of the bed of the river? Shingle and sand. There is nothing objectionable in that.

2477. Then cast iron screw piles would have done? Perfectly, and the earthwork could be carried up much higher. You could save a great deal in that way.

2478. Then screw piles would have been cheaper? Yes, I should think they would. I don't think there would be much difficulty with foundations in the Leven, because there is not 20 feet depth of water. I should do without any coffer dams, and should recommend bridges of that kind.

2479. Then, in most cases where the foundations are suitable, screw piles are much more economical than masonry work? Yes, I think iron screw piles would answer admirably, especially where you have the worm.

2480. In respect to the maintenance of main roads, I think you said that the road boards acted as boards of advice? Yes, the road trusts are, as a rule, appointed by the boards to carry out repairs to the main roads; that is, the trusts elected by the people here to deal with the cross roads. As a rule these funds are expended by them, and the Government employ them for the purpose of carrying out the maintenance of main roads, the inspector for the Government superintending the maintenance.

2481. Are no surveys made of these main roads? As a rule there are.

2482. Was there a survey made of these roads you speak of between here and Table Cape? I think so, but it is quite a study to look at the way these surveys are made out.

2483. Do you know if a section is made at the time these surveys are carried out? I do not think so. I never saw plans with sections.

2484. Then after the survey of a road is made, I suppose the grades are merely obtained by rule of thumb? Yes, by rule of thumb. In the first instance, it was the rule that grades were not to be less than three or four chains. The difficulty in many cases was to get a grade of that length, and in consequence they went to the trouble of trying to make them.

2485. Do you not think the extra cost of making a proper survey with a section of these roads would be saved in the long run? Yes, saved over and over again.

2486. Do you know how the surveyors are paid,—are they on the staff or do they work by contract? Some by contract, and some by day work on estimate.

2487. Do you think the contract system the best? No, I do not think the contract system good. In surveying the roads you cannot be too particular in getting the best route—that the people themselves can recommend. I have been in the bush myself for months trying to find a line, and then have not got the best road. The bush is so dense in many places you cannot see the contour of the road at all. If a man goes wrong it may be excusable; but I have no sympathy at all with an engineer who makes mistakes in carrying a road along an open coast like this.

2488. *By Mr Lawder.*—When does your financial year end? It did end on 31st December, but I think we altered it last year to March. It has been from January to December.

2489. But do you not consider it would be advisable to make out the allotments for expenditure in the succeeding years so that they should be known before the beginning of the new financial year? Yes, our Parliament meets as a rule in July, and Ministers are supposed to give a *résumé* of expenditure to June. That was under the old arrangement, when the year expired on the 31st December. They showed their plans up to 31st December, and also a *résumé* showing how the present year works up to date. We are now going to alter the financial year to close on the 31st March, so as to bring the actual accounts up closer to the meeting of Parliament.

2490. But do you not think it would be desirable for the Public Works Department to be aware of the grants voted for expenditure during the coming financial year within the present year, so as to give them plenty of time to arrange for the coming twelve months' work? Yes; there can be no difficulty as far as the maintenance of roads is concerned, because that is a charge which is going on from year to year. They cannot be in ignorance of what is wanted, and there should be no delay in getting on with the estimates. They know that Parliament will pass the works. The other votes being scheduled clearly in Acts of Parliament, cannot lapse. The department has plenty of time to do these works in the very best and quickest way.

2491. There would be no hindrance. Nothing to prevent them going on on account of votes lapsing? No; the votes don't lapse. We have roads here that should have been made in the summer, and now they are sending plans and advertising for tenders in the beginning of winter.

2492. In cases where the roads were made, as you say, twice over, was that the contractor's fault? No, certainly not.

2493. Was he paid twice for the work? I don't know. In the case of the Flowerdale Road they have been taking the apex up the hills, and then cutting it down again.

2494. In that case was the contractor paid twice over? Yes, he would virtually be paid twice over.

2495. Can you give the dates of the construction of these roads? Well, I cannot exactly. I suppose three or four years since.

2496. Does anyone usually inspect the alignment of new roads? Yes; the Government has one or two inspectors.

2497. Does not the inspector align the roads himself? No; I think it is done by the superintending officer, never by the inspector.

2498. Then there is no one to supervise the alignment but the inspector of the district and the superintending officer? Yes, there is the Chief Inspector of Roads, Mr. Duffy.

2499. Does he inspect the roads,—is it a part of his duty? I do not think he does inspect the whole, but it is his duty.

2500. I think you mentioned in reference to the loop-line on the railway at Latrobe, on the Mersey, that the Department should be credited with the building of the two bridges? Yes, decidedly; it would be entitled to an excess on that account, and also as far as the difference in value of the land was concerned. (Witness here explained the difference in the routes and cost by reference to the plan.) I merely wish to put the thing before you. As to what the Department can claim as excess, it is a matter of calculation simply.

2501. Do you think it would have done to have constructed the line on the west side, with a branch into Latrobe? No, I do not. I don't like branches, because in working they are very expensive.

2502. Would it not have saved a bridge there? Yes, but look at the cost of running up and down for the mere sake of a local train or two.

2503. It would perhaps have saved heavy outlay? Well, what is the cost of a bridge—about £5000 or £6000.

2504. Can you give us an idea of the items which the Department is fairly entitled to claim in addition to the two bridges? I would give the Department the benefit of the doubt in reference to accepting the western route. There is no excess to which they are entitled excepting that entailed by coming down to Latrobe. The deviation at Horsehead Creek was really a saving, and they are not entitled to anything on that. That deviation was an unfortunate one. The original survey was straight across the creek, and the line should have gone that way.

2505. Then you don't consider they are entitled to any other items on account of or affecting the excesses? No, certainly not. Besides, instead of buying land for the station buildings at Formby they

have destroyed the esplanade, not taking sufficient land for the station at all. Now they have concluded to take land for the Formby station, the people have bought the land up.

2506. Do you consider the public have had fair value for their money in the construction of this line? No, I do not. I think the line has been a very expensive one.

2507. Has the money been extravagantly disposed of in too expensive works? No, they are not too expensive; the works are as cheap as they could be built.

2508. Well, do you think the money has been extravagantly expended and thrown away? Well, so much work has been done without the necessary science and supervision that the money must in some way have been lost.

2509. Wasted, in fact? Yes. I think the line should have been built for the estimate.

2510. Can you give any idea, as far as you can think, as to the way in which the waste has been incurred? I can't tell you. I am only estimating the cost of the line as compared with several others. There is only 37 miles of railway line, and on 17 miles of that all the work except the upper part of the permanent way had been done before. That line has cost £160,000 or £170,000. I don't know what to say about it, but I think the line should have been made for £4000 a mile,—from £4000 to £5000 a mile any way.

2511. Do you happen to know what was the estimated cost of the Leven bridge with stone piers? From £4000 to £4500.

2512. What has it cost now? About £5000. You will get the exact figures from the estimates for the year. It is scheduled to cost £500 more than the scheduled price—more than the money voted by Parliament. The stone piers were abandoned and piles substituted in the plan brought before Parliament last year.

MR. WILLIAM REID BELL, *examined.*

2513. *By the Chairman.*—What is your name? William Reid Bell.

2514. You are a Civil Engineer? Yes, a Civil Engineer and an Associate Member of the Institution of Civil Engineers.

2515. What branch of the public service are you engaged in? I am now carrying out the works of the breakwaters here at Emu Bay and also at Wynyard.

2516. Under what Department? Under the Public Works Department.

2517. That is, the roads and bridges branch? No, it is the Public Works Department. Mr. Fincham is my chief.

2518. I believe that before you came to this Colony you had experience in New Zealand? Yes, for three and a-half years. I was brought up in connection with works on the River Weaver, in Cheshire, and on the Clyde.

2519. What works have you carried out in the Colony? This is the first work of construction I have been connected with in Tasmania, but was employed three years ago on the Parliamentary surveys for railways here.

2520. In the construction of works by public tender what plans do you follow? The plans I am acting on here were from Mr. Napier Bell's designs. I am working on the lines of his report.

2521. Suppose the Government authorises you to carry out the spirit of that report, what plan do you adopt? In this work tenders were called for about a year before I was called in. They were all too high, and the Engineer-in-Chief decided to carry the work out by day labour, under the supervision of the Department.

2522. Was that a proper way, and is it satisfactory? Yes, the prospect is good. I am getting out tenders for necessary machinery that is not started yet.

2523. Is it, then, proposed to carry out the extension by day work? Yes.

2524. Then the question of preparing these works for tender is not considered? No.

2525. After you determine on a plan of proceeding, do you communicate with the Department and obtain the sanction of the chief officer for the portion you intend to construct? Yes; and then he gives me authority to employ the men, and either to purchase the necessary machinery or requisition for it through him.

2526. Of course Mr. Napier Bell in making his plans and estimates would make such an estimate as a consulting engineer would make, leaving you to carry the details out? He gave detailed plans.

2527. How would his estimate be considered by Parliament—would it be generally or particularly adopted? Regarding this work I can hardly tell you. He would have got his information for his estimates from Mr. Fincham, or he would have put his own prices on the work.

2528. Suppose you intend to extend the pier a hundred yards, and you made the cost out at £1000, how would you satisfy the department that it was a reasonable estimate? I should give my prices, or I should get an estimate from elsewhere, or by comparison with other works.

2529. Suppose the work you estimated at £1000 could not be done, the amount being insufficient, how would you go on with the work? The work would then be at a standstill until I could consult with the Engineer-in-Chief. I am not allowed to exceed the votes.

2530. What is your opinion about that plan of procedure—is it a desirable one? I think it is not, as it leaves necessary works incomplete, because when an estimate is made for a certain work Parliament is apt to cut it down. I think the works should be carried out upon the Engineer's estimate or not undertaken at all.

2531. That would throw a great responsibility on the engineer—is that desirable? Certainly. I went very carefully into the estimates, because I knew that Mr. Fincham was depending on me, and Mr. Napier Bell was the same—he was depending on me too.

2532. What is the system of construction? Concrete blocks set with a crane.

2533. Is there any filling in or hearting? No, it is a solid pier, no heart.

2534. You do not know anything about the way the Government have advertised for tenders for works? No, I don't know. I am carrying out the works at Wynyard. There was £2000 voted by Parliament for that work.

2535. It has been pointed out to us that in the case of a local bridge tenders are advertised for, to be deposited on the 17th March, and that plans can now be seen at Emu Bay and Table Cape, but neither the specifications nor the plans are here yet. Can you say if the Department is always as retrograde as that? No, I can't say at all.

2536. As compared with New Zealand, or the system adopted in the other Colonies, is your Government particular in getting plans and specifications of works exhibited in due time? Well, they are usually not so far behind as that. There are now and then cases in which delays may occur.

2537. It is now the 15th of the month, and tenders are advertised to be returnable on the 17th. It is surely impossible for local tenderers to send in their tenders in time without seeing the plans? Yes; if that is the custom, most certainly two days are not sufficient.

2538. The contractors should have ample time? Yes, they should have ample time.

2539. Is there any information you can give that would render the working of the Department more perfect and economical? I don't know that I could give such information. Estimates seem to me to be cut down in Parliament, and the works not carried out fully according to intention.

2540. You would, then, recommend the Department to adhere to the estimates of its officers when sent in, and resist any reduction of the votes in Parliament as far as it possibly could? Yes, the officers should be held responsible for the estimates.

2541. In reference to your work here, how far do you propose to extend the pier? For an additional 200 feet.

2542. What is its length now? About 160 feet.

2543. What depth of water have you now? Five feet at low water.

2544. And what will it be at the end of the extension? Fifteen feet.

2545. Will that allow steamers like the *Balmain* and *Australia* to come in and berth? Yes.

2546. It has been pointed out to us that a mistake has been made in the direction of the present jetty; is that so? It is so. Mr. Jones, the Harbour Master, will be able to tell you about it. It was before my time.

2547. How are you treating that matter? I am building a wall outside of it,—filling up a T, in fact.

2548. Are there any further remarks you wish to make? I think not. I may state that, as regards the work at Table Cape, there was a vote of £1000 at first, and then last session another £1000. The Marine Board had no officers of its own to carry out the work, and arranged with the Public Works Department to do it, and the Department put down a tramroad and extended the work. Some of the Wardens then wished for tenders to be called, and I did so, under instructions from the head office.

2549. Was that work similar to this? No, it is a rubble mound. It is merely to improve the entrance to the river for the local shipping.

2550. You have charge of the work? Yes, I have charge.

2551. Anything more you wish to say? No. There are often complaints about the Public Works Department as to the work done under it being more costly than when done by contractors. I can only say the work carried out at the Table Cape breakwater by day work was within the contractors' prices. Some of the tenders sent in were three times as much as the work cost by day labour before the contract was let.

2552. How will the shipping obtain shelter if they land goods there? That is a river, and the wharves are in the river, and protected from the sea on the north. The breakwater is on the west side of the river, ships landing their goods at the jetties in the river. The Table Cape Marine Board desires that more money should be spent there. That is a case where, if the harbour is worth improving, it should be done at once, and the works carried out as a whole.

2553. Can you put your remarks in writing on that subject? I can do so.

2554. You think it ought not to be necessary to ask for a larger vote? I should rather see the work kept back till Parliament should vote a sufficient sum. It is much better than expending small votes. If they cannot see their way to do the work at once, they should wait till they have money enough.

2555. *By Mr. Lawder.*—What is your system of carrying out day work? I have foremen under me, and I make them responsible for the conduct of the men to me.

2556. Do they keep a tally? Oh, yes, they keep the time-book, and I check it and see that it is right. If a man is lazy I make them accountable for that man.

2557. Then, in what way do you return your labour employed to the Department? I send in my pay-sheet to the Department at the end of the month. I get orders from the men in the meantime to have their

money paid to me ; then I keep a special bank account, and issue cheques to the men on that account. I also keep books showing the detailed cost of the work.

2558. You pay the men personally? Yes.

2559. You say you send in a return to the Department? The pay-sheets are sent in on the 1st of each month, and then the men come to me for their money.

2560. Suppose a man is leaving, and asks your aid? I had a case of that kind at Table Cape. Two men had gone from Table Cape harvesting, and I had paid them. I got the money afterwards.

2561. Suppose you had got their names on the pay sheet, and an order to receive their money, and they had gone away, you could not have paid them their money? Of course I could not have done so.

2562. Would that not be an anomalous position for you to be placed in? It would. The Public Works in Hobart give me every facility for paying the men, but there are difficulties in connection with the Audit Department.

2563. Then, what I suppose might happen. You have a certain amount of money in your hands not paid away, and yet the men's receipts for that money are in the Treasury as having received the money? Yes, I could keep the whole of it, and yet the documents would apparently show that the men had received their wages.

2564. How do you mean to manufacture your concrete blocks? describe your system? The stone will be spalled in the quarry, and then lifted up to the stone-crushers. I shall have mechanical means then for moving the stone crushed; and, when it is guaged, it will fall into the mixers, through a hopper, and from the mixers will be carried in buckets to the block-boxes, and then a 25-ton crane will come along and take the blocks up when set.

2565. What is the quality of stone you intend using? Clean basalt.

2566. What size do you break it into? It must go through a $2\frac{1}{2}$ inch mesh.

2567. You don't use any stone larger? Yes; I intend to use rubble about a cubic foot or so, as specified in the original specification.

2568. There is a certain proportion to which you work? No; I follow Storey in his work on the Dublin harbour works, and other authorities.

2570. What is the shape of the blocks? Rectangular, 12ft. 6in. \times 5ft. square.

2571. Placed edgeways in regard to the length? Yes.

2572. With flush faces? Yes, with plumb faces to the sea.

2573. What batter do you give? About 1 in 8, in the direction of the length of the jetty.

2574. How are your cranes worked? There will be a travelling crane with a jib. This comes along the road that is laid down.

2575. Do you build a temporary road in the direction of the pier, or place your rails on the top of the blocks as they are built up? I put the road on the top of the blocks.

2576. How long do you allow your blocks to set? About three days, but not less. In a paper on the Jersey harbour works, it is stated that three days more are sufficient to let them harden before stacking or lifting them.

2577. What is the proportion of cement used? About 1 in 8,—that is, as regards the mortar, 1 of cement to $2\frac{1}{2}$ of sand.

2578. Is it salt-water sand? It will be sand that comes from the mouth of the River Emu. It is a salt-water sand, quite clean. It is of a coarse gravelly nature, the only sand we can get here free from shells.

2579. Then, that per-centage is $2\frac{1}{2}$ of beach sand and $4\frac{1}{2}$ of rock? Yes, that is the proper proportion, according to the experiments I have made.

2580. You say you have used a certain per-centage of rubble? Yes, say about 2 of rubble to 3 of concrete.

2581. Do you intend to make any tests of the cement mortar used? No, we are satisfied.

2582. Has it been tested? Yes, samples were tested in Hobart, I understand, and were satisfactory.

2583. Has it been tested in block? No.

2584. Don't you think it desirable to test it in the first instance, and also to test the blocks as placed in position? No; the only test you could make would be by breaking girders or an arch of concrete. You could not break small briquettes.

2585. You could make a breaking test of this kind,—don't you think it advisable to test the blocks as you go on? Probably so, but I have no means of testing it in this way; I have no appliances.

2586. You could make an appliance to do it? Yes, and I would like to do that, but I can't for want of funds. I can only send the briquettes to Hobart to be tested.

2587. You could as easily arrange a test machine here with timber and weights? Yes, but I should be very chary of using this for any general calculations of what I could make here. The Government ought to have a proper and satisfactory arrangement for testing these blocks on the works. In my opinion Government ought to provide special testing apparatus, not for small works, but for all large works that will have to be made. The question of the quality of Portland cement is a very intricate one, and it is necessary that testing machinery should be kept at all important works during the progress of the works.

2588. You mentioned the granting of allotments for work at Table Cape, £1000 one year, and £1000 the following year, and the Chairman put the question as to loss by your having to wait for want of funds, owing to the way in which the grants were given? Yes, that system is very expensive.

Happily, in the case of Table Cape, Parliament voted the second £1000 before the first £1000 was entirely expended. We shall now want to continue the work, and cannot do so until Parliament meets again. There will be considerable loss from deterioration of plant; and, besides, it is always expensive to start such works again.

2589. Do I understand you that Parliament hinders your carrying on the work? They may do so.

2590. You have arranged for carrying the work to a certain distance? No, not to a distance, but to the extent of a certain sum of money.

2591. That is, the cost of the work governs the distance you can go? Yes.

2592. Then you do not see any way of keeping on your labour in the expectation of any further grant from Parliament when it meets: it may or may not vote the money, and you don't see your way to keep on your establishment? No.

2593. And you say there is great loss in carrying on your works where the money is not voted to complete them? Yes, there is a great amount of loss. I have seen it before in other colonies, through work being stopped when the vote came to an end.

2594. Then of course the Department would stop you? Yes; the Resident Engineer would send notice to the Engineer-in-Chief's office that there was no more money available.

2596. Then do they send you any notice? Yes. I would send and tell them when the money is nearly run out, and they tell me to stop.

2597. Then you are responsible for stopping the work? They would reprimand me if I allowed the vote to be exceeded; so I have to let them know when the money is out, and stop.

2598. What would happen in such a case as your exceeding the grant through misadventure,—suppose you exceeded it say in dealing with half a month? I don't know. If it were exceeded in this way I suppose the Minister would ask why it was so exceeded, and on my representations would have to appeal to Parliament for an extra and supplementary grant.

2599. Would it be necessary to give your work people any amount of notice? Yes; the labourers work by the day, and, in the case of a contractor, I would have to give him notice. I would like to say that here public works seem to be carried out, not on the principle of doing a certain amount of required work, but the object seems to be to spend a certain amount of money. It is not a question of making a certain extent of breakwater, but it is a question of spending a certain amount which has been placed on the estimates. The Engineer is merely responsible that he gets as much as he can for the money.

2600. Were any specifications given you? Yes, by Mr. Fincham.

2601. Has he been down often? He has been down here once, the works not yet being in full progress. He consults, when he requires to do so, with Mr. Napier Bell, who is Consulting Engineer to the Tasmanian Government in connection with these works.

2602. From whom do you receive your instructions? From Mr. Fincham.

2603. From Mr. Napier Bell, through Mr. Fincham? No, from Mr. Fincham direct. I correspond with Mr. Napier Bell informally, and sometimes write to him for instruction on particular matters, and he gives it me.

2604. *By the Chairman.*—Referring to the question Mr. Lawder put to you as to your responsibility for money, does the Government require any fidelity guarantee? No, not here. I believe they do in New South Wales in some cases.

ADDENDUM.—With regard to Question 2599, I wish my meaning to be clearly expressed, that in Parliament, where a necessary work is proposed, if the vote for the whole work is not approved, an arbitrary sum is frequently placed on the Estimates to satisfy the district for the time being, without reference to whether full value can be got for the money, and the Public Works Department has to make the most of this. This, of course, is an evil possibly inseparable from the system of Government; but the Department is constantly saddled with the blame of it where works are left unfinished and unproductive for want of funds to complete them out of hand.

MR. WILLIAM JONES, *examined.*

2605. *By the Chairman.*—What is your name? William Jones.

2606. What are you? I am a Farmer, and Chairman of the Road Trust of Emu Bay.

2607. What public works have you under your jurisdiction? The main and by roads and the bridges.

2608. That is, the roads and bridges that are completed by the Government and handed over to you for maintenance? Yes, Sir.

2609. In the construction of main road works is it usual for Government to consult the local trusts before deciding on any particular work? I don't know.

2610. What has been your experience? I have not had so much to do with the main roads as with the by roads. The main roads are really under the District Inspector. He comes and requires to see the members of the board and consults them as to the best part of the road to be done, not as to the way in which it should be done.

2611. Then he does not consult the board as to the character and quality of the work, but as to the places where the roads are required first? Yes.

2612. Is that the best way of doing it? No; I think the members of the boards should have a voice in the construction as well.

2613. Don't you think if the works were submitted to the members of the boards for discussion in council in the first instance, that greater economy might be secured? Yes, by far; I am positive of it.

2614. Can you instance any works where improvements might have been made if the works had been carried on under the boards? Yes, where there is kerbing on our works; we have protested all through. They have the kerbing all through the country, and we have offered to make the roads four feet wider all through the country.

2615. Do you mean the pitching? No, the kerbing. I have represented the matter, and written letters to say we would make the roads three or four feet wider if they would do away with the kerbing.

2616. It is pointed out to us that when works are to be let by tender in the districts, plans and specifications are generally advertised to be seen at the local post and telegraph offices. We have a case here where plans are advertised to be seen at the Post Offices at Emu Bay, Table Cape, on the 17th March, and we have it in evidence that these plans and specifications are not lodged there at present. Is that a desirable way of proceeding? No.

2617. Is it an exception, do you think? Well, I have heard of such cases before, and I have heard complaints about it, but not often.

2618. Is it possible that any local contractor could tender for the works under such a system? No.

2619. Would not that practice tend to drive the work into a particular channel? Decidedly; a man at Table Cape has a chance of seeing the work and tendering for it, while the man at Emu Bay cannot do so. He has no chance at all when the time is so short.

2620. We have been told that the system of drawing the specifications is faulty: can you give us any opinion on that point? No, Sir, I don't see the specifications.

2621. Has the matter ever been brought under the notice of your Board as to the specifications and the description they give of the work being insufficient? No, we have had no complaint of that kind.

2622. It is said that the work is described in the specifications so loosely that the local contractor cannot tender, and that the man who has had experience in such works is in a better position than the local tenderer? He might be.

2623. In reference to the making out of specifications for roads, has due care been shown, or otherwise? No; quite the other way.

2624. Can you instance cases where, in your opinion, care has not been shown? Yes, the deep cutting here, and this side of the deep cutting coming from the river Blythe. The road originally went round the saddle. We offered to make it for half the money, and to do it at a better grade, but Mr. Creswell went the other way.

2625. He made the road, then, to his own design? Yes, sir. We offered to do it, and went to the Lands and Works Office about it. It is there to be seen now.

2626. What remedy have you in such cases? None at all.

2627. You have your local Member? Of course; but I could mention instances to show that it is difficult to obtain a remedy.

2628. Then, as far as the main roads are concerned, you are helpless? Yes.

2629. Then come to the by-roads: what is the practice of the department? They always consult the road trustees. As a rule they send down a form to the trustees to sign, promising to maintain the roads after they are made if they have Government supervision of the roads while in course of construction. Now, in reference to the by-roads, there is a road on the eastern side of the river Cam. There was a road laid out there by the inspector against which I protested at the time, and took the inspector through and showed him a better design for the work; but he took no notice. I went to the Lands and Works Office about the matter, but no notice was taken of it. The road was made at a grade of 1 in 5, when we showed it would be quite easy to make it on a grade of 1 in 30. I happened one day to go to our Member, and I represented the matter to him. He wrote to the Minister of Lands and Works, and he sent Mr. Duffy to inspect the road. Mr. Duffy stopped the work immediately, and ordered the road to be laid out on a better grade. The road was all arranged for, and the owner of the ground through which it would pass made no objection, but the road is not made yet.

2630. Do you think the influence of the Inspector has had anything to do with preventing the road being made? I can't say; I can make nothing else out of it. The Government Inspector was going on all right before I showed him where a better line of road could be got.

2631. How long is this since? I can't say; it was before the last Parliament met. We have a road less now, and the man has not been paid for compensation for his land on the road. The people now can't either get the old road or the new road.

2632. Are the people suffering inconvenience? Yes, sir.

2633. With reference to the construction of bridges and larger works of the district, have they been constructed in an efficient way? Yes, sir, as far as I know.

2634. There is a bridge here, crossing the Emu Creek, where on the north-west abutment the piles are stated to be built above the level of the ground? No, no.

2635. It has been alleged here that the heads of the piles were not cut off below the ground level on the north-west abutment: is that the case? Yes, I believe it is so; I believe the ground is right enough there. I think the eddy of the river has swept away the ground and displays the piles.

2636. Are the foundations of the bridge as stable as they could be made? I think so, yes.

2637. *To Mr. Lanvder.*—You have a paper there referring to a deviation of a road: would you let us know what you have to say about it? Yes, it is the deviation of the Mooreville road. Money was placed on the estimates enough to go through with the deviation, but when Mr. Brown came in they reduced the vote; now we will be stuck half away. Mr. Smith, our Member, tried to get a sufficient amount to

complete the work but could not. Now when completed as far as the money will go, no one can look near it only from one side. It will take £700 or £800 to complete it.

2638. *By the Chairman.*—Then, I understand that according to the estimates recommended by the Public Works Department only a portion of the work was completed? Only half of what the Government took in hand to do. Now there is a long gully which no one can get through—you can't get at it till the work is done. There is a similar case on the Stowport Road. There is only half enough money voted to put it through, yet tenders will be called for, I dare say, in a few days. Then there is a new country road through it. Before that work is completed the winter will be on us again; and, when completed, it will not be so substantial as it would be otherwise.

2639. Have the plans of it been exhibited? Yes, I think they have.

2640. Anything else you wish to say? No. Generally I should like to see tenders called for at the proper time, so as to get the works done at the proper time of the year.

2641. When are they advertised for, as a rule? In the winter, when they can't get bottom for the roads, and cannot move material about. There was a complaint about that Hellyer road. It was first commenced as 10 feet wide—it is now 25 feet wide. They are now calling for tenders for a bridge, and there are no means at present to get to it. If they left it as it is now they could get to the bridge, but if they go calling for tenders now they will not be able to get at it.

2642. Then, instead of facilitating traffic, it will retard it? Most undoubtedly.

2643. *By Mr. Lawder.*—Is it difficult to get contractors to tender? Oh dear no, there are plenty of tenderers.

2644. Is there any greater difficulty at one season of the year than at others? Of course, at harvest time it is a little difficult to get tenders, but that is only for a short period.

2645. No difficulty at any other time? No; we can generally get tenders, but from February to March the contractors have a little difficulty in getting labour.

2646. Then if tenders were called for, say in September and October, it would facilitate construction and repairs? Oh yes, no doubt of it; any time towards the spring of the year.

2647. I think you mentioned that you had to sign a form when the inspector consults with you in reference to the alignment of roads: what is the nature of that form? Simply a promise that we will maintain the roads after they are constructed by the Government.

2648. Then you are not consulted in any other way—as to the direction of the roads, for instance? Yes, in the case of by-roads.

2649. Do you then have the alignments laid down according to your views? Yes, Sir. We have no complaint whatever to make as to the way in which the by-roads are carried out.

2650. You are certain that is the procedure? Yes, in our district.

2651. In other districts? I can't say about other districts.

2652. In reference to the particular road (the Mooreville Road) you complained about, and which you said was not made owing to shortness of funds, what have you heard from Mr. Duffy about the road? Nothing at all.

2653. And what time has elapsed? It was brought before Parliament last Session. It was about 8 or 9 months ago the question arose.

2654. Did you complain about the delay on the road through your Member; and which of the roads has been delayed? Both have been delayed.

2655. How long ago is it since the occurrence which caused the delay? About 7 or 8 months ago; that is, the Mooreville Road.

2656. When did Mr. Duffy inspect that road? About 9 months ago.

2657. And you have heard nothing from Mr. Duffy since? No. We have heard from the Inspector that they would have it done.

2658. And Mr. Duffy has taken no further action? No, none.

2659. Have you enquired what had taken place? Yes, through the Member for the district, Mr. Norton-Smith.

2660. And what was the result of the enquiry? The vote was thrown out of the House by Parliament.

2661. Then it required more money to make the road upon the better gradient? It would not have taken more money if they had not squandered the money on steep gradients.

2662. Then the faulty alignment took all the money voted? Yes.

2663. Then, as you say, the Road Board approves of the alignments. Did you go over this alignment? Yes.

2664. And did you approve of the steep grades? No, we wanted alteration.

2665. Had you objected in the first instance? Yes.

2666. In spite of that objection the road was made on that alignment? Yes.

2667. Can you quote any letters in which you objected to this alignment? No; we did it from the Road Trust.

2668. Have you not any copies of the letters? No, we don't keep copies of these documents. I went myself, and complained as the chairman of the Road Board.

2669. Then how could you prove that you had objected? I could only say so. I could do no more. The minutes of the Board would show that I had authority to complain about these works.

2670. Can you favour us with a copy of those minutes? Yes, I will endeavour to do so.

MR. JOHN THOMAS BROWN, *examined.*

2671. *By the Chairman.*—What is your name? John Thomas Brown.
2672. What are you? I am a Civil Engineer, and an Associate Member of the Institute of Civil Engineers.
2673. What is your present occupation? I am District Inspector of Roads for the Leven District.
2674. What extent of country does that district comprise? From the Forth Bridge on the east to Cocee Creek, about two miles west of Emu Bay, and running south to Waratah and beyond.
2675. How long have you been engaged in the Department? About five years.
2676. What important works have been constructed under your supervision? The bulk of the metalled roads and several new bridges, also several schools, court houses, and post office buildings.
2677. In reference to bridges, what particular bridges have you supervised? The Leven bridge, the Forth bridge (now in hand), bridges over Chasm Creek, River Wilmot, and a bridge at Waratah.
2678. Now, in providing information for the Department—when a work is contemplated what is the first duty of the Inspector? We are called upon during the time Parliament is sitting to recommend such provision as we think necessary for roads in the district; we then report on works which are considered the most important, and give that report to the Engineer of Roads and Bridges.
2679. In that do you give particulars or furnish any estimate? No, merely length of road and cost.
2680. What details do you give? No details beyond naming the locality and a lump sum for the probable cost of the road.
2681. Do you consult the local authorities? We do often consult each other, but hardly officially, as our report is private.
2682. Then you don't think it necessary to consult the authorities? I am not required to do so in that matter, and they report separately where they think it necessary.
2683. We will suppose an extreme case. Suppose that the Department should propose a particular work and the inhabitants should object, how would they proceed? In Parliament, through the member for the district; that is the only way. I never knew of a case in which the Government had constructed a work against the desire of the inhabitants of the district.
2684. Then after a public work has been proposed by you for construction, how is the money obtained—through Parliament? Yes, it is obtained through the Parliament.
2685. After which you call for tenders? Yes; we lay out the work, take the levels, prepare the specification, and sometimes send a longitudinal section for the information of the Public Works Department.
2686. In submitting the works for tender is it necessary to advertise in the district as well as in the head office? Yes, copies of the plans and specifications are lodged in the post offices in the district.
2687. It has been alleged that this practice is neglected, and we have been referred to a case in point—a bridge over the Hellyer River—for which tenders are returnable on 17th inst. We are informed that plans which should have been lodged here have not yet arrived? Indeed!
2688. Do you know if that is the case? No, I do not know about it; it is not in my district.
2689. I thought your district extended to Waratah? Yes; but the bridge to which you refer is on the Table Cape road, outside my district.
2690. Can you report as to the road improvements at Hamilton-on-Forth. Have the plans for that been lodged? That is also outside my district, on the east.
2691. Look at this advertised list and see if any of the roads named are in your district? The witness looked at the list and said: I am not aware that any required plans and specifications for works in my district have not been lodged at the post offices. Occasionally there has been neglect, but I have always called attention to it, and the matter has been remedied.
2692. Whose duty is it to see that the plans are sent to the advertised local offices? It is the duty of the head office.
2693. Does it not prevent local tenderers from tendering if the plans are delayed? It does, certainly.
2694. Should not the Department consult you as to the deposit of these plans? It would be better, certainly; but we have no offices, and no practical means of doing it.
2695. Suppose the case of a bridge in your district,—should not the plans be sent to you, in order that you might take them to the post office, and so know that the plans for the work were duly lodged? It would be better.
2696. How otherwise could you know whether the plans were there or not? Only from people anxious to tender who might inform me of it.
2697. Is not that a loose way of doing business—is it not a matter that the local officer of the Department should know? It is not a right system.
2698. Could it not be easily improved on? Certainly.
2699. Don't you think it would be better? As we have no offices, it would be giving us more work than we have to attend to now.
2700. How do you get your letters now? Through the post office.
2701. Could you not get the plans of works that way and lodge them? It could be done, undoubtedly.

2702. You see this case of the Hellyer River bridge. It is stated that the plans are not there at the present time, and the tenders are to be in on the 17th instant. If these plans were sent to you could you not have lodged them at a place there for the information of local contractors?—would that not be an improvement? It would be, no doubt.

2703. Don't you think the neglect to deposit the plans and specifications becomes a means of injury and involves a loss to the Government? Yes, it might cause an injury and loss in that way.

2704. You stated that you supervised the construction of the bridge at the Leven. Do you think that bridge a suitable one for the site and locality? I think so.

2705. Do you not think it would have been better to have had iron cylinders or cast-iron screw-piles, instead of timber? It would have been better, undoubtedly.

2706. It has been alleged that the marine worm, the *Teredo*, is very bad there? It is, I believe. The piles of the old bridge were completely perforated.

2707. That is a fact? Yes, that is a fact.

2708. Was any communication as to the condition of these piles as to their being badly perforated by the *Teredo* made to the Department? I don't know exactly. I remember the matter being discussed in the papers.

2709. Do you approve of the design of the new wooden bridge? Yes.

2710. Do you think the double stays are an advantage? Well, they are hardly of much use.

2711. As to the roadway, do you think it an advantage to load the road with a large amount of road metal, as has been described to us? Yes, it is better, I think, than the bare wooden floor.

2712. Do you not think it would be better to put a second floor, and when the top planking is worn out, to replace it? The spans of this bridge are only 40 feet each.

2713. What would be the weight of the metal on one span of the bridge? how many cubic yards? About 20 cubic yards.

2714. Well, that would weigh about 40 tons: is it desirable to load the floor of the bridge with this dead weight? I think the bridge is amply strong enough to carry it.

2715. Do you not think this metal will tend to the decay of the timber? No. Of course there is that additional strain on the bridge, but it protects it from the rainfall.

2716. Do you not think this metal tends to keep the timber constantly damp, and so liable to rot, and prevent the sun and air exercising a beneficial influence upon it? Oh, of course, the sun and air would get at the boards; but the sun has rather an evil influence on our timber than otherwise.

2717. In reference to the minor part of the bridge—I mean the overhanging road—do you know what the cost of these iron brackets were in this bridge? I do not. The iron brackets would be from about 150 to 160 lbs. There are 104 of them in this bridge.

2718. In round numbers, that is about seven tons of iron? Yes.

2719. What would be the worth of it? £25 per ton, about.

2720. Do you not think £175 would have been better spent by putting in an additional row of piles with a trussed superstructure? Yes, I think that would have been better. The money would have been better spent in construction than in ornament.

2721. Does not the road now show symptoms of sagging? Yes, the footway, slightly.

2722. Were you consulted about this bridge, or only engaged in carrying out the construction? No, I was not consulted in any sense. The sagging has only recently shown, and it is slight.

2723. Is there any plan you can suggest whereby the attacks of the marine worm might be prevented? No; we have tried tar, red lead, and arsenic at the Leven bridge.

2724. Do you think that is a suitable prevention? I have known it done in other cases.

2725. How long would the arsenic mixture last? As long as the tar remains on the timber.

2726. How long do you think that would be? I can hardly say from experience.

2727. Was ever the question considered as to the use of this road bridge in connection with the railway? Not officially.

2728. No proposal ever made, or any recommendation? Not officially.

2729. Do you approve or disapprove of the combination plan? I certainly approve of it.

2730. Do you think any inconvenience or danger to the public would arise from the combined use of the bridge, supposing that precautions were taken to protect the foot-passenger traffic when passing over? Not if the bridge was near a station.

2731. There are three notable instances of combined bridges in the other Colonies. In New South Wales there is one long bridge over the Murray, at Echuca, another over the River Hawkesbury at Penrith, at Oxenbury, and on the Great Southern Line, from Sydney to Bathurst, over the River Murray near Wodonga. These appear to work well. Have you any experience in any of the Colonies, or have you seen these combination bridges in working? Yes, in India I have seen them combined, but with the road underneath.

2732. But not on the same level? No, not on the same level.

2733. How do they answer? They answer there very well indeed.

2734. Where did you see them? At Cawnpore, and at Allahabad over the Jumna.

2735. Do you think, generally speaking, in reference to the supervision of the works, that the department exercises ordinary care in carrying on the works? Yes, there might be improvements, no doubt.

2736. Can you suggest anything—without being disloyal to the department—that would be for the advantage of the public service? I think if we could get the road works carried out during the summer that would be an advantage, and to have the estimates always in advance of the requirements.

2737. When would you recommend that tenders should be called? They could not be called for until the money is voted.

2738. What months would you recommend that tenders should be called in? I think when Parliament is over, say in September or November.

2739. So that you might be able to move material without loss of power? Yes.

2740. What is the present practice? We have to lay out works and prepare all our specifications after the Session is over.

2741. Presuming that your financial year ends on the 30th June, could the Government prepare estimates in time to be dealt with by Parliament, so that the works could be undertaken in the following year? I do not understand.

2742. Suppose your financial year ends on the 30th June, could the Government prepare estimates in time for the Parliament of the following year? No, they would not have time.

2743. If they anticipated the votes, could it be done then? Yes, it could be done then.

2744. Would it be any advantage to obtain authority to expend money before it could be used? Yes; that would be an advantage.

2745. Anything else you wish to say? Yes. I have made a note of two or three things. We usually have to lay out roads on the lines that were surveyed years ago, but the land surveyors of those days were not good at laying out roads; having no experience of earthworks they gave bad grades, and these it is now difficult to alter. It would be better that the work should be done by engineering surveyors.

2746. You have no body of men in the service whose duties would be to effect these surveys? Not regularly employed.

2747. Do you make improvements in these old surveys? Yes, as far as we can, but the compensation for land is the great difficulty.

2747A. Do you think that without obtaining an Act the Government would be able to leave the money value to be settled afterwards, and take the land? Yes; under "The Branch Roads Construction Act."

2748. Is that an Act of Parliament? Yes.

2749. In carrying on the works is there any money disbursed by you as an officer of the Government? No, not in works.

2850. Do you give any fidelity guarantee to Government? No, none.

2751. We are told the contractors sometimes complain of delay in receiving their money? They will be able to give you information upon that point.

2752. That would be a matter of Treasury regulation, I suppose? Yes, I believe so.

2753. Are not the Government Regulations rather obstructive? They are. I was twelve years in India, and often have seen the money earned in the morning paid in the afternoon.

2754. Is that possible here? Quite possible.

2755. Do you think the system could be simplified? Yes, it might be, to some extent.

2756. What else have you to say, Mr. Brown? I have employed men on day work at different times, and they have to wait a long time for their pay and often complain.

2757. Who is the paymaster? The Director of Works. If a system could be devised of earlier payments to contractors and workmen a great deal of money might be saved.

2758. Have you ever urged that on the Engineer-in-Chief? No, but it has been done in the papers.

2759. *By Mr. Lander.*—Some remarks have been made about roads laid out by the land surveyors, and it has been represented by you that roads should be laid out in advance of requirements? Yes.

2760. Could you ensure a better system? With the charge of a district I would not have time to do it.

2761. Would it be possible with the aid of subordinates to do so? Certainly. No doubt better grades could be got, and the roads could be made at less expense.

2762. I think you said it entailed large expense for embankments and cuttings to make roads coincide with the fences? Yes, just so.

2763. If the lands were not settled in the first instance, could you not lay out the roads far better? Yes, we could.

2764. Take the estimate for such a bridge as that at the Leven—what did it amount to? I am not aware, as I made no estimate.

2765. Then you sent in no estimates? No.

2766. No report concerning the cost or the design of the work? No.

2767. Then you only work from the design that has been adopted? Yes.

2768. Who designed the bridge? I can hardly say. It was done in the Engineer-in-Chief's office.

2768A. Were the dimensions for the beams for the footway shown in the plans as now in position? Exactly.

2769. With dimensions of the angle iron struts? Yes.

2770. Was there any signature to the design sent? There were initials on the drawings.

2771. Whose initials do you consider them to be? I don't know them.
2772. Do you take these drawings to be signed documents or attested documents? Attested documents; the originals would be sent afterwards for signature of contractor, with contract papers.
2773. You have never seen the original? It is in the Public Works Office.
2774. Who is it signed by? I have forgotten.
2775. You are convinced that the tracing coincides with that original? Yes.
2776. Do you consider there is sufficient strength in the angle iron brackets for a forty feet span? I think the angle iron is strong enough: it is the weight of the floor and handrail which has caused the sag.
2777. Don't you think the angle iron is too weak to prevent it from sagging? were not weather braces introduced into that original design? It is cross braced: there are no horizontal braces—none whatever.
2778. Is it not usual to put weather braces into a work of the kind, above the struts for instance? Under the girders, do you mean?
2779. No, above the struts themselves? No: there were none in the design.
2780. With reference to the Forth bridge, two spans of 90 feet on pile abutments. This has been adopted instead of one span of 125 feet: can you give the reason for the adoption of this larger waterway? The 125 feet?
2781. I mean was the waterway of 125 feet not sufficient? I have never seen it insufficient during the time I have been in the colony.
2782. You did not propose those two spans of 90 feet? No.
2783. Did you condemn the old bridge, and did you make any communication as to the waterway that should be allowed? I made no recommendation as to the waterway; I merely sent a section of the river.
2784. On what plan was that set out? I took it from my field levels, and from a transverse section of the river.
2785. Did it show highest flood level? It did.
2786. Do you know any reason why stone abutments were not adopted instead of pile abutments? No; unless for cheapness.
2787. Would stone abutments not have been cheaper? No, I don't think so.
2788. Would a stone pier not have been possible at the same cost as the present pile piers? I think not.
2789. Would there have been much difference in the cost? Yes, we should have had to construct a coffer-dam and pump out the water. It is a loose gravel foundation with drift timber as we get down.
2790. Would cast iron cylinders have been difficult to sink? We should have had a difficulty with the drift timber in the bottom of the river.
2791. Would that not be a difficulty in driving the piles? We drove into one log, and, I believe, split it. It was about 12 feet below the surface.
2792. Why should there be more drift timber here than elsewhere? I do not know. There is a deal of drift timber about the Northern rivers.
2793. Is that exceptional? No, all the rivers on the coast contain timber.
2794. Then it would not be easy to sink cylinders? No, not easy.
2795. How about getting down iron screw-piles? Oh, yes, you could do that.
2796. Where is the railway bridge to be situated at the Leven? I can't say. The last peg is opposite Webb's hotel.
2796. Would it not have been possible with economy to combine a road and railway bridge at the Leven? It might. The railway has only been contemplated since the road bridge was built.
2798. Would it not have been possible to combine the two without adding much cost to the road bridge? Yes, at the first. It could not be done now.
2799. Could you not construct a bridge on screw-piles strong enough to carry the railway as well as the road? Certainly.

The Chairman informed the witness that should he think of any other matter which might be for the public interest he might forward a written statement. Mr. Brown promised to do so, and withdrew.

TUESDAY, MARCH 16, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

MR. EDWARD DERWENT ATKINSON, *examined.*2801. *By the Chairman.*—Your name? Edward Derwent Atkinson.

2802. And your occupation? I am the District Inspector of Public Works generally.

2803. How long have you been in the service of the Government of Tasmania? Eight years.

2804. Will you describe the extent of your district? I commence at Cooe Creek, about $2\frac{1}{2}$ miles west of Emu Bay. I then extend along the road to Circular Head in one direction, and then west and south along the coast to the Pieman River.

2805. In round numbers, what area does that district comprise? It is 160 miles long. From Cooe Creek to Circular Head is 46 miles.

2806. And what is the average breadth of the district from the coast? Roughly, ten miles. My district really covers 460 square miles, but a great portion of this area comprises country not at present inhabited.

2807. Practically, then, your duties are confined to the main thoroughfares where there are bridges and roads? Yes.

2808. Will you state when a work is required how it is brought under the notice of the Department? Sometimes at my own suggestion, sometimes otherwise. In the case of a road, it generally begins with a track, and develops into a road.

2809. But how do you ascertain about these tracks or roads? From my own observation.

2810. Do you not have any representations from the settlers?—what causes you to move? If I know of any good land I recommend a track to be made into it. Sometimes I act on the suggestions of other people.

2811. When you determine on a new work, what step do you take then? I should send particulars to the Department for consideration, stating whether it is practicable or otherwise, with my report and recommendation.

2812. Before you send in that report to the Department, do you consult the local authorities at all? No. I would consult any settlers who might know the country thoroughly.

2813. Supposing the district comprised a Road Trust, do you not consider it desirable to consult them? Yes, certainly. That is the practice, as a rule.

2814. Are you guided by the information that is thus afforded you? Yes, if I agree with it.

2815. Supposing your representations did not agree with the views of the Chairman of the Road Trust what would do? I should refer the matter to the Department.

2816. You would send your own report in with the remarks of the Chairman of the Trust appended? Yes, certainly.

2817. After this step has been taken, what would be the next proceeding? The work would be approved by the Minister, and his approval would be sent to me with instructions to take the necessary particulars.

2818. And then the matter would be submitted to Parliament? No; I think there is a vote for this kind of track. The Minister uses his discretion as to making the expenditure.

2819. Do you, after a vote is obtained, receive instructions to make a more minute survey? If a survey is required it would be sent to the District Surveyor to make.

2820. And he would send the proper and authentic plans to the Department? Yes, taking my lines as a basis.

2821. And these plans come back to you in due course with instructions to have the work carried out by day work or by tender? Yes.

2122. What is the practice in tendering for the work? Having prepared the particulars, I should send them to the office and they would advertise for tenders for the work. It is out of my hands then.

2823. It was pointed out to us yesterday that, although work of this kind was advertised, delay occurred in forwarding plans and papers to the different local authorities for the information of intending tenderers. For instance, there is the case of a bridge over the Hellyer, for which tenders are due on 17th March, and it is pointed out that although plans and specifications are advertised to be seen at Emu Bay, Table Cape, none have yet arrived. Is that usual? Oh no, that is an exceptional case.

2824. Generally, then, if plans are advertised to be here are they forthcoming? Yes, certainly; as a rule they are here punctually,—it is quite an exception to find it not so. I assure you it is an exception in regard to my district, at all events.

2825. Then, as far as your experience goes, the public have all the facilities necessary to enable them to tender? Decidedly. The plans are sent up: they have a reference to the inspector also, and he points out the work to them.

2826. Suppose the local road authorities and you differ as to the construction of a work, what effect is given to their representations? I have three Trusts in my district with those of Table Cape and Emu Bay. I get along very well; we have no trouble at all, but with the Circular Head Trust I have a great deal of trouble. They always differ. There has been nothing but differences for the last seven years.

2827. How do you account for that? Primarily, I think, from a difference I had with Mr. Spicer, the chairman. There has been a great deal of trouble over matters at Circular Head.

2828. Then, generally speaking, you get on well? Remarkably well. The Trusts and I work together for the good of the public. Emu Bay has as an excellent Board.

2829. Is that part of the country east of the River Cam in your district? Yes.

2830. It was mentioned yesterday by a witness that there is a road laid out in that district which goes over a very steep hill to which the residents objected, that representations were then made to the Minister, but these were also ignored,—is that the case? That is the road from the River Cam on the east side southwards.

2831. Can you inform the Commissioners as to the facts of the case? There was a vote of £500 for it, and it was laid out on the old road, which has been open for 20 years.

2832. Then the road you recommended was the old track? Yes.

2833. What did the local authorities recommend? They recommended a deviation,—the local authorities, and Mr. Norton-Smith.

2834. Did that involve a greater distance? No; taking the levels through, I found it to be about the same distance.

2835. It was alleged that on the road recommended by you grades of 1 in 5 were adopted, while on the other road the grades were only 1 in 30,—is that so? I do not recollect anything of the sort. They applied for the deviation as it was a better outlet, and I was instructed to take particulars for it.

2836. What was the worst grade on the road you recommended when it was completed? Roughly, I should think about 1 in 12 was the steepest.

2838. Were there any other objectionable features? No, nothing that would not be quite practicable. The other was the better line.

2839. The road you proposed? No, the deviation was the better line.

2840. What was the length of the road between the two points? I think it was over a mile.

2841. Then your proposal, what length was it? Both roads had nearly like conditions; they were nearly the same as to distance.

2842. Were the gradients on the proposed line less severe than on the original line? Yes, they would have been better gradients.

2843. What was the steepest grade on the line proposed by the local authorities? I should think 1 in 18.

2844. When Mr. Duffy came up did you point out both roads to him? Yes. He recommended that we should take the deviation as proposed.

2845. It has been stated that the land was resumed by the Government on the proposed line, it having been previously taken by private owners,—is that the case? Yes.

2846. A sum of money was arranged to be spent? There are no funds available for the line at present.

2847. The expenditure is authorised when the department is in funds, I presume? Yes, it will have to be done by a Parliamentary vote.

2848. Does the delay in proceeding with this work rest with you? No, I can't say that it does. I don't think so.

2849. Are there any facts within your own knowledge?—is there anything on your part which should have been done which has not been done? No, I can't say there is. I took the levels when instructed, and sent in my report. Everything has been done on my part.

2850. That is the point. From what the witnesses said we were led to believe that because their views did not accord with yours that you had not been so hearty in pushing on the matter as you otherwise would have been? They never consulted me at all; they went to the Minister of Lands and Works. Mr. Norton-Smith wrote a letter about the matter, and I then got instructions to take sections. I at once did so. Nothing on my part that I could have done has been left undone.

2851. Now the matter will wait for the vote of Parliament? Yes; I shall include it in other necessary works for next Session. The reason I did not like the deviation was that it would be a more expensive road to make.

2852. What proportion would the expense bear to the other? The other road had been partly cleared and formed, while the proposed road was in a bush state. With the money I had I could have made the old road passable. There were a few steep saddles; but the deviation was by far the most expensive to construct.

2853. Was there any particular advantage by the original road? No; I think the deviation would have made the better road for all concerned. The deviation would have opened out some of the V.D.L. Company's land, and a great deal if ever extended.

2854. Then, as regards the general public, would more public land have been served by the old road? No, I don't think so. No, it would not much affect the public either way; but the deviation would have benefited the Company's land to a greater degree.

2855. For what length of the line would it have accommodated the Company's property? To the extent of about three-quarters of a mile.

2856. Had you examined the country before recommending the original route? There was no recommendation for the original route. The vote was for the road.

2857. Then, as a Government officer you had no particular reason for recommending either one or the other? Certainly not; I never dreamt of the deviation when I laid out the road.

2858. Now come to the system of tenders. Are the specifications provided by the Department sufficiently explanatory to enable parties tendering to do so without checking what work is required? Certainly; any contractor can also come to the Inspector for information.

2859. But a man who does not understand the procedure of the Department would not know what is required, and might put a higher price on the work to cover risk, through the specifications not being sufficiently explanatory. Do you consider the specifications provided give all the information that tenderers require? I do, certainly.

2860. Can you state what they do provide? The usual specifications of the work in detail, made to carry out works of this kind. They are made out from measurements.

2861. Do they define the material to be required? No, they do not give that, because we might mislead the contractor if the material was not at hand. We might have an opinion on that, but the man might differ.

2862. Do you determine where the sand, stone, or lime shall be taken from? Not in all cases.

2863. Do you indicate generally where such material shall be taken from?—suppose you had to make a road between Emu Bay and Table Cape, would you not indicate where stone might be taken from, and of which you might approve? Yes, certainly.

2864. Is that generally done? Yes, certainly; if there were two kinds of stone available I should compel him to take the best quality.

2865. Suppose you should say there was good stone at AB, but that there was better stone at CD, at a greater distance, do you mean to say you would compel the contractor to go to CD? No, not if the stone was good enough at AB.

2866. Are you clear in your own mind that it is not part of the conditions that the contractor is limited to an approved locality? I believe so.

2867. Then if he could discover an approved stone nearer than the locality named, you would allow him to use it? I should offer no objection. I should allow him to use it, but, on the other hand, if there was any little thing that had to be done outside the conditions I should expect him to do it.

2868. Have you built any bridges? I have had the supervision of them.

2869. Was there any novel principle of construction involved, or were they built in the usual way? In the usual way.

2870. What bridges were they? Cooe Creek; a stone abutment truss bridge.

2871. Are the specifications drawn in any particular manner, or do they contain provisions as to what way the work shall be carried out, and of what material? No, I don't think they are very particular about that. Most of the material used is obtained in the district. There are special cases. In the case of one bridge, the Government had to get timber from Maria Island.

2872. As a rule, then, you make your timber of marketable sizes and such as can be found in the district? Yes.

2873. Is your timber cut to marketable sizes, or to arbitrary sizes? We use the ruling sizes.

2874. The timber merchants cut their timber to a scantling that is suitable for public purposes, and then when outside scantlings are specified they require more. Do you adhere to marketable sizes where you can do so? The specifications of bridges are drawn out in the office, we don't do them here.

2875. But what do you recommend? No, I have simply to send a section of the work and the size. They prepare plans and specifications.

2876. Would you not recommend marketable sizes if cheaper? I should probably do so, but I have had very few bridges to construct.

2877. Would you consider it your duty to recommend such a provision? I am afraid I should not have thought of it. I should do so now certainly, when my attention has been drawn to it.

2878. Do you not think, if the inspectors recommended an easily obtainable description of timber it would be of advantage in building? The timber specified here is, as a rule, cut on the ground. The contractors themselves generally get two sawyers and cut it. They might get it from the mill at Table Cape if they liked; but, as a rule, they do not, except when the work is near.

2879. Are the floors of your bridges laid with metal? Yes.

2880. Do you approve of that? Yes; it is a good plan for preserving the floors.

2881. Do you think it has that effect? It practically does. If lots of tar is used, it should do so.

2882. Have you experience of it? I have not seen enough of it to say. I know if the floor is not protected it soon gives way.

2883. Does not the load on the bridge deflect the timber? Oh, no. There is not weight enough for that.

2884. In driving piles have you taken any precautions to protect them against the attacks of the sea-worm? No, nothing beyond coating them with tar.

2885. Have you seen anything of the ravages of the sea-worm? No.
2886. It is said that at the old bridge at the Leven the piles are completely eaten through? That is not the case in my district. Where we have tidal rivers I do not notice anything of the kind.
2887. Any remark you wish to make as to the practice of the department? No; I do not think of anything.
- (The Chairman informed the witness he might make any statement, should it occur to him, in writing.)
2888. *By Mr. Lawder.*—You mentioned, I think, that the District Surveyor, as a rule, lays out the road? Not lays it out, I think; the District Surveyor merely surveys the road.
2889. With what intention? So that the roads can be plotted down in the Government charts, and so as to get their magnetic bearing.
2890. Then was the line of road you speak of on the east side of the River Cam taken upon the original surveyor's alignment? Yes, I think it was taken upon the original alignment.
2891. Was there any objection raised on the score of alterations in the boundaries of the land taken up by the altered line. No, not on the score of the alteration of the boundaries.
2892. Where does the responsibility rest for the delay in making this alternative line? There is no vote,—there is no money to make it.
2893. Then it rests with Parliament, I presume? Yes. We have spent most of the money, and it will take a lot more than the balance to make this road.
2894. You said that there was £500 voted? Yes, but part of it was spent on the ordinary line under discussion, before anything was said of the deviation.
2895. How much, do you think? I should think about £80 or £90. A portion was spent on a different section of road altogether, where there was no complaint. There is some in hand yet, but not sufficient to make this road.
2896. How much? I don't know the amount.
2897. Then you have to wait until a fresh grant is obtained before you can make this road? Exactly so; we cannot do anything until we do.
2898. Suppose the new alignment or deviation had not been made, would you still have had to wait? No; we could have spent the £500 on the old road and improved it, but it would not have completed it. It has already been used for traffic during the last twenty years.
2899. Then the making this deviation has caused the delay? Exactly so. In the meantime the people must just use the old road as well as they can.
2900. Something has been said in evidence about the South road at Circular Head, which was complained of by the local road trust as being so badly made that they would not take it over? Yes, there was a lot of correspondence about it.
2901. Can you tell us what you know about it? Yes. I had charge of the road and finished it; that is the South road, south of Circular Head. It goes away from the main road about three miles from Circular Head, and goes south to the settlers through cleared land to about eight miles from Circular Head, and from that to the bush.
2902. What is the length of the road? About 8 miles from its connection with the main road.
2903. What exception was taken to that road? No exception was taken. After I had finished the road I met the Chairman of the Trust on the road. He asked me if the road was finished. I said that it was, and no objection was taken by the Road Trust to the road. It was then in good order, and looked well.
2904. You say no objection was taken by the Road Trust? Not at the time I speak of. About 5 months afterwards I received an intimation that the Trust would not take it over. This was after there had been enormous traffic on it, and it also came on wet weather, which cut the road up a great deal.
2905. What exception did they take to the road? After the damage was done, they said the contract amount of metal was not on the road.
2906. Was the amount of metal there? Yes; I measured the road carefully, and there were 104 chains of metal by measurement. I could not find a slack part in it when finished. The specified metal was nine inches. Then that would not be there after five months' heavy traffic. It was hardly fair to measure the road after that length of time; it would not go the quantity after that.
2907. At what time, after a road has been completed, do the trustees usually accept it? In regard to the Emu Bay and Table Cape districts, they take it over at once and begin the repairs.
2908. Did you then assume that this road was taken over after your visit? Certainly. I told the Chairman the road was finished, and thought it would be taken over.
2909. Do they not give you a receipt for the road? No. Since then I have tried to get an acknowledgment in writing, but I can't get a reply.
2910. What is the form used in making over a road? There is no form understood. When the road is finished the Trustees just take it over. I assumed that this road was taken over. That has been the practice the last six or seven years.
2911. In cases where the local authorities have not been consulted as the construction of a road, are they then supposed to maintain the road, although they have no voice in the alignment? As far as I am aware, they are consulted before the road is constructed. Before the work is commenced the Trustees have to sign a form that they will take the road over.
2912. Then an agreement is signed? Yes, signed by them. It does not go through me, but through the Public Works Department. As regards the South road (judging from a subsequent measurement)

there may have been a slack part on it. I had about 25 contracts on at the time, and no help whatever. I believe there was a slack place where it was short of metal—at least, there might have been, but after four months' traffic it would be difficult to discover it.

2913. What was the cause? I cannot tell. I would not like to accuse anyone of taking off the metal.

2914. Was it the fault of the contractor? It might have been his negligence. I cannot say how it occurred.

2915. Did anyone on behalf of the Road Trustees ever complain to you of the road being under-metalled? It was the chairman of the Road Trust who inspected the road.

2916. Did he inspect the metal? I expect he did, but he did not call attention to the metal until after a large amount of traffic had passed over the road. It was unfair to me to refuse to take it over after that. No road could stand measurement after that.

2917. *By the Chairman.*—Would you like to put in any statement in writing so that you might state further your own view of the matter, so that it would be a reply to any allegations they might make? Yes.

2918. I presume, Mr. Atkinson, you have no particular interest in desiring that this road should go in any particular way? None whatever.

2919. *By Mr. Lavder.*—Have you any property in the district? I have, but not in this Trust.

2920. *By the Chairman.*—Were your motives entirely for the public convenience and good. Just so, my action was taken entirely for the good of the district, and in the settlers' interest. I should like to say that when I first came I had no assistance. Now I have two sub-inspectors, and have more time to attend to my duties in inspecting roads.

Mr. Atkinson subsequently forwarded the following letter:—

Table Cape, 20th March, 1886.

SIR,
WHEN I had the honor of attending you at Emu Bay on Tuesday last, you kindly gave me permission to write in case I had anything to state relative to your enquiries.

It was mentioned that the specification for the new bridge over the Hellyer was not at the Emu Bay Post as advertised. I have since learnt the specification was in the hands of an intending contractor at the time it was enquired for by the Royal Commissioners.

It is not improbable that other specifications, said not to have been at the offices as advertised, may have been missing in a similar manner.

I have the honor to be,
Sir,

Your obedient Servant,

E. D. ATKINSON.

The Hon. W. A. ZEAL, Chairman Royal Commissioners, Hobart.

MR. WM. PEART, *examined.*

2921. *By the Chairman.*—What is your name? William Peart.

2922. What are you? At present I am Sub-inspector for the Government in this district.

2923. What is your trade or profession? I have generally carried on the business of a builder and contractor on and off under the Government the last nineteen years.

2924. From whom did you receive your present appointment? From Mr. Atkinson and from Mr. Fincham. I was inspector nine or ten years ago, but I did not continue in the service.

2925. What do your duties consist of? In looking after the work and sending in a monthly report.

2926. Have you anything to do with bridge work? Yes, road and bridge work.

2927. Have you a good knowledge of the condition of the bridges in this district? Yes; I had some of them under my charge, and on some I was a contractor.

2928. What bridges did you look over as inspector? I finished the Inglis bridge.

2929. That is a timber bridge? Yes.

2930. How many openings? There are seven spans of 30ft. openings. It is a pile bridge, with timber top.

2931. Any iron? Only the usual fastenings. I had the Flowerdale Bridge under me. That is a pile bridge, with stone filling.

2932. As a builder, do you think these bridges have been built in a sound and workmanlike manner? Yes; what I have had to do with timber is good.

2933. As to the metal on roads: what do you do, where do you obtain it? As to broken metal, 5-in. used for foundation, and covered with small metal.

2934. Do you inspect the quality of the metal? Yes, and I condemn it if it is not according to specification.

2935. Do you see the earthworks properly constructed? Yes; I see to all the work generally, and that it is done according to specification.

2936. Are you satisfied that the works are carried out in such a manner as to give satisfaction to the public? Not in all cases.

2937. We are told some of the work has not been carried on to public satisfaction: is that owing to the contractor? Yes; there are some works on Hellyer road.

2938. Do you take the usual step in such a case to protect the public? Yes; I have power to condemn anything that is not right.

2939. Do the local authorities ever consult you as to the condition of the works? No; all my reports go to Mr. Atkinson. I report to him on whatever is not right.

2940. During the time you have been Inspector have any complaints been made to you by the local authorities as to the manner in which work has been carried on? Yes, slight complaints.

2941. Individual or official complaints? No, only casual, not official complaints.

2942. What is the nature of the complaints? Only to say that the work was not being done in the way some people would like. As a contractor I gave general satisfaction. I look after work from Rocky Cape to the Hellyer.

2943. Has there been any delay in the payment for these works, when contractors have been kept too long without their money? No, not during my charge of works. I believe there have been disputes.

2944. Is there any other remark you wish to make? The witness here said he was tired of the work as an Inspector. He had only 10s. per day, and frequently had to walk 25 miles to check a road, with a swag on his back, and only a boy to help him. He was allowed nothing for a horse, even when his duties compelled him to use one. He intended to go to Hobart and see if he could not get his position improved, or he would resign.

2945. That is a personal matter. What have you to say about the roads? Referring to some deviations, they could be improved, I think. The Calder road should be made shorter; at present it goes up a steep siding. It could be made much better.

2946. Who laid it out? It has been laid out the last fifteen years.

2947. Is it a road taken over by the Trust? Yes, sir.

2948. Then it is not a duty of the Government? The Government spend the money on all the roads. This is only a bush track, and several alterations have already been done.

2949. Do you think that proper care is taken by the inspectors to see that the best road is obtained? I don't think they have taken proper care. I don't think they have the power. We only have to report. It is a great mistake when we are starting roads that there is not a survey made. They could make the roads much shorter and straighter. That is the fault of the inspector not having proper authority to act.

2950. Do they not take sufficient care? I do not know. They would do so if they had sufficient power.

2951. Are the roads, then, laid out in an indefinite way? They don't take sufficient notice of the curves. I am sure the compensation in reduced distance would pay for it. If you make a road five chains when you could get a good road in two chains, you will see you might save a lot by the shorter route.

2952. In making better construction? Yes. In Emu Bay and Table Cape there are roads that will show it. There is the road at the Cam: I could easily get a much better road; it goes into a hollow, into a regular bog, when they could get a much better line by going on the ridge. They go round the ridge and down into the bog,—when by going straight through they might have got a nice road.

2953. Whose fault is that? They have followed the track of the old surveyors.

2954. Cannot the inspector take notice of these things? I don't know. I have power to report these things to the inspector when I notice them. There is a sideling on the Hellyer that takes a turn right round, when they come on a much better road that could be made with less expense and much shorter.

2955. Is much money wasted in this way? Yes, a great deal of money.

2956. Can you state the amount? I could not.

2957. Roughly? I have no idea. Most of the money spent at the Cam has been thrown away. The culverts are now all blocked up. That is the fault of the Road Trust.

2958. It is a fault in construction, I presume? Yes, a fault in construction.

2959. To whom chargeable? Mr. Cresswell had charge of the road at the time.

2960. What is the present practice when you send in these reports to the office—in what way is a proper representation made to the department? That I cannot tell.

2961. You represent all you see, do you not? Yes, I make my report upon what I see, to the Inspector, but I can't tell if he sends it in to the office. I can't tell what he does.

(The Chairman asked Mr. Peart if he had any other representations to make to put them in writing.)

2962. *By Mr. Lawder.*—Have you worked as a contractor on any of these bridges? Yes, as a contractor.

2963. Did you take up any of the work at Emu Bay? No.

2964. At the Blythe? No, not that way. I know nothing about the bridges to the east of Emu Bay.

2965. What bridges were you interested in as a contractor? The Seabrook Bridge, which has stone abutments; the Parson's Creek bridge; another bridge at Table Cape, but Mr. Fenton was the contractor for that; I had only charge of it.

2966. Do you know of any bridge with abutments of stone built on piles? Yes, there is one at Table Cape, the Camp Creek bridge, at Wynyard.

2967. What is the span of that bridge? Fifty feet.

2968. At what level were the piles cut off on which the masonry was built? Two feet below the level of the bed of the creek. That is nearly dry at low water; we dug down and cut the piles two

feet below. It was really similar to the principle of a coffer-dam, and the men were bailing out the water so as to cut off the piles at a sufficient depth. When the creek run out we dug down and formed a coffer-dam.

2969. Then did you found your abutments on the piles two feet below low tide? Yes, two feet below low tide, or the bed of the river.

2970. In reference to the Hellyer river, is it proposed to build a new bridge? Yes.

2971. Is that the work advertised in the papers now? Yes, and the plans and specifications should be here.

2972. What is this bridge to be? A pile bridge with timber top.

2973. What is the foundation in the river? That is what I would like to know.

2974. Have you not examined it? I was never instructed to do so. They have called for tenders.

2975. What are the banks of the river? The banks are rock, but the river down below shows large boulders.

2976. Who prepared the specifications? They are prepared in the office. Mr. Atkinson took the particulars for the specifications, but they have never been referred to him.

2977. Then you think the bridge is being constructed on insufficient data? I think so.

2978. What is to be the mode of construction? If the piles cannot be driven, we are to blow holes in the rock and set them in, and put concrete round.

2979. Can that be done? I don't think so. The river runs at great speed.

2980. What in your opinion should be done? I should recommend postponing the tenders, and waiting till the river can be thoroughly examined. It will make a great difference in the tenders to get a proper specification. If I were tendering I should certainly put on £200 or £300 more to cover the risk involved by the imperfect specifications.

2981. Is the specification not that if the piles cannot be driven, you may then drill holes in the rock, or blow a hole in and set the piles in concrete. You say the contractors would put in a large amount to cover this? Yes. The specification provides two different modes of construction. It would be necessary for anyone tendering to provide against the probability of having to use a large quantity of powder or dynamite.

2982. Then do you believe these plans provide for concreting in a foundation? No, they show no particular plan, but that a hole may have to be made for every pile.

2983. And that would be filled up with concrete? Yes, but I don't see how they are to do it.

2984. But that is the plan the Department proposes to adopt? Yes. What I should like to see done would be to have the river properly sounded before calling for these tenders: that would show distinctly what was required to be done.

2985. You think the information is defective? Yes, I do; and the reason I say so is that this place is difficult to get at. There has only been a track opened up yet, and you could not get to the river to make a proper examination and soundings. That should be done first.

2986. If the specification provides for two classes of work distinctly, as you describe, is that not sufficient? No; because a man cannot tender fairly in two ways. You must put in a tender for one amount, and take your chance as to whether you may not have to adopt the more expensive mode of construction.

2987. Is it at all obligatory on a Government officer to prepare the specification in this way? I believe so. There is something deficient there.

2988. Does not the specification leave the contractor to find out the quality of the river bed for himself? Yes, he can do that, and he might only have to drive his piles, but he might have to drill or blow up the rock, and he would put £200 or £300 on his tender for that.

2989. Then you suppose he might be £200 or £300 in pocket? Yes; one contractor has come to me for information on this point.

2990. I suppose whatever work the contractor puts in he would be paid for? Certainly.

2991. Then if he was obliged to drill or blow holes in the rock and cement the piles in, he would be paid for that; and if he drove the piles in as in the other way, he would be paid for that and not for the other? I don't know if he can do that. I have not the detail specification. I should think not.

2992. Then do you consider that the contractors are not properly informed? I don't think the information given in the specifications is sufficient for the guidance of anyone tendering. If I were going to tender I should not be satisfied. I should like to try the river for myself.

MR. WILLIAM MOLLISON, *examined.*

2993. *By the Chairman.*—What is your name? William Mollison.

2994. What are you? I am a Shipwright.

2995. What position do you hold in the public service? I am superintending harbour works under Mr. Bell,—the breakwater works at Emu Bay.

2996. Had you any employment in connection with the erection of the bridge at Emu Bay, and what was your position? Yes; I was sub-inspector.

2997. It has been alleged that the foundations of the north-western abutment on the Emu Bay side of the bridge was built on piles, and that these piles stood considerably above the level of the surrounding ground. Was that the case or not? No; the piles were driven as far as it was possible to drive them into the bottom of the river, and cut off below low water level.

2998. How much below? I should think a foot or two below low water.

2999. Is that extreme or average low water? I mean average low water mark.

3000. It has been stated in evidence that the piles stood considerably up above the ground? That is not so, I am positive. The men were up to their waists in water when cutting off the piles. I should say the tops were quite a foot or two below average low water level.

3001. And how did you keep the water out when doing this? We built up embankments of sand and then bailed the water out.

3002. In fact you made a sort of temporary coffer-dam? Yes, that is it, sir.

3003. Then we are to understand that the piles are covered below low water? Yes, they are, perfectly.

3004. Then you state that the piles do not stand above the ground—the masonry on the top is much below the ground? Yes.

3005. As a practical shipwright do you consider that the bridge has been constructed in a substantial and workmanlike way? I think it an exceedingly good job.

3006. You consider it sound and stable? Yes, sound and stable.

3007. *By Mr. Lawder.*—You were head foreman over the works at this place? Yes.

3008. What was the thickness or depth of the wooden frame-work on pile heads under the masonry abutments of this bridge? I think it was about 6×9 timbers, and then it was planked with 4-inch stuff.

3009. That would be 13 inches in depth? Yes.

3010. Then if the piles were cut off 12 inches below low water this planking would show? If it was a very low tide, or if the fresh in the river should scour the channel out, they might.

3011. If the tide was exceptionally low? Yes, but still it would be below low-water level. Then it was filled in with concrete on top and the slopes were pitched. I think it was a sound job. The piles were driven until we could not drive them any further.

3012. How far were they driven? About 17 feet.

3013. *By the Chairman.*—Are you satisfied that if a scour came down the river the timber would not be exposed,—that the piles would not be out of the water? Oh, no, sir.

MR. EDWARD DERWENT ATKINSON, *re-called and examined.*

3014. *By Mr. Stanley.*—Before you commence the permanent construction of the roads in your district what steps are taken to determine the best route for any particular road? The chief roads were made, cleared, and partly metalled before I was engaged.

3015. But what should you do now? I should forward a report on any road to the department.

3016. Was any survey made of the road to Table Cape before you came? Yes; the survey was made before I took office.

3017. My attention has been drawn to some very unnecessary detours. There is one at Cooee Creek. There is a long detour round a point which seems quite unnecessary. If a straight course had been followed a saving of quite seven chains of road could have been made? Yes, at Cooee Creek the deviation was laid out by me the other day, but they would rather keep the old road as adopted.

3018. Why was the old road followed? That has not been constructed yet. I suggested the deviation, but the compensation asked by the landowner was so excessive that I think it might be better to keep the old road.

3019. What do you pay per chain for forming and metalling a road? About £8 per chain if the stone is to hand,—that is, for metalling 12 feet wide and 9 inches deep.

3020. Do you think the compensation asked would have amounted to more than what you might have saved? Yes, certainly. You might effect a saving of a few chains, but £350 was the amount required for compensation. The Road Trust were unanimous in their wish to do away with the deviation.

3021. Can you inform the Commissioners the amount of saving if the road had been constructed round by the Cam Heads instead of the way it is now taken? There would have been a saving of seven to ten chains that way of construction, but the distance is greater by about 18 chains.

3022. Was any survey made of that route? Not when the road was made. A survey was made afterwards.

3023. If a survey had been made, what would you have saved in construction by making the road round by the Heads? The deviation has actually been made straight for them, and it is 18 chains shorter than the old road.

3024. Has your attention been drawn to the deviation that might be made with advantage near M. Kenzie's, where the road takes a turn round, I think? Oh yes! I know where you mean. The old road went round by the beach. The reason it was not taken the other way was that it went through the site of owner's orchard and house, and the present road was adopted half way.

3025. But the present road: does that pass through any improved land? Yes; the matter was referred to Hobart and decided upon there.

3026. As pointed out to me, that land is not improved? The reason pointed out to me was that it would pass through a site that a settler intended to build a house on.

3027. There is another point on the road to which attention was drawn; that is between Dr. Wilson's and the Seabrook Creek. It makes a turn there round by the beach whereas a straight course should have been taken? Yes, that would have been much better.

3028. What was the reason it was not followed? The bridge was built on a 14 chains level and I had to join on to the next level; it was too late to take another course after all that work had been done.

3029. Another part of the road seems unnecessary—between the 101st and 103rd mile post: why was not the straight course adopted there? It was straightened a good deal there, but no regular survey was made of that road.

3030. Can you give the Commissioners any information as to the reason for the way in which the Flowerdale road has been located. As it is now, you ascend a steep hill to descend again. There was no reason why both hills should not have been avoided by keeping on the low lands? It would have increased the distance very much. (The witness explained by reference to a plan.)

3031. How was this Flowerdale road located—was there a survey? No; the survey was made after the road was made at this particular part.

3032. Then the road was made previous to the survey? Yes, near the junction with main road. There might have been a saving, certainly, there, but the selected route was asked for by the settlers. I did not look where your deviation would be. I don't know the country there. It would also have lengthened the metal, and the money voted would not have been enough. No doubt it would have made the line a better road. The question was, had we got the money to do it?

3033. Was the bridge over the Sisters Creek constructed under your direction? Yes.

3034. Will you state why this bridge was constructed in the way it has been, with logs instead of the usual mode of construction? It was a question of pounds, shillings, and pence. The bridge was originally built about six years ago. It was for economy that it was done in that way.

3035. I observe that several of the timber bridges are being covered with metal; is that by instructions from head quarters? Yes.

3036. Do you think timber is more likely to decay under such circumstances than when exposed to the sun and air? No; I think when covered it would last longer. In the case of the Inglis Road Bridge but for the ruts made in the metal I don't think the water would get through. That is owing to carelessness. I have not had much experience of this system, but I think that, covered, the timber would last longer.

SATURDAY, MARCH 20, 1886.

PRESENT:

The Hon. WILLIAM AUSTIN ZEAL, M.L.C., Chairman.

HENRY CHAS. STANLEY, Esq., C.E.

ARTHUR WILLIAM LAWDER, Esq., C.E.

THOS. C. JUST, Esq., Secretary.

THOMAS M. BATH *examined.*

3037. *By the Chairman.*—What is your name? Thos. M. Bath, contractor on the Fingal Railway.

3038. What is the name of the firm? M'Neil, Grant, & Bath.

3039. Were they the successful tenderers for the railway from Corners to St. Mary's? Yes.

3040. When did you tender for the work, and when was it accepted by the Tasmanian Government? We tendered some time in November, 1884, and our tender was accepted some time early in December, 1884.

3041. What is the gross amount of your tender, as accepted by the Government? I cannot give the exact amount, but £83,000 is the approximate.

3042. Can we say it is under £84,000? Yes.

3043. What time was given you to complete the work? About 18 months.

3044. When will that time expire? June 1st next.

3045. Is it proposed that you shall hand over the work to the Government before that time, or at the end of your contract? As far as I am aware, we shall hand the line over to the Government at the termination of our contract time.

3046. Has the general character of the works been at all altered since your contract was accepted? Only in respect to bridges.

3047. Have the levels and formation been altered; if so, where? A few alterations have been made in the levels and grading of the line at about 15 miles and 15m. 10ch. from the Corners.

3048. Is that in the neighbourhood of Avoca? Yes. The alterations were very slight. There was another alteration about 41 miles, at which the height of the bank was increased in order to secure it from flood-water.

3049. Has that work been tested by any flood during the progress of the work? Yes.

3050. Will the alterations as proposed provide for a sufficient height above the flood? I think so.

3051. What was the alteration made at the 15 miles? At about 15m. 7ch. the Main road crosses the line. On the original section the approach to this Main road crossing would have required a considerable cutting, and the line was raised in order to remove this cutting.

3052. Are there any other alterations on to the termination of the line at St. Mary's? Yes, the waterways have been increased.

3053. For the cause you stated previously? Yes, to enable it to carry off the water. We had a flood in May last, and it was then found that the waterway was not sufficient.

3054. Are the Commissioners to understand that that portion of the line from the immediate neighbourhood of Avoca is the same as you tendered for? Yes.

3055. It was pointed out to the Commissioners that the line was to go south of Avoca, crossing St. Paul's River at a narrower portion than that now crossed. Had you anything to do with that tender? Nothing whatever.

3056. Can you state anything in connection with this change of route which it is desirable for the Government to know? Nothing.

3057. Have you walked over the line? Yes, but have not taken particular notice of it.

3058. Speaking generally, which route would be the cheaper? The original route, most decidedly.

3059. What would be the cost of going south of Avoca? There is no doubt the cost of excavation would have been very much less.

3060. What would that amount to? I should say about £3000, including the approach to the station.

3061. Contrasting the two bridges shown in the designs for crossing St. Paul's River, one at the present site and the other south of Avoca, how would they compare? I have not seen the plan of the original crossing at St. Paul's River, and cannot give an estimate of the cost, but the cost of crossing St. Paul's River at the original site must be much less than at the present site, the river being much narrower.

3062. Would the cost of delivering the timber, &c. make much difference? There could not be much difference in the cost.

3063. If you were shown plans of the bridges, could you make an approximate of their cost? Yes; that would be a mere matter of calculation.

3064. Can you give a rough estimate of the cost of the two lines, that is, the original route and the one selected? I could not do so without going into the quantities, &c.

3065. You say you have walked over the route originally surveyed: how does it compare with the line now being constructed? I have not seen the sections on the original line, but I should say, from walking over it, that the construction of the former line would be much less.

3066. If the sections are given you, will you be able to make a rough estimate of the cost of the two lines? Yes.

3067. Are there any portions of the present line which, in your opinion, will be damaged by the floods? In one or two instances I think the waterway is not sufficient.

3068. Will you enumerate the places you allude to, and what you would suggest? About 11 miles 15 chains on the section there is a 12in. drainpipe shown. In January last, during very heavy rains, that drainpipe proved insufficient; the water came over the line, washing away the ballast.

3069. What would be necessary there? I think it would be necessary to raise the line, and insert some box-culverts.

3070. Would you propose to raise the line, and if so, to what extent? I would propose to raise the line to 1ft. or 1ft. 6in. in bank. There is a very great gathering ground for water on the south side, and the water flows from this land on to the cutting.

3071. What waterway would you provide? I would provide fully 6ft.; that would be two flat topped box-culverts.

3072. Are there any other places in which you would suggest alterations—anything at the Fingal Rivulet? I think additional waterway should be provided there. There is a single culvert 3×2 at the 12 miles 25 chains, and on two occasions I have seen that culvert insufficient to carry off the water.

3073. What alteration would you propose there? I would double the culvert. It is at the 12 miles 15 chains I see by the plans; the culvert is 1ft. 6in., and I would double that quite.

3074. Do you think that would be sufficient? Yes.

3075. Is there any other culvert requiring alteration? Yes; at 15 miles 2 chains I think that requires additional waterway.

3076. What is the provision there made, and what would you propose? The original proposal was a single box-culvert, 2ft. by 1ft. 6in.; that was doubled, and has proved insufficient to carry off the water.

3077. What would you propose now? There is about 4ft. or 5ft. bank; the best thing would be to put in one 10ft. clear opening, with piles driven and sheathed.

3078. You know the maximum height of floods in St. Paul's River—has the permanent way been made sufficiently high above the floods? Yes, there is no doubt about it. The line was increased to 4ft. 6in. above the highest floods.

3079. Is there anything else requiring alteration? At 20 miles 40 chains, between Avoca and Fingal, I think there is only a 9in. drainpipe; it requires a box-culvert, fully 3×2.

3080. Is the permanent way sufficiently high above the floods? Yes, it is there. At 25m. 55ch. and 25m. 70ch. there should be better provision for carrying water clear of the line. The side cutting has been taken out on the south side, and there is a large gathering ground; the water gathers there extensively—this is midway between Avoca and Fingal. There is danger in the time of floods of a large body of water flowing through the side cutting, and, as the bank is very shallow, there is danger of the water flowing right over the line.

3081. What would you propose? At 25 miles 60 chains and 25 miles 72 chains long outlets should be made in order to take the water from the line as speedily as possible. The waterways are sufficient, but the outlets are not sufficient. Alterations have been made from the original sections which I cannot recognise.

3082. Will you prepare a list for the Commissioners, showing where the waterways are insufficient, and additional works required, of places which you think are dangerous, and what remedies you would propose? Yes.

3083. There were several places along the line where the Commissioners observed the culverts being thrust out of place by the embankments. To what do you attribute this? I think it is owing to the design of the culverts, and the way the walls were placed. The reason why the walls have come over is in consequence of using two classes

of material in their construction. In the arches cement concrete was used, and in the wing walls, masonry. There is no bond between the two.

3084. If the masonry is not embedded in the concrete, is not that the fault of construction? We wanted to make the whole of concrete. We had to go to the expense of putting up concrete arches, and had no opportunity of recouping ourselves in the walls.

3085. Will your remarks apply to 5 miles 40 chains, 8 miles 25 chains, 10 miles 20 chains, and 11 miles 44 chains? Yes, with the exception of 10 miles 20 chains, where the walls are uninjured. There is nothing wrong with that culvert.

3086. *By Mr. Stanley.*—Your contract is a schedule one? Yes.

3087. Have you found the quantities in the schedule show approximately the amount of work you had to carry out? No, by no means. The quantities as scheduled, and on which we tendered for the Fingal line, have been no guide whatever. In one item of side cutting, where the schedule was 12,000 yards, our measurements up to date are over 109,000 yards.

3088. Can you mention other instances? Yes, in the excavation for station yards there is a considerable increase on the scheduled quantities, but I am not prepared to say to what extent until I compare the schedule with our last returns. The same applies to the cuttings in road approaches and all the principal works.

3089. Can you furnish the Commissioners with a list of the work completed as compared with the schedule? Yes.

3090. Will you include the probable amount of work still to be done? Yes.

3091. Can you give the Commissioners an idea of the probable amount of the contract when completed? No, I cannot.

3092. Can you estimate it? I can give you some slight idea of the quantity of work to be done.

3093. Is it likely to exceed the amount of the tender? That I cannot say. For instance, we have asked an additional price for the side cuttings we have taken out. The side cuttings have hampered us in consequence of the Government not taking sufficient areas of land for that purpose.

3094. Leaving out of account any question of extra prices, are you prepared to submit the probable total amount of your contract? Yes.

3095. With regard to side-cuttings, you stated that sufficient extra width was not taken to allow you to get out the required quantity. Is that so? Where side cuttings were necessary in many places additional land was not taken to provide for the material. The manner in which the land was taken has always been a puzzle to me. Additional land was taken where there was no necessity for it, the cuttings being slight, and where large side cuttings were necessary the land was not taken.

3096. Did your contract have any anything to do with that? No, except in many places we applied for additional land. It seems as if the extra land had been taken for the cuttings instead of for the embankments.

3097. Have you been able to leave the required width between the toe of the slope and side of the cutting? No, in many instances we could not.

3098. Has that been due to sufficient land not being taken? Yes.

3099. Have you applied for additional land for side cuttings? Yes.

3100. With what result? No additional land has been taken. It was pointed out that the delay in getting the land would be great, and we could not wait. We had a good deal of side cuttings.

3101. Have the officers of the Department enforced the terms of the specifications in respect to width of cess between the side cuttings and the foot of the banks? They have not.

3102. Have you at any time made any objection to the designs of those culverts which have failed? I have personally to Mr. E. Climie, who was in charge of the line at the time, and who made those designs.

3103. Did they not form part of the contract? No; they were furnished during the progress of the works.

3104. Were they provided by Mr. Climie as Resident Engineer? Yes.

3105. Was the thickness of the face walls insufficient in your opinion to give the required strength to resist the pressure of the bank? Yes.

3106. Can you state what is the thickness of the face walls on the double 10ft. culvert? No, from memory I cannot.

3107. Was any dry stone backing filled in between those walls? Yes, at Stony Creek.

3108. Only there? Yes. It was done there, and Mr. Climie objected to it, and it was some considerable time before he would allow for it, but as we got no instructions to discontinue it, we continued until Mr. Climie came on to the ground, and he objected to it altogether. I pointed out during the construction of those culverts that the Engineer-in-Chief decided to have concrete in the arches, and I wanted to have concrete in the abutments as well, but he objected.

3109. Did you receive the designs from the Engineer-in-Chief or from the Resident Engineer? From the Resident Engineer.

3110. As a contractor, is it the practice to receive altered plans without their having been approved by the Engineer-in-Chief? Not in Victoria, New South Wales, or South Australia. In none of those colonies would a contractor think of receiving any alteration except it had been signed by the Engineer-in-Chief or responsible officer. The practice here is unusual.

3111. In the case of the Fingal line these were merely handed you by the Resident Engineer? Yes. There were special designs for all the stone and concrete bridges. The Avoca bridge over St. Paul's River is not carried out according to contract.

3112. Was that design prepared by Mr. Climie? Yes.

3113. Can you state generally in what way it differs from the original design provided for in the contract? The original design was a bridge square to the line of railway. The one constructed is very much on a skew. The details of the construction are entirely different.

3114. Have many alterations been made in other bridges and works of the contract? Yes. Nearly all the timber bridges have been altered on the line.

3115. Speaking generally, have the works constructed by you differed considerably from those provided for in the contract, and for which you tendered? Yes, they have differed considerably.

3116. Have they differed in such a way as to introduce a different class of work? No, with the exception of the bridge over the St. Paul's River. That is altogether different.

3117. Are the masonry works different to the contract? No, with the exception of using two classes of material. We never anticipated that we would have to build a culvert partly of concrete and partly of stone. We expected that the abutments would also be concrete, not a mixture of concrete and stone. We were put to extra expense in building the arches of concrete, and were not enabled to recoup ourselves by making the walls of the same material.

3118. Had the original design provided for any batter in the face? No.

3119. Then it does not differ materially from the work designed? Not so far as I am aware.

3120. Referring to the matter of the survey of the Fingal line, have you generally found the levels to be correctly taken and the line correctly set out? Yes, with one or two slight exceptions we have found them correct.

3121. Are there any serious errors? No; but in connection with the survey, or rather setting out of the work, it was very roughly done. A mere sapling had been put in, and the permanent pegs had never been properly marked. A blue or common lead pencil had been used, and we could not recognise the numbers of the pegs. No side or fence widths were set out.

3122. Who set out the fence widths? We did.

3123. *By Mr. Lawder.*—From your knowledge of the locality, what is your opinion of the comparative advantages and disadvantages of the two lines at Avoca, relative to the requirements of the public and traffic? If the original line had been carried out the advantages to the general public would have been very much greater than at the present time? As the bulk of the traffic comes down St. Paul's Valley, the original route would have been of greater advantage to the public generally, and would make very little difference to the people of Avoca. The station on the original site could have been made at much less cost, and provided better accommodation than the present one.

3124. Down at Fingal would it have been possible to obtain a better line above the town, avoiding the low land and the amount of bridging now necessary? I have no doubt a better line could have been obtained by going to the south, or high side. The waterway would have been much less.

3125. Would the cost have been increased, or lessened? The cost would have been lessened, as the Government have several reserves on the high side of the township, and on the present site the ground purchased is the best in the town.

3126. Would the actual cost of construction have been much more? I think not.

3127. Do you think the steep grades would have been avoided? No.

3128. Is the present line in considerable danger from floods? Yes, there is always that danger.

3129. We observed that the water from the Fingal rivulet was distributed through a number of channels and inclined to flow down the side of the line where it is on a descending grade; is that so? Yes.

3130. Is there considerable danger from water during floods? Yes, it was so in January last.

3131. What would be the consequence of a severe flood in the Fingal rivulet? It was demonstrated in January, when the waterway was not nearly sufficient. There was a portion of the flood water running down the formation of the line.

3132. Did it first flow down the drain for a portion of the way before crossing the line? Yes.

3133. Was there not adequate provision to turn the water, and prevent it running down? No.

3134. You stated that the bank had been raised at about the 43rd mile? Yes.

3135. Was that to take it out of the flood level?—and was the waterway increased there? Yes, that was not tested by the January flood.

3136. That bank is a new one? Yes, barely completed.

3137. It has not been tested by rains? No.

3138. It appeared to the Commissioners that the line was very low from 41 miles to 44 miles, lying in swampy ground—is that so? Yes.

3139. Would it have been possible to take the line on higher ground without a great détour, or much more length? No doubt it would have added to the length to go on the higher ground, but not to any great extent.

3140. Could it have been carried towards the main road with advantage? I do not know.

3141. Do you think the line perfectly safe from any floods? No, I do not think it is perfectly safe. It wants raising to be made perfectly safe.

3142. It seemed to the Commissioners that the line in that locality really lay along the lowest part of the watershed, where the water might lie,—is that so? Yes.

3143. By taking it a little higher towards the road it might have been carried along without any risk of water lying, and a saving made in the height of bank and the flood-way,—do you agree with that? Yes, perfectly.

3144. Do you consider the present bank is raised high enough to keep it out of floods? Yes.

3145. We notice that some of the bank was of black alluvial, a soluble material, such as an engineer would not prefer in a bank liable to floods. Do you consider that the floods which may occur there are likely to rise sufficiently high on the surface of the bank to saturate this perishable material, causing a continual settlement? There is certainly a risk.

3146. You know the material I allude to? Yes; and to protect it I should think it necessary to pitch it.

3147. Would you not prefer more permanent material than that which pitching may never protect? Yes.

3148. Do you think there is a liability of settlement there for some years to come? Yes.

3149. We noticed that the side drains were carried through without stops; have you any specifications as to stops in side drains? No.

3150. Do you not think it dangerous to have side drains of this length—12ft. wide by 3ft. deep—without stops? Yes, decidedly.

3151. Is there not risk from scour? Yes.

3152. What would you suggest to prevent the scour? It would be necessary to build walls of dry stone, or else to sheath it.

3153. You remember the January flood; was that the severest flood known in the country for some time? No; such a flood may be expected any winter. Very much higher floods have been known than that. It was described to me by residents as a three-quarter flood.

3154. With reference to the backing of the arches of concrete culverts, was it carried into the face walls? Yes.

3155. Are you sure there could not be any mistake about it, because we noticed that cracks extended right down to the spring of the arch? When the first portion of the face walls came out of perpendicular the greatest coming over was on the crest of the arch, and gradually coming to nothing at the spring. Mr. Climie saw this, and he gave instructions to have the face of the arch brought out with additional concrete, and so bring it flush with the wall that came over.

3156. Then additional plaster has been added to the face of the arch, and the fracture of the face wall has been greater than the Commissioners observed? The Commissioners saw the extent of the fracture of the wing wall by taking the measurement of the work. In one case it was 6in. and in the other 4in. The face of these arches have been brought out 6in. and 4in. at the crown, running to nothing at the spring.

3157. The curve must then have been greater than the Commissioners observed, as the face of the wall was bulged in a concave form. If you added a face to the arch to bring it out further then the wall must have been prized out more than it now appears? Yes.

3158. Are there any provisions in the case of such culverts placed below high banks for invert by which the pressure is more evenly distributed or for beds of concrete? Yes, this is provided for.

3159. What is provided,—the Commissioners did not observe any inverts? No, there are no inverts provided.

3160. What was provided for? Merely the foundations for the abutments.

3161. No additional floor is carried along the base of the culvert? No.

3162. What were your instructions regarding those foundations? They were built to the satisfaction of the resident officer. As long as he was satisfied that was all required of it.

3163. With reference to the laying out of the line, do you know any places where the line might have been taken to save gradients or sharp curves? The only place where I know the line might have been improved is from 14m. 40ch. to the other side of Avoca. If the original line had been carried out it would have made a very much better line.

3164. In addition to the places you have mentioned in which you consider sufficient waterway has not been provided for, there are two places the Commissioners observed near 24m. where small openings have been placed underneath the bank? I think between 23m. and 24m. the waterway is sufficient.

3165. What is your opinion on the kind of fencing used: is it of sufficient stability? I think the fencing on the Fingal line is not suitable for broken country. It would be very efficient fencing on flat country, but for land of a broken character it is not suitable. It does not accommodate itself to the nature of the ground.

3166. Do you think sheep might creep underneath? Yes; but that might be got over by making additional fencing.

3167. Do you consider the fence stiff enough for horned cattle? No.

3168. What is the cost of the existing wire fencing, compared with posts and rails? There was no difference in our price.

3169. What would be the difference in the actual cost? That would depend on where we could obtain the posts and rails. If timber is scarce the posts and rails would cost more.

3170. In this locality would it be the cheaper? No.

3171. What would have been the difference in the cost? Post and rails would have been much more costly.

3172. Is your schedule price cheaper or dearer? Slightly higher for posts and rails. I think the present fence could be made a fine fence by doubling the posts, making the length of wire between them $7\frac{1}{2}$ yards instead of 15 yards.

3173. Are not the wrought iron distenders liable to cause the wires to rapidly oxidise, and thus decay? Yes.

3174. At the 32 miles the Commissioners noticed several places where the line hugged the road, and is in deep cutting in made ground, and there appears to be danger from slips during heavy rains: do you consider that safe? No, signs of slip have occurred now.

3175. Is not that highly dangerous? Yes, decidedly.

3176. Has anything been done to provide for that danger? Retaining walls were provided on the plans we signed, provision being made for retaining walls to support the road.

3177. *By Mr. Stanley*—The road is on made ground, and the line has encroached on the made ground also: has not that considerably increased the danger of slip? Yes.

3178. *By Mr. Lauder*—Was it originally intended to build retaining walls there? Yes, retaining walls were provided for at each place.

3179. Why have those retaining walls been omitted? Mr. Climie, Resident Engineer, said the retaining walls were not necessary, and gave instructions that they were not to go in.

3180. Did you represent that their omission would be dangerous? Yes.

3181. What would be the probable cost of retaining walls in those places? I could not say.

3182. Does not the contract cover cost? Yes, the contract shows the retaining walls.

3183. Do you consider the retaining walls absolutely necessary for the public safety? Yes.

3184. Would ordinary pitching be sufficiently good? No, not on made ground.

3185. With reference to pile bridging in embankments, do you think the planking inside piles a wise provision? The idea of planking those bridges and supporting them with stone is to provide strength and preserve the timber.

3186. Do you think that the water is partly admitted into the bank through the planking, and thus causes a settlement of the bank? I do not think that ever likely to occur.

3187. The Commissioners noticed that the flood marks of the South Esk at Avoca were very high: have you ever seen that river in flood? Yes, in January last.

3188. How high was the floor of the bridge above the flood? About 4 ft.; from my observations the flood was not within 4 ft. of the bridge.

3189. How much would that be from the approaches where the roadway is lower? It might be within a foot of the floor.

3190. Is that the highest flood on record? It is not the highest flood on record. I have been informed that a subsequent flood came over the floor of the bridge.

3191. How much above the bridge? I do not know.

3192. Did the water then flow over the approaches? Yes.
3193. How long has that bridge been built? About 18 months, or 2 years at the outside.
3194. Who was the engineer in charge of that work? I do not know, I never heard.
3195. Do you know if timber is carried down the river in floods? Yes, a quantity of heavy logs are carried down.
3196. Do you consider the bridge endangered by these trees? No.
3197. Do you not consider that if the water flows over the bridge, that the bridge will hold back the timber? Yes, I consider it would.

MONDAY, MARCH 22, 1886.

PRESENT:

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.
HENRY CHARLES STANLEY, Esq.
ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

MR. T. M. BATH'S *examination continued.*

3198. *By the Chairman.*—You were asked on Saturday to produce certain papers, particularly one in connection with the deviation of the line at Avoca from the original plan. Have you prepared this statement accordingly—the estimate as per contract, and the actual cost of the works now finished? Yes.
3199. Will you hand them in? Yes. (Witness produces detailed statements.)
3200. State the total amount of each? This is a statement of the actual cost of the line as constructed from 14m. 47c. to 18m. 40c., and amounts to £10,114 19s. 4d.
3201. Does that cover the whole length of the deviation from where it left to where it joined the original line? Yes, that distance covers it.
3202. And now, what is the cost of the original line as per contract? The cost, as per our schedule of prices for the line as originally surveyed, from 14m. 47c. to 18m. 40c., amounts to £7589 6s. 9d.
3203. And what is the exact difference? The exact difference is £2525 12s. 7d.
3204. What does that amount represent? It represents the excess of cost of the line as carried out over the original line.
3205. And from what cause does that excess in cost arise? There are two causes,—one is on account of extra bridging, and the other heavy cutting and earthworks in the Avoca station yard.
3206. When you speak of extra bridging, do you refer to one or more structures, or only to the structure crossing the St. Paul's River? The contract embraced those two structures,—that is, the bridge as designed by the contract over the St. Paul's, and the bridge, as executed, crossing the St. Paul's River on the present line.
3207. What would be the difference in cost of those two structures? It would be difficult to arrive at that without extracting the figures.
3208. Well, you obtained the contract on the basis of the first line to the south of Fingal? No; the alteration was made before the contract was let.
3209. Then how did these prices get into the possession of the Government? We took the same prices as in the schedule.
3210. The estimate which you give is for the line as now constructed? Yes.
3211. And have you heard that the original line proposed to be taken by the Fingal railway was south of the Township of Avoca? Yes.
3212. Well, how do you make a comparison between the works as constructed and the works it was originally intended to construct? I take the section of the line originally intended, and I take the quantities and estimate those works at the same rate we have in our schedule.
3213. From whom do you obtain plans and details—from the inspecting engineer? Yes, from Mr. Home, the engineer, who is at present the engineer of the line.
3214. From what you know of the country do you know that that plan was the correct one? Yes.
3215. Have you examined the locality where the original bridge was proposed? I have.
3216. Contrasting the width of the valley on the original line with the present line,—is it narrower or broader? It is much narrower.
3217. You are aware that at the eastern approach to the present viaduct there is much heavy earthwork? There is.
3218. Would that correspond to the earthworks on the original line? No.
3219. What would be the difference in the depth and length of those two banks? I have examined the plan and find that the length of the eastern approach on the original line is very much less in length and very much less in depth. In one case the height of the bank on the original line would vary from 7 to 8 feet, and on the line as carried out it is 20 ft. high.
3220. How do the earthworks and cuttings affect the station? You are aware that the line as carried out has the station in a deep basaltic cutting—is there any cutting of the same depth of work as this on the original line? Oh no, nothing near it.
3221. What is the average depth of the cutting at Avoca? The average depth is 9 feet.
3222. And the maximum depth? The maximum depth is fully 18 feet.

3223. Making a comparison between that cutting and the cutting on the original line running south of it, what would be the extreme depth of the cutting on the original line? The corresponding cutting on the original line would be about 3 ft. 6 in.

3224. That is, the earthworks on the original line are comparatively insignificant? Yes.

3225. Are there any other works on the line now being constructed which vary from the original line in any material degree? Yes, the approach to the station yard. The road approaching the station yard is very expensive, and that would have been avoided altogether on the original line.

3226. To make that clear, is it not the case that the formation level of the cutting at Avoca is considerably below the surrounding ground, and that the original approach was to be from comparatively high ground down to the level of the station yard? Yes, that is the work I speak of.

3227. Can you supply the cost of that approach? The cost of that road approach is £675—4500 cubic yards at 3s.

3228. Now, is that cost an additional one to the cost which would have been required for a road approach on the south or original line? Yes.

3229. It is entirely additional? Yes, I should say so.

3230. Is that the total cost, or merely the cost of the earthwork? The cost of the earthwork.

3231. I presume the approach would have to be metalled? Yes.

3232. What would be the cost of that? Approximately, the cost of metalling that road would be about £157,—that is, the extra cost for metalling.

3233. Would there be any provision required, in the shape of metal, for the approach road of the southern or original line? Not so much.

3234. To what extent? It would be very small, because the road would run right through the station ground,—in fact there would be none at all.

3235. Would not a short length of approach road be required? No, the only road would be right through the station itself.

3236. To make a liberal contrast, what would be the cost of that road from the highway to the station on the original line—how many chains, and at what cost per chain? £20 would make ample provision for it.

3237. Are there any other works on the line, as constructed, additional to those originally proposed? Yes, there are two extra public road crossings.

3238. How are they provided for—by crossing gates or self-acting crossings? By cattle-guards.

3239. What would be the cost of these? It is shown on the estimate I provided.

3240. Are there any other additional works? No, I think these are the principal ones.

3241. Any extra waterways? No, about the same waterways.

3242. Comparing the two lines,—the proposed line and the line as constructed,—how do the lines compare upon an average as working lines? The original line is far the best line.

3243. Are the approaches to the station more easily guarded and protected in the one as against the other? Yes.

3244. Why? I do not think, in taking the grading of the two lines, there is any difference—that is, about equal.

3245. But, as far as signalling is concerned? For the protection of the yard in signalling the original line is the better line.

3246. Why? Because there are very few curves in it.

3247. Would that deep cutting have any effect in obstructing the observance of the signals? Do you mean the cutting on the west side of the bridge? On the other side of Avoca station—would that cutting offer any impediment to the observances in signalling a train coming into Avoca or approaching Avoca? I do not think it would offer any disadvantage in that respect, but the work of the station could not be done as easily.

3248. Would not the original station yard be on a straight line as against the sharp curve on the existing one? Is it desirable to have such a curve? Most decidedly not.

3249. What other objections are there? The cost of working the yard would be greater.

3250. Are there any other remarks you wish to make with reference to this precise locality? No, except that in the original line the station yard would have cost very much less, and altogether been very much better. I have no doubt that the land for the other line would have been obtained very much cheaper.

3251. Why? Because it is outside the township altogether, and, speaking from my own experience, offered more advantages.

3252. Is what you say the precise value of the extra cost? I think so, as far as I know at present. There is evidence of some accommodation works being required at Avoca station yard for ready access through the station to the township for passengers. Steps will have to be provided on this side of the cutting for the use of pedestrians.

3253. You stated on Saturday that the difference in the length of the two lines was not material? No, it is not.

3254. Then the entire difference in cost will be the more elaborate works at the one line as compared with the other? Yes.

3255. I think you stated, in answer to Mr. Lawder, that at some point where the railway approaches the present coach road from Corners to Fingal the original contract contemplated putting retaining walls to protect the two slopes? Yes; that is between the 31st and 32nd mile.

3256. What would have been the cost of those retaining walls? I could not tell you except by referring to the cross sections and quantities in the scheduled work; but I could hand in a statement.

3257. Will you do so? Yes.

3258. *By Mr. Stanley.*—Do you consider the present station at Avoca convenient for working the traffic? No, not by any means.

3259. Are there facilities for extending that station yard in the event of traffic developing to any considerable extent? Not on the eastern end—that is, nearer Fingal.

3260. Would any extension in that direction not involve heavy earthworks? No, not to any considerable degree. We have taken the hill away altogether—cut right through it.

3261. It would involve an embankment? Yes.

3262. Is it not objectionable to have sidings laid on embankments? Yes, I should say so; it involves additional maintenance.

JOHN HOME HOME, C.E.

3263. *By the Chairman.*—You are at present Resident Engineer on the Fingal Railway under the Government of Tasmania? I am.

3264. What is the nature of your duties? The supervision of the contract generally; to forward the monthly certificates and returns; and the usual duties pertaining to the office of Resident Engineer.

3265. What is the extent of your district? From the Corners to St. Mary's.

3266. You have the entire charge of that work? Yes.

3267. Will you state whether you commenced the work at its initiation or took it up at a subsequent date? Mr. Climie was Resident Engineer when the work was commenced, in January, 1885, and resigned in September, 1885. I was then appointed Resident Engineer.

3268. Then, practically, Mr. Climie had 9½ months' supervision of the work? Yes.

3269. During that time can you state what works were commenced, and what progress was made with them? I can, to the best of my ability, by referring to the records in the office.

3270. But generally—will you state how much of the earthwork was finished? The earthwork wall all done up to the 43rd mile, with occasional gaps amounting to about 3 miles, leaving about 3 miles to complete, with the 3 miles of gaps, or together about 6½ miles.

3271. What culverts, bridges, and viaducts were commenced, and what state they were in? The culverts were all done underneath such banks as were completed. The bridges were completed up to the 23rd mile, about half way. The flood openings and viaducts I include among the bridges.

3272. Do you include the viaduct over the St. Paul's River? That was practically altogether completed when I took charge.

3273. Are you aware that some of the culverts on this railway show that the wing walls are failing? Yes, it has been under my notice.

3274. Who had charge when this work was under construction? Mr. Climie.

3275. To what do you attribute the failure in these works? Well, it is a concrete arch, with a masonry face; and I am informed that the face was only in lime mortar, and I think it should have been cement mortar.

3276. Do you know whether the wall was toothed or bonded into the masonry in any way? Not as far as I am aware; and that is why I think it should have been stronger.

3277. Considering the banks are high, do you think a vertical and straight wall the best form to adopt? Well, I have seen them used successfully under similar circumstances.

3278. Supposing you had designed the work at the commencement, would you then have so-designed the walls or have given them a slight batter? A slight batter would have increased the strength; but at the same time a vertical wall would stand well.

3279. Do you consider that the failure of this work arose from the composition or the design? The only thing I could attribute it to is the want of cement instead of lime mortar.

3280. Supposing those walls had been battered, do you think they would have yielded like they have done? I think it is very possible they would.

3281. Can you state anything with reference to what is known as the deviation of the line at Avoca? Yes, I can. I received instructions from the Department to make a comparative estimate of the deviation.

3282. As to the origin of the deviation, is your knowledge obtained from anything you are aware of, or is it only hearsay? It is only hearsay as to the origin.

3283. Do you think that deviation a desirable one or not? No, I think the original line ought to have been adhered to.

3284. Will you state any reasons why you think the original line was best? I consider the cost of the present line exceeds the cost of the original line by nearly £3000; and I do not think that the Township of Avoca is of sufficient importance to warrant that extra cost for the sake of putting it 10 minutes nearer the station.

3285. What distance was the original line from the Township of Avoca? From Foster's Hotel it was 60 chains.

3286. On the original line how would the crossing of St. Paul's River compare with the crossing now adopted by the Department? The bridge is 550 feet in length, and I calculate that a bridge of the same design could be erected on the original line only 315 feet long.

3287. That would make a difference of 235 feet in favour of the bridge on the original line? Quite so.

3288. Now, as to the cost of these two structures, how would they compare? I estimated the difference in cost of the bridges at £1475.

3289. That is, the bridge on the adopted line is £1475 in excess of the one on the original line? Yes.

3290. Are there any other additional works rendered necessary by the construction of the deviated line? Yes, there is a larger amount of excavation at the station ground than would otherwise have been required; also the making of a new road, which had to be constructed from the main street of the town to the station.

3291. Was this new road necessary? Arthur-street now terminates in a steep bank owing to the excavation for the station below it; therefore it was necessary to make this new road to get to the station.

3292. In other words, you commence at the Main Road at Avoca and make a new approach somewhere below Foster's Hotel to the station buildings in the new cutting? Yes.

3293. What is the depth of the cutting at the point where the prolongation of the permanent road would have crossed the station site? Approximately, it is about 14 feet deep.

3294. That would have rendered it absolutely impossible to approach the station buildings by that thoroughfare? Yes.

3295. Is that the reason why the Government made the approach road? Yes.

3296. How does the deviated line compare with the original line in point of advantage for signalling and working? I cannot say I have considered that question at all, but, as you saw, this line is very much more curved, the original line being straighter all through.

3297. Would there be any greater difficulty in seeing a train approach on the deviated line than on the original line? Yes, because of the sharp curve.

3298. Then, as far as signalling is concerned, the deviation is no improvement upon the original line. Now are you aware how the deviation came to be adopted by the Department? I believe that instructions were given to Mr. Climie to make a trial survey for the deviation in consequence of a petition sent in by the residents to have the line brought into the township.

3299. As I presume you have some considerable knowledge of the district, do you think there would be a larger amount of traffic on the north side of the Esk or the south side of the Town of Avoca? Both lines are on the south side of the river.

3300. Comparing the two sides of the river, is greater traffic to be found on the north side or south side—that is in the neighbourhood of St. Paul's Dome—or Ben Lomond? St. Paul's Dome.

3301. Then the line as originally designed by the Government would have accommodated the larger amount of traffic? I am not prepared to say that, because the traffic of the township would be nearer the present line.

3302. But setting aside the township and taking the surrounding country only? From my knowledge of the district I should say that the traffic was about equal.

3303. Then there was no special advantage as far as the traffic was concerned? No, no advantage as far as I know.

3304. Then the advantages you describe are a decrease of cost and more ease in working the original line? Yes.

3305. I presume your information is obtained from records in your office and what you know of the district? Yes. All the estimates as to quantities and cost are obtained from data in the office, and I can only give hearsay evidence about the traffic and the district.

3306. Do you think sufficient provision has been made for extraordinary floods in the different watercourses of the present line? Yes.

3307. What extra provision did you make upon the original estimate? I recommended a slight increase in the waterway between Fingal and St. Mary's a few months back.

3308. Why did you make that recommendation? At the places where floods seemed to be most dangerous the flood openings were not complete. When I examined the locality there had been a flood, and by the flood-line on the embankment I thought it better to increase them.

3309. Are you of opinion that ample provision has been made for the Fingal rivulet? Yes, I am.

3310. Are there any other portions of the line about which you made recommendations for alteration? I had a 10 ft. opening put in place of two 12 in. pipes in a bank just past Killymoon Bridge.

3311. That is on the eastern extremity of the line towards St. Mary's? Yes.

3312. Any other there? I put in an additional 10ft. opening between the present bridge over the Fingal rivulet and the five 15ft. openings at 34 miles 28 chains.

3313. Was that in consequence of something you saw on the 9th of November, 1885, or was it from information you obtained by knowledge of the country? It was through what I saw when the flood was there.

3314. Was that flood in 1885 a high flood? Not exceedingly high.

3315. Was it an extraordinary or an ordinary flood? An ordinary flood, but a high one.

3316. You are acquainted with the point where the line meets the high road, in the neighbourhood of Tullochgorum? Yes.

3317. Do you consider those works safe and durable? I do, except that I condemned a quantity of pitching.

3318. Assuming a very heavy rain took place, do you think the line safe where the railway comes into immediate contact with the public road, and follows the same course as the road at Vinegar Hill? I think that the slopes of those cuttings at Vinegar Hill are too steep in parts.

3319. It has been stated that the original contract contemplated retaining walls,—do you intend to build retaining walls there? At all events I should flatten the slopes where they are in "made ground."

3320. Do not you think the alterations are necessary? Yes, I do.

3321. Will the alterations you now indicate be sufficient to make the line perfectly safe, or are other works necessary? No, to the best of my knowledge, the line is safe.

3322. As the retaining walls were designed in the original contract, do you know why their execution was stopped? I only know that when I took charge from Mr. Climie I pointed out that the slopes were very steep there and that retaining walls were necessary, but he said he thought they would stand.

3323. Who do you think responsible for the omission of this work from the contract? I presume Mr. Climie recommended leaving them out.

3324. You have no letter dealing with this question? No, I have not.

3325. Are there any funds at the disposal of the department for carrying out the work in case it is found to be necessary? I do not know what was the original sum voted by Parliament, but there will not be any margin in this contract to enable it being done.

3326. What was the amount of the contract with Messrs. McNeil, Grant, & Bath? £83,807 1s.

3327. What was the amount of the work performed when you took over the line? £42,704, according to Mr. Climie's last return.

3328. Was that the gross amount? That was the total value of the work done.

3329. What is the amount of the last certificate? In round figures, £73,000 is the gross amount of the work done up to the present time.

3330. What sum do you think necessary to complete the line? I think it will require about £1700 over the contract; that is, £12,507 will yet require to be spent.

3331. Are you satisfied that £85,507 will be sufficient to complete the works of the Fingal line now under your charge? Yes.

3332. Are you aware what the contractors' price was for fencing? Originally 31s. per chain.

3333. Was that for the present fence, or post and rail fences? That was for Bain's patent wire fence with iron standards.

3334. The same as now used? No, an alteration was made, and the department agreed with contractors to substitute same wire fence, with hardwood straining posts, at 23s. per chain.

3335. What was the price of post and rail fencing on the same line according to the contractor's schedule?
33s.

3336. Assuming the contractor's price for post and rail fencing was 33s. per chain, would you have adopted it had you commenced the line as responsible engineer, taking into consideration its cost, durability, and its applicability to do what it was designed to do? I should have preferred post and rail fencing, as being more durable, of course; but, in the case of a light line, where money is limited, I think the present fence sufficiently good to adopt.

3337. Do you think the present fence would resist the rush of a mob of cattle? No, not if they rushed at it; but we have provided against that by making post and rail fences at the gateways and cattle-guards.

3338. Do you notice that the lower wire is raised above the ground where there are inequalities of surface? That is the great trouble with those fences. Over the level ground it is satisfactory enough, but when the ground has hollows it is absolutely necessary to make special provision.

3339. How do you propose to make it sheep-proof? By driving a short additional post into the ground and drawing down wires to meet it.

3340. What do you consider would be the extra cost per chain to do that, and make the fence thoroughly sheep-proof? I only think this is required in exceptional cases, and do not know what the cost per chain would be.

3341. Will you make a recommendation to that effect to the Engineer-in-Chief? I have already done so.

3342. In your estimate of £1700 to complete the line, did you include the necessary provision to make the fence sheep-proof? Yes.

3343. *By Mr. Stanley.*—What are your instructions, Mr. Home, in respect to altering work from that originally provided in the contract drawings? I have no definite instructions on the subject; but before making alterations of any importance I invariably report to the Engineer-in-Chief for his approval.

3344. In all cases of altered works, do you obtain the sanction of the Engineer-in-Chief before instructing the contractor? Yes, except in respect of any small matters. I refer to alteration of design.

3345. The alteration in the design of a culvert, for instance: would you think it necessary to report that for approval? Yes, certainly.

3346. Are there not written instructions for the guidance of the Resident Engineer as to the duties he has to perform on the works? I believe there are; but when I took up the work they were not supplied to me.

3347. You have not at present received a copy? I have not.

3348. In the case of alterations in the design of the works, is it your custom to obtain the signature of the Engineer-in-Chief to the altered plans? Very often alterations are recommended in writing without plans being sent. In the case of large alterations, of a bridge design for instance, of course I should have the Engineer-in-Chief's signature.

3349. As a matter of fact, have any altered plans in your possession as Resident Engineer been signed by the Engineer-in-Chief? No, no plans of mine.

3350. Are the masonry culverts carried out according to the original designs? No; I think Mr. Climie made special working drawings for the one at Stony Creek, and also the 6ft. culverts.

3351. Have you these altered drawings in your possession? I have.

3352. Are they signed by the Engineer-in-Chief? I do not think so.

3353. Can you inform the Commissioners as to the thickness of the wing walls at the culvert at Stony Creek? I could by reference to the drawings in the office.

3354. Can you tell whether the walls are of uniform thickness or whether there are any set-offs? I cannot say.

3355. In answer to a question put by the Chairman, you stated that you were aware of similar designs having been executed, that is to say, in respect of the winged walls being built without batter on the face? No, that is a misunderstanding; I understood it was the vertical face wall.

3356. Can you state any instances that you know of where the wing walls of culverts of this nature have been built with a vertical face and not battered? No, I cannot give an instance.

3357. Then your reply to the Chairman's question was made under a misapprehension? Yes.

3358. Do you not think that these wing walls would have been very much stronger had they been built in the ordinary way with a battered face? Yes.

3359. In your estimate of the probable total amount of the contract have you included any sum for rebuilding these wing walls? No.

3360. Do you not think that it is likely they will have to be rebuilt? No, it did not strike me that the failure was to such an extent as to make that necessary.

3361. In the event of the embankment becoming thoroughly saturated by heavy rain, is it not likely that the failure we have observed would be considerably increased, and, in fact, that the walls would fall forward? We have had the embankment saturated with heavy rain already.

3362. Have you observed any increase in the cracks in the wing walls? I cannot say I have.

3363. Have you taken any means of ascertaining whether any increase of failure has taken place? I have not.

3364. Then you have not, I presume, had the cracks pointed up with a view of ascertaining whether any further movement has taken place? No, I have not.

3365. Were you Engineer in charge of the Works when the embankments were tipped over these culverts? No, that was previous to my taking charge.

3366. Are you aware of what precaution was taken in tipping the banks over the culvert? I cannot say.

3367. I think you stated that the distance of the alternative station site at Avoca, on the original line, was 60 chains from Foster's Hotel: can you state approximately the distance from the same point to the present station? About 12 chains.

3368. Then the difference in distance would be a little over half a mile? Yes.

3369. The present station is on a curve? Yes.

3370. Do you not think that is an objection in a station yard, causing inconvenience in working traffic? Yes.

3371. In the event of the traffic developing to such an extent as to necessitate further accommodation at the Avoca station, would the extension of the station not involve considerable expense in excavation? It would be necessary, as they are cramped for room.

3372. Can you state whether the omission of the retaining walls at Vinegar Hill, near the 32nd mile, received the sanction and approval of the Engineer-in-Chief? I could not state.

3373. Can you state if the quantities in the schedule attached to the contract fairly represent the actual amount of work to be executed? No, there was considerable variation.

3374. From your observation, do you think that these quantities have been arrived at by actual calculation, or merely estimated? My impression is this—there are certain classes of work, such as timber, masonry, or brickwork, and so on, which, to a certain extent, it was intended to leave to the discretion of the engineer carrying on the line, as circumstances might arise to alter the decision as to which class of material should be used. I therefore think that, in taking out the quantities, an estimate was formed subject to the class of work that would be required.

3375. Do I understand that the quantities have not been arrived at from actual calculation from the contract drawings? It would be impossible for me to say.

3376. We observed a number of drain pipes between the 22nd and 24th miles: do you think that these generally are of sufficient size to carry the necessary water away? Yes, they were quite sufficient during the last flood in November last.

3377. Was that an unusually heavy rain for that part of the country? It was an ordinary high flood, but not an extraordinary flood.

3378. Were any of these drain pipes running full? No, I did not observe hardly any of them running quite full.

3379. *By Mr. Lawder.*—Do you think any better alternative alignment closer to the town could have been obtained at Avoca than the original line? No, I think not.

3380. Anywhere between the two? No, I think not.

3381. In what respect?—do you think there is any objection or difficulty? I had a cross section taken, as you requested, between the two.

3382. Could you not get a trial line taken between the present one and the old alignment? Yes, I could get that done.

3383. The Commissioners inspected the Fingal rivulet with reference to the flood down the side of the bank, and they were told that the flood had topped the bank: do you remember that? No.

3384. Do you think there is no danger of the flood running down the bank there? No, I do not.

3385. Particularly at the flood opening, two of 15 ft., at 34m. 11ch.? We took some special precautions there by running out a wing to the bridge, and backing up that behind with the effect of driving the water down.

3386. Is that extension sufficient to outflank the water on the ground outside the boundary of the railway? I think it would take the highest flood I have seen to outflank that wing.

3387. But outside the railway land, any water getting behind the wing would be certain to run down into a garden there and cause a claim for compensation? Do you not think it would be better and more secure to run an oblique wing wall up to the point where you intend putting a temporary road bridge over that stream? We considered the question pretty thoroughly, and we came to the conclusion that the present wing was best; but we intend to make some such alteration as you suggest to avoid having to pay compensation.

3388. You increased the height of the bank at about 43 miles, and provided additional flood openings? Yes.

3389. What was your experience of that November flood. Up to within what distance of formation level did it rise at that point? Within about 2ft. of the formation.

3390. And how much did you raise the bank? About 3ft. 6in. at the point I refer to.

3391. Do you consider the bank there perfectly safe? Yes.

3392. You consider the formation above the possible flood level, under all conditions of weather? Yes; to the best of my judgment.

3393. I see you provided a great number of openings between the 43rd and 47th miles: why did you provide these openings?—is the water still water or running water? There is not a very great amount of current, but the principal reason is that the banks are so low we could not get large openings.

3394. The water has very little flow? Yes.

3395. Under these circumstances, the line appears to be on very low ground? Yes.

3396. Would you have preferred taking the line on higher ground? There is hardly any rise at all, the ground being very flat for some distance back.

3397. Is the fall north or south towards the present road? The fall is towards the road, the ground rising towards the hills on the north, but the fall is very slight, and to get on higher ground a great *détour* would have to be made.

3398. But your line appears to be tolerably straight in that locality? Yes; because to have altered at all we would have to go a long way back.

3399. Would it not have been possible to take it parallel to the present alignment, and with a long curve to lead into that straight? Possibly; but there was a balance against it—it would be a greater length of line.

3400. So that matter was considered at the time? Yes; I examined it as I laid out the line from Fingal to St. Mary's.

3401. The Commission noticed several places where the waterways do not appear to be sufficient: do you know of any places where you would like the waterways increased, or do you think sufficient waterway has been given? I think sufficient has been given, and no more is required.

3402. With reference to those cuttings where the line hugs the road at the 32 miles, do you think these are safe as they at present stand? No, I do not.

3403. Have you made any provision for the public safety? I drew Mr. Climie's attention to it when I took over the line: He replied that they would stand.

3404. Did you accept Mr. Climie's opinion as sufficient to warrant your omitting to make a recommendation yourself upon the matter? I found the contractors, as practical judges, appeared to take the same view as Mr. Climie, upon which I deferred my judgment.

3405. What do you think should be done now? I think the retaining walls will ultimately have to be built perhaps.

3406. Can you give the Commissioners any idea of what the extra cost of the retaining walls would be on these dangerous portions of the line? I could not at present, but I will frame it for you.

3407. With reference to the Avoca station yard upon the original alignment, I wish to ask you a question that was not quite answered. Would it not have been possible to extend the original station yard with a minimum of cost should the traffic have demanded it, owing to the flat nature of the ground? It would be possible to extend it at a far less expense than it would on the present line; but the ground is not absolutely flat.

3408. Is there any portion of the line now supposed to be finished and in good running order? Yes, it is in fairly good running order from the Corners to Fingal.

3409. Do you consider that it is in a sufficiently good state to make it over to the traffic department for working? No, I think the contractors will have to keep up a repairing gang, as is usual on new lines.

3410. Apart from that, you think the line fit for traffic trains? Yes.

3411. And nothing more remains to be done by the contractors with reference to the permanent work? The contractors are now running over it, but they have men repairing it.

3412. Will you get any better top to the road? No.

3413. Do you consider the proper cant has been given to the curves, &c.? Yes.

3414. Do you restrict the speed of the contractors' train over portions of the line not sufficiently finished? No, it is not necessary to do so; the contractors always slow over those parts where repairs are going on.

3415. Are there any regulations? No, not that I am aware of.

3416. No regulations as to signalling in the neighbourhood of permanent way gangs and men in charge of bridge work—no flags? No, we have no regulations.

3417. Are there no flags or signal lamps? The contractors are bound to keep the line in a safe condition, but we have no regulations for the use of the contractors.

3418. Are you aware that after the face walls of the concrete culverts were forced out by the pressure of the bank the faces of the arches were plastered thickly? No, I was not aware of it.

3419. When were these cracks first discovered in the faces of these walls? As well as I remember, it was mentioned to me by my inspector of masonry about four months ago.

3420. Is that after the November flood? It was before it, to the best of my recollection.

3421. Have you any report from the inspector of masonry? No, it was a verbal communication. The inspector reported it to me as a very trivial matter.

3422. Did you inspect the works yourself after that? Yes, the next time I went there.

3422.A What action did you take? I did not consider it sufficiently serious to take any action.

3423. Did you not report it to the Engineer-in-Chief? No, I did not.

3424. Who got out the contract drawings and schedules for works upon this line? Mr. Edwards, to the best of my knowledge.

3425. Do you think the present alignment could be improved anywhere by slightly altering it so as to avoid unnecessary dips, without any increase of cost? No, I am not aware how it could be improved.

3426. Have you ever considered that matter? No.

3427. *By the Chairman.*—Is there anything you wish to state, or supplement your remarks in any way, Mr. Home: we shall be very glad to have any further communication you may wish to make? No, I have nothing further to say.

TUESDAY, MARCH 23, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

EDWARD C. RENNICK, *examined.*

3428. *By the Chairman.*—What position do you occupy? I am a Civil Engineer, and have been engaged by Messrs. M'Niel, Grant, and Bath as contractor's engineer on the Fingal railway.

3429. Have you been occupied on the railway from its commencement? No.

3430. How long have you been engaged? From either March or April, 1885, to the present time.

3431. When you came what position had the contract assumed? Most of the earthworks were finished or brought well on; they had all been commenced.

3432. What had been done in regard to culverts? Most of the pipe culverts were in; the box culverts between the Corners and Avoca were in; none of the pile culverts were commenced, and only one stone culvert was finished, at six miles thirty chains; all the others were under way.

3433. And the bridge over St. Paul's river at Avoca? That had been started; a few piles were driven and some head-stocks on.

3434. The works were just in a state of commencement? Yes.

3435. You have noticed the stone culverts which have shown signs of failure: to what do you attribute that failure? To the wings not being heavy enough, and there being no bond between the masonry and the concrete arch.

3436. Is there no bond whatever between the masonry and concrete? No.

3437. Did the contractors make any reference with regard to this to the Government Officer? Not that I know of.

3438. Did they ever make any representation as to the instability of the design? Not to my knowledge.
3439. Have any representations been made to the Government officers that this culvert has failed? Yes, they were aware of it.
3440. What did they propose? They waited to see if the wing walls moved for a certain time, and then seeing that they did not move any further, they just faced them up with cement again.
3441. The masonry having slipped over the face of the arch, was it supposed that the settlement would stop, or was the cement pointing done to hide the defect? I cannot say.
3442. As far as stopping the settlement, it was useless? That I do not know.
3443. Was it then done to note any further settlement? It might have been.
3444. Did the Government officers order that pointing? Yes.
3445. Then what was the purpose? It may have been to hide the defect. It was done at the request of the Government officer.
3446. Did the Government officer ever affirm that the work was not equal to specification? The Government officer was always very well pleased with the work, and the inspector said the work could not have been surpassed.
3447. With reference to the other works, do you know of any other settlements or defects? No, with the exception of that work from 30 miles to 31 miles, where the slopes are rather steep, and part of the cutting is in the old bank.
3448. Is that at Vinegar Hill? Yes.
3449. With reference to that locality, in the original specifications it is provided that retaining walls should be built: do you know why they were struck out? I never heard any reason given for it.
3450. Did that arise from a suggestion from the contractors, or the Government? It arose entirely from the Government inspector.
3451. Are you quite sure? Yes.
3452. Who was the Government officer? Mr. Climie.
3453. Did you hear Mr. Climie make that request, or was it a matter of hearsay? That work was just commenced when I went on the line, and it was one of the first things I did. Mr. Climie supplied me with drawings showing what slopes he wanted and how far he wanted the work taken back. The contractors fully expected that the retaining walls would be built, and they knew nothing about their not being built until they were supplied with the amended drawings.
3454. Did those amended drawings show any provision for retaining walls? No.
3455. Did the contractors make any provision of materials for these walls? It was expected that they could get plenty of suitable stone for the walls in the hill.
3456. Had you discussed the matter? Yes, and we knew that we could get the material.
3457. Are you quite clear about what you have said? Yes.
3458. Do you think the provided works are sufficient and will stand? I do not think so.
3459. What would you recommend? Either that the slopes be flattened or retaining walls built.
3460. That would be carrying out the original idea? Yes, if retaining walls were built.
3461. Without that, the public safety will not be provided for? No, that is one of the most dangerous parts of the line.
3462. Were you on the ground during the flood of November, 1885? Yes.
3463. Did you notice any portions of the line which had been flooded? No, not at that time.
3464. It was pointed out to us that the line from the Fingal rivulet towards Fingal had been almost submerged from the overflow from that rivulet—did you note that? Not from that flood, but from one early in this year.
3465. Has anything been done by the Government officers to make provision for floods? There have been several extra openings of 15ft. and splay wings made, and they have made provision for cutting a side ditch about half a mile nearer the station.
3466. Do you think that sufficient? No.
3467. What would you recommend from your knowledge of the locality? They put in a 15ft. opening between two ordinary openings, between the bridge of 5 openings and the bridge of 10 openings: These are within five chains of each other; they ought to make it one continuous pile culvert, from the extra one on to the 10 openings bridge.
3468. How would the cost of the continuous pile culvert compare with the cost of the bank and the alteration now made? It would increase the cost, but not to a very large amount.
3469. What is the cost of a 15ft. culvert per lineal foot—would it be £1? I have never ran it out.
3470. The increase of cost would be very small? Yes, very small.
- 3470A. Without this the line is safe? I think the increase ought to be made.
3471. Are there other portions of the line where extra provision ought to be made? Yes, about the 12 miles there are two box culverts which I think ought to be increased.
3472. What is necessary there? I think the waterway ought to be doubled.
3473. Do you say that from observations made after the flood, or is it merely your opinion? I have seen the water coming from the culverts, and after heavy rain I have seen the box culverts just as full as they could hold.
3474. Where are their positions? A single 3 × 2 culverts at 12 miles 8 chains that should be doubled—that would be sufficient. Then from 11 miles 7 chains to 11 miles 20 chains the line is in shallow cutting less than one foot in depth. The line ought to be raised there, and there is a 12-inch pipe crossing this cutting which ought to be a box culvert 3 × 2.
3475. Are there other places of which you can speak? No, I think that is all.
3476. You think those additional works would make the line safe? Yes, I think so.
3477. Taking the line from Fingal towards St. Mary's, are there any additional provisions necessary? I do not think so.
3478. Do you think the additional provision made will meet the requirements of the floods? I think so.
3479. Do you think the line sufficiently elevated above the marsh? Yes, I think it is.

3480. Do you know any circumstances in connection with the deviation at Avoca that induced the Government to alter the original line to that contracted for? I do not know.

3481. Mr. Bath promised to hand in some statistics: have you them ready? Yes.

3482. Do you produce an estimate showing the cost of the necessary works to complete the line from the Corners to St. Mary's? Yes.

3483. What is the amount? £89,476 5s. 6d.

3484. That is the total cost? Yes.

3485. What is the total amount of the contract as scheduled? £83,807.

3486. That shows £5669 will still be required? Yes.

3487. To what do you attribute this extra cost? The most important is in the side cuttings. There are about 120,000 cubic yards that will have to be done in all before the line is finished, and only 12,000 cubic yards are scheduled.

3488. How do you account for this enormous discrepancy? They must have made a mistake in making up the schedule.

3489. What is the next item of difference? Excavations in station yards. There will be about 18,000 cubic yards, and only 1000 cubic yards were scheduled. In excavations for road approaches there will be 18,000 cubic yards when the line is finished, and only 2500 yards were scheduled.

3490. Is there any other item? Regarding the excavations for cuttings, I would like to explain. I put it down at 200,000 cubic yards. The quantity up to the present would make it 190,000 cubic yards. I increase the quantity to 200,000 yards, because in all the cuttings I have measured I find a certain increase, so I add 5 per cent. on to the total quantity that we have measured in our last progress return.

3491. Is this last return of yours the only one which is not actually determined? No, not altogether; all the work is not completed.

3492. But the others are from measurement? Up to the last return there were only 113,000 yards of side cuttings shown, but there is a considerable portion required to finish the line.

3493. Are you satisfied they are quite reliable? I think they are.

3494. Would they be under or in excess of your estimate? I think I have allowed plenty, but they will not vary very much.

3495. Do you regard them as reliable? Yes.

3496. Are there any other increases? In the timber works there is a large increase. Take the first item, for instance—the 17-inch diameter piles. There were 3500 lineal feet in the contract, and 6800 feet will be required. They are scheduled in two quantities. They have made a difference between piles driven and those planted on sills. All ours are driven. Those in the schedule come to 3500 feet.

3497. Have you contrasted that with the work done, and if so, will you give us the difference between the quantities? In the 17 inch diameter piles, 3500 feet were in the contract, and 6800 feet will be required, showing an excess of 3300 feet; in 15 inch piles, 2000 feet were in the scheduled contract, and 12,600 feet will be required, giving an excess of 10,600 feet.

3498. How do you account for this discrepancy? The openings have been increased considerably since the line was let.

3499. But the last amount increases the estimate sixfold? I can only account for that by all the openings being increased in length, and small openings having been increased to pile culverts. 3 by 2 culverts have been increased to 10 and 15 feet openings time after time.

3500. You have handed in a tabular statement showing the increases over the schedule—is that reliable? Yes. The quantities are taken from the schedule, and the estimate is correct so far as I know. One thing in the case of piles: I have only put down 2000 feet in item 63; there are only 2000 feet scheduled. The reason I put down only 2000 feet was that there is a difference in price between piles set and piles driven, and I did not see how I could add in 1500 feet in one item to the 2000 feet in another item.

3501. But was there any other source from which you could obtain your money? No.

3502. The only difference would be 6d. per foot between the two items? Yes.

3503. Then the Commissioners can compare items Nos. 63 and 64 in the contract with your estimate? I have only put in 2000 feet, but they expected 3500 lineal feet of 17-inch piles.

3504. Would it not be better, seeing what appears in the original schedule, for you to enter your last estimate under item 64, giving us the total of the two amounts, and then contrast it with the amount of lineal feet that will be required; otherwise a discrepancy will arise between your figures and those of the Government? Yes, I will do it.

3505. Will you sign your statement and put it in? Yes.

3506. What as to the work at Vinegar Hill? There are 1715 cubic yards of dry stone wall provided for, but only 50 cubic yards were shown in the schedule.

3507. Then the drawings and the schedule do not agree? No.

3508. What would the money value be according to schedule? £2572.

3509. Supposing that this work has to be carried out that sum will have to be added to the excess cost of which you previously spoke? Yes.

3510. Are you clear about that? Yes.

3511. *By Mr. Stanley.*—Can you give the dimensions of the wing walls of the double culvert at Stony Creek, with the thickness at top? Not from memory.

3512. I understand these are not built according to designs in the contract drawings, but by some altered designs. Can you furnish us with the designs of the plan upon which they were built? Yes.

3513. Up to the present the Commissioners have been unable to ascertain what the dimensions of these walls are? I can get them from the drawings.

3514. How was the masonry of the spandril of the arch built—was it in cement? In lime mortar.

3515. Was that in accordance with the instructions of the department? Yes.

3516. When was the failure in the face walls of these culverts observed? As soon as the bank was taken over.

3517. What month was that in? I cannot say.

3518. Was it previous to the flood in November last? It was before that.
3519. Can you state whether the failure was increased after the rain in November? I do not think the rain increased it.
3520. Do you think there was any carelessness in taking the bank over these culverts? No.
3521. What precautions were taken to prevent unequal pressure? They were brought up evenly and tipped up from the bank, and then rammed in layers not exceeding 9 inches or a foot; and this was done until we got up 8 or 9 feet above the arch.
3522. You are satisfied this work was faithfully and thoroughly done? Yes.
3523. Was it carried out under the instructions of the Inspector of the Department? There was an Inspector at Stony Creek, I think right up to the time the bank was completed.
3524. You are satisfied that the failure of these wing walls has arisen from defective designs, and not from the construction of the walls or carelessness in taking up the embankment? It has arisen from defective designs.
3525. With regard to the slopes at the cuttings at Vinegar Hill, can you state whether a portion of the slope is constructed in made ground or in solid excavation? Portions of it are in made ground and portions in solid.
3526. Has any bench been left? No.
3527. Is it carried up in one uniform slope? Yes.
3528. Do you think serious slips will occur there? Very probably.
3529. Have any indications of slips been made apparent? Yes.
3530. You stated you had noticed considerable discrepancies between calculated quantities of cuttings and those from actual measurement: do you think it likely that the calculations were taken out from cross sections or from longitudinal sections only? I think from longitudinal sections only.
3531. Without reference to the cross sections or allowance for slope of ground? I think so.
3532. From your observations do you think the quantities as scheduled have been arrived at from actual calculation upon the basis of the contract drawings, or assumed? Some of the calculations I think have been taken from contract drawings, and are very nearly correct; others I think have been assumed. The 12,000 yards of side cuttings I think have been assumed altogether.
3533. Is it usual to assume such calculations? No; it is usual to get them from the disposal sheet.
3534. Were the contractors furnished with a copy of the disposal sheet? Yes.
3535. And did this show the quantity of side cuttings required at different places on the line? Yes.
3536. Did the quantity of the side cuttings on the disposal sheet agree with that of the schedule? I am sure it would not, but I never added it up. The disposal sheet is the one on the longitudinal sections; there was none other provided. The quantities of side cuttings shown in the disposal sheet shown on the sections would greatly exceed that scheduled.
3537. What has been the practice in respect to obtaining extra land for side cuttings where required; has it been the custom of the Department to provide additional land where required? The only additional land taken was at Stony Creek. I do not know whether the contractors applied for that or not; it was taken before I came.
3538. It is stated in the specifications that where side cuttings are taken a cess shall be left of not less than 6 feet between the toe of the slope and the edge of the side cutting. From what we observed this has not been carried out? No, it has not.
3539. Why? Because the quantity of the land taken was not sufficient for us to take out the side cuttings with the quantity of land.
3540. Did you ask the Department for additional land to get out the side cuttings, and so keep within the terms of the specifications as to cess? We have asked them frequently that sufficient land be taken.
3541. And were steps taken to provide that land? No.
3542. Practically, the Resident Engineer, in not providing the additional land, sanctioned your departing from the specifications in not having the required width of cess? Yes.
3543. Did he make any objection to your not leaving the width of cess? No.
3544. *By Mr. Lawder.*—You know where the road crosses below Mr. Bath's house at Fingal? Yes.
3545. The Commissioners noticed that the line lies very low there, and were informed by Mr. Bath that the flood water crossed the line there at one time. Is that so? Yes.
3546. Do you consider that portion of the line safe, or is it possible to raise it and leave more openings through the bank? It had better be raised, but it could be made safe. There is a box culvert a few chains up towards St. Mary's, and water from that passes through the culvert and then back on to the line. By turning this water away, and having a side ditch cut on the high side, it would keep the water clear of the line altogether.
3547. Do you remember the culvert at 34 miles where a wing of piles and planking has recently been erected? Yes.
3548. It appeared to the Commissioners that the water had, before the wing was placed there, flowed down inside the bank, and that it would probably cross the line at this crossing now mentioned: was that the case? Yes.
3549. Do you consider that the present wing as erected will prevent that water flowing effectually, or that the flood water will outflank the wing? It will outflank the wing.
3550. It will be ineffectual unless other measures are taken? Yes.
3551. From 42 miles to 47 miles the line runs through a wide valley, it also apparently runs through low-lying ground there: from your knowledge of the alignment, do you think it would have been improved by taking it to the left or right, without increasing the length of the line or the cost very much, and getting it out of the reach of floods? I think the line is in as good a place as it could be.
3552. Then you think if the line had been taken on higher ground the same openings would have to be put in? In many places the line is not a quarter of a mile from the foot of the hill, so that the watershed is comparatively little greater.
3553. It is given in evidence that the water lies stagnant there, with little current, and the flood through these openings will not be rapid: is that so? I think these openings will carry off the water fast enough.
3554. You consider it would not be an improvement to take the line out of the low ground? There may be one or two places where it might have been moved a little to the left or north with advantage, but taking the general course of the line I think it very good.

3555. Have you given the alternative line any consideration? Yes, I have.
3556. Do you consider there are sufficient drainage openings allowed through the bank on the sidelong ground between 22 miles and 24 miles? Yes.
3557. You do not think anything else is required there? No.
3558. Was the backing of the arches at Stony Creek continued to the face walls of the culvert? Yes.
3559. How then do you account for the cracks being quite down to the spring of the arch along to the extrados, and then running horizontally? That would naturally be the turning point of the wing wall.
3560. Would there not be no pressure upon the wing wall, up at least to the height of the backing? The backing of the arch and that wing wall are of two different classes of work; one is of rubble, and the other squared masonry, and the only reason I can give is that the binding between the two is not sufficient.
3561. Then you consider the face wall was fractured from the excessive pressure? Yes.
3562. You have shown the Commissioners that there have been several increases in the scheduled items of the contract: is it not usual in this Colony to enter in the schedule alternative items which may or may not be adopted after the work has been commenced? Yes.
3563. In these circumstances have not the increases in certain scheduled items been compensated for in other alternative items in the schedule? Yes.
3564. With reference to the side cuttings at Vinegar Hill, I would like to know if the cuttings made were finished and approved by Mr. Climie when he directed that the retaining walls were not to be constructed? Yes.
3565. They were cut out as directed by him? Yes.
3566. And in all respects they were as they now stand when he gave the orders for the non-erection of the walls? Yes.
3567. *By Mr. Stanley.*—In regard to the practice of laying on formation, I observe, in accordance with the 40th clause of the specifications, folio 42, "In special and exceptional cases, where it may in the opinion of the Engineer-in-Chief appear advisable to lay the sleepers directly on the formation, the contractor will be permitted to do so provided he obtain permission in writing from the Engineer-in-Chief. . . . No engine or tender shall be allowed to run over any portion of the road (except in the case hereinbefore mentioned) until 3 inches of ballast have been placed under the sleepers, and the road properly packed." Has it been the practice on the Fingal line to allow this to be done? Yes.
3568. Before doing so had the contractors applied for and obtained permission in writing from the Engineer-in-Chief in accordance with the specifications? I do not know.
3569. If any application was made I presume you will have a record of it in your office? Yes, there would be a record.
3570. Will you ascertain if such application was made by Mr. Bath, and whether the approval of the Engineer-in-Chief was obtained? Yes.
3571. I observe also, in accordance with the provisions of the same clause, that no engine or tender shall be allowed to run over the line until 3 inches of ballast have been laid, and the section plans provide for balks of timber being laid under rails till they are properly packed: has that provision been enforced on the Fingal line? No.
3572. You have been in the habit of running an engine and ballast wagons over the road before the sleepers were packed up? Yes, at slow rates.
3573. Was that approved by the Resident Engineer,—because the practice is in clear opposition to the provisions of the specifications? It never was objected to unless the head of the road got very far ahead of the ballasting.
3574. What limit was placed on the distance between the ballasting and the head of the road? At a time when an objection was made it was not a mile. The distance was not stated when the objection was made.
3575. The Resident Engineer has not placed any special limit on the distance? No.
3576. I presume the Resident Engineer was aware that you were running over the line before the sleepers were packed? Yes.
3577. And except in the case mentioned, no objection was made to the practice? No.
3578. Has your attention been drawn to the fact of some of the rails having been crippled as the result of this practice? No.
3579. Can you account for the crippling of the rails in any other way? I did not know that any were crippled.
3580. That is a matter beyond doubt; the rails will speak for themselves. Your attention has not been drawn to it? No.
3581. *By the Chairman.*—In carrying on this ballasting, I presume the Resident Engineer has been along the line frequently, from day to day, to see what has been done? Yes, from time to time.
3582. Has he ever protested against what you have done with ballast? Only in the case where the head of the road was some distance beyond the head of the ballasting. As a rule we kept them together as well as we could. When you were up there was only one day between them.
3583. Would there not be sufficient means of getting ballast without galloping out? No; it would not be possible.
3584. Is there not ballast along the line? As far as Fingal there are places where ballast can be got, but beyond Fingal there is no ballast at all.
3585. *By Mr. Lawder.*—Is any portion of the line supposed to be finished and in good running order? Part between Avoca and the Corners is supposed to be in fair running order.
3586. Finished as far as the contract goes? No, not finished; there are several little things to do.
3587. I mean regarding the permanent way? Two gangs of men are employed there.
3588. Are they maintenance men? Yes.
3589. What is the depth of the ballast? 6 inches under the sleepers, and packed up to within $\frac{1}{2}$ inch of the top of the sleepers,—10 inches in all.
3590. In the portion of the line that you say is finished, has a reasonable superelevation been given to the outer rails on all curves? Yes.
3591. For what speed has the superelevation been calculated? I cannot say.
3592. At what rate of speed do you run over that portion? Seldom more than 17 or 20 miles an hour.
3593. What is the maximum speed you have run over it? We did 34 miles in 55 minutes in case of emergency.

3594. At what speed has the engine run over the remaining portions, from Avoca to rail head? We make a difference in the speed between the ballasted part and the unballasted.

3595. At what speed are you supposed to run on the ballasted, or that not quite finished, and that which had been only formed? We have no fixed rate of speed for any of them. We do not exceed 25 miles an hour on the ballasted portions, and 10 miles on the unballasted.

3596. Do you leave it to the discretion of the engine-drivers? Yes.

3597. Do you make any arrangements when running your trains for flag signals for the protection of gangs working on the line? We only work one engine, and the wagons are, as a rule, either in the pit or with the engine, so that the engine-drivers know exactly where they are.

3598. If you leave the wagons on the line do you not consider it necessary to provide for their safety? The engine-driver knows exactly where they are.

3599. Suppose the engine returned after dark, would it not be advisable to have flags for day signalling and lamps for night, to prevent any serious accident? I do not think they would do any good.

3600. Have you ever received any instructions from the Public Works officers as to any regulations of the kind? Not that I am aware of.

MR. J. H. HOME, *re-examined.*

3601. *By Mr. Stanley.*—It appears to be the practice for contractors to run engines on formation—is that so? It has been permitted to a certain extent.

3602. I understand from the 40th clause of the specifications that this is only to be allowed under the special permission of the Engineer-in-Chief in writing: was that obtained by the contractors? No.

3603. Did they obtain the necessary permission from you? Yes.

3604. Under what restrictions have you permitted it? I considered if the ballast was kept up near to the head of road no injury would ensue. When they did so, I gave orders for them to keep up the ballast.

3605. What limit did you put on the distance between the ballast and the head of the road? I had no specified distance, but anything over half a mile I would object to.

3606. I observe from a provision of the specifications that under no circumstances is an engine or wagon to run over the road until the sleepers are packed with ballast: has that been enforced? It was considered in this case that the formation was exceptionally good. It appeared to me to be the practice, and, as the Engineer-in-Chief saw it on his next inspection and made no objection, I allowed it to go on.

3607. The Engineer-in-Chief was aware of this being done? Yes.

3608. Do you not think the practice very liable to cause the crippling of the rails? I think it is, unless the contractors are strictly watched. It would depend on the amount of traffic run over the road in that state.

3609. As a matter of fact, have the rails been crippled by the engines and wagons being worked over the unballasted road? I think not.

3610. You have not observed any crippling of the rails? No, I have not.

3611. *By Mr. Lawder.*—In reference to your remarks relative to a superior alignment between 42 miles and St. Mary's, do you remember water crossing the main road at any point between the 42 miles and St. Mary's? There are several culverts.

3612. Does the water cross the road? It did so at a very high flood near St. Mary's two years ago, the culverts being insufficient.

3613. Was that between the 42 miles and 43 miles that I speak of? No.

3614. I observe from the contract drawing that very few waterways are shown as passing through the road to the right of the railway bank? The road culverts would not all be shown in the survey of the line.

3615. If the floods had not crossed the main roads, would the waterway allowed thereunder have been sufficient for the railway line? Yes; it would be the same area.

3616. From what the Commissioners saw, the road waterways are very much smaller than those allowed in the railway bank? Yes.

3617. You stated that you consider a portion of the Fingal line is finished and in fair running order: has the requisite amount of superelevation been given to the curves? Yes, to the best of my knowledge.

3618. For what speed was the superelevation calculated? The table of superelevation of curves was drawn out by Mr. Climie, and submitted to the Engineer-in-Chief, and adopted. I believe the speed is 30 miles an hour.

3619. You are not certain? No.

3620. Has any provision been made for semaphores at the various stations on the Fingal line—have you received any instructions on the subject? No, I have not.

3621. To the best of your belief, have they been provided, or are they to be provided for this railway? On referring to the schedule I find no semaphores are provided for.

3622. Do you know if they are to be adopted or not? I cannot say.

Fingal, 8th April, 1886.

DEAR SIR,

In looking over the proof of my evidence sent me for correction, a portion of it, relating to the alterations I recommended after the flood, near 43m., seems to me liable to convey a somewhat erroneous impression as to the increased height of bank, though my answers were correct. At the time of my inspection, after the flood, wide gaps were of course existing in the embankment where the flood openings were to be built: notwithstanding these large vents for the water the flood-line was within 2 feet of the top of the bank at a certain point. It had to be considered that, when the bridges came to be built and the bank closed in up to them, the waterway which had existed at the time of the flood would be largely reduced, which accounts for the fact of the bank being placed at any point 5ft. 6in. above the flood-line of last November.

I am, &c.

W. A. ZEAL, *Esq., Chairman Royal Commission.*

J. H. HOME.

MR. JAMES FINCHAM, C.E., *re-examined.*

3623. *By the Chairman.*—Since your last examination, Mr. Fincham, the Commissioners have examined the Mersey line, and also that from the Corners to Fingal. It is proposed now to deal with the Fingal line, and hereafter to give you an opportunity of making certain explanations regarding the Mersey line. In examining the Fingal line it was observed that certain culverts between 5m. 30ch. and 12m. 40ch. had shown symptoms of failure. This was where the stone walls joined the concrete arches; the failures are found in the wing walls of the culverts. Have you observed these defects, and can you account for the cause? I discovered some slight cracks on my last examination of the line, and called the attention of the resident engineer to them, but at that time the damage appeared to me only trifling. The resident engineer, Mr. Home, stated that he had observed them previously, and said that in his opinion the small fronts ought to have been set in cement mortar. The whole damage appearing really was very trifling.

3624. These defects occur in the culverts at 5m. 43ch., 8m. 25ch., and 11m. 44ch. The greatest defect is at 8m. 25ch. (Stony Creek). The parapet of this culvert on its south side has assumed a convex line to the railway, and it is curved from 6in. to 8in. Was the defect as great when you observed it? I did not observe that.

3625. Would not that indicate that the settlement was increasing? Were the walls cracked so far! I assure you they were not when I saw it.

3626. It seems as if the bank was thrusting the wall out of its place? I did not notice that.

3627. We noticed these cracks have been cemented up: was that to hide the defects or to detect future settlement? I do not know; it was not done under my instructions.

3628. Was it intended that there should be any bond between the walls and the concrete arch; were they to be bedded into the arch? Not practically; had I been carrying out the work I would have done so, but it was not so shown on the drawings.

3629. Would that be a matter of detail for the resident engineer? I should have considered myself bound to see that the bond was made safe. The work was not carried out under Mr. Home.

3630. Where two walls formed of different materials join each other, do you not consider that they ought to be bonded? They, at least, should be joined in cement mortar.

3631. Where there is considerable danger of thrust caused by the settlement of the bank, should not provision be made for the two to be bonded into each other? Yes, either by bonding it or by tying it back with iron ties, as I have done in England.

3632. Were these walls originally designed to be built to a vertical or battered form? I provided contract drawings, and the original designs were vertical.

3633. Are you aware, from memory, how they were to be built? Vertical, as shown.

3634. Would it not be an improvement in deep banks to build them to a batter or that the form of the walls should assume a similar shape to that which now the thrust of the bank has given them or a convex to the line of railway? In any case of doubt I should prefer to build them parallel with the line of sides.

3635. You are aware that the wing walls of railway culverts are usually battered? Yes, I am aware that is the English practice, and that walls and batter are built in one curve.

3636. Do you not think it better to build them slightly curved rather than allow the thrust to come on them in an unprotected way? I think I would prefer to have wing walls built square on to the railway.

3637. Who had charge of the line before Mr. Home? Mr. Climie.

3638. Did you inspect these defects before Mr. Climie left? No, only about four months ago.

3639. Were they pointed out to you? No, I discovered them myself.

3640. Did you think any provisions were made for bonding the work in the contract? Had I been resident engineer I should have taken some steps to join the fronts with the arch.

3641. With reference to the provision for carrying off storm water, it has been pointed out that additional culverts and waterways are provided: has that been done with your knowledge? They were chiefly put in from my instructions.

3642. How did you determine the size of these waterways—did you visit the line after floods? Yes, partly so.

3643. Are you satisfied that reasonable precautions have been taken to provide for the discharge of storm waters equal to those that occurred in November, 1885, along the line? If the suggestions that I have given have been carried out, I do not think there is much fear.

3644. It has been pointed out that the Fingal rivulet is a treacherous and dangerous stream, and that in November last a large body of water broke over the bank and found its way on the line towards the station at Fingal: do you think ample provision has been made there? I am quite satisfied with the provision of waterway at the Fingal rivulet, and, if necessary, further provision could be got by clearing away the rubbish that now hampers the stream and forces the water over the banks.

3645. A quarter of a mile east of the Fingal station a timber stop had been placed in the flood channel, thus leaving open to the ravages of the flood a large amount of property and several gardens: do you think it is desirable to leave the work as it is, or is some provision to be made to protect these properties from floods? I know the stop you mean, for I instructed it to be put in. There is a fall of nearly 50 feet between the Fingal rivulet where the railway crosses it and the river near the Fingal station, and I saw that at any cost I must prevent the flood breaking down along the line.

3646. Do you intend to make any additional provision to that already provided? I am not at all aware that property is damaged, or likely to be, by that stop. It may be so, but I am not aware of it.

3647. In other respects you are satisfied that ample provision has been made for flood water on the line? As far as I know, with the addition of some pipes in places. I will explain. I told Mr. Climie that I did not like the pipes for taking off the storm water on steep ground on the Ormley estate, about 7 miles east of Fingal.

3648. It was pointed out that on low ground near St. Mary's portions of the line had been raised above flood level: do you think ample precaution has been taken there against floods? If the proposals made had been carried out, most certainly so; they are far in advance of what were originally fixed by Mr. Climie. Subsequently Mr. Home has further increased the altered provision made by Mr. Climie.

3649. Would a flood there be merely shallow water spread over a large area? Merely water spread over a large area by a sudden storm.

3650. Do you consider the drains provided would allow this water to discharge without damage to the line or property? I do.

3651. Our attention was drawn to apparently dangerous places on the line at Vinegar Hill. Will you state why the retaining walls, which the contract provided should be built there, were not constructed? The last time I went through the works with Mr. Climie I drew his attention to the slope of the cutting next the main road at the spot you refer to. His opinion was, that owing to the dry hard nature of the material it would stand, and that he could save the cost of the retaining wall. After discussing the matter we decided to leave it for a few months, and keep the question of building the retaining walls in abeyance. The building of the retaining walls has never been actually countermanded by me, or, I believe, by the resident engineer.

3652. Do you consider these retaining walls will be necessary, speaking from subsequent experience? I think, owing to the nature of the ground, that the slopes as they stand are likely to remain for years.

3653. Do you think that the slopes of the railway embankment will stand, built as they are on sidelong ground, which forms the river bank? Yes, if properly benched; and I have no reason to doubt it has been properly benched.

3654. And the old road embankment, seeing that it has been undermined by the railway, will not the constant vibration of trains cause it to slip? The road has been made so many years that it has thoroughly set, and I really do not see cause for danger.

3655. Has it been tried? It has been tried by the contractor's heavy trains.

3656. Have you had heavy rains since the line was made to test the stability of this work? The rain would flow from the hills above and would all be caught by the table drain away from the railway, and so carried on. It is only the small amount of rain that would fall on the road that would cause the damage.

3657. Has there been such a rainfall since the railway was made to test this? There must have been plenty of rain, but I cannot say what amount.

3658. When was the road made? I cannot remember.

3659. Are you aware of any indications of slips? I am not aware.

3660. When did you examine the locality last? Between three and four months ago.

3661. It appeared to the Commissioners when passing over the line that the vibration of passing trains, and other causes incidental to railway construction, have developed indications of slips. Have any suggestions been made to you by the resident engineer to provide for this? No; it would be a very easy matter to put in the retaining walls as first intended at that spot.

3662. Do you intend to make such provision? Not without the slopes are reported as slipping and unsafe.

3663. What induced the Government to accede to the deviation of the line in the neighbourhood of Avoca, and to adopt the present route? A report of Mr. Climie that the cost would be equal.

3664. Was that the only consideration that weighed with you in recommending the deviation to the Government? The sole consideration.

3665. Are you quite clear that no Parliamentary pressure was brought to bear on the Minister or the Department? Not beyond the petition that came in to the Minister from Avoca, asking that the line might be brought through the township. I instructed Mr. Climie to examine and report upon the line. He reported the cost would be equal, and on that ground I recommended the Minister to accede to the petition.

3666. You are certain that it was on the strength of Mr. Climie's report? I am perfectly clear.

3667. Can you produce that report? I can. (Mr. Fincham here produced the report.)

3668. This appears to be a letter from Mr. Climie, with a report in detail and the estimate of the cost of the deviation—is that so? Yes.

(The letter dated 24th May, 1885, from Mr. Climie to Mr. Fincham was then read.)

3669. What did you do when you received that report? I at once recommended the Minister to accede to the prayer of the petition.

3670. Regarding Mr. Climie's estimate by the light of your subsequent experience, how has it been borne out? I estimate that the excess cost on the deviation in the works will be £2571. I am also quite clear that Mr. O'Connor claimed and received an extra amount as land compensation for this deviation cutting off water, &c. I think a fair estimate of the cost of the deviation might be set down at £3000.

3671. Mr. Climie does not give any detail of the bridge over St. Paul's River, merely saying it would cost not more: did he also state that verbally? I am pretty certain he did.

3672. Had you from him at that time such a detailed estimate as would enable you to verify his calculations? The details of the estimates now before you are all the particulars I received.

3673. You reasonably assumed that Mr. Climie, residing at Avoca, had taken every means of satisfying himself of the truth of the report before having sent it in to you? Yes, he had been specially deputed to send in the relative cost of the two lines.

3674. Which line would better suit the district—bounded by Ben Lomond range on the north, and by St. Paul's-Dome range on the south? I think that on the south, where the line went originally, the best line.

3675. Comparing the two districts as to population and quality of land, which line would be the most advantageous for the Government to construct? I think the original line. There are a number of farms near St. Paul's River:

3676. Is there much cultivation on the south side? I cannot speak with certainty.

3677. Is there a large amount of settlement? Yes, running 10 or 12 miles back.

3678. A plan has been given us by Mr. Home showing the two lines and routes: is that an accurate plan? Yes, that would be so.

3679. Why is it necessary to carry the road from Avoca to the site of the present railway station? Simply as a means of approach. There are no means of getting to the station without making the road.

3680. There is the Swanport road—could not the station have been approached by that road at its north end? No, it is impracticable.

3681. Where is there any obstacle, either natural or artificial? The grade would be far too steep for an approach to a railway.

3682. Was a deep cutting necessary to make the approach road? The only means were to make a perfectly new road to the station.

3683. Was that your only reason? Yes.

3684. Which line is the best for signalling purposes? The original line, certainly; it is straighter. Confirmation has been given to the selection of the original site by every engineer that has been over it. I made a flying

survey some years ago, and I fixed on the Rockford site. Another engineer afterwards did the same, and Mr. Climie, who was left free in the matter, fixed also on the same site. I am quite sure there is no site equal to it.

3685. Would the station be at such a distance as to be of disadvantage to the inhabitants? No, I think it would be an advantage. The distance is not more than 50 or 60 chains.

3686. Have you the plans of the two bridges, that on the original line and that on the present line? No, I have only that of the present line. The alteration of route was effected while the contract was in operation.

3687. A sketch has been shown us showing two bridges, one on the original route and one the north route? I have never seen any drawings for the bridge upon the original site.

3688. This bridge was a reproduction to suit the larger length of the valley where crossed on the original line taking the same sized timber and span. Have you never seen that plan? No.

3689. Did Mr. Home? Yes, probably, for the purpose of comparison. Mr. Home informed me that he had made an estimate for the bridge of the same general character as that carried out.

3690. If we undertake to supply that drawing, will you undertake to look it over and see whether the bridge was capable of providing for the south line if the south line had been adopted? Yes.

3691. *By Mr. Stanley.*—Were you aware that any alteration had been made by the Resident Engineer in the designs of the culverts on the Fingal line from the contract drawings? No, I am not aware of any. He sent me a sketch once of a drawing of a culvert, and I told him that I would prefer that he would work to the type drawings attached to the contract.

3692. It has been stated to the Commissioners, both by the contractor and the Resident Engineer, that such an alteration was made; in fact that the culverts, as built, have not been in accordance with the contract drawings: are you aware of that? I am not aware of that. The only alteration that I know of was when I ordered the contract drawings to be followed.

3693. Then the Resident Engineer did not apply for your authority to make such an alteration? Not that I am aware of.

3694. Did you approve of these face-walls being built vertically, without any batter? If there is sufficient strength it is a common practice, and it has been my practice with fronts parallel to the railway.

3695. But in case the wing walls are built with vertical faces, is it not usual to have set-offs on the back to give strength to the walls where strength is required? Yes, certainly.

3696. Was provision made in the contract drawings for this? No.

3697. Did the back of the wing walls shown in section on the contract drawing as vertical, have any set-off? It has.

3698. What is the thickness of the wing wall in the case of a 10ft. culvert? Three feet.

3699. Do you consider that 3ft. is sufficient to resist the thrust of embankments such as that at Stony Creek, which is 29ft. from floor to top of coping? If the front is a long front, shown on the contract drawing, I do not think it sufficient for a surcharged wall.

3700. We have been informed that it was originally intended to build the arches of these masonry culverts in masonry, but concrete was substituted; was that alteration made with your approval? It was.

3701. In approving of that alteration, did you give any instructions as to the mode by which the masonry of the culvert faces should be bonded into or connected with concrete? No, it would not occur to me. That would be a matter of practical detail which the Resident Engineer would necessarily be left to deal with.

3702. We have also been informed that the masonry is bedded in lime-mortar, not cement, where it joins the concrete: was this done with your approval? No, I knew nothing of it until the work was built.

3703. Did you remember examining these culverts during their construction? Yes.

3704. Were you satisfied with the quality of the work? Yes, I saw the large culvert at Stony Creek during construction, and I thought the work was very good.

3705. Will you state to what you attribute the failure of the faces of this culvert, seeing that you have approved of the design and the quality of the workmanship? The quality of workmanship that I spoke of referred to the part below the springing. I attribute the pushing over of the front which has been described at the large culvert to the want of adequate strength. With regard to the smaller culverts, I think it is due to want of toothing or some other proper connection between the arch and the small weight of the face above it.

3706. Do you not think that where an important alteration is approved by you from the original contract drawing, that it was very necessary or vital that such conditions as have been referred to should be stated at the time—I mean in reference to the bonding of the masonry and concrete? I consider that a matter of detail that any Resident Engineer competent for his position would deal with without reference to me.

3707. Whom do you consider responsible for the designs of those culverts? I must be responsible for them, as the work was done by contract under my directions.

3708. Has your attention been drawn by the Resident Engineer to a considerable discrepancy between the quantities as scheduled and that of the quantities of work as executed? Not that I am aware of.

3709. Can you state how the quantities in the schedule were arrived at? They were got out for me in common with quantities for other lines by Messrs. Edwards and Co., and I assumed that they had made calculations as to the amount of the various kinds of work.

3710. Did you take any steps to check the quantities in the schedule? It was not possible for me to do so personally.

3711. Were you under the impression that the quantities had been calculated from the contract sections and drawings? Yes; except in one or two of the items which I saw had been put down to fix the price. For example, I will take item 30, where 500 yards is put down in the schedule—I take that as a guessed quantity.

3712. If you will just glance through the quantities of concrete, brickwork, and masonry, it must be apparent to you that they have been assumed, and not taken from actual calculations? The figures certainly look too regular for actual calculation, but it was competent for the engineer under the contract to do away thoroughly with the masonry work and substitute timber work if thought desirable and the price justified it.

3713. If these quantities have been merely assumed, and not arrived at from actual calculations, how could the total amount of the tender be any guide to the total cost of the work? Because in many cases one item would correct another.

3714. It would be a chance if they did, seeing that they were arrived at from no basis of calculation? It might be so, but the quantities given in the schedule did not imply that the department was fixed to the style or work provided for.

3715. Is it not usual in the case of schedule contracts to prepare the quantities in such a way that the total amount when run out at contract prices will approximate with the actual cost? It should be so.

3716. Are you aware that the quantities under the head of earthworks have been based upon calculations taken on the sections, or merely assumed? They were based upon calculations taken from sections for each cutting in detail.

3717. Can you explain why in the item of side cuttings only 12,000 cubic yards are scheduled, whereas if you add up the total amount by the disposal on the section the quantity will be 62,000 yards? I can account for a large amount of that at once, and that will illustrate what has proceeded from a change of work. With regard to the crossing at Stony Creek, alternative plans were shown in the contract, one plan consisting of a timber viaduct, and another plan consisting of an arched culvert with a solid embankment across the creek. This solid embankment with an arch was what I decided to adopt, and that alone absorbed 30,000 yards of side cuttings. I suppose that the adoption of this plan, which was determined on to secure greater permanency of work over that afforded by a timber viaduct, has cost in all probability £2000 additional. Before entering upon it I obtained from Mr. Climie an estimate, and when I decided to adopt the earth bank the excess as estimated by him was about £1000. The great depth to which it was necessary to carry the foundations of this culvert, and the greater amount of side cutting necessary above that estimate, caused the difference to approach the figures I stated.

3718. What you state might explain the discrepancy between the quantities as executed and scheduled,—but my question refers to the discrepancy between the figures on the disposal sheet and those scheduled. I assume that the schedule was prepared simultaneously with the contract drawings? It was.

3719. Then, how could there be such discrepancy as that shown by the schedule, which is 12,000 yards, and the quantity shown upon the sections, being 62,000? No, there should not have been that difference.

3720. Should not they be accurate, seeing that the schedule was prepared at the same time as the contract sections? They should be accurate if the disposal was correctly shown, but to the best of my belief a large amount of side cutting was provided in the disposal sheet that would have to be thrown to spoil.

3721. What do you mean by side cutting thrown to spoil? It was balanced in too short lengths.

3722. Will you further explain what you mean? What I mean, shortly, is that I noticed in going through the sections side cuttings were provided to make up a bank, when material could be obtained at a short distance from the cutting proper.

3723. That explanation would be perfectly intelligible if it referred to the quantities as actually executed and those shown in the schedule; but what I wish you to explain is why the scheduled quantity does not accurately represent the amount of side cutting shown by the disposal on the contract sections? I can only explain it by assuming that when the engineer took out the quantities he was aware of this and reduced the total accordingly.

3724. Can you state whether the quantities in the cuttings were calculated from the longitudinal sections only, or with the assistance of cross sections? I cannot say.

3725. I ask the question because it has been stated in evidence by the contractors' engineer that he finds a considerable discrepancy between the quantities in the cuttings and those in the drawings: how did you explain this? The quantities were all taken out for me, the cross sections were in the hands of the gentleman who took out the quantities, and I have no reason to doubt that he took them into account. I know of one excess at Avoca, where the contractor has been overpaid some 4000 or 5000 yards, but this is no fault of the quantities.

3726. The contracting engineer, speaking generally, said he found a considerable difference between the measurement as ascertained by the tape and those shown in the sections? I should prefer to take the statement of the resident engineer on that point.

3727. Do not the contracting engineer and resident engineer measure these cuttings conjointly? Yes.

3728. Then I presume the quantities measured have been agreed upon between them? As progress measurement, no doubt.

3729. Are we to understand that you accepted the schedule as furnished you by the engineer, Mr. Edwards, without taking any steps to check its correctness? It was simply impossible for me to do it personally, or have it done by others. We were pressed to get the contract out by a fixed day, and the quantities were only supplied at the very last moment, after the contract drawings were finished.

3730. When you say you were pressed, do you mean that the Minister of the Department brought pressure to bear on you? I mean, in the first instance I was asked to agree with Mr. Edwards as to a day when the Derwent Valley and Fingal lines would be ready for tendering. Mr. Edwards did not complete his work within the time originally fixed, and I had to ask for an extension of time. This proved insufficient, and Mr. Edwards's men had to be kept at work for weeks late into the night as well as on Sundays.

3731. Had you no assistants in your own office who could check generally the correctness of the schedule? No one.

3732. Did you not think that you accepted a very grave responsibility in calling tenders for such important works without being able to satisfy yourself as to the correctness of the drawings and quantities? I trusted implicitly in the correctness of the work turned out by such an experienced man as Mr. Edwards, who had been so long employed in the engineers' branch of Victorian railways.

3733. Had you any previous personal experience of Mr. Edwards's reliability and competency? No, but he came with high testimonials from Mr. W. H. Greene, engineer of existing lines in Victoria.

3734. Do you not think it was incurring rather a risk to your reputation in trusting so implicitly to a professional man in whom you had no previous personal experience? I could not do otherwise under the circumstances, and as I was aware that the estimates were regarded as approximate, I thought they would allow me some margin.

3735. Did you at any time represent to the Minister the desirability of your being placed in a position to check the correctness of the figures supplied by Mr. Edwards before accepting the tenders for railway works? I did not specially with reference to Mr. Edwards, but I did with regard to obtaining a more efficient supervision of the preliminary work connected with the preparation of those contracts.

3736. Was your application acceded to? The Minister of my department, being able to appreciate the difficulties of my position, cordially endorsed it; but he informed me afterwards that the Cabinet were indisposed to entertain the application for the assistant engineer I had asked for.

3737. Do you consider you have sufficiently protected yourself by protest against the manner in which these contracts were prepared previous to tender? I never made more than that application, and had no reason to doubt, nor do I now, the efficiency of Mr. Edwards. I put the difference down to the over-hurry in which everything connected with the work was done.

3738. In reference to the deviation at Avoca, I think you stated that your recommendation in favour of the adoption of this deviation was based upon Mr. Climie's report and estimate? Only upon that.

3739. Do you not think when an important alteration in the line such as this was contemplated, that it would have been advisable to satisfy yourself whether Mr. Climie was correct in the information he gave you? No, it did not occur to me. I had no reason to doubt the correctness of his report.

3740. Did you make any personal inspection of the two routes before making your report to the Minister. No, I did not.

3741. You appear satisfied that the weight of evidence was strongly in favour of the original line? Yes.

3742. That being the case, can you explain why you thought fit to accept Mr. Climie's report in favour of the alternative route without personal investigation? I am not aware—I am not nearly sure, that the other engineers did go into the question of the new route as closely as Mr. Climie did, and I had perfect confidence in his judgment.

3743. But seeing that the surveyors engaged in this work had strongly supported the adoption of the original line, and you were satisfied that it would have accommodated the traffic better than the present line, you must have had some very special reason surely for altering your opinion? I wanted to satisfy the people of Avoca, and I saw, according to Mr. Climie's figures, that I could do so without entailing extra cost to the Government.

3744. Did Mr. Climie deal with the question of the comparative value of the land passed through by the two routes? No, he did not, that I am aware of. It will be shown in the estimate I have handed in to the Chairman.

3745. Will you look and see if Mr. Climie's estimate includes any amount for land compensation? On reference to the report I find it does not.

3746. What, if any, steps did you take to compare the comparative value of land on the two routes before forwarding your recommendation to the Minister? None whatever.

3747. Are you aware that it has been the practice on the Fingal railway for the contractors to lay on formation? Yes; it has been so.

3748. Was your approval obtained to this mode of laying? No; but I should not object to it, so long as the engine did not run over the formation when it was soft from rains.

3749. I observe from the 40th clause of the specifications, that laying on formation is only to be allowed upon the approval in writing of the Engineer-in-Chief, and also that under no circumstances is the engine or ballast wagons to be run over the line until the sleepers are properly packed with ballast. Are you aware that this very necessary provision has been entirely disregarded? I regard it as a provision to be put in force under exceptional circumstances, and was entered there for my protection. Engineers know that cases must constantly occur where it would be needlessly oppressive to enforce it in its strictness.

3750. Do you not regard such conditions as very necessary to avoid the crippling of the rails, especially considering that the rails on the Fingal railway are only 40lbs. per yard? Not if the ground is hard and dry, and the sleepers are packed with dry earth as they go on.

3751. So far as we could observe going over the line, no attempt has been made to pack the sleepers even with earth: are you aware this has not been done? I always insist on its being done whenever I am aware of its neglect.

3752. Although you may regard some of the provisions in the specifications as inserted for the protection of the department, and not necessarily to be enforced, do you allow important conditions to be waived by the resident engineer, or only with your sanction? My sanction was not asked in that respect in the case of the Fingal line, but it was in the case of the Mersey line.

3753. Do you consider that the resident engineer on the Fingal railway has exceeded his authority as resident engineer? I think for his own protection he should have asked me.

3754. *By Mr. Lawder.*—With reference to your reply to Mr. Stanley stating that the clause *re* running upon formation was entered for the protection of the department, and that it was usual for contractors to be allowed to neglect these conditions, is it not rather understood in the contract that strict attention shall be paid to all conditions of the contract, no matter what they may be, and that only the chief officer of the department has power to waive them in writing, and such permission he can again revoke if necessary? The signed contract, of course, requires that the contractor should get my permission in writing; that I considered should be used at my discretion, but that might become oppressive, because it might be impossible for the contractors to reach their ballast pit unless by running on formation.

3755. Quite so; but in such case it is always open to the contractor to make such request. If such important conditions of the contract can be neglected by the contractors with impunity, how is a contractor or resident engineer to discriminate what terms of the contract shall be carried out, and what may not? It would have been better if my permission had been asked, as was done in the Mersey line.

3756. With reference to the concrete culverts, it is given in evidence that after the cracks appeared plaster was put on the face, and that the cracks are really more serious than we observed, that is, that the face of the arch has been brought out by plaster: do you know anything of that plastering being done? We do sometimes have a joint pointed to ascertain if it moves further.

3757. I understand that plaster was put on the face of the arch to bring that face out in a line with the face of the wall? Certainly I have no knowledge of that, and have given no orders for it.

3758. Would you approve of that being done? Certainly not.

3759. Did you inspect the alignment of the Fingal line when it was completed by Mr. Climie at any time before the contract was begun? Portions of it.

3760. Not the whole alignment? No.

3761. What portions were you able to inspect? Various portions at both ends of the line; but I never inspected it continuously throughout.

3762. I understand Mr. Climie laid out the railway from the Corners to Fingal? That is so.

3763. Who laid it out from Fingal to St. Mary's? Mr. Home, under the supervision of Mr. Climie.

3764. Did you inspect the alignment between Fingal and St. Mary's? A portion of it near Fingal.

3765. How many miles from Fingal? About a mile and a half from Fingal.

3766. You were not aware how the alignment goes between 42 miles and 47 miles? I know now, of course.

3767. During its construction you observed it? Yes, and I know it from the plans.

3768. Do you approve of the line being taken along the low ground between 42 miles and 44 miles? We were forced in that position to keep clear of the buildings and farm of Mr. Legge.

3769. Would it not have been possible to go round these farm buildings, which occupy a small area, and keep the line close to the road or more upon the hill side? The line going closer to the road was objected to by Mr. Legge.

3770. Upon what grounds? That it would damage his dairy farm.

3771. But in a case where it is a matter of vital importance to the railway, and which concerns the expenditure of many thousands of pounds initial cost, as this railway will, and in this case an excess for additional flood openings that have been added since the contract was made, would the reason you have given be sufficiently weighty to have caused the proper line to be given up? I can hardly agree with you as to its being a question of thousands.

3772. I allude to the initial cost of the work as being one of many thousands of pounds, and of the excess cost caused by the additional waterways which were found necessary owing to the nature of the ground the line now runs through? The line running close to the road, would have left a long narrow strip of severance and damaged property; and the line being taken in the hill would have lengthened the line. It might have reduced the required area of waterways, but I do not think it would have materially reduced their number.

Public Works Office, Hobart, 17th March, 1886.

SIR,

I HAVE the honor to request that the Commissioners will be good enough to place on record, in connection with the evidence, my statements as under; viz. :—

That when the first large Public Works scheme for roads, bridges, &c. was passed in 1877, amounting to £137,350, only the mere nucleus of a field or office staff existed, and the works had to be arranged and organised over a large area of the Colony, with entirely new and untried men, and were carried out with only such few defects as would belong to the starting of any new machinery.

That similar difficulties, on a greatly extended scale, have existed in connection with the preparation of proposals for, and execution of, railway works, amounting in value to some three quarters of a million sterling, both under outside pressure, and without the necessary trained office or field staff (such as now, even, exists only in the latter case).

I doubt not but that the Commissioners, as professional men, can fully realise my position under the above circumstances, while carrying on various other duties as well, especially when application for assistance in the professional work of the office (concurrent in by the Minister of the Department) was not entertained.

I have the honor to be,

Sir,

Your obedient Servant,

J. FINCHAM, *Engineer-in-Chief.*

*To the Chairman of the Royal Commission on
Railways and Public Works.*

WEDNESDAY, MARCH 24, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

MR. FINCHAM'S *examination continued.*

3773. *By Mr. Lawder.*—As the line was originally laid out, very much smaller waterway was provided through the bank than is now put in? That is so.

3774. And you have found this larger amount to be necessary from experience? I did it on the advice of the Resident Engineer.

3775. The Commissioners observed the waterway under the existing road a few chains away from the line, and running for some miles parallel and close to it, was very much less than that now under the line: would you not have saved by going nearer the road, as already suggested, this very excessive amount of flood openings? If the number of flood openings have been considered necessary in the present position of the line they would be equally necessary had the line been nearer the road.

3776. Why so? if the amount of waterway under the road which now carries all the drainage is so very much less than put in at the railway, it is the same watershed? Yes, but the railway has the greater catchment area behind it.

3777. The ground dips from the railway towards the road? Yes.

3778. Generally? Generally there is a fall from the foot of the tiers to the road, and a very considerable fall.

3779. In that case the waterway below the road would require to be very much greater than that now required beneath the railway? Lower down the hill you go the larger waterway would be required.

3780. But we have been informed that the road is never flooded, and the waterway through the road, which is said to carry off all the drainage, is very much less than has been put in below the railway. Under these circumstances I assume that the road lies higher than the railway? I do not think for one moment that is the case. The ground along the road at that place is very deceptive. I remember testing by aneroid the difference of level of the seeming flat between the entrance gate of the road to the Mount Nicholas mine and the flat next to the foot of the tier, and there was a fall of 50 feet in the flat towards the road.

3781. Then are we to understand you to say that the water flows over the road, or must flow over the road? No, I do not say that at all.

3782. How does the water get away under the circumstances I have stated? By means of the side ditches and culverts.

3783. From our inspection we could not perceive there was any equivalent waterway through or beside the road to be compared to that put in under the railway? The raised embankment of the railway offers more obstruction to the water than the road below it on a level with the surface ground. The difference of cost when building these timber waterways between a 6 feet opening and a 10 feet opening is so small that it is always better to give a more liberal provision.

3784. Do we understand you to say that although the water would not flow over the road, that the railway bank being higher would form a greater obstruction to the water than the road? Of course it would, because allowing the water to get a certain height it would go over the road, while at the railway it would be banked up.

3785. Did I not understand you to say that the water did not go over the road? Oh, no; I do not know whether it goes over or not.

3786. Have you made any calculations upon the subject? No, I do not think I have.

3787. Do you entirely approve of the alignment from the 42nd to the 47th mile, including the addition of these waterways?—do you consider it the best that could be obtained there under the circumstances? I consider it the best under the circumstances, partly for the reasons I stated yesterday, and partly because the object was to get as near as possible to the Mount Nicholas Coal Mine without unnecessarily lengthening the line.

3788. Would it not have been equally near a few chains to the right or left, practically? If by a few chains you mean anything between three and five chains, it would.

3789. To the road does not appear to be more than that? Oh, considerably more; the plans show that. It only goes near the road at St. Mary's.

3790. Would it have been possible to have obtained a line above the town of Fingal at anything like the same cost, by which several drain openings on the Fingal rivulet would have been confined to one bridge, by taking the alignment above the town slightly? It is quite possible that we might have saved a timber span or two over the Fingal rivulet by the line suggested; but that would have been accompanied with other disadvantages.

3791. Would you kindly enumerate these disadvantages? Worse grades; intersecting a great number of township allotments, many of them in a diagonal direction; taking the line right away from the township, besides lengthening the same.

3792. Have you satisfied yourself that these disadvantages would accrue from the alignment I have suggested? have you had the alignment made there? Previously to the contract survey being carried out where the line is now made, I, on two separate occasions, examined the route myself which you have suggested.

3793. Can you give us any idea how far above the main street of the town the alignment would cut in? It would have been some 60 chains south of the present line.

3794. Did you have this line laid out by instrument, or did you simply gauge it with the eye? In going over the ground I had a large scale plan of the township, and an aneroid, and I could see quite enough then to determine me against the line.

3795. Are you aware that a portion of the present line immediately below the town is said to be liable to floods? In the face of that danger would it not have been preferable in your opinion to take it above the town, notwithstanding these other disadvantages? I duly considered that danger. The land is certainly liable to floods, but the level of the railway is far above the height to which these floods have ever been known to rise.

3796. You have stated in your evidence, Mr. Fincham, that you would yourself, as a practical engineer, have constructed the wing walls of culverts square to the line, that is, I presume, at right angles to the line? I said that in deep banks that was preferable.

3797. In that case why were the contract drawings sent out from your office with the face walls shown therein running parallel to the alignment? Generally they are less expensive. Neither myself nor the Resident Engineer was absolutely tied to those adopted.

3798. But you have, in point of fact, bound yourself to them by having them constructed? It is a very common form; and different Engineers have a different practice.

3799. You also implied in your evidence yesterday that you did not consider it necessary to give detailed instructions as to the construction of such a work to your Resident Engineer? It would be too much to expect that I should give specific instructions for every minute detail in connection with the works.

3800. But is it not part of your duty, or whose duty is it, that a proper amount of supervision should be exercised over your subordinates as to these details? The mere matter of putting a parapet or fronts to the culverts with concrete arches is a detail that in my opinion clearly belongs to the Resident Engineer.

3801. But such matters as this are of vital importance to the stability of such a structure, or of more important structures: do you not consider that they should be looked after by you or by some competent officer? I consider the whole damage referred to but very trifling, and suppose that a £10 note would correct all the damage done.

3802. That is hardly the question. You seem to place implicit faith in your Resident Engineers, and allowing that these officers may be perfectly reliable, they are, in common with other human beings, liable to errors and omissions which supervision over them, occasionally exercised, would prevent and correct? I do always check and call attention to any practical details that require remark when inspecting the works; but in this case the fronts were built long before I saw them.

3803. Then what do you intend to do with reference to those face-walls and the concrete culverts alluded to? I cannot say till I have seen them.

3804. Allowing them to be dangerously cracked, do you intend requiring the contractor to rebuild them? I cannot say till I have examined them.

3805. You mean to examine them? Certainly. The mere fact of the front of a culvert being curved in the way in which the front of the culvert at Stony Creek has been described, does not necessarily mean its permanent failure. I have in mind the case of four large wings to a 60ft. arch carrying the Midland Railway over the North-Western at St. Albans, in England. These wings were some 40 feet in height, parallel to the railway, and the pressure of the earth between forced them from their direction into a curved shape, without in any way destroying their permanent efficiency.

3806. Were these wing walls built perfectly vertical in the face, or had they a batter? I forget, but I have a photograph of the bridge in question.

3807. That may fairly happen without any risk to the stability of the wall in a case where the wall had a batter; but in this case the wall had not received a batter, and being cracked, would you consider it safe? If the crack was a serious one I should take it down.

3808. Would you in that case require the contractor to rebuild it, or who do you consider would be responsible for its failure,—the officer who designed the plans, or whom? Supposing the work to have been honestly and faithfully done, the officer supplying the working plan is responsible, as he had full authority to strengthen the work.

3809. Were the plans issued to the resident engineer authorised by you, or what is the practice under your system? I cannot at this moment remember if I have ever seen the plans.

3810. You do not require such plans should be submitted to you for approval? No, I do not, in a case of the kind.

3811. And you would allow your Resident Engineer to design such plans and have them carried out, without reference to you? As long as they followed the general lines of the contract drawings.

3812. And these drawings the Commission understands were got out for you by Mr. Edwards? Yes.

3813. And you approved of these contract drawings and plans? Yes.

3814. About the fencing: what reason led you to substitute the present iron wire fence for the usual post and rail fence usually employed in the Fingal District? There is far more wire fencing, or wire with a top rail, than post and four-rail fencing in the district, on account of the scarcity of the timber.

3815. Do you consider the fence you have adopted sufficiently substantial to keep out both cattle and sheep, or anything likely to knock against it? Yes, I think it is a good fence. Some scores of miles of lighter quality have been purchased and erected by large sheep and cattle owners in this colony. I selected originally a wire fence with a top rail, because the contractor's price was lowest for that description, but I was glad to take advantage of his offer to substitute the fence erected for the fence with a single top rail, at the price of the latter.

3816. Then your reasons were economical ones, I presume? No, I prefer the present fence.

3817. Do you consider it as strong as the post and rail fence? Quite as effective in every way for keeping stock off the line, while there is a minimum of risk from destruction by fire in summer time, owing to the small quantity of timber in the fence.

3818. The Commissioners noticed that several places where this fence has been erected sheep are able to creep under the lower wire owing to the posts being a long distance apart on uneven ground? This is simply the case because the contractors have not had time or have not carried out my instructions with regard to these depressions in the ground. But that will all be put right by the time the line is completed.

3819. How do you propose to put that right? By a post or posts in the deepest part of the hollow, and wires radiating to where the normal height of the fence is sufficient.

3820. That is, you would have extra wires inclined down from the ordinary posts to supernumerary posts in the centre of the hollow? That has been my instruction.

3821. Would not this add to the cost of the fence considerably? No, it is a cost that would have been incurred in erecting post and rail fences.

3822. But in the case of a post and rail fence, the posts are how far apart? 8 ft. 3 centres.

3823. In the present case how far are they apart? They run according to the ground, but generally speaking it might be about 50 feet.

3824. Does it not seem quite clear that in the case of a post and rail fence with posts close together, the extra wires you have mentioned would not be necessary? It is usual in the case of a post and rail fence crossing broad creeks to lengthen the posts and supplement the rails.

3825. Quite so; but it is unequal ground we are discussing, not creeks. With 8 ft. 3 centres you have six times the number of posts that you have in the present fence; now how far do you insert the ends of the present posts in the ground? About two feet.

3826. Then you have one post placed 2 feet in the ground at every 50 feet to resist the pressure that may be brought against the fence by cattle, as against six posts placed the same depth in the ground in the post and rail fence, allowing the wires to be sufficiently strong themselves. Do you not consider this a great disadvantage? A considerable disadvantage if you are to estimate the pressure on the fence at so much per square foot; but since the greatest pressure would probably be that of a few sheep (cattle would not press against the barbed wire) and the whole fence would give like a belt of canvas; it would be secure enough.

3827. In the event of accident, say a dray knocking against one of the posts and breaking it, would there not then be considerable advantage in favour of the post and rail fence, inasmuch as you would have practically 100 feet of fencing down and useless in the one case, and in the other the fence is hardly affected? It would not be useless; it would only have the effect of lengthening the distance between the posts, as the wires would not fall, while the post and rail fence would come down.

3828. The Commissioners did not see any stays to the straining posts; why were they left out? I can only say that I have seen struts in several places.

3829. Do you consider they are sufficient? I cannot say whether the contractors put in all that are required.

3830. Would it not be necessary to do so as he proceeded with the work of the fence? He would use his own judgment, but he should require additional struts to be put in if we thought them requisite.

3831. We observe in the contract drawings that wrought iron straining posts, with 1½ in. square iron struts have been provided: but there is an alternative entered that round hardwood posts may be substituted. The contractor has informed the Commission that he was not required to supply or put in any struts to these round hardwood straining posts: is that the case? Not from me.

3832. But I suppose that your sanction would be required to an important matter of that kind before the contractor would presume to omit them? Yes, it would, no doubt.

3833. Then, if they have been omitted, who is responsible for the omission? The resident engineer; but I am not sure that they are necessary.

3834. But you have stated that it was necessary to obtain your sanction; and as the resident engineer has not done so, the question of their being necessary for the fence or not would not apply. You mentioned, Mr. Fincham, yesterday, that the contractor had been overpaid for some work at Avoca? So I have been informed.

3835. Have you no information about this matter? I have understood that a quantity of earthwork to the extent of between 4000 and 5000 yards has been returned in excess at the cutting at the Avoca Station. This will, of course, be adjusted in a future certificate.

3836. It will? Yes.

3837. For what maximum rate of speed has the superelevation of the outer rail upon curves upon this railway been calculated? was the calculation made in your office or by Mr. Climie, or was the calculation ever made? I gave no instructions at all upon the matter, but our general working speed could be well known to Mr. Climie.

3838. Is it not desirable that you should sanction such important matters, and have them brought to your notice? We have a fixed rule that on our sharpest curves, viz., 5 or 6 chains, the superelevation should be about 3 inches, and this determines the superelevation of the easier curves.

3839. For what speed has that been taken out? Seventeen to twenty miles per hour.

3840. Would you, then, consider trains running at 30 miles an hour properly provided for? Yes. The superelevation over five chain curves on the Main Line does not exceed 3 inches, and the trains on that line run faster than we do on the Government lines.

3841. Then do you consider the provision of that nature on the Main Line as a precedent for those upon the State lines? It has there borne the test of 12 years' experience or working.

3842. *By Mr. Stanley.*—Was the Parliamentary Survey for this line effected by officers of your Department or under contract? By officers temporarily engaged for that purpose.

3843. Not on contract? No.

3844. How was the work of survey carried out? By day work.

3845. Then the contract method was not followed at the Fingal line? No.

3846. Can you state approximately what the cost of the survey amounted to per mile? The contract survey—the permanent survey—cost, for field work alone, £1027, and the mileage was 47 miles.

3847. That is something over £20 per mile? That was for the field work alone, exclusive of the preparation of plans.

3848. Can you state what the cost per mile would amount to, including the office work in preparing the plans, taking out quantities, &c.? Not at the present moment.

3849. I presume you charge the cost of preparing plans to the vote for the survey? There was no vote for the contract survey.

3850. Then was the survey expenditure charged to the general vote for construction? It was.

3851. But in so charging it, I presume there would be an account for expenditure on surveys under a sub-head? Yes.

3852. And to that sub-head would you charge the cost of preparing plans and taking out quantities? Not necessarily, because it would be difficult to divide the cost of preparing plans and sections from the cost of preparing working drawings for bridges, culverts, &c., all work having been included in one contract rate.

3853. Then to what account did you charge the expenditure in preparing the working plans, schedules, &c.? To supervision and plans.

3854. Can you state, for the information of the Commissioners, what was the amount of your original estimate for the Fingal Railway? The Parliamentary estimate prepared by me amounted to £150,000. Before the Parliamentary estimate was made, and in the previous session, I made a flying survey of the railway, and reported to the Minister, for Parliament, upon the probable cost, which I stated would not exceed, in any case, £4000 per mile. As a matter of fact, the railway, when completed, will be constructed well within that original estimate.

3855. Does that opinion appear in any Parliamentary paper to which you could refer the Commissioners? It does appear in a Parliamentary paper, which I will hand the Commissioners.

3856. I have a Parliamentary paper dated 21st September, 1885, No. 126, and I observe in this paper that you state, "I have every confidence, after going through the fuller information afforded by the Resident Engineer, that the total cost of this undertaking, with equipment, will be from £150,000 to £156,000, (under £3500 per mile, including the extra cost of taking the line through Avoca); but this amount will be reduced by £1000 for duplicate parts of rolling stock purchased under the construction vote but transferable hereafter to working expenses." Will the ultimate cost of the line be within this amount? No, it will exceed it.

3857. What do you estimate the total cost will probably amount to? Exclusive of accommodation for the proposed coal traffic, which has not yet been authorised or estimated, I think the total cost will be between £172,000 and £173,000.

3858. Is any provision made in this estimate for rolling stock? There is; it includes every possible contingency as far as I am aware of.

3859. Can you hand in that estimate from which you quote, for the information of the Commissioners? Yes; I do so.

3860. I observe from this estimate that you put down the total amount of the contractors' account at £83,807 1s.—that, I believe, is the amount of the original tender? That is so.

3861. Are the works now being carried out not likely to exceed this amount? Before making the statement in the Parliamentary Paper to which I have referred, I had been advised by Mr. Climie, who had instructions to revise the whole probable expenditure for the purpose of this Parliamentary Paper, that the contract would be completed within the tendered amount, and Mr. Bath on more than one occasion confirmed this opinion. The excess of £3000 on the Avoca deviation was not known to me at that time, and the statement as to the £6000 would have been increased when I wrote that report had I been aware that the Account Clerk had overlooked payments in London in connection with rails, &c., to the extent of somewhere about £10,000. I found this out subsequently in going over the estimates.

3862. We understand, Mr. Fincham, that the tender was based upon what is called the Avoca deviation, so that the excess in cost of that over the original line could not form a credit in this account you have just handed in? It could be so fairly credited, because the full amount of earth-works in the station yard, and the cost of the approach road (some £700) was not included in the original quantities.

3863. That would hardly be a fair way of accounting for the increased expenditure, seeing that the contract plans were based upon the line known as the Avoca deviation. Your explanation would account for what appears to be an error in taking out quantities; but it is hardly legitimate to take credit for the increased cost of the Avoca deviation under these circumstances: do you think so? Not altogether. I see now I could only claim part.

3864. This statement of the probable total cost of the Fingal Railway, I observe, is dated 9th March,—since the opinion furnished you by Mr. Climie in respect to the total expenditure for contract work. Have you not obtained any advice from the present Resident Engineer, Mr. Home, as to the probable total amount of the work as being executed? I have obtained information from Mr. Home since my examination yesterday, when the Commissioners informed me that the excess stated by the contractors as incurred in connection with the earthwork. I omitted to explain at the time that although in some items, for want of information the quantities might be deficient, still there was in the contract, as in all others, a provision for these extras to the extent of 10 per cent. upon the estimated amount. Taking the items of fencing, earthworks, concrete, brickwork, masonry, pipes, woodwork, pitching, and metalling, I find there is a total estimated excess over schedule quantities in the earthwork, pipes, and woodwork to the extent of £16,514; while the estimated saving under fencing, concrete, brickwork, masonry, and metalling amounts to £7162—leaving a difference of £9352 in excess. Deducting from this the provision made in the contract amounting at 10 per cent. to £7619 upon these items, there is only an excess left of £1733.

3865. Are these figures based upon information you have received from your resident engineer, Mr. Home? They are.

3866. Since preparing the statement which you have handed in this morning? They were prepared for me yesterday, at my request—yes, since the statement was made.

3867. The contractor's engineer, Mr. Renwick, has stated that he estimates that the total amount of the contract will be £89,476, being an excess of £5569 over the tender? I should receive that statement with considerable caution, coming from the contractor, as it would no doubt include many claims he is not likely to get.

3868. It was understood that this really only included the actual measurement of work, and not claims outside of that? As I said yesterday, I very much prefer to rely on my own figures than those of a young man like the contractor's engineer.

3869. Then you think, from what you have heard from Mr. Home, that the contract will be exceeded by about £2000? Yes.

3870. This is over and above the provision of 10 per cent. for contingencies in extra works? Yes.

3871. Would you be good enough to ask Mr. Home for an approximate statement showing the probable total amount of the contract as executed? Yes.

3872. The estimate given in the statement you have referred to, the total cost amounts to £173,168? Yes, exclusive of the provision for the coal traffic.

3873. Comparing this with the estimate which you furnished in September, 1885, viz., £156,000, will you state generally to what you attribute the excess, which amounts to about £17,000? About £10,000 is due to the omission of certain London and other payments, in connection, I believe, with freight of rails, by the account clerk who furnished me with particulars, but who had only just taken over the work.

3874. Will you furnish particulars of this amount? I will.

3875. Then to what is the balance of excess, £7000, due? I must have a little time to prepare the statement for the Commission.

3876. In your estimate furnished in September, 1885, what provision was made for compensation for land and charges? I have not at present the information upon that matter.

3877. Will you be good enough to furnish it? I will.

3878. Can you state from memory whether the actual expenditure under this head has exceeded the estimate or otherwise? The figures are only approximate, as the land purchases, in a great many cases, have not been concluded yet, and I have no means of knowing what the charges for conveyancing will come to.

3879. Then you cannot say whether any excess of expenditure over your estimate can be attributed to this? No, but you can compare the figures put down in the statement you have before you as the estimated cost for the land and charges with the amount for the same in the Parliamentary paper giving details of the Parliamentary estimate.

3880. Would you be kind enough to have prepared, for the information of the Commissioners, a comparative statement showing the various amounts included in your original Parliamentary estimate of September, 1885, (£156,000) under the various sub-heads, with the expenditure on the works as executed, showing the difference, either increase or decrease, in separate columns? I will do so.

3881. Is it your intention to make any provision for signals at the various stations in the Fingal Railway? If required by the manager. That remark indicates one of the items of increase throughout all the lines.

3882. Did you not contemplate signals originally? I do not think them necessary except at the junctions.

3883. Do you not think them necessary where trains pass each other? Yes, that might be included.

3884. But have you made no provision for the constructing of signals on these lines? They were erected on the Mersey, on my recommendation to the Ministers, out of deference to the late manager.

3885. Has no application been made by the present manager to provide signals on these new lines? No, I have had no business communication whatever with him at present.

3886. Then you cannot say whether he considers such provision necessary? I cannot. I know that his ideas run in a more economical line than those of the late manager.

3887. But do you think that where the safety of the travelling public is at stake that questions of economy should be considered as paramount? No, I do not say that.

3888. But that might almost be inferred from what you state? No, I would never sacrifice safety or efficiency to economy; but with a slow traffic of 15 miles an hour I do not consider signals necessary at each station. They are useless except at the places I have indicated.

3889. I think you said it might be advisable to provide signals at passing stations? At junctions and passing stations.

3890. Do trains always pass at the same stations, or are the passing stations not liable to be altered? I hardly know how to answer that question. There are none, except on the broad gauge line.

3891. Are there no cases now where trains pass at stations on the lines open for traffic? No, only on the broad gauge at Longford.

3892. Do trains never pass each other on the line between Deloraine and Formby? Not that I am aware of; always excepting a special train which might be shunted into any siding.

3893. Has your attention not been drawn to the advisableness of protecting passing stations by signals on the lines open for traffic? Not on the Government lines, but it has upon the Main Line. In fact I have made special recommendation in my reports upon the Main Line that passing stations should be protected by signals.

3894. Have semaphore signals been erected on the line between Launceston and Deloraine? Yes.

3895. And do you think that the requirements of the line beyond Deloraine are not such as to necessitate protecting the stations by signals similar to those erected upon the line between Launceston and Deloraine? No. I consider them useless expenditure, generally, with our traffic. It is a very different matter if you are running a fast express traffic over a line.

3896. Can you say whether the Board of Trade in England would allow any line, however small the traffic might be, to be opened without having the stations protected by signals? No, I do not think so.

3897. And do you think it is well to depart from experience gained in such matters on English railways? I think what is good enough for average traffic in America and elsewhere is good enough for the small traffic in this Colony.

3898. Can you state whether it is the practice in America to omit to provide signals at stations? I have heard it is so on many stations, but I cannot say from my own knowledge.

3899. *By Mr. Lauder.*—You have stated that you consider signals necessary upon junction stations or passing stations: would you not also consider them necessary for the protection of station yards where any shunting may be

going on, especially where the engine shed siding takes off the main line? When the traffic is confined to one, or, at most, two trains per day, I do not think it is necessary.

3900. But an accident might happen in this way, from either hand shunting going on at unauthorised hours, or by the wind blowing standing stock down across the points leading into the main line? Scotch-blocks would prevent a waggon getting away by the action of the wind.

3901. Are scotch-blocks always provided in such a case? I should consider them necessary in every case.

3902. Have they been put in in all such cases? Not on the Mersey line, but on the Launceston and Deloraine they have.

3903. Is it usual on English, American, or European lines to take off your spare sidings, or engine shed sidings from the main line, as is done at Formby and elsewhere here? It would not be usual. They would be taken off sidings.

3904. What is the reason for adopting plans elsewhere found to be dangerous? Simply because there is no danger here owing to the limited traffic.

3905. In such a case you throw a very large responsibility upon the officials working that traffic? As there are at present only two trains per day, the officials have a more ample margin of time in which to perform any shunting, and any accident could only result from gross neglect or carelessness.

3906. Still, the security of the public practically rests upon the care taken by those officials? Yes; and enough security would be given by the official in charge of shunting-places showing a red flag at a short distance from the station.

3907. In the case of the Avoca station, which is placed upon a sharp curve, and is in a deep cutting, and the approaches also to the station winds round the hills, do you not think that signals are essentially necessary, as in this place it would be impossible to see anything going on in the station-yard from certain points of the approach? I only consider it would be necessary in the case of a fast express through traffic. Every train would pull up on approaching the locality of a station.

3908. But a train would not usually pull up until it had reached the platform, whereas there might be some disarrangement by which the train would be run off the main line into a siding? No, it would slow before reaching the platform.

3909. Then, getting into a station would be left entirely to the care of the officials in charge of the train? But the official in charge of a train would look out for any signal from the station-master or porter in charge.

3910. Then who would be responsible for working the train into the station? The responsibility would rest over both the officials in charge of the station and the officials in charge of the train.

3911. But not having the legitimate means for working the station, you could hardly make the station official responsible? I must differ with you there. I consider the use of hand signals perfectly legitimate means for guarding against accident with such traffic.

3912. *By the Chairman.*—In the estimate which you have given previously, do you include the cost of the Engineer-in-Chief's staff at Hobart, and general executive officers over any line, or is that generally chargeable to the railway works as a whole? It is chargeable to the vote.

3913. Is any proportion of that charge made against the Avoca line? Every expense in connection with survey—clerical work, and draughting staff, engineers' salary and expenses, clerk of the works' salary and expenses—is all charged to the Avoca construction, nothing for such services having been included in the original estimates.

3914-5. With reference to the land, we noticed that in several places along the line the quantity of land taken by the Department from private owners appeared to be rather insufficient. Will you state why such small quantities were obtained passing through different properties? The case which now comes into my recollection is passing through those embankments near St. Mary's, where the contractor had to take a considerable quantity of side cutting, and the cess required by the specification is not the width it should be, and the slopes of the side-cuttings are very much steeper than described in the specifications. Would it not be better to take three or four yards more than run to the narrowest margin? Yes; and if I had been applied to I should have given the extra amount.

3916. Should not the officer be empowered to bring this case before you? I generally suppose that they do so, as has been the case in the Scottsdale Railway, where extra amounts have been applied for for side-cutting purposes.

3917. We noticed this to be the case in more than one instance, and, with a view of preventing it in future, would it not be better to issue a circular to officers in charge, instructing them to call attention to any of these cases? I will note that.

3918. Now, with reference to the fence, do you propose to take any measure for strengthening the fence on the Avoca line? At present the posts are 53ft. apart, and the nature of the ground being broken, do you propose to do anything to render the fence sheep-proof? The strain on posts so wide apart and not strutted, would tend to bring the fence out of line or disfigure it in some way. What provision do you intend to make to remedy this? In places where sheep can get under, I propose to put additional wire, or bank up the hollow spaces with sods. Of course, where straining posts are evidently required for the stability of the fence they will be added.

3919. With reference to the water supply of the line, in your estimates have you provided for water tanks being erected at different stations on such points where these are absolutely necessary for working the traffic? I have a sum of £1550 put down for water supply on the Avoca line.

3920. How do you propose to obtain the water, by gravitation or pumping? By pumping for the supply at Stony Creek, which, indeed, is only required for working the coal traffic. The next, and only other water station, will be at St. Mary's. The Resident Engineer has promised to run levels to see if the water can be supplied by gravitation, otherwise the water will have to be pumped from the creek near.

3921. Do you propose to make any provision at the Corners?—is there any water there, or where do you make any provision for a supply? Stony Creek is only eight miles from there. No water can be obtained at the Corners. During the construction of the Main Line a well was sunk there over a hundred feet unsuccessfully.

3922. Have you made any provision for a turn-table, or how do you propose to turn the engines? Provision has been made at St. Mary's for an engine turn-table.

3923. Is provision made for that in the estimate? It is.

3924. You do not propose to have one at the other end? There will be one at the Corners if the railway is worked altogether independent of the Main Line; but until the Government has arranged how to work the traffic it is quite impossible for me to state distinctly what will be done at the Corners.

3925. But assuming a turn-table is required at the Corners, does your estimate provide for it? Yes, it does, as there is a sum of £1450 for the turn-tables, and I believe I am quite safe in saying that two turn-tables have been ordered for this line.

3926. As you have laid some stress on the undesirability of spending large sums of money on provisions for signalling, on the ground that this Colony is small and sparsely populated, and the trains infrequent, have you considered the desirableness of working the railway with the telegraphic system? A telegraphic line is provided for the special use of each railway.

3927. Is provision made for connecting each station on your estimate? Yes; that is, another extra £1150 is put down for that, and that will be sufficient to connect all stations. In my original estimate, in order to save cost I intended to use telegraph poles along the main road, putting in short loops to the stations which are quite close to the road; but since then arrangements have been made with the Superintendent of Telegraphs, with the approval of the Minister, for an entirely new line at a cost of £1150, which is now being constructed.

3928. Practically, then, the line will be worked in connection with telegraph signals? Yes; each one of our lines are.

3929. Why should not some uniform plan be adopted for erecting stations, so that the same plans for construction might be used? I have adopted several standard plans, some for roadside traffic, and some for township traffic.

3930. Take the station now being erected at Avoca: there is no similarity in design between that and the other stations on the lines—it appears to be an entirely new type; is it not? The station at Avoca is a similar type to that at St. Mary's and that at Fingal.

3931. But why not the same as those on the Mersey line and New Norfolk? There is no station identical with the New Norfolk one, which was built to give the extra accommodation required there for the excursion traffic. The buildings on the Scottsdale line will be the same as on the Fingal line; but when the Mersey line was being constructed I had not settled upon the type plans, and, moreover, we were pinched for means, which induced us to adopt buildings that were inferior to what would be desired as standard types.

3932. Which, then, is the type? The one at Avoca.

3933. What station buildings, other than the Corners, Avoca, and Fingal stations, do you propose to erect on the Avoca line? There will be a goods shed and station at Avoca; the same at Fingal and St. Mary's.

3934. Have you made provision for these? Yes, £6000; that will leave a margin.

3935. We noticed on all the Government lines that hardly any stations are named. Would it not be advisable, and more satisfactory to the public, that notice boards showing the name of the station in large letters should be put up? Yes, and in these new designs you will notice a special fascia board where the name may be written on in bold letters. It should have been done on the Mersey line, and in future I intend to carry it out.

3936. Is there anything you wish to say in explanation of answers you have made to any questions? No, I think I mentioned to the Commissioners the extra cost for the greater permanence of the Stony Creek work not provided for originally; and, although I cannot give the exact figures, I am certain some extra expenditure was incurred by the deviation of the Parliamentary line from near Killymoon to St. Mary's. The line was laid out in the Parliamentary survey through the level land at the south of the road, and had a most favourable crossing over the Break-o'-Day River, I suppose very little over two chains in length; but in order to better accommodate the anticipated coal traffic the line was drawn on to its present crossing at Killymoon, which the Commissioners must have observed was a long one. In addition to that I am pretty sure that the earthworks were more costly, because on the original line they would have been largely made from simple side-cuttings.

3937. When this deviation was proposed, did you report to the Ministers that this would entail an extra outlay? No, I was not in a position at the time to do so, not having made any survey.

3938. As a public officer may be reflected upon when his estimates are increased from the preliminary estimate, would it not be better—in fact for your own protection—that you should make such a report to the Minister that would put permanently on record the reason why the estimate was departed from? If I had considered for one moment that I should be securely tied to this approximate estimate, I should have done so.

3939. For your own protection would it not be better, whenever departure is made from what was originally proposed, that reasons for that departure should be given by you as a public officer? It would have been better, and I am sure it will be done in the future; but every allowance must be made for the haste and bustle in which I had to get everything started.

3940. If the estimate is exceeded, the public generally only know that such an estimate has been exceeded, and do not sufficiently comprehend at all times the cause which leads to that increase. Taking that view, and knowing how critically the public analyse the estimate of a public officer, would it not be better for you to adopt that principle in future, so that your views should appear on record? It would be so, and I shall profit by the experience gained in dealing with the new lines sanctioned during last session of Parliament.

3941. If it could be shown that parliamentary or public pressure has compelled the Engineer-in-Chief to depart from his original estimates, in that case such a document would clearly absolve him from all consequences. Bearing that in mind, do not you think that you have in some measure acted injudiciously to yourself in not taking this course? I am quite sure I have; and, if the Commissioners will allow me, I would like to add a few remarks with reference to the matter with regard to the lines sanctioned during last session of Parliament. I have been placed virtually in the same difficult position that I was placed in with regard to the Latrobe deviation, where Parliament ordered work never contemplated or included in the estimate in the case of those so-called light lines sanctioned last session. I was asked specifically for estimates for light agricultural lines. I made approximate estimates for such lines, stating that I proposed to use 30lb. rails. I thought this a guarantee that no attempt would be made to work the lines with the ordinary speed and stock; but Parliament objected to the 30lb. rails, and included a provision for increasing the weight to 40 lbs. At the same time, although I stated that the line would not be fenced, the Act was passed compelling the erection of fencing. I have now to provide not only for the cost of fencing, but for the incidental cost of erecting crossing gates, cattle creeeps, &c. that would have been avoided. Moreover, I am afraid that the adoption of the 40lb. rail will eventuate in my being compelled to complete the line as an ordinary line without having adequate provision for such. I have called the attention of the Minister of my department to this matter in an official report.

3942. *By Mr. Stanley.*—At whose instance was the deviation at the Break-o'-Day River effected? Mr. Adee Douglas suggested that it would be advisable for me to consider whether the line should not be removed to its present position for the sake of convenience in working the coal traffic.

3943. And did you recommend to the Minister at the head of your department to adopt the deviation? No; bearing in mind the suggestion referred to, I ordered the permanent survey to follow the general course adopted.

3944. Did you not consider it necessary to bring the matter under the notice of the Minister of Lands with a view of obtaining his sanction? It is most probable that I did mention it, but I cannot say. I did not do so officially, but it would be very unusual if I did not mention such an alteration as that.

3945. But where an important alteration is made from the line, as shown in the Parliamentary plans, is it not your practice to submit the matter for the sanction of the Minister? Not in an official form always.

3946. Have you authority as Engineer-in-Chief to deviate to any considerable extent from the Parliamentary line without the approval and sanction of Government? Yes, there is no check, but I never make an important alteration without consulting the Minister of my Department verbally on such a matter.

3947. Can you say whether the Minister gave his sanction to the deviation which you have referred to? Certainly no objections were ever raised against it.

3948. Did he approve of it? I cannot recollect his giving direct approval, but I am sure he made no objection. It was considered by him and others, as well as by the late Premier at the time, that it would be advisable to run the railway as close as possible to the coal mine.

3949. Whom do you consider responsible for the deviation and the additional expense incurred thereby? I am responsible, but I made the alteration as I considered it in the public interest to do so.

3950. *By Mr. Lawder.*—At what point of the line will the coal traffic come in? About 4 or 5 miles from St. Mary's; I cannot say exactly, because the branch has not been surveyed yet.

3951. Can you give any idea? About the 43rd mile.

3952. Would it not have been possible to have retained the original crossing spoken of at the Break-o'-Day River, and join to the present line about the 43rd mile? Not without turning almost at right angles, and lengthening the line at least three-quarters of a mile.

3953. But that would have enabled you to avoid an expensive crossing of the river, and taking the line down into low ground? Yes, but I should have been very sorry to have engineered a railway with that alignment.

3954. For what reason? I should not consider it any credit to me.

3955. In what way? The loss of direction, and the increased length.

3956. But the capital cost would have been decreased? I have not gone closely into the figures, but the Commissioners can easily judge for themselves by comparing the Parliamentary plan with the contract plan.

3257. Would you kindly supply the Parliamentary plan to the Commissioners? I will obtain it from Hobart.

3958. With reference to the telegraph line you propose to construct, will the line be open to the public? The one for the use of the public will run on the same poles; there will be two wires, one for the railway and one for the public.

3959. The offices will not be in the same place? No, they will not be in the same place.

3960. Where do you propose placing your turntables? At St. Mary's, and perhaps another at the Corners,—the latter depending on arrangements for working the line. We do not know yet whether we will run over the Main Line or terminate at the Corners, leaving the Main Line Railway Co. to carry on the traffic from there.

3861. But will there be any necessity for the turntable if arrangements can be made with the Company so as to enable you to use the existing triangle formed with the Main Line to reverse your engines? No, that might be saved if the Manager of the Main Line will allow the Government to use his line in that way.

3962. I suppose economical arrangements could be made? No doubt, as we assisted him in other ways.

3963. Then the turntable would be available for another line? Yes.

WILLIAM KNIGHT, *examined.*

3964. *By the Chairman.*—You are a mechanical engineer and iron-founder, carrying on business in Launceston? I am.

3965. You have had considerable experience, I presume, in the construction of wrought and cast iron-work? Yes, ever since I was 15 years of age I have been engaged in it.

3966. We are informed that you have undertaken a contract for some ironwork on the proposed Derwent Valley Line,—is it not so? Yes.

3967. When you undertook this contract, was it stated to you for what bridge the iron work was required? In the case of only one bridge upon that line, No. 2, I have been informed.

3968. The designs are in triplicate,—the three designs are similar? Yes.

3969. That being the fact, was the iron work different for any of the bridges? One bridge has a sunken platform, I think it is for the Plenty River, the other two are raised platforms.

3970. When you entered into negotiation for the construction of ironwork, were you provided with specifications? I think there were specifications, but previous to seeing Mr. Falkingham I went to Hobart and saw Mr. Fincham as to the character of the work, and whether he required the edges of the iron to be planed up, because there was no planing machinery, and if he required that no local firm could tender. He distinctly told me in his office that he only required a good strong rough job, and read the specification over to me. I submitted a price to Mr. Fincham, and told him I was prepared to contract for it. This was on account of the girders for the Mersey line having been constructed in England, which, by rights, should have been constructed in the Colony. Mr. Fincham then referred Mr. J. Falkingham to me.

3971. Then Mr. Fincham satisfied you as to the description of work required? Yes, in his office.

3972. We have also been given to understand that the Government bound the contractors, if possible, to have the work done in the country? That is correct.

3973. Did the Engineer-in-Chief give you to understand that any particular description of iron would have to be used? The specifications stated that R H Crown, or any other Staffordshire iron would be approved of.

3974. What description of iron have you used in the construction? In ordering my iron, I ordered R H Crown, or any other brand of Staffordshire iron.

3975. Yes; but what description of iron did you actually use? It all came from one firm. I have never examined the brands to see what description, but I have noticed Consort, Crown Best, and Granville.

3976. Are these brands of iron well known in the trade, or are they outside brands? I have used the same brands for years; the Granville brand I have used for many years as the best for making boilers.

3977. What portions of this iron work is Granville,—is it plate or angle iron? I think the top cover-plates the 18 by $\frac{5}{8}$, is from the Granville.

3978. You have seen and read the specification? Yes.

3979. You know the test the Government stated should be applied to the iron? Yes.

3980. Did the Government in any way apply any of these tests during the process of construction? About five weeks after the work had commenced Mr. Jowett came up, and prior to his coming up no one had been near, and we had got seven sets of top and bottom plates of the 18 by $\frac{5}{8}$ and the angle iron punched, and 120 webb plates punched. Mr. Jowett asked for a sample of the iron. The iron was lying all about the yard, and he was asked to take up any piece he liked and have a sample cut off it. He took up a piece and they sheared off a piece which he took away. I was not present at the time or I would not have allowed such a small piece to be cut off with the shears, as I consider that cutting it so closely laminates the iron. It should have been shorn off in about 3in. or 4in. pieces, and planed down to the necessary width required. Instead of that they cut a narrow strip of about 1 $\frac{1}{2}$ in., and opened out the fibres of the iron with the intention of afterwards putting that damaged piece through a very severe test. That the iron is of first quality might be seen in a little boiler I made of the same, the ends of which are bent over and welded—a boiler now on board the T.S.N. Co.'s hulk at the wharf.

3981. What is it used for there? For driving a little steam winch in hauling up the coal.

3982. Do you know whether Mr. Jowett satisfied himself by any test of the quality of the iron? I believe no test was made, for this reason—Mr. Fincham came up to the works some little time after this iron was taken and examined the girders, and said there were no appliances in the island for testing iron, and they would probably have to send the iron to some other place. From that I inferred that the iron was not tested any more than submitting it to a sample examination.

3983. As far as you are concerned, there was no other communication between the Department and you with reference to it? No, excepting a letter to Mr. Falkingham, of which he sent me a copy, in which portions of the iron—the 6 by 4 and the T iron—was of doubtful quality.

3984. In consequence of that what did you do? I wrote to Mr. Falkingham and told him the test I put the iron to, and never heard any more about it.

3985. When Mr. Jowett obtained this shearing of iron from off of one of the plates did he inform you what he proposed to do with it? No, he simply left word with my brother that it should be forwarded down to Hobart.

3986. Did you understand the iron was taken for the purpose of testing? Yes.

3987. In what way did you mark it? I put our letter brand on the iron.

3988. Where did you obtain this iron from? I obtained it from Messrs. Roberts, Morris, and Meeks, of Melbourne.

3989. Without showing us the price of the iron, can you produce an invoice showing the brands of the shipment? They have that; I entered into an agreement with them.

3990. Can you obtain a statement from Messrs. Roberts, Morris, and Meeks showing the description of iron, and any information in their possession relative to it? This might be accompanied with a statement from the manufacturers of the iron that it had been subjected to certain tests, and if you get an authoritative invoice it would strengthen the statement you make considerably? I will write across next mail and ask for a copy of the invoice of the iron as shipped by the manufacturers.

3991. Since the work has been in process of execution, have any Government officers attended and pointed out to you in what way they approved or disapproved of the work? Yes; Mr. Jowett has been on the works seven or eight times.

3992. Did he make any objection to your work, and state what portions he objected to? I do not think there was anything on the works to which he objected.

3993. He just visited the works, saw what was going on, and expressed no disapproval? No, he seemed to be perfectly satisfied with the work, and especially so with the rivetting.

3994. We noticed in marking this iron, previous to punching it, some of the plates were incorrectly spaced—how was that? We have a templet which goes over the girder, either the top or bottom plates. We put the templet down on the top of this girder, but being such a length, we draw a centre line and then mark from that line and punch to the centre line.

3995. How did this mistake occur? It is not a mistake.

3996. It is punched out of true position? No, it is punched in true position, and one plate fits another through working from the centre.

3997. How do you cut and bend this angle iron? We have a balling furnace, and put the angle iron in to heat, and having a block for the hydraulic rivetter we press them into shape.

3998. How do you cut them? We have angle iron cutters which will cut up to four inches.

3999. Do you cut the angle iron hot or cold? It is all cut cold.

4000. How is it that in cutting the T iron used for stiffening they have been cut rather short something like $\frac{3}{4}$ in.? The iron is not all of exact measurement, some are $\frac{3}{4}$ in. under, some $\frac{1}{4}$ in. The cover plates are supposed to measure 18in., but some of them are 18 $\frac{3}{4}$ in., and the majority of them are over 18in.

4001. In these bottom web-plates shown on the drawings, what width are they cut to? We have to cut them at each end to 18in., up to 2ft. 6in.

4002. Are any of them cut under that? They are 18 $\frac{3}{4}$ in. and 18 $\frac{1}{2}$ in., I doubt whether you would find any of them 18in.

4003. In setting up these girders, it is provided that they shall have an inch camber,—did you so build them? We will build them as near as we possibly can, but some will be a trifle under and some over. We stretch a line from end to end before we rivet to see what camber is in the girder.

4004. We noticed some of the plates of the girders we have seen are not quite straight,—how does this occur? The only way I can account for it is that in the last four girders built the plates were put through the rollers to straighten them. We cambered the plates 2ft. 6in., and then turned them upside down and straightened them. After this there was still some kinks which could not be got rid of.

4005. Do you think a portion of this is attributable to the action of the punching machine, which causes a slight camber? If you have the camber one way and then the other, the plates being reversed, they ought to come out all right.

4006. These plates appeared not to have been put through the rollers? Some were not put through the rollers, and others after they had been put through, we still found the kinks there, and they could not be got out.

4007. Have these girders during their construction been tested by the Government officers to determine their strength? I have not heard.

4008. Is it proposed to test them in your yard, or to deliver them and test them afterwards? They are to be tested when erected.

4009. Have you been informed in what way it is intended to carry out the test? I think 96 tons are to be spread over each girder.

4010. Over each span? Yes.

4011. As you have constructed a great deal of iron work, how do you think these girders are calculated to bear that weight? I think it will have but very little effect upon them. The way we have rivetted them they would have to shear through the rivets to get away.

4012. Have you taken any measures to ascertain the deflection of these girders? That is outside of my jurisdiction.

4013. That is the contractor's work? Yes.

4014. In rivetting up these girders, we notice you do not rivet any by hand? No, all machine rivetted.

4015. Was any Government officer present during rivetting up? Yes, Mr. Jowett was present several times.

4016. Has he expressed any approval or disapproval? He was pleased with the rivetting by machinery, much more so than he would have been with hand rivetting.

4017. What provision has been made for fixing the deck or floor on the top of the girders? None whatever, as far as I am concerned, only that I leave rivet holes 4ft. apart at every T iron.

4018. Have you heard the Government Officer say how he proposes to fasten them? From what I understood, when the girders are laid down the deck rests on gravel beams running parallel with the girder and bolted every 4 feet.

4019. But these gravel beams merely connect one piece of timber with another, and they are bolted down through the deck. Are the Commissioners to understand that the timber is to be bolted down through the rivet holes you have left in the upper members of the iron work? I believe so, but this has nothing to do with me.

4020. What bracing other than these head plates do you provide? None, except the wind braces.

4021. Any other bracing? No, only the 5ft. 10½in. square plates by ¼in.

4022. This girder shows it has one end braced to the L iron below, but it does not show any provision for the top of the girders. Do you imagine the Government intend to provide additional fastenings to make rigid the top of that girder? Nothing more or less than is provided on the plans—the six bracing plates.

4023. I think you said Mr. Jowett told you to leave rivet holes—what for? I understood him, for fixing the decking at uniform distances of 4 feet.

4024. If the railway department does not intend to add to the stiffness or rigidity of these girders, in your opinion would it be sufficient provision? I hardly think it would.

4025. You must bear in mind, Mr. Knight, that this is a novel form of girder: it has the same height as depth, and assumes the form of an elongated box. Having only these 6 braces do you think sufficient rigidity is given by making use of the decking timber to stiffen it, or, if not, what would you propose? That question requires a little study before giving an answer. I have not gone into the practical part of that, because I have not had occasion to do so.

4026. Do the Government propose no other braces than these L irons? There are two wind braces at each end of the girder, but only one is being put in.

4027. Why? I have a letter to that effect from Mr. Jowett stating that "one end of the brace can be cut and joined with the plate as arranged with your manager; the other one at each end can be left out altogether."

4028. *By Mr. Stanley.*—I think you stated that you undertook the construction of these bridges under Mr. Falkingham? Yes.

4029. Upon what specifications did you undertake to construct them? The specifications as supplied to Mr. Falkingham by the Government; being the printed specifications applicable to the contract.

4030. Can you state what tests are provided in that specification as to the quality of the iron? I cannot state, but I read it through at the time.

4031. Is not one of the tests a bending one? Yes, I believe it is; the iron is to be bent round to right angles.

4032. Has the inspector made such a test at your works? Yes, at my works.

4033. Were you ever asked to make arrangements for testing the tensile strength of the iron? No.

4034. Would there be any great difficulty in rigging up a rough testing machine for that purpose by means of levers? Well, it could be done.

4035. Assuming it is required to go to 20 tons to the square inch, would there be any insurmountable difficulty in rigging up a machine sufficient for the purpose of applying that test? No, at a slight expense—it might cost £10.

4036. You have received no instructions to make such tests? No.

4037. I think you have stated that the specification provided that the iron should be R. H. Crown or other Staffordshire brand? Yes.

4038. As a matter of fact, are there not different qualities of Staffordshire iron? There are; but as a rule Staffordshire iron is all good quality.

4039. Still, some brands are better than others? Yes.

4040. Are there any of the Staffordshire brands, do you think, that would not stand the tests provided in the specification? I do not think there are, for we use nothing but Staffordshire iron in our boilers, and we flange the ends without difficulty.

4041. Did you specify certain brands in ordering? I told the party I required R. H. Crown, but I was told it would be equal quality, and I was satisfied.

4042. Over what period did the visits of Mr. Jowett extend? We were at work at this job 4 or 5 weeks before we knew anyone had been appointed. We then got a letter from Mr. Jowett stating he had been appointed inspector.

4043. When did you take the contract? My agreement is dated 14th February, 1885, and I ordered the material then, commencing operations in October. In about 5 weeks I received a letter from Jowett stating he had been appointed inspector, and at once wrote to Mr. Fincham asking who was appointed, as Jowett's letter was not an official document. Mr. Fincham replied that Jowett was appointed; and I then wrote and told Jowett that I was ready to receive him, and would be glad if he would come up.

4044. What was about the date of Mr. Jowett's first visit to the works? About November.

4045. Since that date he has paid 7 or 8 visits? Yes; in December, in January—I suppose he was nearly a week in Launceston then—and again about a month ago.

4046. In the absence of Mr. Jowett, was anyone appointed to look after the work on behalf of the Government? No.

4047. Have you had any previous experience in the construction of railway girders? No, these are the first I have made.

4048. Do you know whether it is the usual thing to test such girders before they are passed? I do not.

4049. What amount of deflection should you suppose would be caused by a load equal to 30 cwt. to the foot on such girders as those you are constructing? I do not think it would bring them down half an inch.

4050. Even supposing that load was passing over the girder at the rate of 25 miles an hour? I have not had any practical experience of that work, and have never tested a train passing over girders.

4051. You stated that the girders were designed to carry the road on the top? Yes, according to the plan.

4052. What would be the cost of altering those girders so that the road should be carried on the bottom flange above cross girders, placed 8ft. apart to centres, with L iron stiffeners brought down to the top of the cross girders? It would be considerable.

4053. You have seen the design of the Plenty River bridge for the Derwent Valley line, with the road on the bottom of the girders, and are aware how the cross girders are secured. Will you give an approximate estimate for altering the girders now being constructed so as to be of a similar design to the Plenty River bridge? Yes.

4054. *By Mr. Lawder.*—The Commissioners observed, when inspecting the girders in your yard, that the joints of some of the upper and lower flanges between the cover plates were not very close, and the same thing was observed at the junction of the web plates. Could not this have been obviated by proper shearing? We have done our level best to keep them as close as we possibly could.

4055. You are aware that in this case, the upper and lower flanges particularly, undue strain will be thrown upon the rivets themselves? In all such cases they touch in parts, and we put wedges in where they do not quite touch.

4056. In some places I observed no such wedges. You do not think those open joints could possibly have been avoided in the construction of the girder? No, I do not think they could, with the appliances we have at our disposal.

4057. With reference to the waves or buckles we observed on the upper and lower flanges, would these not have been caused by incorrect punching of the rivet holes? No. If you had been down when the top and bottom plates were put together, you would have found that 99 out of 100 were properly punched.

4058. There were some rivet holes we saw that were not correctly punched with reference to other holes for the same rivet, not corresponding in some cases by as much as $\frac{1}{4}$ inch? You may get out a little in long plates like that.

4059. Do you not think that punching rivets one after another in a long row together with such errors in the punching, would have caused this waving in the flanges when riveted up? No, I am confident that it did not.

4060. We also observed in the plates lying there that some holes had been erroneously punched, and filled up with iron, and the plate punched again in the same locality, but to one side? I account for that by the fact that the T iron stiffeners did not correspond with the plates, and to make them correspond we would have had to shorten them.

4061. I speak of the 18 by $\frac{3}{4}$ put into the upper and lower flanges? The only way I could have got over that was by shortening the iron and putting packing pieces in them.

4062. You think it would be very difficult to avoid mistakes of this kind with the appliances you have in your hands? No, I do not think that. That was an error which might have been overcome, but we got too far before the Inspector came up. If he had come up before we should not have done so many.

4063. But to put iron in that has been punched and filled up and re-punched, the work would not be so strong as if the holes had been properly drilled in the first instance: did the Inspector make any objection? No; he said it would have been better if the holes had not been cut, which I admitted myself.

4064. But made no positive objection? No.

4065. I think you stated that your responsibility would cease when you delivered the girders at the Main Line Railway Station? Yes; that is my agreement.

4066. Now if the contractors tested the girders in position at the bridge site, what would the result be should they fail in that test in any way? I do not know.

4067. It would have no connection with you whatever? I do not think so.

4068. You presume that the contractor for the iron work would make his own arrangements without reference to you? Yes, that is my opinion; or the designer would be responsible.

MONDAY, MARCH 29, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

MR. JOHN MACNEILL M'CORMICK, *examined.*

4069. *By the Chairman.*—What position do you occupy? Superintending Engineer in the employ of the Tasmanian Government.

4070. How long have you been engaged by the Tasmanian Government? About two years.

4071. Have you had considerable experience in the adjoining colonies? Yes.

4072. Extending over what length of time? For 12 years in the colonies, and I had been engaged on public works many years before that time.

4073. What are your present duties? Superintending the construction of the Scottsdale railway as superintending engineer.

4074. Have you under your charge any other public officers? Yes; the work is divided into sections. At present it is divided into two sections. Mr. M. Creswell is the resident engineer from Launceston to the Upper Piper, a distance of 20½ miles, and Mr. W. P. Hales is resident engineer from there to Scottsdale; the total length of the line being 47 mls. 4 chs.

4075. Were you engaged on the survey of the Scottsdale line previous to the commencement of the work? I was engaged on the permanent survey, but not on the Parliamentary survey.

4076. Had there been a survey previously made? I think there had been two Parliamentary surveys, one of which was adopted by Parliament, and which I had to deal with.

4077. Did these Parliamentary surveys give you much information for the line, and to what extent? The Parliamentary surveys helped us a great deal as to the saddles of the country and general direction of the route.

4078. Under whose charge were they carried out? The one adopted was under Mr. Hales, who had other engineers to assist him. The other was under Mr. Climie, who also had others to assist him.

4079. Has not Mr. Hales now charge of one of the sections? Yes, he has charge of the second section.

4080. Has Mr. Climie left the Government service? Yes.

4081. In laying out the route of the adopted line what course did you follow to determine the best and most practical route? First of all I examined the country as indicated by the Parliamentary survey, and I then directed such further examination to be made as I thought requisite. Traverse lines were run, and contours of the country made to thoroughly determine the nature of it, so as to obtain the best route possible. A certain line of country having been adopted, long cross sections and all other necessary work was done previously to finally locating any portion of the work adjusting the location so as to get the best grades with the most reasonable work, and the best curves possible.

4082. We noticed that the country was very intricate in the neighbourhood of the tunnel and of the Denison gorge: are you satisfied that you took all precautions, and made all surveys desirable, to prove that you had selected the most practicable and payable route? Certainly. So anxious were we that no pains should be spared, that Mr. Hales, who was given charge of that portion of the work, had the shortest section on the line, about 5½ miles only; and a long period of time was taken in inspecting the country and running trial lines to get the best route near the tunnel and gorge.

4083. Have you reason to be satisfied with the manner in which Messrs. Hales and Climie carried out their work? Mr. Climie had nothing to do with our work.

4084. Were you satisfied with the manner in which Mr. Hales did his work? Quite satisfied.

4085. What is the ruling gradient on the line? 39·6, practically 1 in 40.

4086. What is the sharpest curve on the line? 5 chains.

4087. Comparing the character of the country with the Main Line, how does it contrast? I think they will compare favourably, considering the nature of the country we had to deal with.

4088. Do you think the Scottsdale line can be worked at as reasonable a rate per train mile as the Main Line? That I cannot say.

4089. You have not formed an opinion? No, my idea is that it cannot; but I cannot make a comparison.

4090. We noticed that you have adopted concrete in constructing the culverts; is it intended to use concrete entirely, or what other material on the Scottsdale line? On the Scottsdale line a temporary class of culvert is to be put in; but I believe concrete will be ultimately used.

4091. Is there a price in the schedule for these works in masonry, and, if so, what determined you to abandon that material and use concrete? There is a price in the schedule for masonry, and also for brickwork. The reasons by which I arrived at the determination to adopt concrete work are—(1) That the prices led me to believe that the cost of the work would not approximately much differ in the totals necessary to be adopted in both classes of work; (2) I was guided by the fact that good building stone is not to be found in the district of such quality as might be expected for railway work; (3) that skilled labour for the class of work required in masonry is very scarce owing to the, comparatively speaking, large number of works now going on throughout the colony. Besides I look upon concrete as the most suitable material for country of this nature.

4092. Are you satisfied that the concrete work you are putting in is sound and durable? I am satisfied.

4093. We observed at certain portions of the line that you were using temporary wooden culverts, notably one on the Scottsdale end of the tunnel, with the intention ultimately of replacing them with concrete culverts. What reason can you give for adopting wooden culverts? The wooden culverts have been adopted by the Department owing to the deficiency of stone and good sand and the difficulties of access to the line, causing a large increase of cost, which the Department might better meet by erecting temporary structures, and putting in concrete culverts as soon as the Engineer-in-Chief thought proper.

4094. But if you ask the contractors to build these wooden culverts at the schedule of prices, what advantage do you gain? None whatever. These culverts are indicated on the sections of the work upon which tenders were called. There is no doubt that the tenderers tendered on the faith that throughout this (Scottsdale end) portion of the line such temporary work would be adopted, therefore the price at which the contractor is expected and prepared to do concrete work on the Launceston portion cannot be taken as a rate at which he would have carried out the concrete work on the portion of the Scottsdale line where the wooden culverts are shown.

4095. Will you state how many of these structures you propose to build, giving the chainage? From an examination of the plans I find that the following log culverts will be constructed:—At 26m. 27ch., 26m. 56ch., 26m. 66ch., 26m. 75ch., 26m. 78ch., 27m. 75ch., 28m. 3ch., 28m. 12ch., 28m. 15ch., 28m. 40ch., 28m. 68ch., 28m. 78ch., 29m. 5ch., 30m. 10ch., 30m. 40ch., 30m. 58ch., 30m. 70ch., 32m. 5ch., 32m. 18ch., 32m. 65ch., 32m. 70ch., 33m., 33m. 30ch., 33m. 32ch., 33m. 40ch., 33m. 50ch., 34 m. 20ch., 34m. 38ch., 34m. 52ch., 35m. 15ch., 35m. 25ch., 35m. 30ch., 36m. 30ch., 37m. 4ch. 37m. 60ch., 40m. 13ch., 41m. 70ch., 43m. 40ch., 44m. 60ch.

4096. Can you hand in a list of the sizes of the culverts at these different places? I cannot, but you would see the sizes from the contract plan.

4097. Have you made an estimate what the cost of these log culverts will be? They are at fixed designs at prices per foot run.

4098. Can you give an approximate estimate as to what the cost of these log culverts will be? They will be furnished you.

4099. Assuming that you had completed the culverts in concrete as per drawings, what would have been their cost? I will give you that list also.

4100. Will you undertake to do that? Yes.

4101. At the scheduled prices? Yes.

4102. What class of structure did the contract contemplate—stone, concrete, or wooden? Wooden.

4103. Then you are now only calling on the contractor to carry out the work he tendered for? Yes.

4104. What will be the average life of these log culverts? I cannot express an opinion on that point. I am not well acquainted with the timber of this Colony. Personally I should not like to look on them as permanent, but rather to be replaced as soon as convenient.

4105. Then the cost of the permanent culverts should be added to the cost of the temporary structures? I should think so.

4106. Have the Government in their Loan Bill obtained power to raise money for these additions? I am not aware.

4107. Do you know if there is any fund available hereafter for such purpose? I am not aware. The life of the timber must be taken into consideration.

4108. Has the construction of these culverts been recommended by yourself or by the head of the Department? It is one of the designs furnished by the Department.

4109. By your recommendation or from the head of the Department? From the head of the Department.

4110. Which course, in your opinion, would be preferable—to delay the opening of the line and build permanent works, or to open the line at a comparatively early period with these structures? I would not like to express an opinion on that point.

4111. As a practical engineer, what is your opinion? As a practical engineer I might prefer the permanent work; but there are commercial questions affecting the cost of the work which I have not gone into.

4112. Will the estimates that you will hand in supply the cost of the two modes of work as scheduled? Yes.

4113. Will your estimates give the comparative cost of the two works? Certainly not.

4114. Why not? These culverts are indicated on the drawings and on the sections locally indicated, and the contractors have tendered on these plans; therefore the prices given cannot be compared with any fairness.

4115. But assuming that you think it now desirable to construct these culverts in concrete, could you not call on the contractors to build them at the contract prices? That is a point of law I could not decide. I think the contractors would have an equitable claim for further payment.

4116. In what way?—do not the specifications provide for alternative classes of work? I think, from an equitable point of view, it would not be right; but, from a legal point of view, it might be possible to construct them of concrete.

4117. Were the culverts on the Launceston end to be constructed of concrete or wood? I think they are to be constructed of masonry or concrete, and the drawings show them concrete or masonry.

4118. If you had power to substitute on the Launceston end of the line one class of work for another, why not on the Scottsdale end? I take it we indicated the material as shown, because it is believed that the material can be obtained within reasonable distance. The distance in South Australia is limited to a certain radius, but here no distance is specified.

4119. Has the determination of this question been guided by what was thought to be fair and right to the contractor, or by the difficulty you would have had to compel him to carry out the permanent work? By what I thought was fair and right to the contractor under the tender before me.

4120. Assuming that the absence of material determined you in building concrete culverts on the Launceston end of the line, and that no fair price was to be found in the schedule for concrete culverts on the Scottsdale end of the line, could you not have fixed a price for their construction? That can be done by the power of the Engineer-in-Chief under the specifications. He has power to fix the rates when not in the schedule.

4121. As a matter of policy would it not have been better for the Department to obtain permanent material at once, rather than construct the culverts of wood? What has determined the Department has been the absence of suitable material.

4122. What class of work do you propose at 13m. 75ch.? A timber viaduct in concrete foundations; the drawings are before you; a 2ft. culvert would be sufficient there as regards waterway.

4123. Was the cost of that viaduct estimated in the contractor's tender? Yes.

4124. Who prepared the designs for the timber work? They were prepared in Hobart, I believe by Mr. Edwards, and transmitted to the Engineer-in-Chief. Mr. Edwards was employed, I believe, for the purpose to design this work, subject to the supervision of the Engineer-in-Chief.

4125. Have you sufficiently considered the design to form an opinion on it? I have.

4126. As regards strength and suitability? As regards strength, I have examined it; suitability is a matter of opinion.

4127. Have you examined it sufficiently to enable you to form an opinion? Yes; it is a strong structure for the position in which it is placed.

4128. Do you regard it as a suitable design? Personally I would have preferred iron, but as a timber structure it is suitable.

4129. Is it necessary to make large openings for provision of water? No; a 2 feet culvert would be sufficient.

4130. What made the Department choose this structure? It is on extremely sidelong ground of very smooth rock, and if it were constructed with a bank and small waterway it would require a long and strong retaining wall, and that in my opinion as an engineer is always to be avoided, if possible, in high banks.

4131. Have you compared the cost of the proposed viaduct with that of a solid bank and such a concrete culvert and retaining walls as would be sufficient? No; these plans were, I believe, prepared in Hobart. I have had nothing to do with any of the permanent or parliamentary estimates.

4132. Had the Department or the Engineer-in-Chief put to you the question which is the more desirable—to build concrete walls with solid embankments or the design chosen, would you not then have compared the cost of both works? I should have done so; it would then have been my duty to do so.

4133. But seeing that the timber will be perishable, would it not have been better for the Department to have built a permanent work there at the first? I do not think it will be any loss to the Department to adopt the timber bridge. There is plenty of timber in this country, and the concrete foundations are such as would be suitable for an iron structure if necessary hereafter.

4134. Where is it? At 13m. 75ch.

4135. Would not the cost of the concrete work which you contemplate building have provided a culvert and retaining wall? I think the retaining wall would probably be the most costly; but I have not gone into it, and cannot make any comparison. When I say retaining walls, I mean with the accompanying work of banks. It would require a very large bank there.

4136. Can you prepare an estimate of the relative cost of the two works? I can prepare it, but it will only be an approximate estimate, on account of the difficulties in the ground for obtaining foundations for the retaining walls.

4137. Will it not be equally as difficult to build the transverse walls as the dwarf walls? I think one would be equally as difficult as the other: that is a question of cost.

4138. Could you give a rough estimate of the cost of the different works—the work contemplated and that suggested? I am afraid it would be a very rough estimate, as a very large amount of the material would be from side cutting, and the nature of the country is very rocky.

4139. The site itself is very rocky, is it not? Yes.

4140. Assuming all the advantages of the retaining walls, could you not estimate if they would be more costly than the transverse walls? I do not think you can so assume, as some portions of the cross sections are very precipitous at this place, and it might be necessary to carry the foundations for the retaining walls to a depth the extent of which I cannot say.

4141. Supposing you had entire charge of this line, and were solely responsible to the Government, what class of work would you recommend? As I have already stated, I would prefer an iron structure, setting aside the question of cost.

4142. What is the amount of the contract of Messrs. Boland & Scott? £228,541 3s. 6d.

4143. When was their tender accepted? On June 25, 1885.

4144. As far as you are at present aware, will this contract amount be exceeded, or will the cost be within that sum? I have no reason to believe, if Messrs. Boland & Scott carry out the work in accordance with the contract, that this amount will be exceeded. I have no evidence yet before me that leads me to believe it will be exceeded. There is 10 per cent. provided, amounting to £20,000, for extra works, and this is included in the £228,541 3s. 6d.

4145. Does the amount named in that contract provide for the erection of stations, turn-tables, and other works necessary for working the line? No.

4146. Are you aware if an estimate has been made of the total cost of the line, with proper equipment and running stock? I have no doubt such estimate has been made.

4147. You think the Engineer-in-Chief will be able to supply it? Yes.

4148. Do you think the contractors have carried on the work at the rate of speed contemplated in the contract? I think not.

4149. Will you indicate in what way they are deficient? It is a large earthwork contract, and my opinion is that the certified return should be £8000 or £9000 per month.

4150. Have you ever informed the contractors that their rate of progress is unsatisfactory? Certainly, frequently. The works are not so far advanced, however, that the contractors cannot reasonably expect to increase their work to a very high stage next year. They have had some trouble in dealing with owners of land. These have, however, been since overcome by Act of Parliament.

4151. Have there been other delays on the part of the Department beyond giving possession of the land? I think not. The contractors have stated that there has been delay in furnishing drawings to them, but they are of such sites and positions that could not affect the progress of the work. They have possession of sufficient work to prevent any delay.

4152. With reference to the tunnel, which appears to be the key of the line, what time will be necessary to construct that work? I think the tunnel will take nearly the whole of the time. I do not anticipate the tunnel will be done under the time now available—2 years.

4153. Are the contractors carrying on the approaches to the tunnel with sufficient dispatch? I hope they will do so. They have commenced at one end, but it will no doubt be necessary to work from both ends, and if possible to also sink some shafts, to finish it within contract time.

4154. What number of cubic yards are there in the Launceston approach to the tunnel? There are 57,839 cubic yards, that is to say, the whole of the cutting 148.

4155. What quantity has been excavated? All this cutting has yet to be excavated.

4156. Is it proposed to remove all the material towards Launceston or towards Scottsdale? It will be necessary to remove some of it towards Launceston. Material will be obtained from the approach, so that of the tunnel can be spoiled, and can be worked from the approach on either end, or from the shaft, as most convenient.

4157. What is the amount in the Scottsdale end of the approach? 56,655 cubic yards.

4158. At present how much has been removed from that approach? I will furnish you with that from the returns.

4159. Have you made an estimate of the time required to finish that approach, and thus enable the work to be carried on? I have not.

4160. What is your opinion? I do not think there will be any loss of time there. I am afraid the tunnel itself will take the time. It will take two years to complete the tunnel, working from both ends.

4161. The eastern end cannot be commenced until the eastern approach is made? No.

4162. What time will be taken to complete the eastern approach? I will furnish you with a return of that also.

4163. What time will be taken to complete the tunnel? It will take two years, unless worked by shafts as well as from both ends.

4164. Then if the Commissioners add two years for the construction of the tunnel to the time it will take to excavate the eastern approach, the total will give the time necessary to complete the whole line? Yes, it will take 2½ years.

4165. How will that agree with the time of the contract? It will exceed the time of the contract, which expires on March 1st, 1888.

4166. Have not the Department, in the public interest, intimated to the contractors the desirability of starting work at both ends of the tunnel? I think it will be necessary to do so. I would be reluctant to do so until I see the nature of material.

4167. Generally speaking are you satisfied with the character of the work? Yes, excepting the time, which has been a matter of some anxiety to me.

4168. Would not the position of the Department be better if they had requested the contractors to proceed more vigorously with the work? They have been informed frequently that the progress of the work is not satisfactory.

4169. The specifications show that the Engineer-in-Chief should make the request in writing; has that been done? Not that I am aware.

4170. Are you aware that he contemplates doing so? I am not.

4171. *By Mr. Stanley.*—What is the maximum length of the ruling gradient on the Scottsdale line? I cannot tell you from memory. I will furnish you with it. Approximately it is about a mile.

4172. You said the minimum curve was 5 chains? Yes.

4173. Do curves of this radius occur in combination with the ruling gradient? They do.

4174. Do you think that is a desirable thing to do with such extreme gradients as 1 in 40? I think it will very much affect the haulage.

4175. Have you any idea to what extent a 5ch. curve increases the resistance as compared with a straight road? I have not gone into the question in this instance.

4176. From your experience can you not say what effect such a curve has on train resistances? I could take it out for you, but I have not gone into the haulage.

4177. Do you not think it will seriously affect the useful power of the engine in taking trains over that line? Yes, it will materially affect the locomotive power.

4178. Do you know what class of engine it is proposed to use? No.

4179. You are aware of the types of engines adopted by the department here? I have seen them occasionally.

4180. Can you say what the goods engines are capable of hauling on a grade of 1 in 40? No, I cannot say.

4181. Could we not get that information from the Locomotive Superintendent or Engineer-in-Chief? Yes.

4182. Do you think it would have added seriously to the cost of the line had you eased the curves where the ruling gradient occurs—say, instead of 5ch. you adopted a radius of 8 ch. in 1 in 40 gradients? It would have increased it materially.

4183. To what percentage? I cannot say; but local trials have been made in the camp every night endeavouring to work out what curves could be most reasonably adopted. In more than one case we had to work very tight with the gradient. Where it was possible to ease it we did so; but we had to increase the length of the line to get down at all.

4184. I am not understood. That would apply to the length of the gradient required to overcome the necessary elevation; but would it add materially to the cost of the line had you increased the curve where 5ch. curves were combined with the gradient of the 1 in 40? Most certainly, considering the country.

4185. Did you receive any instructions from the Engineer-in-Chief with respect to the combination of these curves and gradients? I did not. The work was submitted to the Engineer-in-Chief, and I am sure he was thoroughly satisfied.

4186. He made no objection to the use of these curves with the ruling gradients? No; of course he is aware of the circumstances.

4187. You stated that probably the contractors would have required increased prices for the concrete had that material been adopted for culverts in lieu of the log culverts. Did you ascertain from them what, if any, increase they would require? No.

4188. Did you not think it advisable, before determining on the adoption of these temporary log culverts, to ascertain the probable cost of more permanent work? I looked upon their adoption as settled when the tenders were called.

4189. Still, as engineer in charge of the Scottsdale railway, is it not your duty to make recommendations to the Engineer-in-Chief where you think changes can be made with advantage, for the permanency of the work? Certainly; but I looked upon this question as settled previous to calling for tenders.

4190. Is it your opinion that the extra cost of the concrete culverts would have amounted to as much as the present temporary log culverts? Yes; I believe so.

4191. Still, you cannot speak definitely if you have not received any offer for the contractors for extra prices they would require? Certainly not.

4192. What provision is made for crossing Barnard's Creek? There are seven openings of 10 feet each.

4193. Are those openings continuous? They are not.

4194. Will you explain how it is proposed to put them in? It is proposed to conduct the present channel from the road approach at Barnard's Creek in one channel of 6 openings, and between the 6 openings and the other opening

to pitch the slope, to take the creek in that opening, and pitch between the two. Any overflow will make its way into the channel.

4195. Did the floodwater of Barnard's Creek extend across the flat? No.

4196. Then the embankment between the 6 openings and the 10 feet opening will not be subject to the effect of floods? It may in some extreme cases, but it will be pitched with a stone embankment.

4197. Is there any serious objection to divert the other creek so as to have all the openings continuous? It would have given a cross flow of water, which I think is objectionable.

4198. Then you think there is no objection to a short piece of embankment between the openings? Certainly not, in this instance.

4199. Is it not usually objectionable from a maintenance point of view? Yes, but in this instance it is doubtful with two creeks from which there may or may not be overflow. There is no depth of water there. I anticipate that when the outlet channel of Barnard's Creek is got free from timber, etc., that there will be no overflow, and the other opening will take away the other creek altogether.

4200. Then you think the floodwater there will not seriously affect the stability of the embankment? Certainly not.

4201. With regard to the objection to the retaining walls and embankment in lieu of the proposed bridge at 13m. 15ch., what provision do you consider would be necessary, were such retaining walls adopted, to carry off the water? I think that a 2 feet culvert would clear off the water.

4202. The area is limited? Yes.

4203. Is there suitable stone in the locality for masonry? No, not the class of work fixed,—squared masonry; rubble masonry could be got, but not squared.

4204. Do you not think a concrete retaining wall there would be suitable? I would prefer a viaduct there.

4205. Do you anticipate any difficulty in obtaining solid foundations for a concrete well? No doubt a stone foundation could be obtained, but a concrete retaining wall would be costly.

4206. It need not necessarily be a high embankment? No, it could be a surcharged wall.

4207. What is the relative price for concrete and masonry in the specifications for retaining walls? I do not recollect.

4208. What class of masonry would you consider necessary to adopt in such position? Rubble in mortar.

4209. Will you quote the relative prices for such masonry and concrete? Yes, I will give you the prices.

4210. I think you have promised to give the Commissioners the comparative cost of an embankment and retaining wall in this locality, in lieu of the proposed bridge; will you also give the cost of a retaining wall in cement concrete? Yes.

4211. From the experience you have had in carrying out the work of the Scottsdale Railway; so far, can you state if the quantities as scheduled represent fairly the amount of work that will be required to be executed in the different classes? So far as the work goes, I have no evidence to show it will not be done within the contract.

4212. I want you to state whether the quantities in the schedule may be considered to fairly represent the work likely to be done? I think we will probably exceed the quantities given in side cutting, principally owing to the settlement in No. 3 bank.

4213. Can you state whether the quantities of side cutting given as entered in the schedule have been obtained by actual calculations, or are they assumed? That I cannot say; they were furnished me by the Department.

4214. Have you no reason to suppose they are assumed? No.

4215. Can you say whether the quantities for masonry, earthwork, and concrete are assumed, or have they been obtained from calculations based on the contract drawings? I cannot say.

4216. What is your opinion? My opinion is that they have been taken from the contract drawings, but I cannot say.

4217. Will you glance at the figures as entered in the schedule in these classes of work, and say whether you think them likely to have been obtained from actual calculation from the drawings, or merely assumed? I believe they must have been obtained from a basis of calculation in some instances, and the others are assumed quantities.

4218. So far as the work has proceeded, do you think that the actual quantity of work in earthwork, masonry, and concrete is likely to approximate with the quantities entered in the schedule? That I cannot say; I cannot say whether these will be exceeded.

4219. Have you had anything to do with the preparation of this schedule? No.

4220. Then you cannot speak from personal knowledge of the way in which it has been prepared? No.

4221. Is it intended to construct any of the bridge piers on concrete? Yes, the bridge piers and bridge abutments.

4222. Are any of the piers intended to be constructed according to the design shown on drawing No. 13? That I am not prepared to say, because the designs of these bridges are in the hands of the Department.

4223. Is the drawing No. 13 intended to be a detail drawing of concrete piers? It is a type drawing or general drawing. I do not take it as a detail of the bridge that will be furnished me; such detailed drawings are in the hands of Mr. Edwards, and are to be furnished me.

4224. Are the detailed drawings for the several bridges of the line prepared in your office, or are they furnished by the Engineer-in-Chief? The detail drawings of bridges shown in the contract drawings by diagrams have yet to be furnished me by the Engineer-in-Chief.

4225. We were given to understand by the Engineer-in-Chief that the detailed drawings were generally prepared by the resident engineer in charge of the work: has not that been done in the case of the Scottsdale Railway? It has to some extent, but not as regards the bridges I spoke of.

4226. Then, in the important works, such as the bridge over the Piper river, the details would not be furnished by you, but from the head office? Yes, the Engineer-in-Chief is correct, and he asked me to furnish the designs, but I objected, saying that there were certain diagrams in the drawings, and the man who furnished the diagrams should make the detail drawings.

4227. It has not been usual in your experience for the superintending engineer officer to do so? No, and therefore I declined to do them. I allude to important works.

4228. *By Mr. Lawder.*—We understand you to inform the Commissioners that, as far as you are aware, the designs were got out by Mr. Edwards, or the Engineer-in-Chief? By Mr. Edwards, subject to the supervision of the Engineer-in-Chief.

4229. To what distance on each side of the alignment was the ground contoured? I cannot say,—that varies. We contoured as far as we thought it desirable.

4230. Can you inform the Commissioners from your experience of the country since the alignment was fixed upon, if it would have been at all possible to obtain a shorter, more level, and less tortuous alignment by undertaking works of greater magnitude, such as tunnels, viaducts, &c., within reasonable cost? Not within a reasonable amount,—that is, such an amount as would be acceptable in this colony.

4231. And would not have been compensated for by economy of working the line? No.

4232. With reference to the designs at Dogwood Gully viaduct, 13m. 75ch., do you think that a suitable design and of sufficient strength for such a high level, rate of grade of 1 in 49.5, and the alignment being on a curve of 6ch. radius, the height of the centre tressel being 40 feet above the masonry cill, no longitudinal bracing to posts for 27 feet in height above the cill, and no straining beams to resist the thrust of the struts? I am not prepared to answer the question.

4233. Do you consider that viaduct a suitable one at a 6 chain curve? As far as I know the design is a suitable one. I do not wish to express an opinion of the designs furnished to me to carry out as a servant of the Department by the head of the Department.

4234. To what extent is it intended to fell trees on each side of the line at deep cuttings? At variable distances. Under the contract the distances were shown on the plan, but outside the contract of Messrs. Boland & Scott arrangements have been made with the landholders for felling trees along the line at such distances back as are necessary for the safety of the line. On high ground sometimes it goes back 5 or 6 chains.

4235. Would it be a distance of more than half the height of the trees? Yes.

4236. What is the usual procedure in handing over land to the contractors as adopted on the Scottsdale line? Under the specifications the Minister of Lands is to give possession of the land to the contractors; clause 5 of the contract provides for it.

4237. Has all the land been handed over to the contractors? I think it has, but I am not certain. We could now take it within 7 days, according to Act of Parliament. It has been handed over by me.

4238. Do you consider the contractors have got possession of all the land required by them, and that they are not placed under any responsibility in connection with the landholders? Yes, as far as possession of the land goes, but not in other things.

WILLIAM PRIOR HALES, *examined.*

4239. *By the Chairman.*—You are the Resident Engineer on the Scottsdale Railway, Mr. Hales? Yes.

4240. You have charge of the western end of the line from Launceston to what point? From 20 miles, as far as the line has at present gone, is my proper section, but I have temporary charge of the whole line.

4241. But your permanent work will be from 20½ miles? Yes, it is proposed to divide it into three sections, but there is no work on the third section yet.

4242. How long have you been in the service of the Government of Tasmania? About a little over three years now.

4243. And you have been principally engaged during that time in the preparation of the contract? No, the surveys.

4244. Marking out the line? Yes; I had the preliminary work of the whole to do. I had the preliminary examination of the whole country, the preliminary traverse from the 23rd mile to 31st mile, and the permanent survey from the tunnel to the end of the Denison Gorge.

4245. Then you only had that portion of the permanent survey from the tunnel to the Denison Gorge? Yes.

4246. Well, as you obtained, no doubt, considerable experience in the preparation of the preliminary survey, are you able to say that the best route has been adopted for the present line? Yes, I think so.

4247. That is on the basis fixed by the Engineer-in-Chief that no gradient should exceed 1 in 40, and no curve more acute than 5 chains radius—observing these, do you think you have found the best obtainable line between the two points? Yes, I am fully satisfied of it.

4248. What information did you obtain to enable you to make that statement? I took barometer heights and ran preliminary traverses in all likely places.

4249. Supposing it had been thought desirable to have introduced flatter curves in the plan of the line instead of those adopted, how would that have affected the general locality of the line? It would have increased the cost of the line to Scottsdale so much that the country would not look at it on account of the expense.

4250. Before going into the expense, supposing the railway had been laid out with minimum curves of 6 or 8 chains radius—would it, in short, have driven you from the present locality into another or one closely approximating to the present line? I do not think it would make much difference in that respect; but it is a point I have not really considered.

4251. You are not able to give definite information as to that? If the Department had adopted 8 chain curves as a minimum, you are not prepared to say how it would affect the plan of the line? No, I am not.

4252. In carrying out the works, we observed at one part of line it was proposed to increase the area of the cutting and diminish that of the banks by reducing the level of the line (making the cuttings deeper and decreasing the side cuttings): can you state how that has affected the contract? To what part do you refer—the 7 to 10 miles?

4253. Yes? Well, roughly speaking, it entailed 15,000 additional cubic yards of cutting, and saved 45,000 yards of side cutting, and all the culverts were shortened—the 6 and 8-foot arched culverts being shortened.

4254. You are of opinion that by this alteration the cost of the line will not be increased? Yes, decidedly I am.

4255. In other words, you say by procuring 15,000 yards of cutting you save 45,000 yards of side cutting? Yes.

4256. But, supposing the contractor is successful in resisting the views of the department, and obtains larger prices for cuttings than appear on the schedule, how would that affect your estimate? It will be more than compensated by the greater reduction of the side cutting. But there is one point I would like to mention. We do not admit in any way that we are called upon to pay anything additional for cutting, except as to the increased depth, and that I consider *sub judice*.

4257. Has the Engineer-in-Chief's attention been directed to this question? Yes.
4258. Have the contractors made any claim for additional prices? Yes.
4259. Was the question referred to you for report, or is it still under consideration? It is still under consideration till the work is completed.
4260. This alteration, I presume, was made for reasons of economy, and because it was difficult to obtain side cutting? Yes, that was the principal reason—almost the only reason.
4261. Supposing you could have obtained additional material from cuttings, where would you have got side cutting from? Well, we would have had to scratch about all over the country.
4262. Had you determined where you could have obtained side cutting before you altered the grade? Yes, we had ascertained we could obtain a little on the flats below and on the other side of the stream, but it would be shallow and full of boulders.
4263. From what you know of the work, are you satisfied now that the alteration was a desirable one in the interests of the department and the public? Yes.
4264. You are acquainted with the locality of the tunnel? Yes.
4265. What information did the department obtain as to the strata which would underlie the surface ground at the cutting; was it obtained by boring, sinking shafts, or in what way? By sinking shafts, as shown on the size of culvert.
4266. Was the information supplied sufficient to enable the department to make a reliable estimate? Well, I cannot say that—you mean sufficient to judge of the nature of the material?
4267. Did the department, as a matter of fact, put increased prices on the tunnel in consequence of the doubtful nature of the ground? I do not know anything about the preparation of the estimates.
4268. Are you of opinion that the waterways as designed and carried out by you are sufficient to meet all requirements of floods and other casualties? Yes, as far as I can see, they are. The matter was carefully considered before adopting the size of culvert.
4269. How did you obtain data to determine this—the flood levels, for instance? The flood levels were got by each engineer on the sections of the permanent survey.
4270. Were the areas of the gathering grounds and watersheds estimated? In some instances they were; but in most of the smaller ones the quantity of the flood water was taken.
4271. As the country is very precipitous and broken, and the delivery of the water extremely rapid, do you think, taking these conditions into account, that the department has provided sufficient waterway in every case? As far as I know, I think it has.
4272. As to the designs of the structures—we have been told by Mr. M'Cormick that it is proposed to put log culverts on the Scottsdale side of the line commencing from the tunnel mouth. Are you able to say from experience what the average life of these timber culverts and bridges will be? No, I cannot; I have not had sufficient experience of this country's timber.
4273. Are you aware of any buildings or structures in the locality that have been erected with indigenous timber which have lasted for any time, and what time? No, I cannot give any instances.
4274. Assuming that you had been principal engineer of this line, would you have adopted wooden structures for the eastern portion of the line, or would you have built them in concrete similar to those on the western portion? I would rather not answer that question.
4275. Are you satisfied from what you know of the timber that the life of these culverts will be that of the ordinary duration of this Colony's timber? Yes.
4276. And that the timber is sound, good, and of average durable quality? Yes.
4277. What would be the cost of a concrete culvert compared with one built of timber? I have not the figures, and could not from memory even give it approximately. I have run out an estimate that the one we were looking at on Friday would cost £100 extra at the schedule rates only.
4278. What culvert was that? The one a little over 26 miles.
4279. At the Scottsdale end, close to the tunnel? Yes, the one they are building now.
4280. Can you not give the approximate cost of that culvert in wood as compared with the cost of a similar structure in concrete? It could only be by running out the comparative cost, and that I did, finding that in this case the difference was about £100 in favour of wood.
4281. If it was only £100 in favour of wood, would it not be better to build it of permanent rather than of perishable material? Well, it is just a question of interest, sinking fund, and that kind of thing. But there is another consideration—we would not get that work done at the schedule prices.
4282. Would you not have insisted upon the work being done at schedule prices? I do not think so.
4283. Why? The contractors agreed to construct log culverts, and to insist upon substituting other material would not be fair.
4284. But does not the contract contemplate the fact that the Engineer-in-Chief may, if he deems it desirable, use any kind of material in building culverts and bridges other than the material described? Yes, there are all the usual clauses of that description, but I consider it would be a breach of faith to insist upon it in this case.
4285. As I understand the question, would it not have been possible to have made some arrangement with the contractor, leaving him to arrange hereafter with the department at a fair price? I should have had to get the sanction of the Engineer-in-Chief before I was allowed to make any arrangement for an alteration of that nature.
4286. Supposing the Engineer-in-Chief had ordered the contractor to complete the structure in concrete, was there no power under the contract to protect the contractor and refer his claim to arbitration? Yes.
4287. Would not the contractor's interests be fairly considered in such case? Yes.
4288. Well, bearing that in mind, was the question ever submitted to you by the Engineer-in-Chief? No.
4289. Or by the superintending engineer, Mr. M'Cormick? No, we have discussed it often enough.
4290. And what decision did you arrive at? Well, we never touched upon it except privately and quite unofficially.
4291. Suppose the department determined to build concrete culverts or stone culverts in place of the wooden culverts, how would that affect the progress of the work. Would it accelerate or retard the work? It would retard it.
4292. To what extent? It would be quite impossible to estimate.

4294. Take that culvert at the eastern approach to the tunnel. Supposing you had insisted upon the contractors building a concrete culvert at that point, how would that have affected the work of the tunnel? They would have had to carry their material a considerable distance over bad roads before they could build it.

4295. Would they have had to provide a temporary structure? Probably they would. That would be easy enough.

4296. What would be the cost of a temporary structure? Very trifling; I do not suppose it would cost more than £50 at the outside.

4297. Then do you think that should stand in the way of deciding as to the nature of the permanent structure? I do not quite understand the question.

4298. Supposing the Department insisted upon the contractors building a concrete culvert, which necessitated their providing a temporary opening over which they could tip the earth to form the embankment—would the cost of that temporary culvert be so great as to influence the Government in deciding the nature of the structure? No, I do not think so.

4299. Was that question ever considered by the Department? I cannot say.

4300. Have you made any enquiry as to the probable time the tunnel will take to complete? Well, I have made an estimate of the time, but it depends entirely upon the way it is worked, and that is not settled yet. I do not think it will be finished at the end of the contract time.

4301. As the tunnel is the key of the work, assuming it is not completed in the contract time, how will you get the rails laid down between it and Scottsdale? Cannot lay them down at all until the tunnel is finished, nor is it worth while.

4302. Then the failure of the contractor to complete the tunnel in the contract time would leave the road on the eastern side of the tunnel without rails? Yes, unless he was prepared to ship the rails to Bridport and cart them over 6 miles to the line.

4303. Have you ever made representations to the contractors as to the present rate of progress? Verbally, I have.

4304. Are you satisfied that they have used their best endeavours in carrying out the works up to the present time? Yes, I think they have done their best.

4305. What ballast do you propose to use? Simply propose to use that mentioned in the specification—gravel or broken stone.

4306. Are you able to obtain suitable gravel? Well, we will get some, but not enough.

4307. Upon what portions of the line do you think you will obtain it? The only deposits of gravel of any extent are near St. Leonard's, close to the Deloraine Railway.

4308. How do you propose, supposing the tunnel is not completed and no gravel is to be obtained on the eastern side, to ballast that portion of the line between the tunnel and Scottsdale? We may get a deposit of gravel there—I do not know yet. There will no doubt be deposits found we did not know of before.

4309. Do you anticipate any difficulty in getting ballast? Yes, I do.

4310. Is the contractor endeavouring to obtain ballast on the eastern side of the line? Not on the eastern side yet,—it is almost too soon to think of it.

4311. Do you imagine that any delay will be occasioned to the opening of the line for want of ballast on the eastern side? Well, it is very hard to say. The whole condition of things may be altered by the time we want ballast.

4312. It has been pointed out that the contractor experienced some delay through the neglect of the Government to give him possession of the land—is that a fact? Well, they have simply taken possession and gone ahead on every part of it except a small portion.

4313. Then the contractors have not been retarded in this respect? Practically, no.

4314. Have the contractors ever applied to you for the possession of land? Yes.

4315. What did you do? I said I could not give him possession.

4316. Why not? At that time we could not, because the Government could not take possession until they had paid for the land.

4317. Is there an Act of Parliament which compels the Government to pay for the land before they give the contractors possession of it? It was, till the end of 1885.

4318. Then from the 31st December, 1885, that former provision has been superseded? Yes.

4319. How is it under the present Act? The Government take possession upon giving 7 days notice.

4320. Since that time has any question relative to the possession of land arisen between the contractors and you? No.

4321. And they can go on any portion of land between Scottsdale and Launceston? Yes.

4322. Do you think the amount mentioned in the contract will be absorbed or not when the works are completed? I cannot say; but no doubt it will be all expended.

4323. Do you think it will be sufficient? I cannot say; I have never made any estimate.

4324. Have any of the works, up to the present time, been increased in such a manner as to lead you to anticipate there will be a deficiency in the amount? Well, bank No. 3 will require additional material.

4325. To what extent would that addition amount? Say it takes 10,000 yards (that is quite an approximation), that would be £750.

4326. Well, will there be any saving in that portion of the line previously indicated, where the cutting was increased 15,000 yards and the side cutting decreased 45,000 yards? No, they balance one another in cost, the 15,000 being at 4s. 6d., and the 45,000 yards at 1s. 6d.; so these figures will balance.

4327. But you said the culverts would be shortened? Yes, there is a certain amount of saving there.

4328. You do not anticipate much saving from that? About £200.

4329. Are there any other portions of the line where you think there will be an increased cost? I am not aware of any at present, not of any moment.

4330. Are you quite satisfied of that? You see, I had nothing to do with making out the schedule or estimate, and do not know how it is made up or arrived at; but, taking the drawings, I am not aware of anything of any magnitude that will be exceeded. Of course, there are one or two little places we were looking at the other day where the cuttings will have to be sloped a little flatter, but that is a very small item.

4331. Are you satisfied with the general manner in which the contractors are carrying on the work? Yes.
4332. Do you think they give reasonable attention to your orders? Yes.
4333. With reasonable despatch? Yes.
4334. *By Mr. Stanley.*—As Resident Engineer, I presume it is part of your duty to measure up the work from time to time? Yes.
4335. From your experience so far, can you say whether the work as measured agrees fairly with the quantities in the schedule? Yes, fairly well.
4336. Under all the different classes of work? Yes, as far as I am aware. I have not made any very exhaustive comparison upon the subject.
4337. Was the disposal sheet for earth work ever furnished by the Department to the contractor? For the balance of earthwork, yes.
4338. Did you find that work tolerably correct? Not always; the per-centages of increase do not always work out.
4339. Did you find the quantity of side cutting provided sufficient for carrying out the work? No, that will be exceeded.
4340. To what extent? I cannot say; I have not gone into it at all.
4341. I observe there are 70,000 cubic yards of side cutting provided for in the schedule: can you not give some idea of the probable total quantity likely to be required? Yes, I could in the office.
4342. Will you furnish that information to the Commissioners? Yes.
4343. Taking the items under the headings of concrete, brickwork, and masonry, do the quantities given under these headings in your opinion fairly represent the actual amount of work to be executed? I cannot say; I have never gone into it.
4344. But, judging so far as you have measured the work, can you give any information as to how they will compare? You see we have executed certain works—so many yards of this material, or this other, which are not connected in any way.
4345. Can you say, from your observations, whether the quantities in the schedule have been prepared from actual calculation on the basis of the contract drawings, or do you suppose that the amounts are estimated? I have not the slightest idea.
4346. You have formed no opinion upon the subject? No.
4347. In carrying out the survey for this line, did you receive any instructions as to the combination of 5-chain curves with the ruling gradient of 1 in 40? As far as practicable, the grades were to be eased on the curves.
4348. As a matter of fact, has the minimum curve been used in combination with the ruling gradient? Yes, I think it has, in one instance.
4349. In only one instance? I mean in one length of the line.
4350. What part of the line is that? The upper portion of the Denison Gorge.
4351. Do you think that was unavoidable? Yes.
4352. Supposing, instead of using 5-chain curves in that locality you had adopted minimum curves of 8 chains, what effect would that have had upon the location of the line? Well, no doubt it might have considerably affected it, but I am not prepared to say what it would be.
4353. Would it have necessitated taking it another road, or could you follow generally the same route? I cannot say. It would enormously increase the cost of the work.
4354. How many curves do you think of the minimum radius occur on a grade of 1 in 40? Three or four, I think it is.
4355. Do you think that the adoption of 8-chain curves instead of these few 5-chain curves would have had a very serious effect on the cost of the line per mile throughout? Yes, it would enormously increase the cost of the line throughout? Another thing, we should not have got the grade.
4356. By lengthening the contour you would. You do not think under the circumstances that it is practicable to introduce 8-chain curves in lieu of the 5-chain curves in that locality? No, it is not practicable.
4357. Were you engaged on the preliminary survey of this line? Yes.
4358. Is the line now being constructed identical with that submitted for the approval of Parliament? No.
4359. Does it differ materially? Yes, very considerably.
4360. Can you state generally in what respect it differs? From the 23rd or 24th mile it takes a different line of country altogether.
4361. Did you receive instructions from head quarters to make this alteration? Yes.
4362. Was it upon your recommendation that the alteration was adopted? Yes.
4363. Do you consider that the alteration was more economical, and shortened the line? Yes.
4364. How does it compare, in regard to accommodation of settlement, with the original line submitted to Parliament for approval? Practically I do not think there is any difference between the two. The present line is three miles south of the Parliamentary line, and there is not much settlement in that part of the country.
4365. Can you state what the practice is here in reference to alterations made in carrying out the permanent survey from the Parliamentary survey? In this case I reported in favour of a trial of this route when I sent in the line approved by Parliament, and recommended it should be tried. I think you will find some remarks upon it in Mr. Fincham's printed report.
4366. Which printed report do you refer to? It is a Parliamentary paper published in December, 1883, or January, 1884.
4367. Was the altered line submitted for the approval of Parliament, or was it adopted on the authority of the Minister at the head of the Department? I am not sure whether it was submitted to Parliament or not.
4368. In answer to the Chairman you stated that in most cases the waterways had been determined by observing the flood levels: in the case of the smaller gullies, where you might not have had an opportunity of observing them, how did you determine the necessary size of the waterways? I did not determine them.
4369. Who did? Mr. Fincham and Mr. McCormick. I only returned my ideas upon my own section.
4370. Did you give any data by which the proper size of the waterways could be determined? No.

4371. Then what had the department to guide them in fixing the size? The observations of all those streams during the progress of the survey, which took a considerable time.

4372. But who reported on these observations? Each engineer on his own section, and Mr. M'Cormick, who superintended the survey.

4373. But, I presume, Mr. Hales, it would hardly be likely that you would have an opportunity of seeing all the different gullies after heavy rain? Oh yes, we did.

4374. Did you not consider it necessary to ascertain the watershed areas in order to determine the size of the culverts? It would have been a work of great magnitude to do so.

4375. Are you not aware that this is usually the practice in other places? Yes, I am quite aware of it.

4376. Did you not think it the safest guide for the department in such matters? I dare say it might be very safe in some countries, more especially flat countries where there is a very long watershed.

4377. You do not think in rough countries, where the water flows away rapidly after heavy rain, it is all the more necessary to obtain information of this kind in order that the department might determine the size of the waterways? In some cases it might be necessary, not in all.

4378. Referring to the map it appears that the general alteration made from the Parliamentary survey is from the 24th mile to Scottsdale? Yes.

4379. Is the alteration chiefly through Crown land, or does it pass through alienated land? Chiefly through Crown land.

4380. What route did the original line follow? From the 24th mile it went west of Red Hill and joined Mr. Climie's original survey near Hall's track; thence through the Denison Gold Fields across the Forrester and over the Brid range, and joined the present line at the Brid River.

4381. You stated, in answer to the Chairman, in regard to substituting concrete culverts for the log culverts now being constructed, that the contractor would probably require an increased price for concrete? Yes.

4382. Were Messrs. Boland & Scott ever asked to submit a price for concrete in this locality? No.

4383. Have you any idea what extra price they would probably have required? No, I have not.

4384. Would there have been any difficulty in getting suitable stone in the localities where these log culverts are being constructed? In some cases there would be great difficulty.

4385. Take the culvert at the Scottsdale end of the tunnel,—is there not plenty of stone there that would answer for concrete? No.

4386. Are you of opinion that suitable stone for the purpose of concrete could not have been obtained within a reasonable distance of the sites of the log culverts? For most of them it could not.

4387. Would sand be difficult to obtain? Yes, in most places it would.

4388. What distance do you suppose the contractor would have had to cart stone and sand, on an average? From 10 to 15 miles.

4389. And what difference do you suppose this would have made to the cost per yard of the concrete? It would probably have doubled the price. It would depend upon the distance the stone or sand had to be carted?

4390. Are you of opinion that the contractors would have required double the price for concrete under the circumstances? I should not care to undertake it myself for less.

4391. If the concrete is 50s. per yard, that would be £5 per yard? Yes.

4392. Then, assuming the work could be done at that price, what do you suppose the difference of cost would be between concrete culverts and the log culverts now being constructed at the Scottsdale end of the tunnel? I have not the quantities to enable me to make the calculation.

4393. I think you stated to the Chairman that, at the amount estimated, there would be a difference of £100 taking it at the schedule rate? Yes, at the schedule rate.

4394. Well, assuming that the concrete would cost double that, would not the difference be £200? No, it might be trebled; it would depend upon the relative cost of the two works.

4395. Will you furnish an estimate showing the actual difference in cost, assuming the price of concrete to be double that in the schedule for that particular culvert? Yes, I will make it out.

4396. Have you ever considered the desirableness of substituting a retaining wall and embankment for the present bridge at 13m. 17ch.? I have not gone into the matter; but I would not care to have anything to do with a retaining wall in such a place.

4397. Do you think there would be any difficulty in securing a foundation? You would get a foundation right enough—you mean a surcharged wall?

4398.A Yes? I do not think it would pay.

4399. Have you ever made an estimate of the difference in cost? No.

4400. Then it is only from your general idea of the work? Yes; only supposition.

4401. *By Mr. Lawder.*—You have informed the Commissioners that you have arranged to ease off or reduce your gradient where sharp curves intervene upon the line: how do you propose to do that? I do not propose to make any alteration in the plans. It has been done where practicable.

4402. To what degree has this been done? Instead of 1 in 39 they have been eased off to 1 in 44, and sometimes 1 in 50.

4403. Is there any ratio for doing that, or is it simply approximated? The ratio I use myself is, if you run 1 in 40, you want to ease that off to 1 in 44 on 5-chain curves to make the resistance equal.

4404. You think that makes the resistance equal to what? To 1 in 40 on a straight line.

4405. Has that been done upon the curves in the contract drawings, or do you do it as you carry out the work? It is done on the contract drawings.

4406. Would you kindly point out where that is done in the case of the Denison Gorge? It is not practicable in the case of the Denison Gorge.

4407. Would you kindly point out where it has been eased off in this way? It is eased at the proposed viaduct at 13m. 75ch.

4408. That is 1 in 49.5 grade, 6 chains radius: are there any other portions of the line where it has not been practicable to do this? I have not examined them, but it is apparent that it is not practicable to do so at 17m.

4409. Has it not been done only at the expense of greater steepness in the approaches to the curves? No, I should think not.

4410. Had the grade on the curves not been flattened, would the general grading of the line have been less steep? I could hardly say.

4411. I notice that from mile 28, the site of the Denison Station, to mile 31, there is a fall of 360 feet with a grade almost the whole way of 1 in 39·6 to 1 in 44; and upon this steep grade you have told us that the 5 chain curves could not be made easier, nor could the grade be lessened or eased off at these sharp curves. I notice also that from mile 31 to mile 34 inclusive, the grade is practically level. Would it have been at all possible to have taken a line higher up the hill side from that mile 34 towards mile 28, so as to have equalised the grade to, we will say, 1 in 80 throughout, with perhaps a short increase of the length, and thus have avoided the sharp curves on very steep grades which now exist in the alignment at the Denison Gorge? Quite impossible; we would not have then had such a good crossing.

4412. Well, then, is there nothing to prevent, other than this crossing, the alignment being taken higher up the hill side between the 31st and 34th mile so as to have taken advantage of the long easy grade in ascending the hill? I am not tied to the present crossing of the east branch of the Denison at 30m. 75c.

4413. Are you in any way tied to the line between the 31st and 34th mile? No; only between the 31st and 28th. I am tied to the following crossings; viz., 28m. 78ch., 29m. 4ch., 29m. 20ch., 29m. 50ch., and 30m. 14ch.

4414. Would not then a slight detour enable you to get a better grade? It would not have helped me, it would only have taken me up the eastern branch of the Denison without any advantage.

4415. Could you not have come round and ascended the hill at the level of the present site of the Denison Station? No, I could not.

TUESDAY, MARCH 30, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

THOMAS MATTHEW ATKINSON, *examined.*

4416. *By the Chairman*—What is your profession and position? Civil Engineer, and Contractors' Engineer on the Scottsdale railway.

4417. Were you formerly employed by the Tasmanian Government? Yes.

4418. What position did you hold under the Government, and what were your duties? I was in charge of a section of the Scottsdae line, also on the New Norfolk, Brighton-Melton Mowbray, and Sorell lines as Engineer-in-charge, carrying out both of those surveys.

4419. Had you nothing to do with the survey of the Scottsdale line before the work was laid out? Yes, on Mr. Hales' section.

4420. I hand you a plan of the country traversed by the present Launceston and Scottsdale railway, on which there are marked certain lines: will you state what those are? Mr. Climie surveyed the line by the Lower Piper, which, I believe, was 66 miles in length, and Mr. Hales asserted he could get a shorter route.

4421. What would have been the length of Mr. Climie's line? 66 miles.

4422. What was the maximum elevation on that line? I do not know.

4423. What was the sharpest curve? 5 chains.

4424. What was the steepest gradient? 1 in 40.

4425. We have heard that the grades and curves on that line are less severe than on the present line, is that so, or is it the reverse? The line as surveyed could not be taken as a representation of facts, as it was only a trial survey.

4426. Will you state in what this misrepresentation consists? At Muddy Creek, near Scottsdale, the line was surveyed in the centre of the creek; whereas it was shown in the siding.

4427. Is there any other? That is quite sufficient, I think.

4428. That would only indicate a misstatement as to a particular locality? Yes.

4429. Do you speak of the line generally, or only of a particular locality? Only of Muddy Creek—a particular locality.

4430. Does the present line cross Muddy Creek? Yes.

4431. How nearly does the line approach to that surveyed by Mr. Climie? Nearly so. There is an alternative route, and the Ministry accepted the alternative route, Mr. Climie's route being abandoned.

4432. Are you acquainted with the curves and gradients on the present line now being constructed by Messrs. Boland and Scott? I am.

4433. Will you describe what is the ruling gradient and sharpest curve? 1 in 39·6 gradient, and 5ch. curves.

4434. What is the mileage of Muddy Creek? About $46\frac{3}{4}$ miles. The total length of the line is 47m. 7ch.

4435. Do you know where the present line and Mr. Climie's line joined? No; Mr. Sheard surveyed that.

4436. Are you tolerably well acquainted with the contour of the country between Launceston and Scottsdale? I am. I have walked over it, ridden over it, and worked over it.

4437. Are you satisfied, with your knowledge of the country, that the line determined on, and now being constructed, is the best that could be found? The route is the best, but the location might have been better in places. We might have done away with a number of the 5ch. curves, and still have kept to the 1 in 40 grade.

4438. Will you indicate where changes could have been made? Yes, I will. I am quite convinced that the route adopted is the best obtainable, but the location might possibly have been altered with advantage. In one particular case, from 13m. 45ch. if the gradient, that is the ruling gradient, of 1 in 40 had been adopted from that chainage to 16 miles, and keeping further up the Piper River, the viaduct might have been done without; that is the viaduct at Dogwood Gully. I qualify my statement by saying that from 13m. 45ch. to 13m. 63ch. I find they have a grade of 1 in 49.5. I then find from 13m. 63ch. to 14m. 50ch. they have a gradient of 1 in 44; then a vertical curve from that chainage up to 14m. 59ch. They then go on a gradient from that chainage up to 15m. 3ch. by 1 in 132. They then have a vertical curve which must break that gradient. They then have a vertical curve at break of gradient up to 15m. 11ch.; they then fall in 1 in 49 to 15m. 38ch.; then have a vertical curve up to 15m. 44ch.; and then go on the limit to Piper River. If the whole of the gradient had been worked off in a 1 in 40, and by keeping up the Piper River, they might have got over the Dogwood Gully with a moderate amount of filling.

4439. Assuming that what you propose had been carried out, would not the entire elevation of the line have been changed by adopting a ruling grade of 1 in 40? It is siding ground all the way. The contour of the country is similar for 100 feet one way or the other.

4440. Twenty or thirty feet is a comparatively small matter, but it would probably alter the route altogether if the vertical elevation was altered. Would adopting the more severe gradient have allowed you to follow the same route? Yes. It would have made no difference as to route.

4441. You say it would have made no difference to the route; but suppose you had to leave the range and go to another, how could you then have followed the same route? I simply say that from 13m. 45ch. to 16m. we have one continuous range to follow, and it is simply a question of gradient from there to Piper River.

4442. Assuming you had got a through grade of 1 in 40, what curves would you have got? You would have to stick to five-chain curves.

4443. If you make a steeper incline and sharper curve would it not be better to adhere to the Government plan? The Government have to provide rolling stock, and it would make very little difference to the Government if the line had a few more 1 in 40 grades, and it would probably have saved the viaduct.

4444. Have you ever made any preliminary survey on this route? I have on Mr. Hales' route.

4445. Then the remarks you have made are based on practical knowledge? Yes, and I have not got a five-chain curve on my section. I flattened my gradients and put in six-chain curves. I am sure that 1 in 40 gradients and five-chain curves are not advisable if they can be done without.

4446. What you have to do is to deal with the country as you find it. What do you suggest to the Commissioners as an improvement on the present line? I would suggest to lengthen the line, flatten the gradients, and increase the radius of the curves.

4447. I understand that your previous proposal was the reverse of this? That was not my proposal. I was referring to one particular point, and not to the whole route.

4448. Did you recommend that alteration? As my instructions were to carry out the location of the line with 1 in 40 gradients and 5 chain curves, it was my duty to carry it out so as to get a line as cheaply as possible. I consider it my duty to erect the viaduct, although not believing in it.

4449. If you could get a flatter curve with a less acute gradient, would it not be better to advise your Chief of the fact? I could do it. If you flatten your gradients and lessen your curves you have more work. Our instructions were to get the best route we could as cheaply as possible.

4450. How would that accord with reference to your remarks respecting Dogwood Gully? The plan itself shews the lesser work. If the Government had stuck to the 1 in 40 gradient and 5 chain curves the Dogwood Gully viaduct might have been done without, but would require filling up.

4451. What difference in cost would that be if the work was less? The gradients would have been increased and the curves lessened, decreasing the cost.

4452. At one portion of the line, between 8 and 9 miles, and before getting to Dogwood Gully, the Government propose to lower the level of the formation on account of the difficulty in obtaining side-cutting at this spot, and where Mr. M'Cormick pointed out that a large quantity of side-cutting was scheduled. Do you think the alteration an advantageous one? I do not know how to answer that question. My answer is not to affect my firm's interests. Apart from that interest my answer is on public grounds. I think they are perfectly safe in doing so from an engineering point of view.

4453. Assuming that the lowering of the formation is a matter of equitable arrangement between the Government and the contractors, what is your opinion? That I should deem it safe for them to do so, but I refuse to go into the matters between the contractors and the Government at all.

4454. *By Mr. Stanley.*—From your knowledge of the country which of the two routes surveyed do you consider would accommodate the largest settlement, and would have been the best line? The Lower Piper route, as far as the settlements are concerned,—no doubt of that.

4455. Which of the two lines do you consider the most economical to construct? The present line is more expensive, but shorter.

4456. Taking into account the difference of mileage, which of the two lines would cost most? As far as figures go the cost is about equal as regards cost of construction, but the present line is 7 miles shorter, and maintenance &c. would have to be taken into consideration.

4457. In view of the larger settlement which you state the lower line would have accommodated, which would probably be the more reproductive, taking into consideration the relative length of both lines? I think the present line will be the more reproductive. It will be a good deal better to make a loop line to Lower Piper rather than take the trunk line all the way round. The Lower Piper line would immediately tap more settled country, and give greater return, but in the end the present line would have to be made.

4458. For what purpose? You would have to tap Upper Piper and German Town, and country near Piper settlement, and make the same, which is the same line that is now being made to Scottsdale.

4459. You stated, in reply to a question, that you were opposed to combine sharp curves with the ruling grade of 1 in 40? Yes.

4460. What effect would it have had on the cost of construction if, instead of having 5 chain curves where 1 in 40 gradients occur, the minimum radius had in such cases been fixed at 8 chains, or to have flattened the gradient when 5 chain curves were used? In many places it was almost impossible to get 8 chain curves; it would have increased the cost £1000 per mile, as we would have had to tunnel.

4461. How many places are there where the minimum curve of 5 chains occur in 1 in 40 gradient? A great number, at the Denison Gorge particularly.

4462. In how many places does this combination occur? Having looked at the plans, I find there are seven 5 chain curves in 1 in 40 gradients.

4463. Are you of opinion that to have eased the curves or flattened the gradients at these places would have resulted in a serious increase in the cost of the line? I think at these particular places it would, but it would not usually.

4464. My question only refers to the cost where there is a combination of the minimum curve and maximum gradient. Are you still of opinion that it would have seriously affected the cost of the work had these gradients and curves been eased at these particular places? I feel quite convinced that it could have been eased to 6 chains without increasing the cost very much. I would not go beyond that.

4465. In cases where it would be impracticable or unadvisable to ease the curves, would it not have been possible to flatten the gradient? I am quite convinced of that, but it would have increased the work.

4466. But seeing there are only seven places in which they occur, would it have had any serious effect on the cost of the line? I feel tolerably convinced that it would have been better to flatten the gradient, if not to ease the curves.

4467. On the section of the line that you surveyed, did you avoid the combination of sharp curves and steep gradients? I did, for the simple reason that I thought the combination unadvisable, and to be avoided if possible.

4468. What part of the line did you survey? From 31m. to 38m.

4469. Is that through rough country? Yes; from the foot of the Denison Gorge to Buttongrass Plains it is very patchy country.

4470. Did you use the ruling gradient on any portion of the line? I did, but not to any great extent. I had to get over saddles with it.

4471. Can you state whether the firm you represent tendered for the Scottsdale Railway on the faith that log culverts would be adopted in the places shown on the sections beyond the tunnel? Yes. They tendered with a thorough faith that wooden culverts would be adopted there, and put in the prices for concrete on that understanding.

4472. Would the substitution of concrete for log culverts have had a serious effect on the contract? I should think I had a clear claim for breach of faith on the part of the Government.

4473. What would be the extra cost of constructing concrete in lieu of log culverts? Thirty shillings per yard at least above the schedule rate.

4474. Did your firm make any offer to the Department in regard to substituting concrete for log culverts? No, certainly not.

4475. Were they not asked to do so? Not to my knowledge.

4476. Can you state approximately what the cost of the log culverts will be which the Commissioners examined on the Scottsdale side of the tunnel? I cannot remember.

4477. Will you furnish the Commissioners with the cost of these culverts? Yes.

4478. Also the cost of concrete culverts in lieu thereof at the prices you have stated? Yes.

4479. From your knowledge of the character of the timber used in the construction of such works as this, at what term would you put the life of these log culverts? Seven and a half years.

4480. Do you think at the end of that time it would be safe to remove the centre row of piles and trust entirely to the cross logs in putting in a concrete culvert? I do not think it would be safe to allow the cross logs to rest on the side piles only. My experience shows me that no man could let the bank down on the concrete with safety.

4481. Do you think it advisable to adopt the timber in lieu of concrete? I do not. I think it is a mistake.

4482. Referring to bridge which it is proposed to construct at Dogwood Gully—13m. 75ch.—what is your opinion of the suitability of this structure according to the designs furnished you? I am afraid it is shaky. The inclines of the braces are not equal, and there would consequently be an unequal strain, which is not advisable.

4483. Have you made any suggestion relative to the bridge designs furnished you? None whatever.

4484. If you have any fear of the safety of the structure do you not incur considerable responsibility in erecting it? Certainly not, because it will last my time.

4485. Do you mean that it will probably last during the term of the contractor's maintenance? Yes, that is what I mean.

4486. Do you think it would be practicable to substitute a retaining wall and embankment at this place? Yes.

4487. Would it be practicable keeping the line as it is? Yes, it certainly would.

4488. Do you think the cost would be much greater? The first cost might be greater, but in the end it would be cheaper, because it would only be necessary to put in a 4 feet culvert, and then you would be done with it.

4489. Would there be any difficulty in getting material in the locality to form an embankment? I would have a side cutting within 10 chains of the site.

4490. Would there be any difficulty in getting a sound foundation for the retaining wall? None whatever; it is good solid rock.

4491. Will you furnish the approximate cost of the retaining wall and embankment compared with that of the present bridge? I will do so.

4492. Was it intended to adopt concrete for the piers of several of the bridges? Yes.

4493. Are these piers to be built according to the designs shown in the type contract drawings? No, there are detailed drawings furnished us of all timber bridges.

4494. The piers are not to be wholly of concrete? No, only on timber. That is, the pier of the Dogwood Gully viaduct.

4495. Then the foundation of the pier is merely constructed of concrete? Yes.

4496. Does that apply to the bridges where iron girders will be used? No.

4497. In that case of what design is it intended to construct the piers? As far as my orders are at present, iron girders are to be put on concrete abutments. We have no double spans in iron.

4498. Are these concrete abutments or piers to be built according to the design on the type drawings? Yes, generally, but details are forwarded from time to time.

4499. According to these designs, are the piers to be built with any batter? Yes, 1 in 12 for the piers, and 1 in 8 for the abutments.

4500. In the case of the viaduct over Piper River, is the concrete pier, so far as you know, to be built according to the type drawings? If I get no drawings I will build it that way.

4501. Has that pier no batter transversely? None whatever.

4502. From your experience in connection with this contract, can you state whether the quantities shown in the schedule of the contract fairly represent the actual work to be carried out? They do not.

4503. Can you furnish the Commissioners with a statement showing where the differences occur? Yes.

4504. In the case of side cuttings, will the quantities actually required differ to any considerable extent from those in the schedule? I assume the difference will be 12 per cent.

4505. To what do you attribute this? To the material itself being very wet and clayey.

4506. Under the heading of concrete, masonry, and brickwork, from your knowledge of the work so far executed are you of opinion that these quantities have been obtained by actual calculation from contract drawings, or that they have been assumed? My impression is they are calculations from contract drawings, but no margin was allowed for sinking the foundations.

4507. Do you think the quantities have been based upon the contract drawings, except so far as work in foundations is concerned? I have no data to enable me to give an opinion on it, but I will go into the drawings if the Commissioners like. I think they have been under-estimated.

4508. Could you at the present time form any opinion as to whether the total cost of the contract work will exceed the amount tendered for? I could not possibly do so without going into the matter. We have only done about £40,000 worth of work out of £230,000.

4509. In the present position of the work you cannot form an opinion? So far as the work has gone it has exceeded the contract amount at the per-mile rate.

4510. To what percentage does this excess amount? 10 or 12 per cent., particularly in side cuttings and length of culverts.

Mr Atkinson was then examined on the Derwent Valley Railway.

4511. *By Mr. Stanley.*—During the time you were employed as an officer on the Government staff, had you anything to do with the Derwent Valley Railway? I had.

4512. Was it in connection with survey or construction? In making deviations from the original survey.

4513. At what points of the line did these deviations occur? At Back River and Ivanhoe, or No. 2 bridge.

4514. Taking the deviation at Back River first, will you state shortly what was the nature of the deviation you surveyed? I made a deviation to save the retaining wall, and put the centre of the line on solid ground. I intended to do without the retaining wall altogether. I think it was 12 feet in the solid. The wall could have been done without altogether.

4515. Have you a plan of the deviation you referred to? The Engineer-in-Chief has.

4516. Could we get it by applying for it? I believe so.

4517. Have you any idea who made the survey which was adopted? I do not know.

4418. Was the deviation surveyed by you after the contract was signed? Yes, after the retaining wall which was built by Mr. Mault had fallen into the river. After its collapse I was sent to make a survey, and try to do without the wall altogether.

4519. Would it have accomplished the object you had in view? Yes, I am certain of it.

4520. Did you make any estimate of the cost? No, that was left to the Engineer-in-Chief.

4521. Would it have interfered with the road and culvert crossing the Back River? It would not have interfered with the road at all, but would have necessitated the moving of the railway culvert 12 feet to the right.

4522. Can you recollect to what extent this deviation would have increased the earthwork? I never went into the cost; I sent it to the Engineer-in-Chief.

4523. What was the nature of the deviation you surveyed at Ivanhoe, or No. 2 bridge? A retaining wall was proposed to be constructed there, and the Engineer-in-Chief sent me to see if it could be avoided. I placed the line on the side of the hill some 40 feet higher than the location selected by Mr. Mault, thus doing away altogether with the retaining wall by the deviation.

4524. Can you state whether that deviation was adopted in carrying out the line? Yes.

Examination on the Scottsdale Railway continued.

4525. *By Mr. Lavender.*—You informed the Commissioners that you had been employed by the Government to make a survey of the Scottsdale line between 31 miles and 38 miles? Yes.

4526. Then you must be thoroughly well acquainted with the country there? Yes.

4527. Who had charge of the section continuous with yours, on the side of the Denison Gorge? Mr. Hales.

4528. Who fixed the obligatory points of your section? Mr. M'Cormick, the Superintending Engineer.

4529. Then, I presume there was an obligatory point fixed about the 31st mile. Yes.

4530. And you were bound by that? Yes.

4531. Do you think a more advantageous line could be obtained, from 34 miles to the side of the Denison Gorge at 28 miles, than was obtained? I do not think so.

4532. The Commissioners observed, in places between 34 miles and 31 miles going towards the Denison Gorge, the formation is level; and from 28 miles to 31 miles inclusive the gradients of the formation run from 1 in 39.6 to 1 in 44. If you had to lay out the line from miles 28 to 34, would it have been possible, speaking from your knowledge of the ground, to have obtained easier gradients between those points? It would have been possible; but the increase in cost would have been enormous. We had to get down the Denison Gorge to where I joined Mr. Hales.

4533. Then the alignment there was compulsory? Yes.

4534. Where did you join Mr. Hales? About 31 miles.

4535. Then you consider the point where the line crosses the Denison River was the best one, and that the river could not have been crossed any higher up the hill side? No, advisably so.

4536. Why not? was it a question of cost or of length of line? It would not have increased the length much, but it would have increased the cost so much that the country would not have incurred it.

4537. Would it have been possible to have taken the line higher up the hill? Yes, an easier grade could have been obtained, but at great cost.

4538. Can you give an idea what the greater cost would amount to? No, I cannot.

4539. What would be the percentage? I cannot say; it would increase so rapidly that I could not give it.

4540. From your knowledge do you consider the wiser course has been adopted in the line at the Denison Gorge? I think under the circumstances they could not have adopted a better plan than they did in getting down to the Denison Gorge. If the line had been taken higher up a great viaduct would have to be built; and I think the very best thing was done under the circumstances, without sharpening the curves and grades.

4541. With reference to the timber viaduct to be constructed at 13m. 75ch., is timber more easily procurable at that site than material for concrete? No; material for concrete is easily obtainable there. It is only a question of getting the cement, and that we have to provide.

4542. Is timber not easily procurable there? Not at that point; but it has been obtained, and is now on the ground. Stone is not far off, and sand is plentiful. There is not much difficulty in getting timber at any part of this line. Here it could have been obtained within a mile or two.

GENTLEMEN,

Launceston and Scottsdale Railway, Tasmania,
Launceston, 3rd April, 1886.

In accordance with my promise to the Commissioners on Tuesday last, I do myself the honor to forward you the information asked for, as far as is in my power.

Re COST OF TECHNICAL WORK IN CONTRACT.

I regret that I am unable to furnish you with the cost of these works, as the quantities cannot accurately be taken out, owing to the cross sections of gullies in which the culverts are located not having been taken, and also to the fact that the designs are not in all cases decided upon.

Re CUTTINGS.

The quantities as given chain per chain are fairly accurate, but clerical errors cause the total amount shown on section to be considerably deficient. There have also been several changes of grade, which have materially increased the scheduled quantity.

Re SIDE CUTTING.

This requires an addition of from 10 per cent. to 12 per cent. to the scheduled quantity, as sufficient allowance has not been made for shrinkage of material.

Re DOGWOOD GULLY.

My estimate of this viaduct, as per present design, is about £3000. If a concrete retaining wall and bank were substituted, the cost would be about £6000. If 60 feet iron girders were used on concrete piers, the cost would be about £3500. This latter would, in my opinion, be the better of the classes of viaducts, nearly as lasting as the retaining wall and bank, and, as the above figures show, for but a slight increase on the cost of present design.

Re LOG CULVERT AT OM. 75C. = 26½ MILES.

The cost of this culvert, as per schedule prices, will be about £220. If concrete were substituted, the cost, owing to the difficulty of carting materials to this spot, would be £1 more than the scheduled price per yard, making a total of about £770.

Re DENISON GORGE.

In this gorge, if concrete were substituted for log culverts, the cost of temporary bridges and roads for carting cement, and the total absence of metal and sand from the sites, would raise the price of concrete to double that scheduled, whereas timber for log culverts is conveniently near to the required positions.

Re LOWERING OF GRADIENT BETWEEN THE 7 AND 9 MILES.

I wish to state that since before the Commission I have gone into the matter, and find that the lowering of this gradient makes a difference in rock cutting of some 15,000 yards. On the other hand, something like 45,000 to 47,000 yards of side cutting has been dispensed with; and, according to scheduled rates, the cost of earthworks would about balance themselves. Although there will be, on the face of it, a balance in favour of the Government of some 60ft. of 8ft. arch, and also some other saving of concrete in smaller culverts, it has altered the average on which the contractors tendered; and consequently, as side cutting would not be difficult to obtain with an extra lead, I consider that my firm has a fair and reasonable claim for lowering of said gradient, and consequent alteration of average.

In all matters touched upon in *this Memo*. I wish it to take precedence of my verbal evidence given before the Commission; and any information I can supply to the Commissioners, to in any way facilitate their enquiries, I shall only be too happy to furnish the same as soon as possible.

I have the honor to be,
Gentlemen,
Your obedient Servant,

THOS. M. ATKINSON, *Contractors' Engineer.*

*To the Chairman and Members of the Royal Commission
on Railways and Public Works.*

MARTIN BOLAND, examined.

4543. *By the Chairman.*—What are you, Mr. Boland? A builder and contractor.

4544. You are the senior partner in the firm of Boland and Scott, and you recently tendered for the construction of the Launceston and Scottsdale Railway? Yes.

4545. The amount of your tender has been stated here,—perhaps you will repeat the gross amount? £228,541.

4546. What does that include? The earthworks, bridges, and laying the permanent way.

4547. Does it include provision for sleepers? No.

4548. Nor rolling stock, stations, or station platforms? No, nothing but laying the permanent way, the cuttings, earthworks, and other works.

4549. Does it include sidings and station yards? Well, I cannot answer that question.

4550. Suppose the line is widened for the purpose of constructing a second road? It is simply a schedule contract, and I do not know that it would include those works.

4551. In tendering for the work what was your understanding with regard to the culverts on the Scottsdale side of the tunnel? All timber.

4552. And on the Launceston side? Concrete, and a portion of them wood.

4553. What was the reason for the provision of these different materials? The cost of carriage.

4554. And, I presume, the difficulty of finding suitable stone on the Scottsdale side of the tunnel? Yes; there is scarcely any on the other side of the tunnel.

4555. It has been pointed out to us that the Government contemplated lowering the formation of the line between 8 and 9 miles? They have done so, I having received notice to that effect.

4556. How does that affect your relations with the Department? We have had a squabble over it.

4557. When you say you have had a squabble, you mean that you dispute having to do the work at your schedule prices? Yes.

4558. Why do you dispute it? Because the material is harder.

4559. In point of fact, this lowering of the formation forces you into more rock? According to my agreement I was simply to run over the rock, and in making my calculations I reckoned on that, allowing for the embankments.

4560. We have been told that this alteration in the formation will decrease the quantity of side cutting which you would have otherwise had to provide? Yes, but that is not the only thing, otherwise it might have been provided for.

4561. Then I presume if the Government meet you in an equitable spirit and pay you fair compensation for the increased labour and cost, you would have no other claim against them? No; but it certainly is a grievance, because I cannot put on the extra number of men; the course of the railway being through a narrow cutting, it would take a great force to drive the work forward with any speed.

4562. As a matter of arrangement, do you think the alteration in the grade, apart from the question of expense, a desirable one for the Government? I should think it was a desirable alteration for the Government.

4563. In what way do you think the alteration desirable? It makes the grade easier, and reduces the length of the culverts and the size of the embankments.

4564. Roughly speaking, what saving in cost in the construction of the culverts do you think will accrue to the Government in carrying out this alteration? Only £200; that would be the outside of the saving on the culverts.

4565. How many culverts will be affected? Two large ones.

4566. A position on the line known as Dogwood Gully was pointed out to us, and it was alleged that the Government proposed to erect a tressel viaduct upon concrete foundations—is that structure a portion of the original contract? It was.

4567. And prices have been fixed for it? Yes.

4568. Speaking as a builder, do you consider that structure well designed and adequate to carry the traffic? I should not consider it such as it ought to be.

4569. Do you consider it well designed? No, I do not. There are not sufficient braces.

4570. Will you indicate how you think it could be improved—if by braces, or what other plan? By diagonal braces and wind ties.

4571. Then you consider the structure not sufficiently rigid to withstand the force of the wind, the wear and tear of the traffic, and other causes? No, I should not consider it so.

4572. Assuming the Government had ordered you to build a concrete culvert with an adequate retaining wall at the foot of the slope, and over all an earth-bank, how would the cost of that compare with the proposed timber structure? I do not believe it would be difficult. I have not gone into the culvert, but should not think there would be a large difference in cost, as there is a great amount of concrete work now in the piers at the bottom.

4573. Would not the amount of the cost of the proposed concrete bases added to the cost of the timber structure, go a large way towards the cost of the earthwork in a bank? It would.

4574. Supposing the Government determined to substitute an embankment, would you think that a more satisfactory work than the viaduct? Yes, it would be permanent. If you put an embankment there it would never require renewal.

4575. Is there any difficulty in the way of foundations—in other words, is the subsoil wet? No, it is all rock.

4576. Then there would be no difficulty? None whatever.

4577. Coming to the tunnel, we noticed on examining the Scottsdale or eastern approach that the Government had given you orders to construct large log culverts? Yes.

4578. Are you aware if it is the intention of the Government to substitute concrete culverts at that point, or is that a matter to be dealt with in future? It is a matter to be dealt with in future. The culverts would last about 15 or 20 years, and in the meantime they could be taken out without any stoppage or delay.

4579. As to the approach cuttings to the tunnel,—in what time do you think you will have excavated the eastern or Scottsdale end so as to allow a heading to be driven? In three or four months, weather permitting.

4580. Have you considered what plan you will adopt in constructing the tunnel? That will be a matter for the Government.

4581. Have the Government engineers given you any instructions as to driving headings? It has not yet been finally considered.

4582. Do you think it will be necessary to excavate any portion of the tunnel by sinking shafts and driving headings, or do you propose to carry on the work only from the eastern mouth of the tunnel? No, I am afraid there will have to be air shafts put in.

4583. At present you have no knowledge of what the strata will consist? No.

4584. We notice you are making a large number of bricks at the eastern approach of the tunnel: for what are they required? That is to line the tunnel in places where it may be required. I have not had any instructions yet about that, which I do not think right.

4585. Assuming the Government find it necessary to line the tunnel, say to a thickness of 18 inches, what quantity of bricks will you have to provide? About a million and a half.

4586. What time will it take to make these? It would take two years, unless things turn out better than at present. I have no instructions, and I have merely made those I have made because I do not want to be altogether unprepared.

4587. Assuming that a portion of the tunnel is rock, which may or may not be sandstone, do you think it necessary to make such a large provision of bricks, or will you wait till the tunnel is well advanced? I would have to have some of them provided; it would be better to get the bricks than be delayed.

4588. Is it possible to bring up bricks and material by laying the rails from Launceston to the tunnel? No.

4589. Then, without you get a definite order from the Government as to what brick lining they propose, the works of the tunnel will be considerably retarded? Yes.

4590. Do you feel yourself competent to speak as to the manner in which the work has been laid out? It is laid out pretty well.

4591. What is your opinion, as a contractor, as to the skill or otherwise which the Government officers have shewn in laying out that line? I do not believe it could be improved upon. The only thing that I think could be improved is the tunnel, which goes right up the watershed, whereas by going on one side it would have saved a great deal of trouble. It would have saved a few thousand pounds had they kept to one side or the other, and we would not have been so troubled with the water.

4592. Would not that have made the approach a rather more intricate one, and increased the cubical contents of the cutting? Yes.

4593. What was the price of the earthwork per cubic yard in that cutting? Twelve shillings.

4594. In other respects, then, you think the Government officers showed skill and judgment in laying out the works? In all other respects it could not be better.

4595. The whole? All the works.

4596. Have you any complaint to make against the administration or the opposition of the department? Yes; if they had given me possession of the land I would have laid the road as far as the Piper.

4597. In what respect has the Government withheld possession of the land? There was no Act of Parliament to give the Government possession.

4598. But now, we are given to understand, there is an Act giving that power? Yes, but previously we could not get possession, and had simply to work on sufferance where we could.

4599. Does that apply to the whole of the land? No, but it applies to all except the Government portion.

4600. Did you make any representation to the Government of the difficulties you were subjected to by reason of this? Yes.

4601. What reply did you receive? I did not receive any.

4602. As you are an old resident of Launceston, have you any idea whether the line which was projected to pass down towards the Tamar and nearer to George Town, proceeding then north and east to Scottsdale, would have been a better road than the present one? No, I should not think so, because I think a main trunk line should follow the nearest route between the two points; besides, there is better land in the direction the line has taken.

4603. It has been alleged that there is better land in that neighbourhood—by way of George Town? It would not keep a sheep to four or five acres; and there is no population, for you might go miles and miles without meeting an inhabitant.

4604. In this plan of the County of Dorset this line marked blue is the one originally projected. It has been pointed out to us that one of the many advantages that would accrue to the public by the construction of this line is that it would render the approach to George Town and certain portions of the river very easy? Yes; but we have got steamers running on the river to do that and supply all their needs. Towards George Town it is all barren land; you have seen a specimen of the country this side of Turner's Marsh, which represents the average run of the land on towards George Town.

4605. It has been also said, that there is a very difficult bar at the entrance to the Port of Launceston, and that during certain times of the tide great difficulty occurs in the discharge of heavily laden steamers or sailing vessels, and that if a line of railway were constructed running parallel with the Tamar, vessels could stop at a point six or seven miles down below the town, and their passengers come on to Launceston by rail? It is over six or seven miles, and the line was one and a-half miles from the river.

4606. Then you know it was intended to construct a branch line? Yes, at Nelson's Creek.

4607. How is the channel of the river at Nelson's Creek? There is no depth of water at Nelson's Creek; you want to go down nearly 20 miles before you get to deep water.

4608. But there is a place called Rosevears where the water appears to be deep? Yes, that is 12 miles down.

4609. How far below Nelson's Creek? About four miles.

4610. Well, if the Government were still determined to run a branch line to Nelson's Creek or to Rosevears, there is no difficulty in the way of doing it? No, there is no difficulty whatever.

4611. *By Mr. Stanley.*—You stated, Mr. Boland, I think, that the reason for adopting the log culverts on the section of the line beyond the tunnel was the scarcity of material for building purposes? Yes, and the difficulties of carriage.

4612. Could you state approximately what would be the extra cost of substituting concrete for timber in that locality at per cubic yard? It would cost ten times as much.

4613. How much above the schedule prices for concrete? I could not form any idea. It would be very expensive. You can only use the roads, such as they are, for three months out of the twelve.

4614. Would substituting concrete retard the progress of the work? Yes, to a very considerable extent. Our great difficulty now is the carriage.

4615. Would it not be practicable, in cases like that culvert we examined last week on the Scottsdale side of the tunnel, to put a temporary bridge across so as not to retard the earthworks? Yes; but it would not pay us to do it.

4616. Would the cost of such a temporary bridge be a very serious matter? Not a very considerable cost. I could put a tressel bridge over.

4617. Where would you obtain stone from for concrete in that locality? It would have to come from this side of the tunnel.

4618. Then you would have to cart it? Yes, for a long distance.

4619. Would the same difficulty occur with sand? No; we cannot get sand anywhere.

4620. Then the difference in the expense of providing concrete would be the difference in the cost of the carriage of stone and sand? Yes, and it would be a big item too.

4621. What do you suppose the cost of the carriage of stone per cubic yard would amount to on an average? It would cost about £6 per cubic yard of concrete, if you could get it down at all.

4622. What distance would you have to bring the stone? Twenty miles. You would have to go round the hills, as you could not get through direct the way we are going.

4623. Do you not think that with a little trouble you would be able to find stone of a sufficiently good quality in the neighbourhood of the tunnel? Yes, but they will not allow us to use the ordinary freestone.

4624. But, in your opinion, as a practical man, can you find stone of a sufficiently good quality for concrete? Yes.

4625. Supposing they allow you to use such stone, could you afford to put concrete in at schedule rates? No, because the concrete costs double.

4626. In that case the difference would be in the carriage of the sand? Yes.

4627. What do you suppose that would amount to? In some cases it would be difficult to get it there at all.

4628. Can you not give an approximate idea? In some cases you would have to sledge it down. You could not carry—that is out of the question—you could not get it down except by sledging.

4629. Would it amount to 2s. 6d. per cask? Yes, and ten times as much.

4630. Ten times? Yes.

4631. From what part? From Piper's River.

4632. Do you mean, seriously, that the cost of carrying one cask of cement from Piper's River to the works on the other side of the tunnel would be 25s.? Yes.

4633. Why, it would not cost as much if you were to pack it? Yes it would; I have paid £9 a ton for packing less distances than that. Taking one place with another it would cost 20s. per cask.

4634. You have had considerable experience, I suppose, in timber structures in this colony? Yes, I have.

4635. What should you consider to be a fair time to allow for the life of these log culverts? 15 years; if well covered they would last for 20 years.

4636. And do you think there would be any difficulty or any danger in removing the central row of piles in order to make way for the concrete culvert which it is contemplated to construct eventually in this locality? No risk at all.

4637. Do you think the logs forming the top of the culvert sufficiently strong to carry the embankment with safety after you removed the central row of piles? Yes; there is no necessity for the central row as far as strength is concerned.

4638. Do you anticipate that your firm will be able to complete the contract for the amount of the tender? I expect so.

4639. You do not think that amount is likely to be exceeded? No, I do not think at the present style of the working it will, for they are curtailing everything they can.

4640. Do you think that a wise economy is being shown in thus curtailing the expenditure upon the works? No, I should not think so; it is not always wise to do things cheaply.

4641. Then, as a practical man, do you think that the alterations being made are done at the expense of durability for the sake of economy in the first cost? No, I do not think so.

4642. Referring again to the question of the concrete culverts, can you suggest any way of getting out of the difficulty which you have referred to in regard to the extra cost of bringing cement on to the works? We could never get it done in anything like time; we have not the appliances to do them.

4643. But supposing temporary tressel bridges were put up, then you could? No, they are heavy banks,—the banks are too deep.

4644. Then, in putting in the concrete culverts eventually can you say how it is intended to deal with the present temporary structure? Do you not think there would be considerable risk in removing the present temporary structure? I should not touch the wood; I should leave it to decay.

4645. Are you of opinion from your observations that the provision for waterway is generally sufficient? In all cases I should think so. They are not troubled with much flood there.

4646. *By Mr. Lawder.*—Would you inform the Commissioners what practice you have had in contract work hitherto? Five and thirty years experience.

4647. Any experience in railway construction? No, not in railways, so far as plate-laying is concerned; but I have had considerable experience in bridges and culverts, and in ordinary roads and bridges.

4648. I suppose you have been accustomed to schedule contracts? I have.

4649. Are you satisfied with all the rates in your schedule under the contract for the Scottsdale Railway, with the experience you have had since taking up the contract? Yes.

4650. Are there no rates that you think will not cover your cost? I find the schedule for rock—for instance, between the 8 and 9 miles—too low.

4651. You have several rates for different qualities? Yes, some portions are for earth and rock, some for loose stones, earth, and rock intermixed; others again, only, mud-banks.

4652. Then consideration has been and will be taken by the engineer in charge, and the Engineer-in-Chief, to the character of the formation met with in various localities? Yes, it is made every mile, so that you can judge whether it is rock in portion or all rock.

4653. In that way I assume they have given you special rates for rock? Yes, but they have not mentioned any.

4654. Yes, but in this case did they not assume that the character of the ground showed its difficulty to work, and you, understanding these matters, took this into consideration? Yes.

4655. With reference to the timber work, has the rate proved a sufficient one? Yes, it is an average price right through.

4656. You think it will quite cover all expenses? It will.

4657. Will the rate for concrete in culverts and bridges, where it is provided on the Launceston side of the tunnel? Yes, it has done so, so far, where we could get the material up freely to the men without long carriage.

4658. With reference to the tunnel work, what is your opinion of the kind of formation you are likely to meet with? Rotten sandstone; I have seen nothing yet to alter my opinion.

4659. Then I presume in that case lining will be required? Yes it will, right through.

4660. Then you consider the manufacture of bricks for the whole tunnel should be taken in hand at once? I consider so.

4661. Do you also consider that the tunnel should be lined on both sides as well as arched? I do.

4662. And the invert will also have to be provided for? Yes, I should consider so.

4663. Is this provided for? Portions only.

4664. Should the lining for the whole tunnel be required, would the cost of the work be largely increased? Yes, about three times the present cost of the tunnel, that is, about £15,000 extra would be required.

4665. Would that £15,000 cover not only the price of lining the tunnel, but the price of shoring up, framing, &c.? No, they would be extra.

4666. What would they amount to? Can you give the Commissioners the total cost of lining the tunnel for the remaining two-thirds of its length yet unprovided for? No, I cannot, but I am confident that by the time we are through the excess will be more on the brickwork.

4667. Can you supply the Commissioners with an opinion after a little consideration? Yes, within a few days.

4668. With reference now to the question of concrete in this culvert on the Scottsdale side of the tunnel, would not the cost of concrete formed from broken bricks be very much cheaper than if formed of broken stone metal carried from a distance? Yes, cheaper.

4669. Will you give the Commissioners some information as to the cost of concrete formed in that manner? Yes, I will supply it.

4670. You have mentioned that considerable delay has occurred in handing over land to you, and that you have been able to complete the line up to Piper's River by this had the land been given over in time. Will you state what difficulty occurred—how long? We have been delayed eight months, and have only just got possession.

4671. I presume you have not been delayed eight months in commencing the work? We wanted to commence at the station in Launceston and go straight on, but when we started they would not allow the land.

4672. But how long would it take you to make the line at the beginning from the station now? We have lost the season.

4673. How long would it take? Three months.

4674. And you have been delayed eight months. There are a great number of places between the point where you have commenced close to the Launceston station up to Piper's River where the work is not finished? Simply because there was not sufficient side cuttings, and the Government engineer would not provide it.

4675. Has the delay in the transfer of land affected that? Yes it has, because we could not go on to land outside of the actual surveyed land.

4676. It is, then, simply a question of side cuttings outside of the ordinary railway boundary by which you have been delayed? Yes.

4677. I presume, then, you have not been delayed actually eight months, inasmuch as your labour could have been usefully employed, and, no doubt, was usefully employed in other localities? Yes, we were, but that prevented us laying down the permanent way.

4678. But you can hardly have been ready to lay down the permanent way, with bridges and culverts not done? I should have put down temporary bridges, and would not have lost the season.

MARSHALL CRESSWELL, *examined.*

4679. *By the Chairman.*—You are a Civil Engineer? Yes.
4680. What is your present employment? I am at present Resident Engineer on the Scottsdale Railway, on Section No. 1.
4681. Is that a portion of the line between Launceston and German Town? Yes, up to 20½ miles.
4682. Had you anything to do with the survey of the line previous to the contract being let? Nothing whatever.
4683. Had you any previous knowledge of the country before you were appointed as Resident Engineer? Yes, I knew the country perfectly, having travelled over it considerably previously as engineer in charge of the roads and bridges and other public works on the northern side of the island.
4684. It has been pointed out that the line to Scottsdale, as originally contemplated, followed the blue line shown on the map of the County of Dorset, and the railway as at present being constructed by a red line on the same map. Now which in your opinion is the better line—best serving population and settlement, and which also passes through the best land? Well, I think that the line being constructed at present best meets the requirements of the population.
4685. Why? Because the population is more dense there, and the quality of the land is better. The country around the other line is very barren, a quartz and gold-bearing country, where you could travel miles and miles without seeing more than mere strips of productive land, and where no good land of any extent is to be found. Going all the way from Turner's Marsh to Alford and the Lower Piper road it is a series of barren ridges, with here and there a little block of land. Further down it is a succession of rugged slaty outcrops for miles. I know the country perfectly well, having been resident at Bangor for the first 12 months I was in the colony, and laid out the tramway there to the Tamar. The best land and the thickest population is found on the Scottsdale side of the Piper.
4686. It is alleged that the original or blue line, would serve the population along the River Tamar to George Town,—what is your opinion? There is scarcely any population here. It is a series of sheep-runs, and when you get past Rostella there is not a bit of land you could put a plough into.
4687. Looking at the plans of the two lines, by the one originally proposed a branch was contemplated to Nelson's Creek. Should it be desirable to connect this railway with deep water, at what point could you go from the line now being constructed: comparing the two lines, does not the blue line give greater facilities for getting to deep water? Certainly.
4688. Are you quite clear in your mind that the land and settlement on the line originally proposed is not as good as it is on the line constructed? Yes; speaking as a private individual, there is not any land down there, with the exception of the edges of the river, that I would give twopence an acre for.
4689. With regard to physical difficulties, which of the two railways would be the easier to construct? Well, I have not been to try the originally projected line. My idea when first it was spoken of was that it would be a very difficult thing to get from Dilston onward, where you would have a very steep piece of country.
4690. Assuming the original line was 22 miles longer than that now being constructed, would the Government, from a national point of view, have been justified in constructing the blue line rather than the red? That is a question I could scarcely give an answer to without having traversed both roads. I know the country generally, and say that the red line is preferable.
4691. But you have said that the land on the original line is of indifferent quality. That being so, would the Government be justified in making a line through there 22 miles longer? No, certainly not.
4692. Can you speak of the whole line from Launceston to Scottsdale—the line now being constructed? I have only been along the line in my own district and about Hall's Track and the Denison.
4693. Then I will confine myself to your district,—Launceston to German Town. As an engineer do you think skill and judgment have been shewn by the Government officers in laying out the line from Launceston to German Town? You can hardly expect me to answer that.
4694. Why not? As to the skill and judgment evinced. You can hardly expect me to answer it.
4695. If you do not answer it, the inference will be that skill and judgment have not been shewn? I must say a good deal of skill and a great deal of judgment have been exercised in getting the line round the difficult country they have got it round.
4696. Do you think you could have improved the route in any way? I do not think I could.
4697. Then skill and judgment must have been shewn according to your standpoint. Do you think you could have adopted flatter curves and less steep inclines? Not without extra cost.
4698. What extra cost would curves of not less than 6 chains radius, with grades of 1 in 40, have made? I could hardly tell you.
4699. Do you know how many 5 chain curves you have on your section? I cannot tell you: I know there are a good many.
4700. Supposing it was determined to alter these 5 chain to 6 chain curves, what would be the increased cost? I could hardly tell you without going over the country and testing it.
4701. It has been alleged that the contractors have not, up to the present time, had possession of the land given to them: is that so? I was not aware they did not have possession, except down here in the neighbourhood of Launceston.
4702. It is asserted that they have taken possession of the land, and that the Government has not, as a matter of fact; taken action? As far as I understand it, they have got possession, with the consent of the landowners.

4703. But at their own risk? I can hardly say, having nothing to do with that.

4704. Who has? The Minister, I suppose, has to give possession. The contractor was on the land some months before I came here; and, with the exception of the dispute as to Mr. Lamont's land, I have not heard of any difficulties.

4705. The usual custom in the Australian Colonies is for the Government to empower their officers to give possession of the land: is not that practice followed here? No: the only line I have been connected with is the Mersey.

4706. What course was followed there? We simply got the consent of the landowners to take possession, pending arbitration, and without prejudice.

4707. Who arranged that the land was to be taken without prejudice? Mr. Rodham Douglas, who acted for the Government in settling with these people.

4708. Is it not a loose way of carrying on the business of a large department, that the contractors should take possession of land at their own risk, instead of the Government officers acting for them? I think it is owing to the law. We have no Act to enable us to take possession of the land without first paying for it.

4709. Suppose the contractors were behind time, could you enforce the penalty, though you had not complied with your part of the contract? I dare say in that case the contractor would have a just claim for compensation.

4710. Would it not, in fact, make the contract a dead letter so far as time is concerned? I think he should have a reasonable extension of time, if he had been retarded.

4711. How have the contractors, so far, carried on the work? Fairly well: they are men new to the work, and have not all the appliances which older contractors have to use despatch in carrying out the work; but they carry it out honestly, fairly, and well.

4712. Do they show willingness to carry out instructions? Yes.

4713. Up to the present date has there been any cause for complaint? None whatever, except I should be glad if they would get on faster.

4714. Have you ever expressed that opinion to them? Simply in a friendly voice of encouragement.

4715. I presume, as you have not given the contractors possession of the land, that neglect has prevented their getting on faster? We served them with a notice about the fencing; that is the only fault.

4716. In what way have they shown neglect about the fencing? They said they could not get the material carried.

4717. Are they now taking steps to remedy this? As far as promises go, they are; they give a promise once a fortnight.

4718. What is the character of the fencing? Some is post and four rails, some is post and wire with a top rail; and there has been an arbitration, and, in one instance, a different class of fencing is going to be put up to that arranged for.

4719. What alteration did the arbitration effect? In that case of Lamont's they made arrangements to put up a wire fence with a top rail, but the umpire took it upon himself to award a post and four-rail fence.

4720. In that case it would not have made much difference, because the material is more easily available at Launceston than along the line? I think you would get it in the bush, where the material is split on the spot, more easily than close to Launceston.

4721. *By Mr. Stanley.*—I observe, among the contract drawings, there is a chock and log fence. Is any of that description of fence intended to be erected? I think there is some intended in thickly wooded districts, and chiefly on Government land.

4722. Upon what part of the line? It would be out of my district; none has been ordered in my district as yet.

4723. Have you carried out any railway surveys for the Department? No; with the exception of running a flying survey, some five years ago, between Latrobe and Formby.

4724. You have not effected any permanent surveys in this Colony? No.

4725. So far as you have been able to notice in your capacity as resident engineer, can you say whether the quantities provided in the schedule attached to the contract will prove sufficient for the amount of work to be executed? As far as I have been able to observe, I think they are. They were re-arranged before I came, to deepen the cuttings and save side cuttings in some localities, but that was re-arranged by Mr. M'Cormick before I came to the district. Now that re-arrangement has been made, I do not think there will be any difficulty about the quantities.

4726. That being the case, do you think the total cost of the contract work will be within the amount of the tender? That depends a good deal upon contingencies. I think there will be no very great difference, except for unforeseen contingencies.

4727. Is it your opinion that the waterways provided on the section under your charge are sufficient for the various localities? I think so.

4728. Are there any places in your section where the minimum curves of 5 chains radius occur in combination with the ruling gradient of 1 in 40? Yes I think there is one place, near the 8 miles, between the 8 and 9 miles, and at M'Kennar's Gorge, or what we call the Dogwood Gully, about 13 miles.

4729. Do you think it would materially increase the cost of the line had the curves in these places been eased? At M'Kennar's Gorge it certainly would; it would have thrown the line much further down the hill. It would have increased the cost in both places.

4730. Do you think such alterations would have had any important effect upon the cost of the line throughout, as such curves are not of frequent occurrence? Altering them in these two places would not have affected the cost of the line throughout very materially, but taken in conjunction with other cases it would have done so.

4731. Are you aware of any other places? I know of some, but I cannot localise them.

4732. *By Mr. Lawder.*—Can you inform the Commissioners what delay has been experienced by the contractors by the non-delivery of land? I do not think there has been any delay caused to the contractors since they actually got to work. They have had possession of the land, and have never been turned off it.

4733. From the time the contract deed was completed? As far as I understand and know, from the time they have been on the works they have not had any delay whatever.

4734. It has been stated in evidence that some delay occurred close to Launceston, and had it not been for that delay we are told, they would have got in the bank from the Launceston junction station? There was only one small piece of Mrs. Turner's land where any difficulty occurred.

4735. How many chains? I think about 9 chains.

4736. How long would it take to construct that 9 chains? They could do it, I think, in about 8 or 9 days; it is a shallow bank, about 5 feet.

4737. It has also been stated in evidence that owing to the delay in getting land required for side cuttings the completion of the line has been much retarded? That is not right. Certainly they were not put in possession of land for side cuttings, simply because they had not utilised the material from cuttings, and we refused to give them land for side cuttings before they used it. We had to tell them that we would not let them have side cuttings until they had used their available material.

4738. Then do you consider it would have been possible for them to have completed their line so as to have been able to lay the permanent way as far as Piper's River, had they obtained all the land they required when they wanted it at first? If they had put the necessary energy into it that would have been easy enough.

4739. Then do you or do you not consider that owing to the non-delivery of the land to them in due time they were prevented from completing the bank for the purpose of laying the permanent way? No; no delay occurred, and I am not aware of any protest. They asked for side cuttings, but we decided that they had plenty of material in their own cuttings.

4740. Were the contractors informed of this? Yes, and told that none would be given until they had used the material from their own cuttings.

4741. Do you usually make any test of your mortar, whether of cement or lime? Not upon the works. We have a testing machine at Launceston, and we make test blocks.

4742. Where is the lime obtained for works upon your section? We are using nothing but cement at present—cement concrete.

4743. Do you intend using any lime concrete, or any lime masonry? I doubt very much whether you would be able to use ordinary masonry, on account of the difficulty of getting building stone. We do not use lime concrete.

4744. I saw you had good basalt stone—sufficiently good for coursed rubble? Yes, but unfortunately it is not in the locality of the works, and it would simply ruin the contractor to cart it the distance to where it is wanted.

4745. But suppose you could obtain stone sufficiently good for coursed rubble, would it not reduce the cost of these works if good lime was obtainable in the same locality? I doubt it.

4746. I see according to the schedule that you have a rate of 40s. per cubic yard for squared masonry in mortar, and 50s. for the same in cement mortar; you have also a rate of 25s. for lime concrete in foundations, and 30s. for lime concrete abutments, piers, arches, &c., as against 50s. for cement concrete in the same position? Well, I have not seen any lime in the neighbourhood of Launceston that I would care to use for concrete.

4747. But have any tests been carried out with the lime procurable? I have just got a sample of lime undergoing a test for concrete that a man brought up from Beaconsfield yesterday. But all the lime I have seen in and around Launceston I should not care to use in concrete for railway bridges.

4748. You are not aware of any lime of a good and suitable quality, of an hydraulic nature, to be obtained about Launceston? No; the only lime of a hydraulic nature that I know of comes from Bridge-water.

4749. Have any enquiries been made upon this point by the Government officers on the Scottsdale line? I am not aware of any.

4750. Do you not consider that in many places fair lime of good quality could have been used in the railway works, instead of expensive cement? Not with such good results.

4751. But with satisfactory results—that is to say, the work would be quite as substantial for the purpose required had lime been used? In fact, do you know if lime is used in any other country for railway works? That is a matter I have not gone into.

4752. But in your own practice—are you not aware that lime is used with very good results for railway works? Yes; I have used it.

4753. And it is not absolutely necessary in dry localities to use cement? No; I have used the lime myself.

4754. Do I understand that the contractors agreed to use Portland cement at a reduced rate: was it entered in the schedule at the reduced rate? I have a faint recollection of hearing Mr. Boland make a proposal to Mr. M'Cormick something to the effect that he would sooner make cement concrete than cart stone to the line, but I could not positively say.

MONDAY, MARCH 31, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

MR. J. FINCHAM, *re-examined on Scottsdale Railway.*

4755. *By the Chairman.*—We recalled you this morning to consider certain matters in reference to the Launceston and Scottsdale Railway, which we wish you, as Engineer-in-Chief, to explain. It has been stated in evidence that the original line from Launceston to Scottsdale proceeded by Lower Piper, Upway, and Alford to Scottsdale, and that this railway would have better provided for the requirements of the country bordering on the River Tamar and George Town. If this is so, will you explain what induced the Department to alter the original line and adopt the one now in course of construction? On the plan of the original survey, upon the route mentioned great objections were taken to its extreme length as compared with the distance by road. At the same time it was argued, as a point in its favour, that it would tap the Tamar at deep water, about opposite Rosevears, and would be also favourably located for connection with George Town if required. The Minister, I presume, after consideration by the Cabinet, pointed out that this route cut off all the very important settlements at the Upper Piper, and, before submitting the scheme to Parliament, Mr. Climie was instructed to prospect for a line intersecting the Upper Piper district. As the time was necessarily very limited, I think the work was chiefly confined to flying levels. He reported against the practicability of the adopted route through Upper Piper. The scheme was accordingly submitted to Parliament upon the original route, with an estimated length of $67\frac{1}{2}$ miles. During the discussion in Parliament the objections raised by Parliament to the circuitous route were very strong, and in the interim between the two sessions in 1883—between September and December—I was instructed to have this route through Upper Piper again tried. Mr. Hales was employed for the purpose, and succeeded in finding the general route now adopted. The time at his disposal would not allow of more than a trial section, and upon this trial section, connected with Mr. Climie's original line two or three miles west of the Denison gold fields, the construction of the railway was sanctioned, this being passed partly on the trial section from Launceston to near the Denison, and partly on the original survey on the blue line shown on the map produced, from near the Denison gold fields into Scottsdale. The original line was not only circuitous, but went through a very large extent of utterly barren ground. The good land on the original route was tapped only at the extreme north end of the Turner's Marsh settlement, intersected the small district of Lower Piper, and then, practically for some 25 miles, roughly speaking, went through the barren country I refer to. The total length of the combined Upper Piper line of Mr. Hales and the eastern portion of Mr. Climie's line was estimated at $59\frac{1}{2}$ miles, that being the length authorised by Parliament. When the contract surveys were in progress, I consulted with Mr. M'Cormick, the Superintending Engineer, and we decided to spare no pains in further reducing the length of the railway. Mr. Hales was thereupon again employed for the preliminary section between Upper Piper and Scottsdale, some four or five miles south of the original line at this part, and running approximately parallel with it. The trial sections having been thought satisfactory, I gave instructions for a contract survey to proceed upon this third route, but not until after I had submitted the proposal to the whole Cabinet upon an occasion when I was requested to attend for the purpose. I then pointed out that this third, or contract, line, as compared with the eastern portion of the original line between the Denison gold fields and Scottsdale, would cost a little more money, that statement being based upon approximate quantities taken out by Mr. Hales for the purpose. I believe the excess was estimated at only £7000, but I pointed out to the Government that these figures were only roughly approximate. I have always thought since that I was thoroughly justified in recommending the adoption of this more direct route, although, as I have explained, it differed widely from the line submitted to Parliament. I not only brought the line nearer to a very large extent of Crown lands fit for selection—nearer the Lisle gold fields—nearer the Springfield settlement—saved the surmounting and descending of a tier 400 feet in height—but also saved the working of the line over $12\frac{1}{2}$ miles of totally unproductive country. Some portions of the original line, namely, near the watersheds between the Piper and Denison and near Scottsdale, are, as the Parliamentary plans will show, very rough in character. The line, as usual, had not been set out closely through this rough country, and from what I have seen of it since I am afraid that Mr. Climie's estimate for the original line would have been exceeded; but, assuming that the original line could have been made without the slightest excess upon the voted amount of £300,000, I am still of opinion that the £60,000 or £70,000 extra which the adopted line will cost will be justified, as the saving in the working expenses capitalised would amount to fully the difference.

4756. Apart from the considerations you have mentioned, how would the two lines compare as to curves and gradients? I think I may say favourably, because in one instance alone, at the Blue Hills near Scottsdale, we avoid crossing a tier 400ft. in height.

4757. That is hardly a reply to the question I ask. How would they compare? Are the curves and gradients on the adopted line more severe than those on the proposed line? No; I think that the curves and gradients on the adopted line would compare favourably certainly with those on the original line.

4758. Will you state what were the sharpest curves and most severe gradients on Mr. Climie's, or the original line? The sharpest curve proposed was 5 chains, and 1 in 40 gradients.

4759. Were the lengths of those inclines longer than those adopted by you on the contract line, or in what way did they differ? I cannot particularise them; but from my general knowledge I have no hesitation in saying that they were favorable as compared with those on the original line.

4760. I presume Mr. Climie sent in a proper section of the work which he undertook between Launceston and Scottsdale? He sent in a proper section of the original line, which had been made by engineers acting under his general instructions, as well as a portion I believe done by himself.

4761. Was that section accompanied by any report from him? I do not recollect any.

4762. Had you on that section, rulings of the different grades which would be necessary to adopt if that scheme had been carried out? The plans and sections were submitted to me with a grade marked for approval.

4763. By him? By the engineer making the sections. Mr. Climie revised their work, and I again revised them.

4764. Can this document be produced? If you refer to the original Parliamentary sections I can produce them.

4765. It will be necessary to produce them, because there will probably be a conflict of opinion as to whether the best route has now been obtained. Will you therefore produce the original sections? I will produce the original sections, and the diagrams of gradients showing the line now being actually constructed.

4766. Did Mr. Climie in his report state what curves could be obtained on his, or the original line? I do not recollect that any report was made, but I gave Mr. Climie the same instructions for the Parliamentary Survey that I gave the engineer for the contract survey—namely, that the ruling gradients should be 1 in 40, and 5 chain curves should be adopted where any material saving could be effected by so doing.

4767. Were these instructions in writing? I cannot say from memory.

4768. Assuming that Mr. Climie disputes these instructions, what means have you of verifying your statement? The engineers employed under him would be able to confirm what I have stated.

4769. Was it a well-known instruction to the engineers that in surveying the line through difficult and mountainous country that grades of 1 in 40, and curves not sharper than 5 chains, should be introduced? Yes; Messrs. Hales, Bell, and Cutten would all be able to confirm that, they having worked upon the Parliamentary surveys.

4770. Comparing the contour of the railway as furnished by the sections, in what respects would the adopted line show any advantage as regards haulage over that of the original line? That will be best shown by the Parliamentary paper I have referred to, and which I have undertaken to produce.

4771. In the adopted line the first summit is Doctor's Hill, then another at the tunnel: are these the only two summit levels on the adopted line? They are the only two summit levels.

4772. What are the summit levels on the original line proposed by Mr. Climie? At the Bangor tramway crossing, 540 feet above datum; the site near the Yarrow Creek at 38 miles, elevation 619 feet above datum; near Hall's track, elevation 686 feet above datum; at Blue Hills, 654 feet above datum. Approximately, at Turner's Marsh, summit 846 feet above datum; and at Hall's track, 1000 feet above datum. From these points to Scottsdale there is no summit level, those referred to as existing on Mr. Climie's line over this portion having been avoided.

4773. As far as your recollection serves you, how would the earthworks and other works on the two lines compare? I think I may confidently say that there is no more earthwork on the adopted line than would have been required on the original line.

4774. Is that the earthwork per mile of railway, or as the total? As the total.

4775. Then the earthwork on the adopted line would be in excess per mile as compared with the original line? I think it might be if the light and heavy work on the original lines were averaged. The original line included some very heavy banks and cuttings, as the Commissioners can see for themselves.

4776. Do you include the cost of the tunnel on the adopted line? No; my reply is confined to earthworks.

4777. Then the cost of the tunnel would be additional to the cost of the original line? Certainly, there is no tunnel on the original line.

4778. Did you consider the advantages which the original line would afford to the settlers of George Town and the River Tamar? I thought of that; but any opinion of mine on that head would have been of no weight compared with the absolute order of Parliament that the line should go through Upper Piper if a practicable route could be found.

4779. As Engineer-in-Chief, and having only the best interests of the Colony at heart, would it not be your duty to make such recommendations as you thought desirable, and leave to Parliament the responsibility of accepting or rejecting your advice? My views coincided with the orders received from Parliament. I should have considered it unwise to have taken all the traffic from the large and increasing districts of Scottsdale and Ringarooma, 20 miles out of its course, for the sake of accommodating George Town. I consider that if it should be necessary to provide railway accommodation in connection with deep water near Rosevears it would be much better served by a branch line. Assuming that the route had been taken round as originally proposed, a separate service of trains would have to run in connection with the steamers. Their arrival and departure would be unlikely to tally in time with that fixed for the train service.

4780. But that plan is already recognised as regards one portion of the railway system of the Colony: what difficulty would there have been on the original line? My great objection was to put the whole of the traffic of one of the largest districts of the Colony—a district that will increase for many years to come—at least 20 miles out of its course.

4781. You speak of the large and increasing trade on the Scottsdale railway: what do you assume will be the gross earnings of that line per annum? I have not gone into that, but it was gone into by the Commission appointed for that purpose.

4782. Compared with the Launceston and Western Railway, what do you think the returns will be? I am not prepared to say.

4783. Will they be greater or less? I cannot answer that question. On the Launceston and Western Railway you have to deal with settled districts; in Scottsdale and Ringarooma the settlements are new; and I, for one, could not form any reliable estimate of what the traffic is likely to be in a few years after the opening of the railway.

4784. Assuming you cannot form an estimate, can you not form an opinion whether the Launceston and Western Railway, constructed through the, comparatively speaking, thickly populated districts of the Colony, and on which some of the best agricultural farms are found, would give a greater or less return than the Scottsdale line? If you will allow me to speak roughly, I think the traffic on the Scottsdale line will be found to exceed that of the Western line.

4785. What portion of the Western line? Mile for mile.

4786. Can you give the returns per mile per annum of that portion of the Western line between Deloraine and Formby? I cannot tell you.

4787. As strangers to the Colony, the Commissioners observe from returns published in the newspapers that the gross traffic on the line between Launceston and Formby does not exceed £1000 per week. Are you now able, from these figures, to give any idea of what the traffic will be on the Scottsdale line? I would rather not express a definite opinion as to the traffic.

4788. But as you said that the large and increasing traffic on this line influenced you in your decision, would it not be right to state what you believe that large and increasing traffic will be? My decision was based on the fact that the contract or adopted line will touch upon a large extent of good land in cultivation as well as land still available for purchase from the crown, as against a route largely through worthless land.

4789. That is merely a comparison between the two routes, the original, or that of Mr. Climie, and the line adopted. What I want is some idea of what the gross annual traffic on the Scottsdale line will be? I cannot give you that. I can only say generally that the line intersecting good land largely opened out must be more productive than one through barren land.

4790. I want, if possible, to elicit what the traffic will be on the Scottsdale railway without making any comparison between the original and the adopted line. What influenced you in arriving at the conclusion that in order to provide for that large and increasing traffic of which you speak it was necessary to construct the adopted railway? So that the railway might be available for settlers on good land, instead of it being practically useless to them.

4791. Then I assume you had made some estimate of the results obtainable from this railway? No; as I have said, Parliament made it conditional that the railway should pass through the large and important district of Upper Piper.

4792. You also say that it is a large and increasing traffic. We want to know what the probable gross earnings will be? Simply because now in the Upper Piper, Scottsdale, and Ringarooma, hundreds of acres will be cleared and made use of that now lie idle for want of cultivation and means of transport.

4793. Are there not hundreds of acres on the Launceston and Western line which have been cleared and settled for 40 years past? Yes; but in some cases the land that was cultivated has been turned into sheep-runs.

4794. Are there on the Scottsdale line any such towns as Evandale, Perth, Longford, Westbury, Deloraine, Latrobe, and Formby? No; but there will be in a few years' time.

4795. How do you arrive at that conclusion? Simply because I believe the district will go ahead now they have railway communication.

4796. Is it not the duty of the officers of the railway department to supply some of the evidence which led them to arrive at certain conclusions? I did not think I was called upon. What I have stated I did. I cannot give you the estimate asked for.

4797. You can say whether the gross earnings on the Scottsdale line will exceed £1000 per week? I have not gone into the question, and it is impossible for me to answer the question.

4798. You have been a resident in the Colony for many years; can you not give an approximate estimate? No; I would rather not. I can only state generally that I believe the traffic will continue to increase until in a few years it will be satisfactory. I do not say there will be any large returns, or much return over working expenses, for some years to come, because the working expenses will be necessarily rather heavy, as on the main line.

4799. In making that statement, what proportion of the earnings will be absorbed by the expenses of working the line? Nearly all, for the first year or two.

4800. If that appears to be a fixed quantity in your mind, cannot you now tell us what the earnings will be? I think the working expenses will probably be equivalent to about 3s. 9d. per train mile; the total will necessarily depend on the number of trains run.

4801. It appears from that you have made no estimate of the trains to be taken over this line? It is not my duty to do so.

4802. Is it not the duty of the Engineer-in-Chief to submit to the Department some idea of what may be expected as the returns of a projected railway? No; that was furnished to the Government by a Commission of qualified men.

4803. Has it never been the custom of the Government of Tasmania to require similar reports from its officers? Never from me.

4804. Are you aware of the practice in other places? No.

4805. Are you not aware that in many of the colonies it is the practice of the Engineer-in-Chief to submit to the responsible Minister his views of what the contemplated earnings of a line will be? I think that is information that should not be required from an engineer-in-chief; the traffic manager is the proper officer to furnish information on that point.

4806. But what advantages would the traffic manager have over the Engineer-in-Chief in compiling estimated returns, seeing that he knows nothing of a district of which the Engineer-in-Chief has, comparatively, an intimate knowledge? He could very readily obtain such knowledge as the Engineer-in-Chief would have of the district passed through, and would be much more competent to form an estimate of the traffic.

4807. But how could he do that without he travels over the country? I see no reason why he could not do so.

4808. You can form an estimate, knowing a locality; but how can you expect a man who has never been over the country to estimate the returns? I simply say it is impossible for anyone to form an estimate upon such a subject without ample time and opportunity.

4809. Is it not a matter of fact that when the Main Line and also the Western line were projected, the engineers of those lines submitted for the information of their respective shareholders and ratepayers the probable returns that would be obtained on those railways? The Railway Commissioners prepared the estimate of the probable returns of the Main Line, and their estimate, I believe, was considerably in excess of the actual receipts.

4810. I am not speaking of what the Railway Commissioners did as regards the Government—I am speaking of what the engineer of the Main Line did as regards the shareholders of that line? I cannot say.

4811. Were you not connected with that company? I was not connected with that company.

4812. Not as engineer? No.

4813. Did you not see the prospectus? I have seen them after my arrival in the colony.

4814. Were they not afforded by the engineer of the company? I really cannot say, it was so long ago.

4815. Can you not give any information as regards the probable traffic of the line? No.

4816. Regarding the question of curves, are you in a position to state what are the curves on the Main Line between York Plains and Antill Ponds, and between the Flat Top Tunnel and Jerusalem? Almost all the curves are 5 chains, and the gradients 1 in 40 practically for miles.

4817. You know the Main Line at Horseshoe Bend, near the coal-field in the vicinity of Jerusalem—is it not a fact that the line ascends from there to Flat Top Tunnel, by a grade of 1 in 40, almost without a break? I believe it is.

4818. What length is that? Between three and four miles.

4819. What would be the length of the gradient between Antill Ponds and York Plains through what is known as Tin Dish Gully? I should think the extent of steep grade and sharp curve through Tin Dish Gully must be between two and three miles.

4820. These are sections of 1 in 40 grades combined with 5 chains curve? They are.

4821. Is there not also some very difficult country in the neighbourhood of Campania and Tea Tree Creek? There is.

4822. Are the same class of gradients and curves found there? Precisely so, and on a length of about three miles.

4823. Was it this that induced you to adopt, on the Scottsdale line, a similar form of construction, viz., 1 in 40 gradients with 5 chain curves? Partly economy, and partly the fact that a line with such gradients and curves was already working successfully in the Colony.

4824. You say partly from economy—was that economy in construction or economical working? Yes, construction, certainly.

4825. *By Mr. Stanley.*—We have had it in evidence, from the Resident Engineer of the Scottsdale line, that there are comparatively but few places where the maximum gradient and minimum curves occur: that being the case, do you not think it advisable to go to some little extra cost in construction to avoid such an objectionable combination—would it not have resulted in more economy in the future working of the line? I should have made a very different answer to the first portion of your question. My impression was, that 5 chain curves in combination with 1 in 40 gradients were much more numerous.

4826. The Resident Engineer, speaking generally, said there were three or four such combinations, and the contractors' engineer, when asked for more definite information, went through the sections, and ascertained that there were seven. Seeing that in a length of 47 miles there are only seven places where this objectionable combination of maximum gradient and minimum curve occurs, would it not have been wise economy to incur a little extra cost to reduce the working expenses for all time? If the cost were only small, certainly yes; but, I fancy, in the places quoted, larger curves would have entailed very considerable cost. This country is not, I believe, the only one in which 5 chain curves are adopted on steep gradients where the mountainous character of the country requires it.

4827. Can you state what is the gross load that one of your goods class of engines can take up a gradient of 1 in 40? We have never had an opportunity of trying. At present they do not work over one in 40 gradients; but, I should think, they could take a load of 80 tons up one in 40. I think the Locomotive-Superintendent would confirm what I say.

4828. What is the weight of your goods engines of the standard type? 22 or 23 tons, exclusive of tender.

4829. Would it not be an easy matter, knowing the dimensions of the engine, such as diameter of cylinders, length of stroke, diameter of driving wheels, and effective pressure of steam in cylinder, to determine the load that these engines will take up a grade of 1 in 40? It could be calculated, of course.

4830. Will you make the calculations and furnish the Commissioners with them? I will.

4831. When you said you thought they would be capable of taking 80 tons up 1 in 40, did you refer to a straight road or a curved road? I had in my mind the curved road that they will have to work over on the Scottsdale line, and I also know what the Main Line engines can take over their road.

4832. Are the goods engines used on the Main Line similar to those adopted by the Government Locomotive Department? No, the design is different.

4833. What would approximately be the comparative power of the two classes of engines? I should think our engines would take very nearly as much.

4834. Are you aware what load the Main Line engines take on the heaviest portions of the road, such as the localities referred to by the Chairman? I think about 80 tons.

4835. Are you aware what effect a curve of 5 chains radius has in increasing the train resistance, as compared with a straight road? Very considerable in ascending an incline.

4836. Leaving gradient out of account, are you aware what is the effect of a curve of 5 chains radius in increasing the train resistance as compared with a straight road? No, I cannot give you the theoretical estimate.

4837. What would you suppose the difference would be? It must vary very much under different conditions. I cannot tell you offhand what the difference would be.

4838. I may state that from a series of experiments which were made on the Main Range section of the S. & W. railway in Queensland, it was ascertained that the train resistance on a curve of 5 chains radius increased by nearly 30 per cent. as compared with a straight road, so that the useful power of the engine would be proportionately affected,—in view of that do you not think in the case of the Scottsdale railway, where there are only a few cases of the combined minimum curve and maximum gradient, it would have been advisable to have gone to a little extra expense easing the curve where practicable, or flattening the gradients where the sharp curves are absolutely necessary? If it could have been done at a small expense, yes. If the Commissioners had asked me, I would have said that the combination in question was much more frequent than has been stated even by the contracting engineer, and the Commissioners will also find that where many of the 5 chain curves occur, especially those that might be termed of a horseshoe form, the grade has been flattened.

4839. Were any instructions issued by you to the surveyors to avoid the combination of the sharp curves and steep gradients where possible, and if so, what instructions? No instructions were given beyond the general instructions, that, where unavoidable, the sharp curves and steep gradients could be used, not otherwise.

4840. There was no standing rule that the gradients were to be eased on the minimum curves? No written order was given, but it was well understood.

4841. How were the surveys on the Scottsdale line effected—by contract or by officers employed directly under the department? By officers acting directly under the department.

4842. And you have found from experience that is the best way of carrying out surveys? I have not a doubt of it.

4843. How were the plans prepared and the quantities taken out? The general plans and sections were plotted from the field-books by Messrs. Edwards and Co., and the quantities were taken out under contract as in the case of Mr. Climie's line.

4844. Then when the plans were prepared you had not sufficient office staff to enable you to prepare them? I had not. The office staff was employed wholly for works for roads and bridges.

4845. Then do you still continue the practice of having the plans for new lines of railway prepared by contract? No work is being done now by contract, and I have no staff as yet for the preparation of the new railway plans. The work that is being done is limited, and is being carried out by two of the engineers who will hereafter be employed in the construction.

4846. In view of further railway extension being undertaken in the Colony, what is your intention in respect to the preparation of plans and quantities,—do you intend to continue the practice of having them done by contract or to get the necessary staff to enable you to have the work done in your own office? I have not decided upon either course. If the work is done by contract I must have some professional assistance to check it, and I anticipate a difficulty in getting my own qualified staff when there is only the inducement of a few months' temporary employment to offer them.

4847. How long is it since the Government commenced constructing the new lines of railway? Less than 2½ years.

4848. And during that time do you not think you could have obtained the necessary assistance to enable you to prepare the plans and drawings under your direct supervision? No doubt, had I known that year by year Parliament would have added to the railway proposals, because then I could guarantee a certain amount of permanency, without which efficient men could not be obtained.

4849. How long is it since the survey of the Mersey line was initiated? Some time before my connection with the department, in 1876.

4850. When were you appointed? In 1877.

4851. At that time what railway construction was contemplated? None whatever.

4852. That, I understand, was the first of the new lines undertaken? Yes.

4853. At that time was it not contemplated to construct various lines throughout the Colony? Not that I am aware of.

4854. Did you consider that the probable work of railway construction would be of such a limited nature that it did not warrant you in obtaining a proper office staff to prepare the plans? Yes.

4855. Had not the Mersey line been proposed before your appointment? A survey had been made, and then the whole matter lapsed.

4856. At the time of your first connection with the survey or estimates of the Mersey line, did you not anticipate that the work of railway construction was likely to be of sufficient importance to warrant you in obtaining a permanent staff? No. Seeing that the one railway proposed had been rejected time after time, I had no reason to believe for a year or two, or longer, after my appointment, that any large expenditure would take place.

AFTERNOON SITTING.

Present—All the Members and the Secretary.

MR. FINCHAM'S *examination continued on the Scottsdale Line.*

4857. *By Mr. Stanley.*—After the experience you have had, are you of opinion that the system hitherto followed of preparing the working plans and drawings is a good one; or would you prefer having them prepared by a competent staff under your immediate direction? I consider the latter by far the preferable plan.

4858. What staff do you suppose you would require for this work in addition to those you have? I have none at present on the railway indoor staff. If all the new railways have to be prepared for contract and construction together, I think that some half dozen qualified draftsmen, and as many juniors for transfer work, would be required.

4859. Have you any idea of the staff Mr. Edwards employed in connection with the work done for your Department? He had at one time 14 or 15 men in his office.

4860. I suppose that was during the time the railways were being pushed on? I should think on an average he must have had a dozen, and worked them overtime for many months in order to comply with the request of the Government for the speedy delivery of the work.

4861. Do you anticipate that preparing the plans and drawings by a staff employed directly under you would be more expensive than the system hitherto followed? No, I do not think so. There was one advantage in employing a gentleman like Mr. Edwards, namely, on account of his large connections and intimate knowledge of the requisite men. I should have more difficulty in getting men than he did.

4862. Do you anticipate any difficulty in obtaining competent men for such a staff? Not if I could pay salaries current in the other colonies; and until the last few days, when I have been able to get a room completed in the new Mines Office, there was no space in which the new men could work.

4863. Who took out the quantities for the contract schedules? The staff in Mr. Edwards's employ.

4864. Are you aware whether the earthwork quantities were taken out by means of cross sections or from the longitudinal sections only? I was informed they were taken out by means of cross sections.

4865. Have you reason to believe that the schedule quantities fairly represent the amount of work which will be executed under the contract? I have no reason whatever to doubt them. I know that special extra trouble was taken with these quantities on account of the generally heavy and difficult character of the line.

4866. Seeing that very considerable discrepancies occur between the schedule and actual quantities on the other lines—the Fingal and Derwent Valley lines, for instance—have you reason to believe that the quantities in the case of the Scottsdale line have been taken out with such care that these discrepancies will not be repeated? I do not think they are likely to occur to any unusual extent in the case of the Scottsdale line, because so much more time was available for the preparation of the contract.

4867. Are you of opinion that the total cost of the contract work will not exceed the amount of the tender? At present I see no reason why it should, as the tender includes provisional money to the extent of more than £20,000.

4868. Can you state whether, in the case of the tunnel, provision has been made in the schedule for lining throughout, or only partially? Partial lining, lining wholly, and partial excavation in solid rock only.

4869. Have you any data on which to form an opinion as to whether the tunnel will require to be lined or not? No; we sunk a shaft before the contract was let, some 20 feet down; the deeper we got the harder the ground became. The quantity of lining allowed for in the schedule was simply a provision for faults that may occur.

4870. In the event of the rock not turning out sufficiently hard to stand by itself, and the necessity arising in consequence of having to line the tunnel throughout, what would be the additional cost to the department? I will supply the information.

4871. What was your original estimate for the Scottsdale Railway? £300,000.

4872. Was that estimate based upon the original survey, or the line as now adopted? It was first of all based upon the original survey, and afterwards upon the combined surveys of Mr. Hales and Mr. Climie.

4873. Was your estimate submitted to Parliament? It was.

4874. Could you refer to the Parliamentary Paper where the Commissioners would find it? It bears date December 14th, 1883.

4875. On the basis of the contract amount, and allowing for expenditure for rails, supervision, stations, as well as land compensation and supply of rolling stock, can you state whether the ultimate cost of the line will exceed your Parliamentary estimate or not? It will exceed it.

4876. By how much? Well, I prefer to say £70,000, although the actual figures up to the 9th March, 1886, are £58,711. Before the tender was accepted I advised the Government that the total final cost of everything would be £370,000, and, allowing for contingencies in connection with the tunnel and other matters, I prefer to be on the safe side and call the probable excess £70,000.

4877. How do you account for this increase in cost as compared with your original estimate? The closer approximation that was obtainable for all quantities when the work was being set out on the ground. The Parliamentary quantities, as in the case of the other lines, were practically based upon trial sections.

4878. Is it due in any degree to the alterations in the route or deviations from the original survey upon which you based your original estimate? It is, partly.

4879. Can you furnish the Commissioners with a statement showing the items of difference between your original estimate and the probable actual cost as you have done in other cases, such as the Fingal Railway? Yes; but in the case of the Fingal Railway the two lines were practically on the same ground; here the lines are over such different country that it is scarcely possible to make a fair comparison—a new route altogether has been taken.

4880. Then are we to understand that the alteration in route between that now being carried out and that originally approved by Parliament will probably cost £70,000? Certainly not; because, as I stated before this morning, I think that the more correct setting out of the original line for the contract and the closer calculation of quantities would have brought the cost over £300,000, the amount of my estimate. The excess is partly due to the shortening of the route, and partly due to the increase in quantities owing to the more accurate data available for their calculation.

4881. Are we to understand that the shortening of the route has resulted in a much higher rate per mile for the construction? It would be so.

4882. Is not your last reply, then, somewhat inconsistent with the statement you made to the Chairman this morning, that the cost of the works on the shorter route adopted compared favourably with those on the original survey? That was in the gross.

4883. Well, but even in the gross it appears that the line now being carried out has cost £70,000 more than was estimated for the original line? But in the one case we got close details of quantities, and the other was only roughly approximated, the line not having been defined on the ground. I could not guarantee that the estimate of £300,000 for the original line would not have been £40,000 or £50,000 more.

4884. Do you think it likely that a detailed estimate, based upon working drawings, of the original line would have resulted in an increase on your original estimate? I think it very probable, especially as the prices of all work are much higher in the schedule attached to the contract than in those attached to the original estimate.

4885. What was your estimate upon the schedule quantities prepared with a view of advising the Minister on the tenders sent in? £240,794 8s. 5d.

4886. Then the contract was let considerably within your detailed estimate? It was let within my detailed estimate.

4887. Would you be good enough to furnish the Commissioners with a statement of the probable expenditure, in addition to the amount of the contract—that is, for rails, supervision, stations, &c.? Yes. (Statement handed in.)

4888. I observe from the statement you have just handed in that the expenditure upon land and charges, exclusive of accommodation works, is estimated to exceed the original preliminary estimate by £3000? I have no doubt it will. I shall be surprised if it is not more, considering the prices we have had to pay.

4889. Then you think it quite possible that the amount set down under that head—£15,000—may be exceeded? It is possible; the items contain so many uncertain charges one cannot be sure as to whether it will be exceeded, or to what extent; and in stating the probable outside final excess at £70,000, I am bearing in mind the cost of clearing outside the railway fence.

4890. That is, in addition to the contract? Yes; outside the contract.

4891. I observe also from this return that your estimated expenditure under the head of rolling stock, shop extension, and wharf, will be within the amount of your original estimate for rolling stock,—viz., £30,000—is that so? It will be within. The original estimate for the rolling stock was based upon a statement furnished by the late Traffic Manager. Subsequently, in order to keep down the cost, the quantities were reduced by 1 locomotive, 1 carriage, 2 horse-boxes, 3 covered goods trucks, and so on. But the estimate also included £1000 for duplicates, which I did not think was fairly chargeable to construction.

4892. With regard to these duplicates, I presume you would have them taken into stock, and charged against working expenses as they are used up? Yes, I think that is the proper way of charging them.

4893. With respect to the deviation which was made in the permanent survey from the line originally approved by Parliament, I think you stated this morning that you had obtained the sanction of the Government to that? I did so.

4894. Was the authority you received a verbal or a written one? A verbal one.

4895. Do you not think that in a matter of this kind, where an important alteration is made from plans approved by Parliament, that it would be well, for your own protection, to have such approval

formally given to you so that it might be placed on record in your office? Yes, I ought to have had the approval in writing; but, at any rate, before the Government was committed to the expenditure. I had their approval in writing.

4896. Can you furnish the Commissioners with a copy of the letter to which you refer? I sent this written statement for approval (statement handed in), but I find I was in error about their having endorsed it.

4897. This written statement shows the probable increase in the cost of the work as compared with the original estimate? Yes.

4898. And in forwarding this to the Government, did you explain that this increase of cost was partly attributable to the deviation to which I have referred? Partly attributable to that deviation, but I could not say to what extent.

4899. Can you furnish the Commissioners with a copy of the report forwarded with this statement to the Government? That is the report.

4900. I observe from this statement that you say that the extra cost is partly due to the heavier works consequent upon shortening the line some $12\frac{1}{2}$ miles: was this not a comparison between the line originally surveyed and that approved by Parliament, or was it based upon and includes the deviation to which I have been referring? It was based upon a comparison between the line I have termed the combined line, approved by Parliament, and the deviation that shortened the route.

4901. But reference does not appear to have been made to the extra cost of the line as adopted between Piper's River and Scottsdale compared with the original survey by Denison Goldfield? Because it was impossible to make any fair and just comparison between a trial survey and a line accurately located.

4902. Then you do not appear to have any official record of the approval of the Government to this deviation? The real approval of Government was given when the tender for the construction was accepted.

4903. In considering the question of the probable traffic on new lines, you stated that you did not consider it part of your duty as Engineer-in-Chief to furnish any estimate for the information of the Government: can you say whether the Traffic Manager is consulted in such matters, from your own knowledge? I think he would be, in a general way; but with regard to this line and other lines, they were under the consideration of a Commission, or a special board was appointed and made a report upon the probable traffic that might reasonably be expected from the several lines.

4904. Were you examined by that board? No.

4905. Are you aware whether the Traffic Manager was examined? I do not remember.

4906. Then you cannot say from your own knowledge what evidence was taken by the board you refer to upon such matters? I know that they took the evidence of residents and producers in the different districts concerned.

4907. But so far as you are aware, they did not obtain any advice from the departmental officers? Not from my officers; I cannot say if they obtained any from the traffic department.

4908. In the event of it being considered advisable to construct a branch line from the Scottsdale line to the neighbourhood of Rosevears, at what point on the present line would that branch probably commence? I do not know the country; but speaking generally, I should think it would be a far better plan to adopt a portion of the original line and make it serve as a suburban railway and take up the Invermay traffic.

4909. In the event of that suggestion being adopted it would amount to constructing a second line parallel to the present one for several miles? True; but a level line as against a hilly line working backwards and forwards.

4910. Will you state whether it is your intention to adopt the chock and log fences for any portion of the Scottsdale railway—I observed that it is provided for in the contract drawings? Where timber is suitable I should adopt them.

4911. Do you think it an economical form of fences, looking to future maintenance? I think, considering their much lower rate in the schedule, that their adoption is justifiable.

4912. Do you not think that in densely timbered country, such as that through which the Scottsdale line runs for a considerable length, that such fences are very liable to be destroyed by bush fires? No; we never hear of fires in that part of the country,—it is almost too damp.

4913. But as the country gets settled and is cleared would there not be considerable risk of such fences catching fire? I do not think any alarm need be felt, as chock and log fences on the main line have been up 14 years without suffering any injury.

4914. But these fences, I understand, are being replaced to a considerable extent by more permanent fences? Not the chock and log, only the post and top rail wire fence.

4915. Have you found this fence suitable and economical? It is certainly substantial and economical, and, where there is no danger, preferable to adopt to a more expensive fence. In speaking of this excess of £70,000, I should wish to state that it includes a sum of £12,000 for plans, supervision, surveys, &c. not included in the original estimate of £300,000.

4916. But in your preliminary estimates, Mr. Fincham, is it not your custom to provide a sum to cover the cost of this expenditure? No, because at that time there was some idea of Parliament being asked to vote a certain sum for a temporary special staff. I believe the matter went so far as to be put before them in a definite shape, but it was not entertained. I was then driven to pay salaries, travelling expenses, &c. of both railway and road staff out of the votes provided for construction.

4917. *By Mr. Lawder.*—You say you were driven to pay this staff out of the construction grant: I presume you did that with the sanction of the Minister? With his full cognizance.

4918. Verbal or written approval? I believe verbal, but I would not be sure.

4919. Do we understand you to say that you included in your excesses of actual cost over estimated cost of line such matters as likely excess in cost of lining the tunnel over and above the provision made for it in the original estimate? Yes; I feel fully confident that my estimate of £370,000 will safely cover all expenses, including possible contingencies in the tunnel.

4920. Then do we understand that you took that probable or possible excess in cost of lining the tunnel in consideration when you thus revised the estimate, or do you merely wish to say that you consider the £70,000 will provide for it, although it is not contemplated, by means of savings? I have a sum of over £20,000 provided in the contract for contingencies that may occur—a large margin in itself—and then the difference between the contractor's tender and my estimate of the value of that tender will allow me an extra margin for any exceptional construction that may be required.

4921. On what data, then, was that revised estimate formed? Upon my estimate of the cost of construction with schedule quantities, the revised estimate for rolling stock, land, &c.

4922. Would you favour the Commissioners with details of this revised estimate, showing upon what data it is formed? I will; but it practically tallies with the estimate already sent in.

4923. What was the amount of the estimate of cost of the original alignment of 67 miles? £300,000.

4924. Was the alignment an easier one, or likely to be an easier one, to work than the present alignment adopted, mile per mile? I do not think there would be much difference.

4925. In other words, would the cost per mile of working have been less than the probable cost of working the present alignment per train mile? I do not think there would have been any such difference that I could estimate it.

4926. You informed the Commissioners, in your evidence upon the Derwent Valley line, that you equated for that line for the comparative cost of working: did you carry out any similar equation for this line, taking the different alignments proposed into consideration? No; because, as I have said before, I was tied by Parliament to the route adopted. I then only had to get through the country with as few sharp curves and steep gradients as possible; and I know that the very greatest trouble was taken by the engineers to reduce these to a minimum.

4927. But, as a professional man and Engineer-in-Chief, who is alone competent, from the data at his command, to prepare such equations and comparisons, do you not consider that it is your duty, as the chief professional officer of the Public Works Department, to prepare such statements for the information of the Minister to enable him to advise Parliament upon a subject about which they are unable to obtain information otherwise? are you aware that it is the usual custom in other countries to perform this? No, I do not know what is done in other countries; but, in this case, I have no doubt I did tell the Minister. But there is very little practical difference in the extent of heavy grades to be worked over between the two lines. The gradients and curves which had already been worked successfully might be adopted with advantage to ensure economical construction.

4928. Do I understand you to employ that word "successfully" in reference to working steep grades and sharp curves to another reason, or in regard to safety? Primarily, in regard to safety. Of course I do not pretend to say that a mountain line can be worked to the same advantage as a line on the plains.

4929. You have already informed the Commissioners that the reason why you adopted these curves and grades was that similar lines were being worked successfully: are we to presume you mean the Main Line? Yes.

4930. Has this proved a success from a financial point of view? It is improving year by year.

4931. Does it pay its working expenses? A little more, I believe.

4932. How long has it been established? About 10 years since it was fully completed.

4933. And it connects the two largest centres of commerce in the Colony, that is, Hobart and Launceston? It does.

4934. And it enjoys, I presume, the largest amount of through traffic of any railway in the Colony? Of through traffic—yes.

4935. And, I presume, is likely to do so for many years to come? Until the traffic is diverted to Formby.

4936. Then, do you suppose the Scottsdale line is likely to be a more successful line than this one? I think you informed us that in a year or two it would more than pay expenses? I said for the first year or two I did not expect it would pay expenses, or hardly pay expenses.

4937. But do you expect in a year or two it will more than pay expenses? I think it would; but its construction would be justified if for the next ten years it only earned the cost of working.

4938. Why? The vast indirect benefit, in all sorts of ways, to the district served.

4939. You have informed the Commissioners that the statistics of the likely traffic, including, I presume, the probable development of cultivation and mining industry, had been ascertained by a Commission Board. To whom was the result of this Commission communicated? To the Premier.

4940. Was a copy of the proceedings ever sent to you? No, but I saw copies.

4941. Can you, then, give any idea of the results of their labours as to what income they estimated would accrue to the line after opening? I must refer you to the Parliamentary paper.

4942. Can you inform the Commissioners where to obtain it? From the Clerk of the House of Assembly.

4943. About what time was that paper sent in? Some time in 1883, preceding the proposals for the construction of the lines.

4944. You have, I think, informed the Commissioners that the reason for adopting the present line in preference to the original one was that Parliament considered that it would not be fair to the settlers in Scottsdale to make them pay carriage for an extra 20 miles? I did not say Parliament said so.

4945. I thought you said "Parliament was of opinion?" No; I said the Government first of all, and subsequently Parliament, objected to the circuitous route, then I spoke of the tax that it would be upon the settlers.

4946. It was your own opinion? My own opinion.

4947. Where is the ultimate destination of traffic from Scottsdale likely to be? Launceston, I presume.

4948. Will any considerable portion of that traffic be for export? I cannot tell you anything about that, sir.

4949. In connection with the branch to Rosevears—what would the length of that branch probably be? Starting from Launceston, about 8 miles.

4950. Would the branch have to be constructed from Launceston to Rosevears? I cannot say, as I do not know the country between the bank of the river and the Scottsdale line.

4951. How far is Rosevears from Launceston? About 12 or 13 miles, by water.

4952. What is known as deep water, on the original Scottsdale line, was, I understand you to say, only eight miles along that line. Then, in the event of Rosevears being connected by railway with Launceston, and a port established at Rosevears, goods from Scottsdale sent for shipment from Rosevears would have to traverse $47\frac{1}{2}$ miles plus 8 miles, or $55\frac{1}{2}$ miles by rail to get to Rosevears? No.

4953. Allowing they went along the branch you spoke of? If they had to go along that branch, yes.

4954. I presume they would go by train in preference to breaking bulk at any roadside station? A jetty is about to be provided close to the Launceston station to accommodate large steamers.

4955. Please do not misunderstand my question—Suppose Rosevears is made a port and is connected with the Launceston Terminus by a railway, goods from Scottsdale sent by rail to Rosevears would have to travel along the present alignment between Scottsdale and Launceston, that is, $47\frac{1}{2}$ miles, plus 8 miles, which you say is the length of railway required to connect Launceston with Rosevears? No, I do not say so, because it would be easy to have some arrangement by which goods from Scottsdale could be brought to the port at Rosevears from the Scottsdale line.

4956. From what point? I cannot say; I know they could.

4957. Then, I presume, carts would be required? Probably it would be practicable to run a tramway or light railway from the Scottsdale railway to the port opposite Rosevears; in that case the actual carriage from Scottsdale, instead of being 56 miles, would probably only be 43 miles.

4958. Then do you consider there would be sufficient traffic from Scottsdale to Rosevears to warrant the construction of a tramway? No; I do not think that the port or the tramway is wanted at Rosevears.

4959. It is with reference more to the event of the port being established, because were the port established at Rosevears a railway may be fairly required between Launceston and Rosevears for the convenience of traffic from all parts of the colony coming through Launceston; but it might hardly be so profitable to construct a tramway from a roadside station on the Launceston and Scottsdale railway for the special convenience of the Scottsdale traffic. Therefore I ask you the question, if goods consigned by rail from Scottsdale to Rosevears would not have to pass over $55\frac{1}{2}$ miles of railway? Certainly, unless, as I have already stated, you might make a short connection from the Scottsdale line.

4960. You have supplied the Commissioners with comparative sections showing the grading proposed on the old and new alignments, but can you say if it is possible for you to supply from any report or data sent in by Mr. Climie a list of curves upon the original alignment? They can be made out from the Parliamentary plans; but, at the same time, it is more than probable that their number would be considerably increased in accurately locating the line on the ground.

4961. Allowing for that, would you be good enough to supply the information from the Parliamentary plan? I will.

4962. Did you, after the alignment was approved, and the contract survey completed, yourself, or by deputy, inspect the Scottsdale line? I inspected the line throughout while the contract survey was in preparation, and after the alignment had been completed.

4963. Did you initiate any improvements in the alignment in any part where steep curves were put in on steep inclines? No, because from time to time the trial sections had been submitted to me, and improvements suggested in many places.

4964. But did you not yourself suggest that improvements might be made at the Denison Gorge, where the incline is as much as 1 in 39.6, and the curves very sharp? No, I do not think it could have been improved.

4965. Did you suggest any alteration in the alignment—in the Parliamentary line? During the survey, no doubt I did. There were many alignments submitted to me, and some of them in connection with the Denison Gorge.

4966. But did you not, owing to the importance of the matter, endeavour to get this incline eased where these curves come in, or to introduce larger curves? We had done all we could, and where the horse-shoe curves occur portions of level were put in to break the steep grade.

4967. Would you point that out on the section? [Section here inspected.] There are only one or two cases where it has been done, but many curves of 5 chains radius occur upon a steep gradient.

4968. Are you acquainted with the line between miles 28 and 34—that is, between the site of the Denison station and mile 34? Yes.

4969. The Commissioners perceive that, while from miles 28 to 31 there is a very steep incline—1 in 39.6 to 1 in 44, from mile 31 to mile 34 the alignment is almost level. Do you think it would have been possible to have obtained an alignment clinging more to the hillside from mile 34 towards 31, and picking up height so avoid the very steep gradients from 31 towards 28. I see the total difference in height divided into the length would have allowed for a continuous gradient of about 1 in 80. Are there any physical obstacles in the way which would involve either much greater length or considerable expense to have prevented that better gradient being secured? The engineer who laid out the line, I believe, called my attention to that same matter, and I think stated that some physical difficulties existed to prevent his taking the alignment as you have suggested.

4970. Have you sent instructions to the Resident Engineers on the Scottsdale line similar to those you said it was your custom to send to Resident Engineers, and which we saw with the Resident Engineer of the Derwent Valley line? I do not recollect if they went.

4971. Should they have been sent? Yes, they should have gone.

4972. Then it was an oversight on the part of your office staff, I presume, inasmuch as we believe they have not been received? Or on my part, for forgetting it.

4973. But I presume that routine matters of that kind are brought under your notice? No; as I stated, a great deal of these details fall upon me.

4974. Routine office work connected with circulars and returns of that kind? Any instructions of that kind have to emanate from me.

4975. With reference to the construction of culverts upon the line, we observed at the Scottsdale side of the tunnel you are putting in log culverts; will you give us a brief statement of your reasons for inserting these log culverts, and say also whether it would not have been possible to have obtained broken brick for the manufacture of concrete if stone had not been procurable in that locality, and what the cost of such concrete culverts would be compared with the present cost per foot run of the log culverts adopted? The log culverts were adopted solely because the engineer failed to find suitable building material in the locality, and no roads exist by which the material could be brought from a distance; seeing that the contractor would have to cut his roads through a heavy forest, cart the material a long distance, and that good timber was available, I decided to adopt the logs as a temporary measure. I also had in view the high price that to a certainty would have been asked for the concrete culverts if I had included those required in places such as the Denison Gorge and nearer Scottsdale. I do not think that any contractor would have put down a lower price for the culverts on this section, if built in cement concrete, than £4 per yard or more. The log culverts in all cases are made of extra large size so as to allow, on some future day, of permanent concrete culverts being built in them without any disturbance of the bank, and could then be built at a low rate on account of the facilities of carriage by rail. I think the total cost of the log culverts as scheduled is something like £5000. The concrete culverts of a similar area, as shown in the type drawings, would, at the estimate of 80s. per yard, cost over £15,000. There is, then, on this basis a present saving of some £10,000. From my intimate knowledge of the timber of the Colony and of this log culvert construction, I am confident that they will be sound and good for 15 years or more. The present saving would thus justify their permanent renewal at the period indicated.

4976. But supposing that your expectations in this matter are not fulfilled, and a failure occurs to any of these culverts in 6 or 7 years or thereabouts, would not the result of this failure in one of these culverts cause the stream to head up behind and wash away the bank at one of the most dangerous places on the line; and would not any repairs be then far more costly than the construction of these culverts in a proper way at first, which would have been far more satisfactory to you and the Government, notwithstanding such extra first cost? The whole work is too substantial for me to suppose any failure likely to take place within the short period stated. The waterway given is enormously in excess of what is required, and would leave ample allowance for even a partial stoppage in the event of any failure taking place. With regard to repairs, nothing would be more easy than to divert the stream and let it cross the railway where the same is on a level; the precipitous nature of the ground would allow this to be done with a very short deviation.

4977. I presume you mean during repairs? Quite so.

4978. The Commissioners observed that there is a good district road which joins the line at the Denison Creek. Could not some good stone be found near that road, and be carried to the culverts by it? There is no difficulty in carrying up to near the Denison station on Hall's Track. The whole difficulty lies in the country between the Denison Gorge and Scottsdale, where there is no road.

4979. Why could you not use good broken bricks where you cannot procure stone? Because there is not the material to burn good bricks beyond the Denison Gorge.

4980. No good clay? No; it is slaty country for miles.

4981. What do you anticipate the cost will be of these concrete culverts per cubic yard when put in eventually? I do not think they will cost more than 40s. per yard at the outside.

4982. Then the cost will be in the aggregate, I presume, about £7500 altogether, or half of the £15,000? Yes, about that; but I think that an outside estimate.

4983. Have you seen all the detailed plans sent to the superintending engineer of the Scottsdale line? I have.

4984. With reference to the viaduct provided for at Dogwood Gully, do you think that a sufficiently stable one for such a high level road with a grade of 1 in 49.5 and a 6 chain curve. The Commissioners observed that the centre tressel is 40 feet above the masonry cill, no longitudinal bracing, no straining beams to receive the thrust of the struts under the road girders. Have you given this design your consideration? Yes, and I consider it a most substantial job. I made the alterations shown in blue in the drawings to equalise the angle braces and give greater steadiness. The viaduct is tied together by longitudinal ties.

4985. How high above the cill is the highest tressel braced? About 25 feet.
4986. For the remaining 25 feet this tressel is not stiffened longitudinally? It is braced at not more than 20 feet from the base.
4987. From tressel to tressel? From tressel to tressel.
4988. What are the dimensions of this bracing? 12 by 6, connected where they cross.
4989. Their length between the secured points? They are 33 feet long, 6 inches by 12 in scantling, intersected at the centre of span, and secured by bolting together. Four ties secured by cross tie 9 inches by 4½, secured by ¾-inch bolts.
4990. Who got out the original design? The original was got out by Mr. Edwards and submitted to me. I ordered the alterations in blue on the plan.
4991. Which alterations are these now mentioned to me? Yes, chiefly.
4992. What do you estimate the life of a structure of this character would be? Certainly 30 years if properly looked after.
4993. Do you consider it will be sufficiently stable in the position in which it is to be placed? I feel sure of it; the spread is very good, and the timber is substantial.
4994. Do you consider that no straining beams are required to receive the thrust of these struts underneath the girders? No; the system adopted of flitching the struts between the two main beams is preferable far to the straining beam, on account of shrinkage in the timber.
4995. In what part do you mean? In the straining beam on the struts.
4996. Then the point of support of these struts would be the intersection of the bolt by which they are secured to the girder beams? Practically, owing to the shrinkage of the timber, the strain, as is usual on our bridges, comes on the bolts; but the plan I have adopted, of gripping the struts between the two beams, makes it quite independent of the effects of shrinkage.
4997. Then, does the timber in this country shrink in the direction of its length, as it would appear to do by what you have stated? Some of it, but chiefly in the direction of width. In what I have said I speak from a long experience of the timber of this country, and of the construction referred to.
4998. *By the Chairman.*—There is one thing I would like to clear up with reference to the lining of the tunnel. I see bricks for 2350 cubic yards are provided, that quantity would more than line the whole arch of the tunnel with brickwork 18in. in thickness, leaving a considerable margin for the side walls. Do you imagine you will require more than this? I have found the ground so hard that the quantities provided in the schedule will not be exceeded.
4999. The contractors intimate that they have not received any definite instructions from the superintendent engineer relative to the manufacture of bricks—are you able to say whether you have so far considered the question as to enable you to give a definite order for any particular number? I do not see how it is possible for the Department to do that until they know what they are going through. The contractors informed me they would make some 300,000 to start with.
5000. In the event of these bricks not being required, what will be the action of the Department—will they take over the bricks, or will this risk belong to the contractors? I have not thought of that aspect of the case, but the contractors may be assured the Department will deal equitably with them.
5001. In the event of the contractors making a good marketable brick, and their not being required for the tunnel, will the Government take over these bricks, or allow them such a margin of profit as would enable them to dispose of the bricks to the public? As a matter of fair play between the engineer and the contractor, I should recommend such a course.
5002. Would it not be as well to arrange it so that the contractor might feel himself secure in making a certain number of bricks: will you consider that at once and communicate with him? Yes, I will.

THURSDAY, APRIL 1, 1886.

PRESENT:

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

Captain AUDLEY COOTE, M.H.A., examined.

5003. *By the Chairman.*—Since you handed in the press copy of the questions you submitted to the Government, we have received from them your original letter, together with certain comments of the Premier on your questions. These and the Premier's reply will appear in evidence, and your statements will form part of the proceedings. I should say the Government in their reply to these questions take exception to the right of the Commissioners to enter upon some of them, but the others have been remitted to them with a request that they should be considered. The Commissioners are very anxious to avoid taking any steps that would weaken the confidence of the Members of the Parliament of Tasmania when considering their report, and with that view they have decided not to enter upon the discussion of any

question which would involve political complications. We, therefore, in the questions submitted to you ask you to confine yourself to matters within your own knowledge, and with reference only to those questions. This is not out of any discourtesy to you, but to enable the Commission to do its duty impartially. At the same time there will not be the slightest hindrance offered to you when giving information on matters affecting the railway? I have no objection to that, provided that the questions appear in detail as I have sent them in to the Government.

5004. The Commissioners undertake that your letter shall be sent to the printer with instructions that it form part of the proceedings, and will print what else is necessary? I am quite satisfied.

5005. The first question which the Government think it desirable should be considered is No. 9—"Is it the case that the Scottsdale line now being constructed has to travel to an elevation of over 1000 feet, and to get to that elevation has to traverse through long tunnels?" Do you wish to make any remarks on that? In going through the plans and sections myself I find they are at this elevation in the position I have named.

5006. I may say that the question put by you indicates the fact? Yes, that is so.

5007. Have you any remarks to make on No. 10 question—"Is it the case that the line now being constructed as a "trunk line" of railway should never have been taken along its present route, but should not the other route have been selected, not only for the benefit of the two districts, but for the more economical working and maintaining of the railway for all time?" What is your reply to that question? My reply is that it is foreign to all engineering economy to take a railway in so direct a line as they are taking this one, in which such heavy works are entailed that the works of the line being so heavy, they are in no way decreasing the cost of the line, but are increasing it during its whole construction, and they are making it not only a heavy line to construct, but an exceedingly heavy line to maintain; and its being a trunk line, a few extra miles further in going round by way of Lower Piper district, where it would open out a large quantity of good land, and also open out a larger population, bringing traffic to the line, and with a difference of some 12 miles further round, even should it be 20 miles further round, believing as I do, that the line would not cost more than £5000 per mile, that is, the outer or original line, even if it were 20 miles further round, the cost would not exceed that of the present or higher line, and it would have been an easy and workable line to maintain; although I have not stated in those questions that I believe they would not get to a greater elevation than 500 feet above the level of the sea, which is only half its present elevation, I was guided by that roughly. I since think it would be about 600 feet to 650 feet above the level of the sea in going round by the original route, but it would avoid all the tunneling and nearly all the heavy expensive work now being carried out on this line of railway. At no time would there be more than about 10 miles of rough country for this railway to pass. Secondly, my opinion has always been that the longer route would be the best for the community at large.

5008. In making this statement as to the elevation and comparison of cost between the two lines, have you arrived at your decision from a personal knowledge of the country, or from reports and surveys presented to Parliament; or by representations made to you by reliable persons living in the locality whose confidence you enjoy; or from the whole of those reasons? Partly from one and partly from the other. For instance, I have travelled over the whole of the longer route, and over part of the present, or shorter, route, and I came to the conclusion that it would be far better to take the line the longer route; and that was confirmed by my going to the office and looking at the plans and sections of the present route upon which the contracts were taken. I took considerable interest in looking at this myself, and made the original calculations. I saw at once that the work would be of an exceedingly heavy nature on the shorter line. I have spoken only once to Mr. Climie, who made the original and longer survey, when I put the question to him if he had been driven round this way? He replied that he could have taken the railway along its present route, but the expense would be so enormous to a colony like this that he was driven to take the line by the longer route; that the works were nothing like so heavy, and also it would benefit larger districts. I was then summoned by the constituents of the surrounding districts to attend a meeting, and I was there informed by two of the leading men of the district, who had lived in the district all their lives, that the plan as shown on the map was not the route that Mr. Climie had surveyed, and that they had offered to have taken him round the route that I had gone round myself, and they informed me that they believed the line would not go over an elevation of 500 feet. I had my doubts about that, and a reference to a memorandum in one of my books showed me, in a memo. I had made roughly for my own information, by an aneroid that I had taken with me on one occasion in going through that district when it was spoken about for a railway, showed that I was up over 600 feet. Knowing that the residents were anxious that the railway should pass through the district, and that they frequently are out in their opinions as to the elevation, I came to the conclusion that my old memo. of 600 feet was the most reliable one. I think it would be advisable that one of these gentlemen and Mr. Climie, who surveyed the route, should be summoned before the Commissioners to state their views independently of what I have stated.

5009. The Commissioners have received the result of Mr. Climie's survey, and his report upon the line now being constructed. Do you not think that from the explanation you have given, and after considering all the papers and documents, that the Commissioners will be able to arrive at a just conclusion on the merits of the two schemes? Yes, I believe they will.

5010. You wish, then, your opinion to stand, but to correct the statement that the summit elevation would not exceed 500 feet,—further inquiry having led you to believe that the elevation will be under 650 feet? That is the only correction I wish to make.

5011. No. 15 question asks,—“Is it the case that the present line will always be an unsatisfactory and costly line to work and maintain, and that its locomotive power will have to be heavier than usual?” In replying, will you consider what has been the experience and practice on Tasmanian railways, both on the Government and Main Line Railways, and will you, if able to do so, state how the Scottsdale line, as it is to be constructed, will compare with the Government and the Main Line Railways? My opinion

is that, as shown in the sections of the Scottsdale railway, and knowing the country as I do, the present Scottsdale railway as now being constructed will be far and away more expensive to maintain than any railway in Tasmania at present at work.

5012. As regards cost of working, you do not think it will compare favourably with the Main Line? I think its working expenses will be considerably above the working expenses of the Main Line, because its gradients are more continuous and its curves are equally sharp.

5013. When you say its gradients are more continuous, do you make that statement from an examination of the sections, or from your belief? From examination of the sections.

5014. It has been represented to us that there are only seven places on the Scottsdale line where a combination of 1 in 40 gradients occur with curves of 5 chains radius, but these are for only short distances, and that similar difficulties are to be found on the Main Line. Are you in a position to say whether that is a fact or not? Not without going over the sections, because it is some considerable time since I went over the sections. The notes that I made afterwards were based upon information from notes which I got afterwards.

5015. It has been represented to us that on the Main Line very long inclines of 1 in 40 are to be found, between Tea Tree and Campania, and between Jerusalem and Flat-top and also through Tin-dish Gully. Do you think the inclines on the Scottsdale line are longer than those I have mentioned? No.

5016. In what respect would they compare? Unfavourably for the grade on the Scottsdale line.

5017. How do you arrive at that opinion? They are shorter grades, but there is a continuation of them.

5018. Are there not, in some instances, flatter grades easing the difficult one? Yes.

5019. Would not that be a favourable feature when comparing the working of that line with the Main Line? As compared with the Main Line it would be, but, having the experience before us of the Main Line Railway, and making another trunk line, as the Scottsdale railway is, and having as a fact before us that those grades could be done without, my opinion is that, as a trunk line, those grades should have been avoided, if possible.

5020. I take it you infer that the Government should improve the railway as compared to the Main Line,—is that so? Most decidedly; if there had been sufficient money in hand when the Main Line was constructed, many of the curves and gradients on that line would not have been put in.

5021. In question No. 18 it is asked—"Is it the case that it is against all engineering economy to shorten a line for the purpose of taking it over a much higher grade, and, in this instance, that the question of first cost after maintenance was not taken into consideration?" Have you any explanation to offer in reference to that? Merely to say that I believe it is against all engineering economy to take a line in such a straight way as the Scottsdale Railway has been taken, and that the Press and the Government were informed of this fact. They were cautioned that in so doing they would be increasing the expense of construction and maintenance of this railway, and that, in Mr. Climie's opinion, it should have been avoided. Knowing, as I did, that every reasonable pressure had been brought to bear on the Government to have the longer route looked over again before the final signing of the contract, and when I was informed that the contract had been signed, and that the railway would have to be constructed in the route now taken, I could only come to the conclusion that they had not considered the question of after maintenance of this railway as against the more economical working of the line going round a further distance of 12 miles only from terminus to terminus, where, in all probability, arrangements would be made for through freight from one end of the line to the other, whether it would be 45 miles or 50 miles long.

5022. Question No. 19—"Is it the case that the haulage power on this railway must always be heavy, and the train loads light?"—is that asked from your knowledge of the country and the settlement in the district on the route adopted by Parliament? In the first place, the route was adopted by the Government and acquiesced in by Parliament. In replying to the second part of the question, I say considering that the gradients might have been much better and in many places less than 1 in 40, the haulage power along the longer route would not require to be so heavy as along the present route, as the curves would not be so continuous, and they would have nothing like the elevation to get over along the longer route; consequently I was of opinion that they will always require to have a heavier class of engine to do the work on the present line than they would require on the longer line. Taking the whole features of the line, I believe they could have taken, so far as train loads go, far and away more along the longer route than on the present one.

5023. It has been stated that the length of the two lines are as follow:—Original line 67½ miles, and the adopted line as now contracted for 45 miles: do you think these figures fairly represent the two lines? At present they represent them exactly, but on the line now being constructed they have been doing their level best, from what is shown on the sections and map, to shorten it in every way possible. Originally it was stated that the outer line was 20 miles longer; as they proceeded with the present line we heard it would be 15 miles shorter; then we heard it would be 12 miles shorter, but in each and every case we were informed the expenses of the construction of the line would be a little more. Although they were shortening the route they were not decreasing the cost of the construction of the railway; consequently, if Mr. Climie's line had been selected, which showed at the time about 20 miles more length in going round. But I have it in evidence from the residents of the district that the line shown on the map is a much longer line than that which Mr. Climie surveyed, there being a difference of about eight miles, so that had Mr. Climie's line been adopted there would have been only 12 miles difference between the two lines as they at present stand. I know nothing of Mr. Climie's estimate,—I have never seen it or spoken to him on the subject. I believe, knowing, as I do the country, that the line *viâ* the Lower Piper could have been constructed as a whole for £5000 a mile, as against £10,000 a mile on the present line. That is to say, although they are making 45 miles of railway, in all probability it will cost them £450,000,

although my estimate, roughly speaking, was under £425,000. I have every reason to believe that the longer line of 12 miles further round would have been completed for a considerably less sum of money than the present line. I have consulted no one on the subject, but as I have been interested in railways for the last 20 years, and have gone over this line once or twice, it is on this I base my opinion.

5024. You state the adopted line will cost £10,000 per mile: may I inform you that the contract shows that the work as contracted for will cost £5078 14s. per mile. On what grounds do you arrive at the conclusion that £4900 additional will be required? I was not aware that there was any contract let but to Messrs. Boland and Scott, and that is £228,541.

5025. Assuming that Messrs. Boland and Scott construct and open this line at their contract price, what leads you to expect that a further sum, nearly equal to the whole cost of their contract, is required? So far as I am aware the contract is merely a schedule contract to do certain works on that railway. It is not to complete the railway with rolling stock, stations, permanent way, &c.

5026. Then your figures are for complete railway stock? It will be for the complete equipment of the line when finished.

5027. What I wish you to explain is, that as there appears to be a large difference between these amounts, how do you reconcile the difference? Because my estimate of the works of that railway were so much more than Boland and Scott's. From what I had seen of the route and what I had seen of the sections my prices were so different in the shape of the works along its whole route, and so different in the cost of clearing timber and all other works of that kind, I have based my opinion on it that Boland and Scott's tender will not be sufficient to enable them to carry out the work.

5028. I do not know whether you are aware that the rough details of Boland and Scott's contract stand thus—Works of the railway, £207,765; provision to be made for other works, £20,776—making the gross total £228,541. Do you think with that provision of 10 per cent., which the contract shows, that the contingencies you have spoken of will be provided for? No, I do not. This particular railway is in no way approached by roads, almost preventing it from being an economically constructed line. For their own use the contractors will have to get all their stock, fodder, and everything necessary for their works from a longer distance than usual, and I think 10 per cent. is not sufficient.

5029. I do not say it is sufficient, but I ask if you are aware that the contract provides 10 per cent., or £20,776, to meet the contingencies of which you have spoken? No, I was not aware of it.

5030. That fact is disclosed by the contract, so that in justice to the department I should tell you it is the case? I was not aware of it.

5031. Supposing the two lines were open and at work between Launceston and Scottsdale, and that the contract line represented a length of 45 miles, and the original 67½ miles, have you any idea of the respective cost of working, taking into account the increased number of maintenance men which the longer line would require? I took into consideration all that for the matter of 12 miles, but not for the longer distance.

5032. In some of the Colonies something like three men for four miles are required; that involves the permanent employment of 17 men for the longer line of 67½ miles? 67½ miles is wrong.

5033. Have you taken into consideration the increased cost of these maintenance men in the conclusion you have arrived at? Yes, but only for 12 miles.

5034. And the cost of working the line as well? Yes, the cost of working the line as well.

5035. How do you think the value of the traffic will compare between the adopted line and the originally projected line? From all that I can glean, the originally projected line would have a continuous local traffic, outside the traffic from the terminus, along its whole route, excepting about 10 or 12 miles. There is but very little good land along many miles of the selected route, and taking into consideration that the original line is on a lower grade, which enables nearly all the traffic to be taken easily to the line, the original line would have obtained a considerable quantity more traffic than the line now being constructed, because it is almost impossible to get the produce from the original line to the present line on account of its great elevation and the entire want of roads—in fact roads cannot be constructed. The adopted line has also gone away from the centres of population. It has left out places where there are as many as 600 souls,—I mean the Bangor Slate Quarry. It has left out a place, although at present there are only 450 inhabitants, when this line was being considered there were 1200 inhabitants—I allude to Lefroy. The adopted line goes nowhere near these centres of population, and can never affect them. On the other hand, the original line would have gone about a quarter of a mile from one, and five miles from the other, taking in the whole of the traffic of these two large districts. Although one of the towns I have named—Lefroy—is under a cloud at this present moment, still, as a mining township, it has, within the last month, increased something like 20 per cent. from the time when this contract was signed; consequently I am bound to give it as my opinion that the present route as selected cannot at any time have the traffic upon it that the original route would have had.

5036. *By Mr. Stanley.*—Have you seen the report written by the Engineer-in-Chief on December 11, 1883, which was laid before Parliament, on the alternative line by Upper Piper—had this the original approximate estimate? Yes, I saw it.

5037. Did you see an approximate statement of the gradients of the Upper and Lower Piper lines? I did not notice it. I saw it hurriedly, and only referred to the lump sum approximately of the line. I did not notice the elevations at all.

5038. By the comparison the Engineer-in-Chief makes in this report, he shows that the grade rises to a total number of feet in travelling over the line, as follows:—“The actual summit levels between Launceston and the common point of junction near Hall's track is—Lower Piper line, 587 feet; Upper Piper Line, 945”—showing a difference between the summits of 358 feet in favour of the Lower Piper line. The aggregate rise, or say, total number of feet that a ton of goods would have to be lifting in travelling over the

line now built, would compare with the original line as follows :—"Outwards from Launceston—Lower Piper, 1832; Upper Piper, 1766. Inwards—Lower Piper, 1255; Upper Piper, 1190." Have you any reason to doubt the accuracy of that comparison? Not at all, only that is based on the difference of distance. He has allowed for going along by the Lower Piper route, 22 miles further in length, and going up, as he said, for 587 feet at its greatest elevation. He has also given 945 for the Upper Piper line, or selected route, but I think you will find it is 1030 feet. That is a great difference.

5039. Does the line as adopted differ from the sections on which the comparison was made? Yes, entirely.

5040. And the adopted line, you think, would also differ from the original trial survey? Yes.

RYTON OLDHAM, *examined.*

5041. *By the Chairman.*—What is your profession? Contracting engineer.

5042. You have had considerable experience, have you not, in the construction of railways? I have been at it from my boyhood.

5043. How many years have you been in this colony? I came here in June, 1871.

5044. You say your experience has been from your boyhood to the present time? Yes.

5045. What part had you in the construction of the Mersey and Deloraine railway? I had nothing to do with the last part. I had with the part from Latrobe to the Coiler's Creek station, 17 miles from Latrobe towards Deloraine.

5046. Is Coiler's Creek the point at which the Mersey tramway ended? Yes.

5047. The works of the tramway commenced at Coiler's Creek and ended at Latrobe? Yes.

5048. In what condition were these works at the time the Government took them over? The sleepers were all worn out, rotted away, and the road was in bad condition.

5049. How was it regarding earthworks and bridges? The cuttings were insufficient, and additions there were from 10 feet to 12 feet. I widened them.

5050. Is there existing any plan or section which would show the state of the works in the locality mentioned by you? Yes, there is a section of the old line and the field plan made by Mr. J. M. Dooley, M.H.A.

5051. Where could these plans be found? In Hobart, I think.

5052. Are they in the possession of the Government? I handed them over to the Engineer-in-Chief.

5053. Will you commence at Coiler's Creek, and state generally what important alterations were made in the old tramway as far as Latrobe? A large cutting was pointed out to the Commissioners as being a part of the old tramway—what did you do to it? It was 9 feet on the formation, and I widened it to 10 feet and cut a waterway.

5054. Did you alter the slopes? I altered them so that the railway carriages could go there.

5055. Are there any other large works on that railway? Most of the cuttings were widened.

5056. They were not, then, the adopted width of the Government? No; our cuttings now average 11 feet wide and the banks 12 feet. They were finished with that.

5057. What width were they? 11 feet and 12 feet were averaged.

5058. What were they completed to? They varied.

5059. The Government adopted some fixed width; what is it? 12 feet and 14 feet.

5060. The difference, then, would be between the first and last figures. Yes.

5061. As to the works on the line, are there any large culverts which you altered? I put in 14 or 16 stone culverts.

5062. Were they entirely new? Yes.

5063. Did you construct any pile culverts? No, we did no piling.

5064. Did the original tramway cross the Mersey? Yes, on the site of the present bridge.

5065. What class of structure was built over the river? Piles, with a 45 feet span, with an iron superstructure.

5066. Is the present bridge over the Mersey an entirely new work? I believe so.

5067. Were you engaged in the construction of the present Mersey bridge? No, I had nothing to do with it; only with the bridge over the river for the roads.

5068. You know where the railway approaches Latrobe at the site of the present railway station? Yes.

5069. Where was the end of that tramway as compared with site? On the road crossing Gilbert-street.

5070. Was that the end of the tramway works? Yes.

5071. Were there no approaches made to any point of the river? No.

5072. Did the company obtain the fee simple of the land from Coiler's Creek to Latrobe? I understood from our party when I fenced Mr. Field's land in, that the land was given conditionally on fencing it.

5073. Your belief is that the company had the fee simple of the land from Coiler's Creek to Latrobe? Yes, that is my belief.

5074. Are you aware what induced the Government to adopt the route of the tramway from Coiler's Creek to Latrobe? I believe they purchased the line for £6000 from Foster's trustees.

5075. It has been intimated that it was the original intention of the Government to depart from the proposed tramway at a point south of the present railway station, and keep on the west side of the river the whole of the way to Formby, thus avoiding the two bridges which at present cross the river at Latrobe. Are you aware of the reason that influenced the Government and the Engineer-in-Chief to depart from that decision and adopt the present route? I know nothing about it.

5076. Do you now reside at Latrobe? I reside at Formby.

5077. Speaking as a resident of Formby, which side would have better accommodated the wants of the district—the one as adopted or the one originally proposed? do you think the latter would have been preferable to the present route? I certainly do not.

5078. What route would you have proposed? I think if they had gone down to Latrobe and then branched off to the North-West Coast, it would have made a better line.

5079. I want your opinion whether the line as made through Latrobe is a better line than that originally proposed, which departed from the present route south of the present railway station and kept on the west bank of the Mersey all the way to Formby? No doubt the west bank would have been a much cheaper line.

5080. How would that have satisfied the people at Latrobe? It would not have satisfied them at all. They would have had to cross the river to reach the railway.

5081. Which, then, is the best route? For the convenience of the people the present route, but for economy the western bank would be the cheapest.

5082. What would be the difference of cost? I cannot say.

5083. Continuing the line from Latrobe towards Formby—can you state what induced the Department to make the deviation at Horsehead Creek? I know nothing about it.

5084. Do you know the locality. Yes, well.

5085. If the original line had been carried out, which would have crossed an arm of the Mersey by comparatively high ground on both banks, would not that have been a less costly route than the present one? I think so.

5086. It has been alleged that the deviation at Horsehead Creek, although longer, has saved the Government an outlay of £1500? I think a shorter line could have been got at less cost from Latrobe to Formby.

5087. When you speak of a shorter line, do you mean the line at Horsehead Creek? No, I mean the line as at present.

5088. In reference to the works at Formby, how do they satisfy the people? Not much; there is no accommodation for shipping.

5089. In what respect? The wharfage at the railway is not sufficient.

5090. Have the railway works improved the facilities of the port or otherwise? I think so, very much.

5091. Would it be as economical to reclaim a certain portion of the foreshore of the river by a retaining wall, and so provide further accommodation at the port, rather than take the line through purchased property at Formby? Something of that sort will have to be done to give facilities for shipping.

5092. How do you think the cost of building a retaining wall on the west bank of the Mersey would compare with the cost of taking the line through purchased property. There is a great difficulty in obtaining material there for filling.

5093. Do you think it would have been more economical to take the line through purchased property? Yes, I think so. There is the Esplanade, which is Government land.

5094. It has been pointed out that the Esplanade has been damaged by the Government taking up nearly the whole of it for railway works; would it have been better to take the line further back? I would have filled in in front.

5095. You think the present route is the most favourable that could have been adopted? Yes, I think so.

5096. Are there any other remarks you wish to make in reference to this work? No.

5097. Are you aware that the land directly north of Mrs. O'Meara's hotel, and which it was, at one time, proposed to form the station site, has since been sold? I know the land you speak of; it has not been sold; it is still open for sale.

5098. Would that have been a better site for the station than the present one? It would not have answered for the shipping. I think the station will give every accommodation there. The difficulty is the wharfage.

5099. *By Mr. Stanley.*—To what extent was the original tramway ballasted? I think the width was about 10 feet and the depth about 9 inches.

5100. What depth was there under the sleepers? There was no ballast under the sleepers. When I took possession, and at a later period, they were very short of means and did not wish to lay out much money on it, but to open it for traffic in 1872, and it was then worked for four months.

5101. What was the character of the ballast? Gravel.

5102. Fairly good ballast? Fairly good ballast.

5103. Available for use on the railway into which the tramway was converted? Yes.

5104. Have you seen the report of Mr. Human furnished by him to the Minister of Works, on the condition of the tramway in 1875? I know he made such a report, but I have not seen it.

5105. Then you are not in a position to say whether that report fairly represented the state of the line and works of the tramway at the time mentioned? I am not.

5106. Was the tramway line fenced throughout? No, there was about seven miles. I fenced six miles of the line out of the 13 through Mr. Field's property.

5107. What description of fence? Post and rail, good fencing.

5108. Has that fence been made use of for the railway? Partly.

5109. What description of bridge was erected over the Mersey at Latrobe by the tramway company? A wooden bridge about 45 ft. span. The whole structure very slight, and a few extra bolts put in to carry a locomotive.

5110. It was not erected under your supervision? No, it was all done before I came.

5111. What works were constructed at Latrobe station previous to the tramway being purchased by the Government? A station house of eight rooms and office of wood, and an engine shed.

5112. Had the platform been constructed? Yes.

5113. Have these works been utilised for the railway? Partly. The platform has been taken away; it was a wooden one and worn out.

5114. Has the engine shed been used? I think only for stabling.

5115. Then, as far as the original station works are concerned, they were of comparatively little value to the railway? They were worth £500 or £600.

5116. But they were of little value for railway purposes? No, they were not worth much for the purposes of the railway.

5117. *By the Chairman.*—Is there any information, Mr. Oldham, which you think it desirable the Commissioners should have with reference to the construction of the Mersey Railway, or the purchase of the tramway company's property by the Government, which you have not already stated? There was some question about the culverts. They were of very light material and not extraordinarily well done. The Engineer-in-Chief asked me if they were capable of carrying the rolling stock, and I told him they were not. I was not often up the line.

5118. When you made that remark was it your impression that the Engineer-in-Chief believed that the culverts of that tramway would be found suitable for the purposes of the railway? I believe he thought so in the first instance, and he asked me to make a statement whether I thought they were capable of carrying the traffic or not. I advised him not to do so.

5119. Upon what information did you arrive at that conclusion?—would it be from a report upon the works shown to you or from your own personal examination? I could not say.

5120. The culverts were not sufficiently stable to carry the traffic of the railway? I do not think so. They were constructed to carry a 10-ton engine, and were generally built with dry stone walls.

5121. Do you know anything about the durability of the peppermint timber used in the piles of the bridges across the Mersey? It is the best timber we have, and when put in appeared pretty sound.

5122. What would your estimate of the life of a peppermint pile be? In water—between wind and water—15 years.

5123. That is if the timber is well chosen? Yes, well chosen, good, sound timber.

5124. Did you observe the piles in the original tramway bridge when drawn? No, I did not.

5125. Have you ever heard what those piles were? Most of the piles were peppermint on that bridge.

5126. Did you know whether they were sound or not? No, I did not see them put in.

5127. What was the timber on the top of the bridge? Stringy bark and gum. The gum was gone in parts, and we had to renew it; it had been up two years when I came.

5128. As an old railway engineer, Mr. Oldham, what time do you think these piles will last? I should average them at 10 years, but there are cases where they might last longer.

5129. Do you think they would require careful examination at the end of 10 years' time? I do.

5130. What determines you in arriving at that conclusion? My knowledge of the timber—having been amongst it for the last 17 years. It is safe for 10 years; it would be risky after that.

5131. Would there be any great difficulty in replacing these piles by others at the end of that time? All depends on the character of the structure.

5132. In those bridges crossing the Mersey? There would not be any very great difficulty.

5133. Would it interfere with the working of the line at all? It might.

5134. Have you ever examined the piers to see whether you thought they could be replaced, in the event of their failing, without stopping the work of the railway? I have not.

5135. Then your opinion is only a qualified one? That is all.

5136. Do you think the present bridge is a desirable form of structure—a timber substructure and an iron superstructure? No.

5137. Why? They are not in proportion as to durability.

5138. One is a decaying substance and the other a permanent one? Yes.

5139. Otherwise I gather that you think there is no great difficulty in replacing these piles by other suitable timber should it be required? I do not think the difficulty would be very considerable.

5140. *By Mr. Stanley.*—In stating that you consider the life of such piles would be from 10 to 15 years, did you consider the effect of the marine borer worm (*Teredo navalis*) in the case of a tidal river? Yes; that would affect it in the case of a tidal river, but in the case of the Mersey there is no such thing.

5141. Is the Mersey not a tidal river at that point? At one bridge, but not at the other.

5142. Do you not think the worm would affect the timber there? No, I do not think so.

(Witness withdrew to admit of Mr. Fincham being examined).

AFTERNOON SITTING.

The Commission re-assembled at 2 P.M.

Present.—All the Commissioners and the Secretary.

MR. J. FINCHAM, Engineer-in-Chief, previous to examination on the Mersey Railway, handed in the following papers:—

I. Detailed estimate of the cost and liabilities of the Scottsdale line, estimated up to January 17th, 1885, with memoranda of some data as submitted to the Government for consideration in connection with the tenders.

II. List of curves on the original or Lower Piper route of the Scottsdale line; the total amount of 1 in 40 grades on the same route, and the total amount of 1 in 41 to 43; and the curves along the 1 in 40 in one piece.

III. List of curves on the line now being constructed; the total length of 1 in 40, and the longest length of 1 in 40 grades in any one portion.

5143. *By the Chairman.*—Is there anything further you wish to state with reference to the Scottsdale line by the way of supplementing the evidence you have already given? No; not since, at the close of the evidence yesterday, I called attention to part of the excess, consisting of an estimated sum of £12,000, was for surveys, supervision, and salaries.

5144. Then as far as you are concerned, the evidence which you have already given will complete your statement as to the Launceston and Scottsdale line? As far as I know, I have said all that I wish.

5145. *By Mr. Stanley.*—This is your report, dated December 11th, 1882, on the alternative line *viâ* the Piper, which I understand you submitted to Parliament. Will you state whether the summit heights and grades of that line are the same as the one now being carried out? No; there is of necessity a variation from it, seeing that one portion of the line, as I said yesterday, is five miles away.

5146. I refer to the summit levels as given in this report; would they be approximately the same? They would be approximately the same.

5147. Does the summit level on the Upper Piper line exceed that given in this report? I think there is very little difference. It is approximately correct.

5148. And that table of aggregate rises in feet on the two lines—is that approximately correct? I believe I am safe in saying that it would be approximately correct.

5149. *By the Chairman.*—Are you ready to go into the Deloraine and Mersey railway? Yes; and I will first hand in the following papers connected with it:—

I. Act for the construction of the railway, dated 9th October, 1882.

II. Mr. J. Human's report upon the Mersey and Deloraine railway, with plans and estimates.

5150. Was he a Government officer? No, he was employed temporarily by the Government. The paper also contains certain petitions and correspondence with reference to the purchase of the tramway, and a statement of the cost of construction to the original promoters of the tramway.

III. Contract specifications and schedule containing my estimate of the construction under schedule quantities.

5151. Does that also give the amount of Fergus and Blair's contract, or is it only a departmental estimate? It is merely my estimate as against their tender.

5152. Was this estimate sent to the Government as a departmental paper? The substance of it was contained in a memorandum in connection with the acceptance of the tender, which I will lay before the Commission.

IV. Copy of contract, with amended schedule and specifications adopted on acceptance of same.

V. A statement from the first initiation of estimate with which I was connected, describing the various estimates, tenders for construction, &c., and containing a list of special items of excess in cost.

5153. Is that the first estimate you gave the Government in reference to this Mersey Railway. It is an explanation of the several estimates succeeding one another submitted to the Government, also a statement of the several items of excess in cost.

5154. Does that give the first and last estimate? Yes, all are embodied in the paper.

VI. A very full and detailed abstract of actual cost, arranged under various headings.

VII. General abstract of expenditure as estimated, and liability to be met.

5155. Are there any further liabilities to be met in future? A few liabilities on account of the purchase of land—a very small matter.

VIII. My estimate of the value of the works on the old tramway made in the year 1880.

IX. Copy of the Parliamentary estimate upon which the construction of the line was sanctioned, and which was not submitted in detail to Parliament as was the case with other lines lately dealt with.

- X. Comparison between such estimate (last referred to) based on Mr. Human's quantities and the actual cost of the line, amounts being divided for each section of the railway.
- XI. Copy of a Return to Parliament (Paper No. 148, H.A., 1885) in reference to the cost in detail of the rolling stock.

I think that is all the important papers, but there are others I will be able to produce if called upon.

5156. *By Mr. Stanley.*—When was the preliminary survey made for the Mersey line? In 1876, by Mr. Human.

5157. Will you describe shortly the route which that survey followed? The route as constructed between Deloraine and Latrobe, and thence from Latrobe to Torquay.

5158. Did the survey to which you refer follow the line of the original tramway from Latrobe to Coiler's Creek? It did.

5159. Was it intended at that time that the Government should purchase the tramway from the company?—did that form part of the scheme? I believe so, but you will find it in the paper I put in—the Engineer's report. The work was done before my appointment.

5160. From what period does your connection with the Mersey line date? From the time when I was asked to furnish the first estimate—within three weeks of my appointment in 1877.

5161. Was the survey being made at that time, or had it been completed? It had been completed.

5162. Kindly state shortly the initiatory steps taken in connection with the construction of the Mersey railway? The first estimate given was in 1877 for a line from Deloraine to Torquay, and was based entirely upon the particulars furnished by Mr. Human. (See Paper No. 73, House of Assembly, 1875.) This amounted to £105,058, which sum I increased to £120,000 by altering the prices allowed by him. On consideration of proposals for the same line in 1879 the sum of £120,000 was thought too large to be submitted, and I was asked what could be done with £90,000. To this I replied that probably by omitting the Latrobe to Torquay section, and reducing the grades and curves to those of the Tasmanian Main Line railway, the latter sum could be made sufficient. There would then have been only the 13 miles of new line from Deloraine to Coiler's Creek to construct, and such additions and alterations to be made to the old tramway as were absolutely necessary. In 1882 the line was again proposed at short notice, the Latrobe to Torquay section being abandoned in favour of an extension to Formby, leaving the old tramway at Sherwood (about 1½ miles from the Latrobe Terminus). The estimated cost of the whole was £120,000, and was based, with some revision, upon Mr. Human's survey and particulars of line from Deloraine to Latrobe, and upon a trial section from Sherwood to Formby. It was understood that all the large bridges should be of timber; that on the old tramway the repairs indicated by Mr. Human should be made to serve as far as possible; and that the cost of rolling stock should be limited to £12,000, for a service of one train each way per diem. The plans and maps laid before Parliament showed the Latrobe station unavoidably at the end of a short spur line; and, as the inconvenience of working the main traffic from Formby and the coast in and out of this spur was manifest, I proposed a station at Frogmore for the passenger traffic, leaving the old Latrobe terminus as a goods yard only. Parliament, however, authorised the construction of a railway extending from the terminus at Latrobe to Formby (46 Vict., No. 22, sect. 5, sub-sect. 2), and I was instructed to prepare for contract upon this route.

5163. Was the permanent survey carried out upon the lines of the plans submitted to and approved by Parliament, or were deviations therefrom effected? Several minor deviations were made on the original survey between Deloraine and Coiler's Creek. No alterations were made between Coiler's Creek and Latrobe; and from Latrobe to Formby the Parliamentary line was widely departed from—first, by the deviation of the line through the town of Latrobe, and then by another large deviation at the Horse Creek. The other deviations from the trial sections (either in plan or amount) were only of a minor character. The large deviation of the Horsehead Creek was not sanctioned till I had obtained from the Resident Engineer an approximate comparative estimate made out in detail of the cost of the two lines. That estimate showed a saving of £1500, and I therefore adopted it, not only as a matter of economy, but on account of the greater security of the line, the original line having crossed the tideway at the mouth of the Horsehead Creek at a width of about 10 to 12 chains.

5164. Were the deviations to which you refer adopted on the authority of the Government only, or were they submitted for the approval of Parliament—I refer more particularly to the larger deviations at Latrobe and Horsehead Creek? The large deviation at Latrobe was adopted on the authority of the Minister of my Department. I am not able to say if he had submitted the same previously to the other members of the Government, but I assume that he did so. The deviation at the Horsehead Creek was adopted by me, and I feel sure that the matter was pointed out to the Minister, as it had to be mentioned to the contractors when their tender was accepted.

5165. Was the tender for the construction of the line, then, based upon the original survey, and not upon the deviation through Latrobe? No, it was based clearly upon the deviation through Latrobe.

5166. In the case of Horsehead Creek, was it based upon the deviation or the original survey? The original survey.

5167. At the time you submitted plans for the Latrobe deviation, did you report as to the probable cost of adopting that deviation as compared with the original line? No, not at that time. I pointed out to the Minister that the Act authorised a deviation for which neither plans nor estimates had ever been prepared or submitted to Parliament, and asked for his instructions as to the preparation of the contract. These instructions were that there was nothing for me to do but to prepare the contract adopting the deviation determined upon by Parliament.

5168. Perhaps, Mr. Fincham, you would kindly point out on the plans the authorised deviation that you refer to? This was one of the plans laid upon the Table of the House. You will observe that the line leaves the old tramway this side of Latrobe, passes through Tarleton, crosses the mouth of the Horse-

head Creek, and so on to Formby, leaving a portion of the old tram between Sherwood and Gilbert-street, Latrobe, as a spur line. The wording of the Act required the extension to Formby to begin at the terminus of the tramway in Latrobe—thus unavoidably necessitating the deviation that has been referred to.

5169. Did this deviation through Latrobe materially increase the cost of the works? Yes, materially.

5170. Will you state, shortly, the principal items of increase? They are all given in detail in the papers before the Commission. Allowing this short spur between Sherwood and Latrobe to be used for goods traffic only, as I proposed, the minimum excess cost of the line between Gilbert-street, Latrobe, and Tarleton over the contract line from Sherwood to Tarleton, both estimated at schedule prices, is close upon £13,000. Had it been possible, as was advisable, to have abandoned the spur into Latrobe, the saving to the Government would have been over £20,000.

5171. What was the additional length entailed by the deviation? The additional length for all the future through traffic from the North West Coast is $1\frac{1}{2}$ miles.

5172. Was the bridge over the Mersey on the original tramway line to Latrobe of such a character that it could be utilised for railway purposes? The piles were thoroughly sound, and the timber superstructure could have been placed upon piers that would have been amply sufficient for the traffic of the goods yard.

5173. Did you not consider it of a sufficiently permanent character to utilise for the railway traffic? or will you state, generally, what led to the construction of a new bridge on the line? My answer to that question will apply to the whole of the river bridges on the line. The estimates were clearly stated as for timber structures, on account of the importance of keeping down the cost of the railway; but, in carrying out the works, I designed the present structures with concrete abutments, and, in one case, concrete piers with wrought iron superstructures, in order to obtain a more permanent job for what would be the future through line.

5174. Was the alteration in the character of the bridge carried out with the knowledge and approval of the Minister of your department? I think he must have been aware of it, but I did not specially call his attention to it. The quantities for the superior structures were included in the contract, and the explanation to the Minister with regard to the excess in cost, which it was known would have to be incurred when the contract was let, must have included some reference to the matter of these more expensive bridges.

5175. I presume you consider, as Engineer-in-Chief, you were justified in making these alterations and incurring the necessary extra expenditure in view of the more permanent character of the line? Yes, I think I was, and also for the following reasons:—When the estimates were made I had little or no knowledge of the country; but further enquiry as to the floods in the rivers crossed determined me not to risk the smaller spans provided in the original bridges, driving me in that way to adopt the iron girder for carrying the traffic.

5176. Did not the deviation at Latrobe necessitate a second crossing of the Mersey? It did; also some 400 feet of flood bridging adjoining the bridge, a long embankment over nearly three-fourths of a mile of flood waters, and further flood openings in that embankment; while the cost of the land for the deviation absorbed at the very least some £2000 of the excess, it being necessary to purchase town properties and much more valuable land than was required for the construction of the direct line, which was mostly a poor description of bush.

5177. Am I right in concluding, from what you have stated to the Commissioners, that the extra cost of the line arose from the action of Parliament in deciding that the extension to Formby should start from the original terminus of the tramway line? Solely.

5178. Do the papers which you have furnished to the Commissioners show in detail the increased cost of this deviation over the originally surveyed line? They do.

5179. And can you state what the total excess amounted to? I have already stated—nearly £13,000.

5180. Does that amount include the purchase of land? It includes everything, and a liberal allowance for putting the spur into Latrobe in proper working order for the mere goods traffic.

5181. With regard to the deviation at Horsehead Creek,—did this shorten or lengthen the line? It lengthened the line.

5182. To what extent? No more than about eight chains.

5183. And did the actual cost of this bear out the estimate furnished you by the Resident Engineer,—that is, a saving would be effected, I think you stated, of £1500? The £1500 was the difference of estimates upon the two surveyed lines at the contract prices, and I am pretty certain that in the actual execution of the works that saving has not been lost.

5184. Are you not in a position to state definitely whether the actual cost of the deviation resulted in a saving equal to that reported to you by the Resident Engineer compared with the original survey? It is probable that there would have been an excess in the construction across the tide-way in the other line, as it is impossible to estimate closely for the amount of subsidence that would take place on the mud-flats, or the amount of puddling and pitching required.

5185. How did you propose to cross these tidal flats? Partly by solid embankment protected by pitching and clay puddle, and partly by several timber spans and the 10ft. culverts.

5186. Do you think there would have been any risk to the stability of the embankment across these tidal flats?—would there be any difficulty in maintaining the line across them? I think there would have been some difficulty in maintaining the line, and that consideration helped me to the decision to go around the head of the creek.

5187. How has this alteration affected the curves and gradients in that part of the line? It has eased the curves and steepened the gradient, but this is not serious, as it is limited to some 20 chains of 1 in 60.

5188. Did your original estimate of £120,000 include a sum for the purchase of the old tramway line? It did. A sum of £6000 had been previously arranged as the price between the Government and the owners of the property.

5189. And that amount you included in your estimate? I did.

5190. To what extent were you able to utilise the works of the tramway line in constructing the Deloraine and Mersey Railway? The old post and rail fencing was utilised by being strengthened and repaired in several places; a few iron pipe culverts have been utilised, and all the rubble bridges. The bridges over small creeks and flood ways have been renewed or replaced with solid embankments. The earthworks, of course, have all been utilised, but a considerable excess has been caused in this item by widening and repairing beyond the original amount determined upon for the extent of the same. The estimate given by Mr. Human as to the quantity of ballast required, viz., 6 inches in depth throughout the line, was relied upon, as he was engaged for many weeks in the examination of the works; but it was found quite impossible to do with this small amount, owing to slacks and inequalities in the original road which had to be dispensed with.

5191. What was the original formation width of the tramway? The cuttings were about 9 feet; the banks, allowing for the rounding of the edges by the action of the weather, would be about 11 feet. I know that in the estimate of cost incurred by the original contractors a sum was included for widening the banks, thus indicating that the probable original width of 9 feet had been increased to the 11 feet as estimated by me.

5192. What width did you adopt in constructing the railway line? Thirteen feet for the cuttings and 14 feet generally where the banks were widened. Where the embankments were very shallow they have not yet been widened—by very shallow I mean from 2 feet to 2ft. 6in.

5193. Previous to negotiations being entered into between the Government and the Company for the purchase of the line, did you advise the Government as to the value of the works on the tramway line that could be utilised in the construction of the railway? It is shown in one of the papers that I have handed in to the Commission. I estimated the value of the work to the Government at £17,000—the cost having been some £53,000 originally.

5194. Then, are you of opinion that in purchasing the tramway line for the sum of £6000 the department received value for that amount in the works which were utilised in the construction of the Mersey Railway? Most certainly; the price was very low.

5195. Will you now shortly state what steps were taken in connection with tenders for the construction of this railway? Upon tenders being called for construction, the lowest was found to be slightly below my estimate, but the contractor withdrew and forfeited his deposit of £500. The next, some £5000 higher, was given up because the contractor declined to fulfil certain conditions upon which the acceptance of his tender was based, while the third, which was some £11,000 above my estimate, was submitted for favourable consideration, with the alternative of inviting tenders for the work in smaller contracts. This third tender, viz., that of Messrs. Fergus & Blair, was eventually accepted upon their offering to reduce the amount by £7500.

5196. What was the amount of your estimate for the contract work? £83,000.

5197. And what was the amount of the tender ultimately accepted? £94,000 was the amount of the amended contract. The first tender was £101,579, and that was reduced £7500 by special arrangement.

5198. What was the total amount actually paid to the contractor in final settlement of the contract? £100,944 9s. 2d.

5199. That is, in round numbers, about £6000 in excess of the tender? Yes.

5200. Will you state to what you attribute this? Largely to the increase in earthwork. Many of the slopes before opening up appeared to have surface rock of a hard character, but when opened up were found so decayed that it was necessary to flatten the original slopes. The accompanying papers, prepared some little time before the final measurement and statement of account with the contractor, will show in detail, on each section, the cause of much of this excess. The earthwork on the old tramway was a large cause of this excess.

5201. I observe, amongst the items in the statement you have handed in, the sum of £5220 under the heading of "ballast"—will you state how this excess arose? Owing to the much larger quantity required upon the old tramway. A much larger quantity of earthwork and trenching was also required, and the flattening of the slopes referred to already. An excess of nearly £300 is also due to a slip near Horsehead Creek, owing to the subsidence of the underlying ground, and several hundred pounds extra was also spent in altering arrangements for the station at Formby, and removing the goods shed from the originally designed position to that now occupied.

5202. In preparing the schedule of quantities upon which this tender was based, did you act upon the information given you by Mr. Human in respect to the available ballast on the tramway line? No, I was guided by the estimate made by the Resident Engineer, who prepared the quantities for me.

5203. Then did the result show that the Resident Engineer had under-estimated the quantities of available ballast on the tramway line? A large quantity of the ballast on being opened out by removal of the old heavy sleepers was thought to be of inferior quality, and an additional quantity of good ballast was therefore substituted.

5204. Did you alter the grades of the tramway line, or did you adopt the same formation level? We practically adopted the same levels, only, as I before stated, taking out the slacks.

5205. What has been the total cost of the line, including all expenditure for land, rolling stock, supervision, stations, &c.? The total cost, when all accounts are finally adjusted, will be closely £190,000.

5206. Would you state shortly the principal items in which the excess of cost has arisen, as compared with your original estimate, and the cause of such excesses?

SPECIAL Items of Excess in Cost.

	£	s.	d.	£	s.	d.
Substitution of Concrete and Iron for Timber in Bridges—						
Bridge over Meander River at Deloraine (0m. 7c.)	2599	0	0			
Bridge over River Mersey at Kimberley's Ford (16m. 8c.)	1796	0	0			
				4395	0	0
Latrobe Deviation—						
Excess of cost of Line from Latrobe Station (30m. 2c.) to Tarleton (31m. 38c.) above estimated cost of direct Line from Sherwood (28m. 50c.) to Tarleton	8550	0	0			
Extra work due to changing Line from Sherwood to Latrobe Station to form part of Main Line.....	4343	0	0			
				12,893	0	0
Additional Stations and Station-yard complete—						
Chudleigh Road	877	0	0			
Whiteford Hills.....	912	0	0			
Railton	1824	0	0			
Tarleton	799	0	0			
Spreyton	891	0	0			
				5303	0	0
Additional Works on old Tramway, not omitted as intended—						
Side-cutting and benching.....	2948	0	0			
Ballasting	2894	0	0			
				5842	0	0
Additional Accommodation Works—						
20 private crossings	788	0	0			
7 Masonry cattle-creeps.....	1068	0	0			
Siding at Kimberley	163	0	0			
				2019	0	0
Cost of land and charges above Estimate .....	...			5453	0	0
Cost of rolling stock	23,511	0	0			
Less provided by Estimate	12,000	0	0			
Additional cost.....	11,511	0	0			
				11,511	0	0
Maintenance of Line, telegraph signals, furniture, &c. not included in Estimate .....	...			2000	0	0
				£49,416	0	0

The last figures are subject to variation, because even yet they are not finally completed. The balance of excess is due to increase in quantities and the rise in price of labour in this Colony, which is generally admitted to be from 25 to 30 per cent.

FRIDAY, APRIL 2, 1886.

PRESENT:

The Hon. WILLIAM AUSTIN ZEAL, M.L.C., Chairman.

HENRY CHAS. STANLEY, Esq., C.E.

ARTHUR WILLIAM LAWDER, Esq., C.E.

THOS. C. JUST, Esq., Secretary.

MR. J. FINCHAM, *re-examined.*

5207. *By Mr. Stanley.*—In explaining the statement of excess of cost in the Mersey line yesterday, I think you stated that a considerable amount—something like £3000—is due to extra ballasting. Is that so? On the old tramway, yes.

5208. I notice, in referring to Mr. Human's report dated June 6, 1875, he points out that the ballasting on the old tramway was very deficient, and in fact in his opinion it would be necessary to re-ballast the whole line. With this information before you, did you not consider it necessary, in preparing your scheduled quantities, to provide for the re-ballasting of the tramway throughout? I knew that there must be a large quantity of the old ballasting that would come in, and not having any opportunity of examining the tramway works in detail, as was done by Mr. Human, I was satisfied to take his estimate of what would be required, which you will find is an average of 6 inches deep and 9 feet wide for the whole line. Mr. Human's report does not to my mind mean that the ballast in the old tramway would be thrown away, but merely indicates the additional ballast to be provided for.

5209. But he states in his report distinctly it would be necessary to re-ballast the whole line, giving as a reason that the sleepers have never been lifted and raised above the formation? That is so to some extent; but still there was a large amount of ballast between, and in some places above, the sleepers which was available.

5210. How were the contract drawings and scheduled quantities prepared for this line? Under my directions, by the resident engineer for the railway.

5211. That being the case, do I understand you did not consider it necessary, in preparing the scheduled quantities for ballast, to provide for re-ballasting the line in accordance with Mr. Human's report? In preparing the contract quantities I ignored Mr. Human's recommendations altogether, and adopted the quantities which Mr. Creswell thought might suffice. It was clearly impossible to arrive at any close estimate of the amount of ballast that might become available, as in places some might be lost when taking out slacks.

5212. I observe from the schedule of quantities attached to the contract there is a quantity of 2597 cubic yards of ballast provided for the old tramway line. This, at the contract schedule rate, would amount to £799 2s. From the return you have shown of actual cost it appears that £7938 has been expended under that item. Will you explain this very large deficiency? The total sum provided in the contract in connection with the ballast amounts to £4240. As an addition to the item you have mentioned there is one for providing top ballast at per chain, amounting to £2710.

5213. But that applies to the whole line, not to the tramway section? The schedule is divided into three. The £2710 applies solely to the old tramway, or section 2.

5214. In stating, as you did yesterday, that the balance of excess in cost was due to the increase in quantities and the rise in the price of labour, how much was due to the first of these causes? It is shown very approximately in detail in the return furnished the Commissioners yesterday.

5215. I presume the excessive quantities is a matter that can be determined exactly by the quantities actually executed and those scheduled? It could be got out, but the bulk of the excess to which I referred yesterday is due to the general increase in the price of labour in the Colony.

5216. In the first place I want to arrive at the amount which you consider is due to the increase of quantities? The resident engineer will be able to get that out exactly.

5217. Can you state it approximately? I cannot from memory, but it would be small in comparison to the other excess referred to.

5218. Referring to the second cause of excess mentioned,—that is, the rise in the price of labour in the Colony,—your original estimate was £120,000: speaking roughly, how much of that amount do you suppose would be affected by the price of labour? Taking only items affected by the cost of labour in the Colony, and taking the original quantities only, the cost for labour at 25 per cent. increase would be between £11,000 and £12,000; but as the original quantities in many respects have been increased, some addition should be made to that sum to arrive at a fair total.

5219. But I understand from this return showing the special items of excess of cost that you have taken credit for extra works not originally contemplated when you prepared your preliminary estimate? In my last remark I referred only to general items particularly excluded from the statement I referred to, as earth-works, clearing, and so on, none of which items, the Commissioners will observe, are in the statement. I put down the increase in the cost of labour at £15,000 as a fair and reasonable figure.

5220. Upon this basis it would leave an amount of nearly £57,000 balance of cost as due to increase in quantities? Pardon me, some £49,000 is due to special items not included in the estimate, leaving a balance of about £6000 due to increase in general items not included in the return.

5221. But seeing that you have taken credit for all the extra works not originally contemplated, and also for the rise in the price of labour, does not this amount of £6000 seem a very large amount for increase in quantities? It was distributed over the whole works, and I do not think it is excessive on 37 miles of line.

5222. Will you state what led you to adopt the present station site at Formby? The exorbitant prices asked for some adjoining allotments on which I proposed to erect the station. I had obtained the approval of the Government to my proposal for the erection of the station offices upon the land referred to, but when I found that the prices ranged from £700 to £1000 per acre, I asked the authority of the Minister for placing the station in its present position.

5223. But does it follow that because these excessive prices were asked that the department would have to pay them? It does not follow that they would have to pay the whole; but the present position of the station is, I think, more convenient, in view of the extension of the line, than the site originally proposed.

5224. But in view of future development of the traffic on that line, does it not strike you that the station may become a very cramped and inconvenient one to work, being bounded on one side by the street and having on the other the river bank? It has always been regarded by me as temporary. In the near future no doubt much more extensive accommodation will be required, and can be easily afforded at a point just beyond the present terminus.

5225. But will not that result in spreading the station works over an inconvenient length of line? The station yard proper could be wholly transferred to the proper site. There would be no occasion to remove the engine-shed from its present position, and a portion of the present station as regards siding accommodation would in any case be necessary, as the railway wharf must always be in its present position owing to the advantages it affords in being out of the reach, to a large extent, of the rapid currents of the river.

5226. Do you then propose to remove both the goods shed and the passenger station, when the traffic warrants it, to the site you speak of? I think it will be a necessity. The present site has always been regarded as a temporary one, both by myself and the Minister.

5227. At what distance from the present station on the extension survey does this site occur? Within a quarter of a mile; about 15 chains.

5228. The Commissioners observed in travelling over the Mersey line that no signals have been provided. Is it not your intention to provide these at any of the stations? They have either been made, or are now being made, for each station on the line.

5229. What do you intend to provide in the way of semaphores? I did not propose to provide any at the intermediate stations. They are being constructed at the workshops of the traffic department. I suppose they will only use the simple home signals.

5230. You mean one double semaphore provided at each station? I suppose so.

5231. This work is not being done under your department? No, under the traffic department; the cost being charged to the contract vote.

5232. Have you taken credit for this in your estimate of excess of cost? It is charged as one of the items.

5233. Then am I to understand that it is not your practice to provide in your estimates for the erection of semaphores? It has not been my practice to do so in the estimates I have made within the last two or three years.

5234. We also observed that few, if any, of the stations are provided with name-boards; do you not think them necessary for the convenience of travellers and the public? Yes, I think so, but not having been asked for them I did not volunteer to provide them.

5235. Where were the iron girders constructed that were used for the bridges on the Mersey line? In England.

5236. Do you consider them satisfactory in every way? The work is excellent.

5237. Did you prepare designs, and were the strains taken out in your office? Yes, by the resident engineer.

5238. Then I presume you satisfied yourself that the girders were in every way suited to the load which they have to carry? They are strong enough to carry much heavier engines, with the greatest safety, than now pass over them.

5239. Can you state from recollection what these girders cost per ton delivered in the colony? As nearly as possible, £21 per ton, but I think that too much, their cost f.o.b. in England being some £14. The difference was due to very high cost of freight, insurance, &c., which amounted to a sum of something like £7 per ton.

5240. What do you suppose such girders could now be landed in the colony for? I do not think they would exceed £18 or £19 per ton.

5241. What price was paid to the contractors for carriage and erection of these girders? £7 per ton.

5242. Did that include carriage to site? Yes.

5243. Then do you think £25 per ton would be a reasonable estimate for the purchase and erection of similar girders, at the present time? I think so, certainly; and I should be safe in saying that girders of suitable, but rather more simple construction, could, without doubt, be fixed in place at £25 per ton. The circular ends and general construction of the girders would be perhaps a little more expensive than the plain girders made for the other lines.

5244. Would the girders as erected on the Mersey line be suitable for a joint road and railway bridge such as you are erecting in other places? Yes, certainly.

5245. They would be wide enough and of sufficient strength? Yes, certainly.

5246. *By Mr. Lawder.*—What time elapsed between the preparation of the original estimate and the actual commencement of construction of the line? About 2 years.

5247. The credit you take in your evidence for excess of £15,000 due to increase in the price of labour—are the Commissioners to understand that you estimated to that extent below the actual cost of labour during construction? Generally; it is well known a rapid rise took place in the price of labour within the two years I have stated, and that would be confirmed by all the farmers and contractors here.

5248. Would that account for the amount of tender sent in by Messrs. Fergus & Blair being in excess of your estimate? No doubt it would.

5249. You have informed the Commissioners that other tenders were submitted at or near the amount you estimated? They were not taken up.

5250. But I presume the tenderers considered the question of rates of wages when they prepared their tenders? I dare say they did, and regretted their estimates, or they would not have withdrawn.

5251. Did all these parties withdraw their tenders? They did.

5252. Seeing that the tender of Messrs. Fergus & Blair was so greatly in excess of your estimate, did you not think it advisable to advise the Government to advertise for fresh tenders? I submitted a statement to the Government at the time the tenders were under consideration, in which I stated shortly that the first two tenders being, as it were, out of court, the reputation of Messrs. Fergus & Blair being good, it would be a relief to me if they could see their way clear to accept that tender, but failing that I stated that I would advise them to divide the work into smaller tenders and re-advertise.

5253. How was it that you did not at first provide for the cost of several stations for which you have taken credit in the statement of excess of cost over your original estimate? The Railton station, which is the most expensive one, was omitted from Mr. Human's estimate, and as that was the basis on which I worked, it was overlooked. The others were stations that were not thought necessary at the time, but afterwards urged on the department, and being recommended by me, were provided for by the Government.

5254. Did you from time to time, or at any one time, submit a statement to the Government showing them clearly that they would be liable for these extras over and above the original estimate? I submitted no estimate at the time, but they were, of course, aware that these extra stations which were considered necessary would help to swell the excess.

5255. Were they made officially aware at any time during the progress of the work that they would also be liable for considerable excesses for the different items noted in the statement placed by you before the Commissioners, such as Latrobe deviation, additional accommodation works, to a superior class of bridges, and additional cost of railway stock? They were made aware generally in the report which was

submitted to Parliament, but it was impossible for me on that date to supply the closer information now submitted to the Commissioners after the actual completion of the works.

5256. Then are the Commissioners to understand that the expenditure for these additions and alterations rested with yourself, subject to the after sanction of the Government, or had you any special sanction or official approval for them previous to their being carried into effect? The Government were advised before the contract was entered upon that there would be a considerable excess to be provided for.

5257. Were they supplied with any details or merely a general statement? A general statement only.

5258. Can you inform the Commissioners if the £6000 for the purchase of the tramway is included in your original estimate? It is.

5259. Is credit taken for any rails or other property obtained by that purchase which may have been subsequently made over to other lines? A credit of £1700 being estimated for, the old permanent way was taken in the original estimate for section 2, namely, the old tramway; and a note was put upon the same estimate that any land required on section 2 beyond what was transferred from the Mersey Tramway Company was not included in the estimate. Certain lands had been occupied for the purposes of the tramway without the purchase having been completed by the tramway owner, and at the time the estimate was made I had no means of finding out what the cost of this might amount to.

5260. I allude more particularly to materials purchased as part of the tramway which, being since transferred to works other than those of the Mersey and Deloraine railway. Have you given credit to this line for the materials so transferred? To some extent. No credit has been given for permanent way material taken from the Mersey line to the Parattah branch, but I am pretty certain it has been for small quantities that have been sold. No credit has been taken for the locomotive, but it was altered and repaired out of the vote of the contract for the line, and is now in general use.

5261. By the traffic department? Yes, and is not confined to the Mersey line.

5262. With reference to the Formby station, you informed the Commissioners that it is proposed at some future time to transfer the passenger station to another site. I understand this site will be partly on the present bank of the river and partly formed by an embankment at a point in the river at some distance—about a quarter of a mile—beyond the present turntable. Do you not think it would have been preferable in the first place to have taken the line at some distance from the river bank, on the flat ground now occupied by some buildings, even at the cost of £1000 per acre, rather than have to reconstruct some of the present station buildings along the river bank, and close out from the town more of the foreshore than it now occupies, such inclosure being in the way of accommodation for shipping, wharves, wharf-sheds, and service roads? The present position is far more suitable in view of the extension to the Leven. The proposal as to a new site for the station is a mere suggestion at present, as I have not had time to think the matter out; but most certainly it will not interfere with the shipping or wharfage, as vessels alongside any wharf at the new site would lie in a very strong current. We do little real damage to the Esplanade, as in connection with the extension we are about to secure a width of at least one chain or upwards between the railway and the private property. The really best part of the Esplanade, which is now being improved by the local authorities, is beyond any point where it would be affected by the railway. This portion is a nice grassy sward, whilst the railway occupies a shingly beach.

5263. Will this Esplanade be affected by the extension to the Leven? Only where it consists of shingly beach.

5264. Will it cut off the foreshore from the town? It need not do so, as I see no necessity for fencing the line at this portion; and even if fencing be demanded, frequent wicket gates, as in the case of the foreshore passed along by the Main Line Railway in the Hobart Domain, will meet the demand.

5265. I presume the price of land in Formby is increasing as the town advances, and in the event of its being found desirable at a future time to remove the railway further into the town and away from the river bank, the price of the land will be much more than at the time when the line was constructed? That is a contingency that is not likely to occur. If the extension is constructed as now marked out certainly the best place for the station is where I have indicated, and not the present one.

5266. That is on the present alignment? Yes.

5267. The Commissioners noticed on their inspection of the line, that the Whitefoord Hills Station is placed on a grade of 1 in 50, and that the spare sidings were taken up on a sharp curve to the east and opposite the station buildings to obtain a level grading.

5268. Do you consider it safe, from your experience as an engineer, to stop a train upon a grade of 1 in 50? Yes.

5269. Under the circumstances of breaks getting out of order or failing to act in any way, would this not be a dangerous place? It would be dangerous for breaks to get out of order in any steep place while a train was travelling.

5270. Or from any carelessness of the guard, or any accident happening while shunting waggons? I may say that the station is a necessity, considering the importance of the surrounding district. It was impossible to arrange a level there, and the plan is that recognised by the New Zealand Government under similar conditions. Only the passenger platform is on a grade; the goods yard is on a level.

5271. I note that the gradient 1 in 50 exists for some distance on each side of that station; but the country being more or less flat, would it not have been possible by putting in an S curve to have got a level grade for the whole station yard? We have got a station yard on a level, but the approaches to it in the way indicated would have been very unsatisfactory, owing to the rough nature of the ground, even if it were practicable.

5272. But the country seems to be fairly level. Did you endeavour to put in an S curve? I had the ground tried with that end in view.

5273. *By the Chairman.*—We noticed, in proceeding up the line, that what is called the third rail has been laid on certain portions of the Launceston and Western line, for the purpose, it has been alleged, of using the existing rolling stock. Can you explain why that plan was adopted, and whether the laying of the third rail gives any reason for the estimate being exceeded? No; the cost of laying the third rail was an entirely separate thing, and the cost has no connection with the Mersey and Deloraine Railway. A separate vote was obtained, and the work was done entirely by the traffic department, under the direction of Mr. Leonard Dowling, the Assistant Engineer, and I merely acted as Consulting Engineer in the matter.

5274. Did you express any opinion as to the advisability or otherwise of laying the third rail? I cannot remember, but I am sure I always considered it a necessity, to avoid transshipment at Deloraine. Had it been practicable I should have preferred to have seen the whole line converted to the narrow gauge at once.

5275. Why was it not practicable? I refer—I suppose I must say—to political reasons, the influence of holders of the original stock, and partly to the objections to spending a large sum of money in the substitution of narrow gauge stock for the broad gauge stock, and selling the latter, instead of gradually converting some of the broad gauge stock for the narrow gauge traffic, as is now being done.

5276. Then you attribute one of the reasons, if not the main reason, of the present system to a question of public policy? That is my impression.

5277. What was the reason you determined to use piles in those three bridges crossing the Mersey, instead of a more permanent sub-structure? Solely scarcity of means; but I took care to so arrange the width of the piles apart that at any future time concrete or masonry piers might be built without disturbance to the traffic.

5278. Would it have made a very great difference in the cost of these bridges if you had used cast iron cylinders instead of concrete piers? It would have cost considerably more, no doubt.

5279. Generally, what extra price per bridge do you think it would take? I cannot guess the amount. That was considered at the time the designs were made.

5280. The question was considered by you? Yes, at the time the designs were made.

5281. And the cost appeared so great that you declined to undertake it? It was so. The piles will be good for 25 or 30 years to come.

5282. Are you satisfied of that? Quite. The old piles removed in pulling down the original bridges were, almost without exception thoroughly sound, after being in the water some 17 years.

5283. Are the piles used in this bridge the best indigenous timber to be found? They are peppermint, a wood that we consider the most lasting in such a position.

5284. Are they from the district? From the district. The contract provided for blue-gum piles, but when I found that sound peppermint piles were available in the locality I was glad to make the substitution.

5285. Were the reasons which led you to arrive at the desirability of using wood instead of iron financial ones, and that a saving of interest on the first cost, if formed into a sinking fund, would renew the structure at any future time? No doubt, because I am convinced it will last for 25 years.

5286. Did you state that you approved of the line of railway going through the town of Latrobe rather than by the route originally surveyed by the Department? No, I did not. I think the right course for the railway would have been on the direct line from Sherwood to Tarleton. I would have done away with the spur into Latrobe, and made a large and efficient station at Frogmore.

5287. But how would that have affected the residents of Latrobe? It would have been nearer to the generality of the residents than the station at Hobart is to the general residents there.

5288. Would the line between Latrobe and the proposed site of the station on the original line have passed over any flooded or dangerous ground? During exceptional floods passengers to the station would have to drive through perhaps 12 inches of water on a hard metalled road; but had the station been made at Frogmore it is pretty certain some provision would have been made to avoid the inconveniences to which you have referred.

5289. Would it be an ordinary or extraordinary flood to give that depth of water? Extraordinary.

5290. How would the road be affected with ordinary high floods? Ordinary high floods, I believe, just leave the road with scarcely a wash.

5291. If that line had been constructed would it have afforded a better means of getting down the north-west coast and inland, or does the present line offer facilities equal to the other line? I think they are about equal.

5292. Coming to the station site at Formby, have you ever considered the desirability, in view of the position of the railway on the esplanade, of reclaiming a portion of the foreshore of the River Mersey for purposes of extension? Do you refer to widening along the eastern line?

5293. Yes, reclaiming portions of the foreshore for railway purposes? No; I think it would be costly, owing to the steepness of the banks of the river. Reclamation can be done more easily beyond the terminus of the railway at the spot I have indicated as the probable site of the new terminus.

5294. The Commissioners are informed that the Government contemplate removing the bar of the Mersey, and making Formby a first-class port. In the event of that being done, would it not be desirable to have more extended wharfage provision in connection with the existing railway? That is already being arranged. The best site for the wharf is where it is now built. We had a vote passed during the last session of Parliament for extending the wharf and connecting it with the railway station yard, and the work will be proceeded with almost immediately.

5295. Then you are satisfied, so far as you can at present observe, that the railway requirements at Formby will be amply met? I think the provision is quite sufficient with regard to general station accommodation for the present purposes. Further accommodation is wanted in connection with the railway wharf; but, as I have already stated, that is about to be supplied.

5296. Are there any other remarks you wish to make to supplement the evidence you have already given? I think not.

5297. *By Mr. Stanley.*—I understood you to say, in reply to the Chairman, that the reason you had for approving of the laying of the third rail between Launceston and Deloraine was that the immediate alteration of the gauge would have necessitated the purchase of a large quantity of new stock? Yes.

5298. In view of railway extension and the new lines the Government was contemplating at that time, do you not think that it would have been cheaper in the end had sufficient narrow gauge stock been purchased to enable the alteration of the gauge to be effected at once, and for the wide gauge stock to have been converted afterwards for use on the new lines? Only a portion could have been so converted. The engines would have all been useless; and at the time the conversion was spoken about enquiries were made with a view of seeing if a sale could be effected in the other colonies, but the enquiries resulted in our being advised that there was little prospect of that. Seeing that so much stock would be lying idle, I coincided with the proposal that the line should be worked as a mixed gauge, and the broad gauge stock gradually worked off.

5299. But, as a matter of fact, is not a large portion of the rolling stock (I do not refer to the engines) now been converted to the narrow gauge? Some portion.

5300. What is it intended to do with the wide gauge engines? To work them as long as there is broad gauge stock to run.

5301. What did the laying of the mixed gauge cost? With the alterations necessary to platforms in stations, about £20,000.

5302. In view of the cost, are you still of opinion that it would not have been cheaper, seeing that additional stock was required for the new lines, to have altered the gauge at once and purchased the necessary narrow gauge stock and disposed of the wide gauge engines afterwards as opportunity occurred? I am unable at the present moment to give an estimate of the cost of the new narrow gauge stock to work the traffic taken by the broad gauge. The matter was long discussed in Parliament, and the plan now being carried out was decided upon. The matter rested far more with the late manager than with myself.

5303. You have provided in your estimates for the new lines considerable sums for the purchase of rolling stock, have you not? Yes.

5304. Could these sums of money not have been made available for the purchase of the necessary stock for this line in the meantime, and so have avoided the expenditure of £20,000 which has been incurred in laying the third rail? No, they could not have been made available. If you refer to the Derwent Valley and Fingal lines, the stock has not arrived yet.

5305. But if an amount of money was provided in your estimate and covered by a Parliamentary vote for those lines, could not that money have been made available for the purchase of the necessary stock for equipping the Western Railway? Possibly, by the authority of Parliament; I should have had no power to purchase stock out of a vote for a purpose outside that vote.

5306. Still, I presume, with the authority of Government, such a transfer could have been temporarily effected? It might have been done, but I should have strongly opposed it, on account of the difficulty there is in getting our small orders for locomotives executed within a short time. The estimate upon which the orders for rolling stock was framed was cut down to the lowest possible point, the late manager giving his estimate for a service of only one train each way per day.

5307. *By Mr. Lannder.*—In the event of it being possible to do without the third or extra rail upon the Launceston and Western Railway—that is, the outer rail—can you utilise that rail in the construction of any new railways? No; I propose to utilise it in renewals of the narrow gauge upon the Launceston and Deloraine section. No further purchase will now be required for maintenance for many years to come.

5308. Would not that lock up a considerable amount of capital for many years? The rails are some 75 lbs. per yard, and I should not care to mix them with rails weighing little more than half that weight, which is our standard.

5309. Could you not dispose of these rails with economy? No; it would be far cheaper to preserve them for purposes of maintenance.

5310. What would you get per ton for such rails if sold in the other colonies or to the public? We should not get more than an average of £3 to £3 10s. per ton, as many of them are very much worn and damaged.

5311. What is the cost, then, of your new rails—the 45 lbs. to the yard? They would average, with expenses, from £8 to £8 10s. That would include freight, insurance, inspection, and other charges.

5312. That is to say, a little more than double the price per ton you could obtain for the old rails? Yes.

5313. And the tonnage of the same length of rail would be not quite half as much again? Yes.

5314. So, for very little more money than you could obtain for the old rails you could obtain new rails? Yes.

5315. Would that not be worth doing, instead of keeping capital locked up in a great number of worn-out rails? I would not care to put old worn-out rails on new railways, and other circumstances have to be taken into consideration, such as the cost of plate-laying.

5316. You hardly understand my question. I was saying that by selling the old third rail on the Launceston and Western Line you could get sufficient money, within a narrow limit, to enable you to

purchase new rails for your extension of new lines, and thereby save the interest upon a certain amount of capital which would be locked up were you to keep this third line in reserve for repairs upon any one line for a number of years? That is all very well if we could get a purchaser for them, but I think there would be some difficulty about that; and we could not use any of the lighter rails—that is, 42 lb. rails—in repairs on the Launceston and Western section. We are now committed to a rail of at least 60 lbs. per yard.

5317. For that line? For that line.

FREDERICK BACK, *examined.*

5318. *By the Chairman.*—What is your present position under the Government of Tasmania? Manager of the Government Railways.

5319. I understand that you have only recently been appointed to that position? Yes, I only arrived last month.

5320. You had considerable experience in New Zealand in a similar capacity? Yes, I was connected with the railways there for many years in various positions, and then some 16 years as manager.

5321. From the limited time at your disposal up to the present date, what is your opinion as to the mode of working and carrying on the railways in this colony? Do I take your question to apply to the method of working the traffic?

5322. Method of working traffic, and the mode in which business is carried on? As you are aware, I have been here but a very short time; but the impression I have formed or received is that everything is of a more or less tentative nature, and that a considerable amount of expenditure will be required over the lines to bring them up to the standard of what I should like to see them in under my charge.

5323. I presume, having had only a short experience of these railways, you are considering your plans before forming a definite conclusion? I have so far formed a definite conclusion that I am satisfied that to work the railways satisfactorily, with safety as a first consideration, we will have to improve the equipment of the line, and make sundry alterations. All the information I require I have not yet been able to obtain, and it will take a month's hard work to enable me to place before the Minister the whole of my views upon the subject. I may say I have already applied to him for a small sum of money for one of the more important adjuncts to safety, and he has consented to all I have asked, so far. I have also informed him that I intend to ask for many more things, but it is no use going on piecemeal. I have only asked for some money for locks at points and stock locks, which I found to be necessary.

5324. As to the mode of working the railways, we notice a general absence of signals and means of reporting trains arriving at stations. Is there sufficient provision made in this respect? I consider we shall require a considerable increase of the signalling arrangements. At present the arrangements are defective, and every one of the semaphores is imperfect in construction—so much so that the rod by which the arm of the semaphore is set is in the wrong direction. It is not weighted, but there is a ratchet fixed by a pin, and if the pin comes out by any cause the arm drops and gives the clear signal. The whole business here has been a very small one, and I think, as I said before, has the appearance of a tentative business altogether. I doubt very much if many of the present staff would understand how to work better appliances if they were placed in their hands. It would be a question of training.

5325. Have you inspected the accommodation provided on the lines, and reported on its suitability? Yes, I have. As I said before, this forms one of the subjects upon which I will report in the way I have just mentioned.

5326. Do you find that any considerable outlay will be required to put these railways into perfect working order? To get them into the state I would like to see them in as manager, I should say yes, because I should completely reconstruct many of the stations.

5327. But, assuming that funds cannot be provided to carry out your views in their entirety, have you considered any alternative plan? Then all I can do is to make such provision for safety as the circumstances of each individual case may make necessary and the means at my disposal permit, much in the same way as you would work a crippled train. In the event of appliances being faulty or insufficient, I would have to take all necessary means to ensure safety, as if the road was defective or a train crippled.

5328. Have you made any estimate of the total cost of the improvements required or necessary? No, I have not yet had time, as up to the present I have been merely inspecting the lines.

5329. I presume you would like to have more experience of the working of the railways before making such an estimate? I could not attempt to give any figures under at least a month. It means quite a day at each station, besides inspecting all the different side stations, and the whole thing going through, systematically.

5330. Are you satisfied with the manner in which the officers perform their duties? I have had very little experience yet, and in so short a time it would be very difficult to say. I find amongst the subordinate officers there appears to be a want of experience that will be overcome by time. They are certainly exceedingly zealous, and do the best they can under very difficult circumstances. The different officers deserve credit for having carried on so well.

5331. Of course the Commissioners, in accepting your answer, take in view the fact that you have been only a short time here, and it would not be right to expect such definite information as if you had lived in the colony a long time, you may therefore speak on the understanding that your answers are such as you can give after a short experience? Well, speaking in a general way, the alteration that I should first go in for effecting would be proper siding accommodation, the removal of all such things as goods-sheds from the Main Line, a proper system of signalling, and providing a more comprehensive rule book; in fact

generally to get the whole system of working the line into what I consider a safe one, and, at the same time, an economical one.

5332. And to re-arranging the working in accordance with modern experience? Undoubtedly, yes.

5333. Would you be able to add anything to your evidence in the shape of a statement? It would take a considerable time. The only thing I could do would be to forward the same report as I shall have to make to the Minister, without having the time and opportunity to do it. At present all I have been able to do is to obtain a sort of general knowledge of what has been done here, and issue a few orders which I considered absolutely necessary for safety.

5334. The Commissioners feel the difficulty of your position, and would not have called upon you for any evidence but from the fact of your being the head of a department, and it might have appeared that we were acting in a discourteous manner towards you in not asking you to give us your views. We are quite sure your evidence will be taken in the manner in which you intend it to be taken, that is in the light of the little time you have had to form your judgment? I think I have answered the questions as well as I was able under the circumstances.

5335. *By Mr. Stanley.*—So far as your experience has gone here, is it the practice to consult your department in respect to the station arrangements on new lines? I really cannot say what has taken place. I had an interview with Mr. Fincham, who expressed his willingness to do so in future, and in all my suggestions met me very fairly.

5336. I presume that you ought to be consulted, as the matter would affect the convenient working of the line under your charge? Undoubtedly. It is always customary, I think, for the man who works the railway to have a say in its equipment.

5337. Have you had any station plans connected with the new lines, such as the Fingal or Scottsdale line, submitted to you? No, I have not seen any plans.

5338. How far do you think it would be necessary to provide semaphore signals on lines such as the Fingal and Mersey lines? I have only run over the Fingal line once, and my attention was taken up by the road; but I may say (though I am hardly in a position to say it) that a proper system of junction signals are certainly necessary; and I noticed at a station called Avoca (I am hardly in a position to call the stations by name) there were no signals at all.

5339. Was your attention drawn to the position of the Avoca station? I noticed it was rather extraordinary to have a station on a curve.

5340. Should you not consider that a very necessary place to be protected by signals? Yes; indeed that is the reason for my mentioning it as one of the facts that came under my notice.

5341. With regard to the Mersey line, I presume in stating you intend to have signals placed at the stations you refer to the principal stations only, and not to platforms? I should consider that to have perfect safety there should be distance signals between Launceston and Evandale.

5342. I refer to the Mersey line? There is an absence of signals altogether. It would be difficult for me to say, without going over the line more in detail, what I should think was required, but taking it generally there should be signals at all junctions and crossing stations, and all signals are useless unless constructed according to system and worked according to system. Circumstances alter cases. The distance signals, which offer a perfect defence, are required in places, and side signals are all that are required at other stations.

5343. I take it that you mean that the system of signalling should be altered to meet the requirements of each station? Yes, and as the traffic increases, so probably would a necessity for increased signals arise.

5344. Do you not think it necessary for the convenience of the travelling public that name-boards should be provided at the various stations? Yes; I have written for authority to call for tenders for more boards at stations where they ought to be provided.

5345. From what we observed, that does not seem to have been done in the case of the line from Deloraine to Formby? No. I noticed the omission, and subsequently applied for this authority, as well as to have these charged against the construction in the same way as the locks and chock-blocks.

5346. You consider the absence of locks and chock-blocks at the different sidings somewhat extraordinary? It would be hard to find an expression strong enough to convey my opinion upon the subject.

5347. Is it not usual to have them? I have often dismissed a man for leaving his chock-blocks open, and for leaving the points unlocked. In fact, it is a rule elsewhere that if a man leaves them unlocked he is dismissed.

5348. I inferred from your answer to a question from the Chairman that you object to the system of placing a goods shed or other structure on the main line? I consider the system unsafe to begin with.

5349. Has that been done in many places on the existing line? Yes, I noticed it in more than one place. For instance, at Perth the goods shed is on the main line where the better plan would have been to run it from a siding.

5350. Is that the case at any station beyond Deloraine? I hardly remember. At Parattah I noticed the goods shed was on the main line, and that waggons had to stand there to unload, and with no system of signalling trains in, there is considerable risk of running into waggons or anything else that might be on the road.

5351. At one station on the Mersey line—Whitefoord Hills—the station is placed on a gradient of 1 in 50: do you think this an objectionable feature in a line from a traffic point of view? I consider it is a very risky thing to do; but if a station is necessary there a site should be made up. I do not think I ever saw a station on a grade of 1 in 50. In England, 1 in 100 would be considered an exceedingly steep grade at a station.

5352. Might it not cause delay and inconvenience in starting a train? Undoubtedly.

5353. Are there other localities where stations have a grade of 1 in 50? I would not be quite sure, but it is something very like it.

5354. Then you think placing a station on a steep gradient should be avoided? Undoubtedly; in fact I do not know any place within my knowledge where I have seen a station at 1 in 50 before. If it is necessary to place a station in such places the ground should be made up.

5355. Are you aware what induced the Government to lay the third rail between Launceston and Deloraine? No, I have not the least idea.

5356. Do you think the working of a mixed gauge is expensive and objectionable? Both expensive and objectionable. I have had experience of working a mixed gauge before, in New Zealand, where we gave it up, and subsequently came to the conclusion that it would have been much better had we given it up sooner.

5357. Seeing that the cost of laying this third rail amounted to £20,000, do you think it would have been more economical in the end to have altered the gauge at once when the Mersey extension was carried out, had the Government obtained the necessary narrow gauge stock for that purpose, and afterwards converted the wide gauge stock, and disposed of the wide gauge engines? I cannot think there could be two opinions about it. Undoubtedly it would have been better.

5358. Had you been consulted, that is the advice you would have given? I should always oppose a break in the gauge.

5359. Have you anything further to add? No, only that I should like you to consider all my replies as having been made under very great difficulties, that is, as to local matters. I have only had time to run twice over the line, and during the fortnight I have been here my time has been taken up by office matters and other matters I consider initial to the alteration of system.

AUBREY WEEDON, *examined.*

5360. *By the Chairman.*—What position do you hold, Mr. Weedon, in the Public Service? At present I am Cashier and Manager's Assistant in the Government Railway Department, but I have been acting as Deputy Manager.

5361. How long have you been in the service of the Government of Tasmania? Seventeen years connected with the Launceston and Western Railway, and about fifteen years in the Government employ—the Government having taken over the line from the Company which constructed it.

5362. During that time how long have you been acting as Traffic Manager? For the last seven months—that is since the late Mr. Lord died. Before his death I acted for him when he had to go to Hobart or out of the colony.

5363. What was Mr. Lord's position during the whole time you have been connected with the railway? Accountant to August, 1872; manager from then to time of his death.

5364. And the system now in force was initiated and carried out by him? Yes.

5365. Generally speaking, did you approve or disapprove of the plan of working the line as it at present exists? Do you mean with reference to the two gauges?

5366. Yes, and as to the working of the line? I approve of it generally.

5367. I presume that the present plan is the outcome of the experience which you have obtained in working the very limited passenger and goods traffic here? It is.

5368. And that the deficiencies which may be found in this line as compared with more fully equipped railways arises principally from that cause? Yes.

5369. It has been pointed out to us that the Government railways are deficient in signals and station accommodation: what are the reasons why more elaborate provision has not been made? The station accommodation is simply a matter of economy. As regards the signalling, I am not aware that for our traffic it is deficient.

5370. With the exception of Longford station, your traffic is worked as a single service system? Yes.

5371. And at no place, other than Longford, do trains pass each other? Yes, at Longford, Westbury, and Deloraine trains cross.

5372. These are mixed or goods trains crossing passenger trains? Yes.

5373. Do you consider the present system of working the Launceston and Western Railway in connection with the Main Line Junction at Evandale a good plan?—does it work well? It works satisfactorily, yes.

5374. Previous to the death of Mr. Lord and your taking a more active part in the management, had he projected any alterations or improvements in the working of the line, or did you subsequently suggest anything? Not that I am aware of. It was not proposed to touch the present system of carrying on the work till after the abolition of the broad gauge. We have to run now to keep both gauges going.

5375. What is your opinion of the working of the mixed gauge? It is inconvenient.

5376. Is it economical or expensive in working? At present there is no material increase of expenditure.

5377. Is it intended to run the present old rolling-stock until worn out, or will the broad gauge be discontinued within a definite time? Within a definite time. It was originally intended to run them off, but it was found to be risky and inconvenient, and they will now be discontinued as early as possible.

5378. Have you ever had any accident resulting from the absence of signals or the protection usually observed in working trains? No, we have never had a serious accident on the line since it has been open.

5379. *By Mr. Stanley.*—Whilst you held the position of Deputy Manager, was it the practice to consult as to the station arrangements on new lines, such as the Deloraine and Mersey line? I was not consulted upon matters of construction.

5380. Not as to matters of station arrangements for working the traffic? As to working the traffic, the Manager would certainly be consulted; but it was all settled before my appointment.

5381. Can you state whether Mr. Lord was consulted in respect to the station arrangements? He was

5382. And as to the necessary provision for station accommodation,—the goods sheds, &c., for working the traffic? No, not in connection with construction,—I understood you to refer to the working of the traffic.

5383. No, I mean in the construction of the new lines? No.

5384. It has not been the practice of the Engineer's department to consult your department upon such matters? No.

5385. Did you or the late Manager intimate the necessity of providing semaphores? Yes, they are in course of construction now.

5386. The result of your representations has led to the signals being ordered? Yes.

5387. How far do you intend to apply these signalling arrangements to the Mersey line? Right through to Formby, on all the principal stations.

5388. Are any steps being taken to provide signals on the Fingal line? I am not aware.

5389. Is it the intention of your department to apply for signals to be erected at the stations on that line? I have not heard Mr. Back's views on that question. We have not taken any steps so far.

5390. Have you found the provision made for working the traffic on the Deloraine and Mersey line sufficient? Yes, with the exception of the rolling stock.

5391. I refer more to matters coming within the province of the Engineer's department,—station buildings and so forth? They have been sufficient for us to work with, but under difficulties. I mean to say that there are means for the practical working, as is demonstrated.

5392. Were you Acting Manager at the time the question of the mixed gauge was discussed? No.

5393. Who was? Mr. Lord was manager.

5394. Can you state whether he concurred in the advisableness of laying down the third rail on the Launceston and Deloraine line? He did.

5395. From your experience in the traffic management, are you of opinion that it was a wise and economical thing to lay down the third rail on that section of the line? I thought so at the time, but experience that has resulted has made me change my mind. Experience has proved that it was a mistake.

5396. Seeing that the laying of the third rail cost £20,000, do you not think that it would have been more economical in the long run had the gauge been altered at once, and sufficient rolling stock obtained to work the traffic on the narrow gauge, leaving the wide gauge stock to be converted afterwards, and the wide gauge engines disposed of as opportunity might arise? I believe now it would have been, though at the time the argument was that the stock could not be obtained; but, in my opinion now, it would have been the wiser course to have altered the gauge.

5397. *By Mr. Lawder.*—Can you supply the Commissioners with a copy of your working time-tables? I can, and will do so.

5398. Have you found the telegraph to work successfully upon the Launceston and Western line? Yes.

5399. And is it used in connection with the station signals and semaphores? It is not.

5400. How do you work, then? By the staff and ticket system.

5401. You do not work the block system? We do not.

5402. Do you not consider it safer? No, if the staff and ticket system is carried out thoroughly, it is impossible to have an accident.

5403. Would you prefer that system? With a limited traffic I think it is quite sufficient protection.

5404. Do you look upon it as an economical system? I am convinced it is perfectly safe, but I have no experience of other systems.

5405. With reference to the passing sidings at stations, I presume that where trains pass each other the points would be kept under control in some manner: what plan is adopted for securing them? Where trains cross the points are always held.

5406. I refer more particularly to the locking of points after the passage of trains into the station,—are these points usually locked with a key? No, I think I can safely say, not usually. We work with a semaphore, and the semaphore stands at danger unless a man is at the points.

5407. Has no arrangement been provided for locking the points? I did not consider it necessary where we had a staff.

5408. They were not provided with proper locking apparatus when constructed? No, not on stations where we have a staff.

5409. Are they not locked over at spare sidings, where you may have spare waggons standing, and at intermediate stations? We have only got that description of siding at large stations where they have staffs, such as Launceston and Formby. They are not locked at these stations.

5410. But are they not locked over after spare stock is allowed to enter them to prevent the waggons or carriages running out? No, the waggons have the breaks put down, and they are hand-locked.

5411. Are all stations provided with sprags and scotch-blocks? They were till the narrow gauge was introduced, when they were temporarily knocked off and have not been replaced since.

5412. Could not a proper plan of scotch-block be devised which, when the block was turned over would fall between the rails? They are in course of construction now.

5413. Then you mean to adopt them? Yes.

5414. Will these scotch-blocks have any padlocks? Yes.

5415. With whom will the care of the key remain? The station master, or the guard where there is no station master.

5416. The Commissioners observed no buffer blocks at the end of sidings? We have them at most of our principal stations.

5417. I believe there are none at most of the stations? There are a couple of sleepers, that is the only block at the end of the stations.

5418. Do you consider that a proper and efficient buffer block? I consider so, with care, especially for ordinary waggons.

5419. But in the case of accidental or mischievous removal? They are bolted to the rails.

5420. Do you consider that quite sufficient even with rough shunting? I think so, at most stations.

5421. The waggons might jump them? No, not over two sleepers.

5422. What is the length of your passing sidings, usually, at ordinary stations? We have no fixed length for them; they are of different lengths.

5423. Do you consider it a safe plan to take off engine-shed sidings and turn-table sidings from the main line, as the Commissioners observed had been done at Formby? Do you ask me to express a definite opinion about that?

5424. Yes? Then I should think it would be preferable to take them off a loop; but that was done during construction.

5425. The Manager's department was not consulted about these arrangements when the station-yards were being laid out? It was not.

5426. Perhaps you will add to the information you have given the Commissioners by saying if you remember whether Mr. Lord preferred working a mixed stock to having a uniform gauge? It was a mere matter of expediency. There was great opposition to the change created. It was largely a matter of policy, and it was also thought that it could be done with greater economy.

WILLIAM EASTGATE BATCHELOR, *examined.*

5427. *By the Chairman.*—What are you, Mr. Batchelor? A mechanical engineer.

5428. In that capacity you have had considerable experience in this colony and also in Queensland? Yes, for 22 years.

5429. During the whole of that time have you been engaged upon railway works? Yes, with the exception of a short period I spent at Gympie.

5430. You came to this colony from Queensland? Yes.

5431. How long have you been engaged on the Tasmanian railways? Sixteen years.

5432. Has there been a continuous improvement and efficiency in the working of the Locomotive Superintendent's branch? We had been at a standstill for a number of years until the last few years.

5433. To what do you attribute this increased activity? To the new lines.

5434. Was it not partly owing to the better prospects of mining in the colony? I do not think so. The Government had decided upon having more railways in the country.

5435. In carrying out these works you are responsible for the locomotive service and rolling stock? Yes, the general rolling stock work.

5436. Have you lately brought under notice of the Government any deficiency in the working of the lines? No, not in the working of the lines.

5437. You are satisfied with the material and stock provided? I am satisfied with the quality, but I feel I have not had enough of it; still, there is some ordered now, and it will be here in a few months.

5438. What number of serviceable engines have you? Five broad-gauge engines, three narrow-gauge, and two small shunting engines; but 16 more narrow-gauge engines have been ordered.

5439. I presume you do not intend to increase the number of the broad-gauge engines? No; we are doing away with those as fast as we can.

5440. We notice that the traffic is worked on the Launceston and Western line by both broad and narrow-gauge stock. What is your opinion of the economy or otherwise of that mode of working the line? I am certain we could not work it otherwise, unless more narrow-gauge trains were put on.

5441. I presume your mode of managing Tasmanian railways is in a measure guided by expediency, and that a hard-and-fast rule which might apply to a more densely populated country would not answer here? No; you cannot work in the same way.

5442. Do you consider that when the converted rolling stock is finished the Government will get value for their money? Yes, I do.

5443. On both the carriages and trucks? I do not intend to convert any trucks—only carriages.

5444. What will your total equipment be when the orders which you have given are carried out? Nineteen narrow-gauge engines and two branch line engines.

5445. That is, a total of 21 narrow-gauge engines. Yes.

5446. Now the rolling stock? We will have 15 bogie carriages (composite), four first-class altered carriages, four second-class altered carriages, two excursion carriages and one small saloon, seven break-vans, three composite vans and three carriages being built, and nine composite vans to come.

5447. Do you consider that will be sufficient rolling stock and engine power for the railways which are now opened or about to be opened? That will be sufficient for the first 12 months, and after that it will very much depend upon the development of traffic.

5448. As to the water supply, what system is adopted, gravitation or pumping? Gravitation where we can get it that way, and pumps where we cannot. We use a pump at Longford and Deloraine, and gravitation at Formby. On the new lines there are two pumps on the Fingal line, and on the Derwent Valley line I do not know what the system will be.

5449. Is the pumping system a steam service? Yes, a steam service.

5450. What is the cost of that? One man works 3 pumps, going to each twice a week, at 8s. per day.

5451. Do you find that economical? Yes.

5452. And is the water on the line very good? Yes.

5453. Is the provision made by the Government for obtaining and delivering coal on the line adequate? Yes, it is all done by tender.

5454. What coal do you use? Newcastle.

5455. Do you propose to use any of the coal discovered on the Fingal line? No doubt we will use it.

5456. Have you expressed any opinion as to the quality of the Fingal coal? No.

5457. In the event of the supply being adequate and satisfactory, will that be an advantage to the new line? Yes.

5458. Is there any other coal supply on the other Government lines? No.

5459. Do you use much wood? We only use it for lighting up.

5460. Not in working the Launceston and Western line? No.

5461. Are your fire-boxes constructed to burn coal only? They are large boxes, but more suitable for burning coal.

5462. In the event of a strike or difficulty arising to interrupt the supply of coal, such as that which has occurred in the other colonies, would you be in a position to carry on the service with wood? Yes, we would be able to run the trains with wood with a little trouble and expense, but we could prevent stoppage.

5463. Are these new narrow-gauge engines so built that you could use wood only? Yes.

5464. *By Mr. Stanley.*—What class of engines do you intend to adopt for working the traffic upon the new lines? Two classes, one for passengers and one for goods, similar to those on the other lines.

5465. Will you state what is the power exerted by these engines on the ruling grade adopted by the Government—that is 1 in 40? The passenger engines, in taking a load of 10 vehicles up a grade of 1 in 50, develop 287 horse-power.

5466. But for a grade of 1 in 40? I have not taken that out yet, but I will supply it.

5467. At what speed is the calculation made which you have given? That is for 20 miles an hour including stoppages, or 25 miles an hour between stations.

5468. Do these engines take a train composed of 10 loaded carriages up an incline of 1 in 50 at 25 miles an hour? Yes.

5469. Is that for a continuous length of 1 in 50, or for short distances? Well, we have an incline of 10 miles, and run up that.

5470. What load would the goods engines take up the same incline? It would take 15 vehicles at a speed of 12 miles an hour, the gross load being 108 tons without the engine.

5471. The gross load is 108 tons without the engine? Without the engine and tender.

5472. Will you also calculate and let the Commissioners know what load these engines would take up a 1 in 40 grade, with curves of 5 chains radius? Yes, I will.

5473. From your experience, can you state what effect a 5 chain curve has in increasing the train resistance as compared with the straight road? It would increase it to about 18 lbs. Theoretically it takes 6.9 lbs. to draw a ton on a level, and it takes 13.9 to draw a ton on a 5 chain curve. But, in practice, I find it is as from 6 to 18.

5474. That is, the resistance is increased threefold? Yes.

5475. And consequently the load will be reduced to a third? Yes.

5476. What is the heaviest gradient on the present line? 1 in 50.

5477. And the minimum curve? Five chains is the sharpest we have on the present line. The ruling curve is supposed to be 6 chains, but I believe there is one of 5 chains.

5478. Has not 1 in 40 been adopted on the Scottsdale line? Yes, I believe it is something of that kind—1 in 39½ in places.

5479. Looking to the economical working of the traffic, do you think it advisable to combine such grades as that with 5 chain curves? From a practical point of view, I do not.

5480. Do you find the provision made on the new lines for the convenience of your department adequate for your requirements? Yes, as far as they have gone, I do.

5481. Are you of opinion that signals should be provided at the present stations? Certainly.

5482. Have you made any representations on this subject as regards the Mersey line? Yes, and we have got the authority of the Minister to make signals for that line. They were not provided for in the original estimate of construction, but the late manager got an order from the Minister to make them.

5483. Do you consider it necessary for the safety of the traffic that sidings at stations or intermediate places should be protected by chock and buffer blocks? The original sidings on the Launceston and Western line were provided with chock blocks, but buffer blocks were never erected.

5484. Is it not usual on lines that you have been on in other parts of the world to make such provision? Yes, certainly, both buffer stops and chock blocks, where no staff is kept.

5485. Do you not consider it an advisable thing to do? Yes, I do.

5486. With regard to the mixed gauge between Launceston and Deloraine, were you consulted at the time this matter was discussed? Yes, the late Mr. Lord consulted me before the third rail was laid down, and I recommended that as he could not get the necessary rolling stock in time that the third rail be laid, and it would come in for other purposes when done with.

5487. If funds had been available for the purpose, do you not think you could have got sufficient narrow gauge stock to equip the line within a reasonable time? Certainly, if ample funds had been provided; but it would have caused a delay in the traffic to shift the gauge, and the old stock would have had to come into the yard altogether to be altered, and it would require a very large yard to hold it all.

5488. But seeing that the laying of this third rail has cost £20,000, do you not think it would have been more economical in the long run to have obtained the necessary narrow gauge stock and altered the gauge at once, leaving the wide gauge stock to be converted afterwards, and the engines disposed of as opportunity might arise? The way markets were at that time we could not possibly have got the engines in a reasonable time, as I felt sure. It took us 18 months to get the first three engines.

5489. If a large order were placed upon the market in England do you not think that you could have got them in reasonable time? At that time I do not, for we were clear about it at the time.

5490. In giving advice in regard to the mixed gauge, were you guided to a large extent by the peculiar conditions of the English market in respect to the supply of rolling stock? Yes, and the economical working of the line. It must not be lost sight of that we still have the rails, and they will come in for other purposes when taken up.

5491. But do you think it is more economical to work the mixed gauge than if you had only one class of stock to run on the line? Certainly not, but the third rail was already laid between Launceston and Evandale Junction, and it was only to take the Main Line traffic to Deloraine, to avoid break of gauge, that it was done.

5492. In what time do you anticipate being able to abandon the wide gauge? In about 2 years.

5493. *By Mr. Lawder.*—Do you find the points and crossings at stations working satisfactorily now? Yes, on the whole.

5494. You do not find any delay occur or any difficulty with the points and crossings not locked properly? I do not know of any delay.

5495. Do you not consider you might have an improved system of locking? We might have an improved system by going into interlocking apparatus.

5496. I mean for locking the points on sidings taking off the main line. Do you think there is any danger, or have you experienced any difficulty from having these sidings unlocked? No, none. Where there is a staff kept and a lot of shunting they would be a nuisance.

5497. Do you consider it a good plan to take off the engine-shed sidings and turntable sidings from the main line, as we observed at Formby? I suppose they would be better taken off the sidings; but at Formby there was no ground on that side, and there it was a matter of necessity.

5498. Do you think it is quite safe? I think it is safe enough for the small traffic there is in this colony.

5499. With a careful man? Yes, with a careful man.

5500. But without a careful man it might not be safe? No, it would be liable to accident.

5501. Have you been over the Fingal line? No, only up to the Stony Creek. To Avoca station? No.

5502. Would you inform the Commissioners upon what part of the lines under your charge you carried out the experiments upon which you base the calculations as to haulage you have given us? I framed those calculations from some experiments I was present at in Queensland.

5503. Would you supply the Commissioners with a statement showing the size of the engines, weight including tender, diameter of driving wheels, cylinder, length of stroke, and weight upon the driving wheels, with any further information on the subject showing the power of the engines? The goods engines have a 14½ in. cylinder, 20 in. stroke, 6 wheels coupled, 3 ft. 3 in. diameter; load on axle, 6 tons; 18 tons on the three axles; 4 tons on the leading bogie; total of engine weight, 22 tons; tender, 16 tons; power for 12 miles, 217 h.p., load 15 waggons up 1 in 50 at 12 miles an hour; would move 124 loaded waggons on a level but could not run them. The passenger engines are 14½ in. cylinder, 20 in. stroke, 4 ft. driving wheels, four coupled; about 6 tons, 18 cwt. or 7 tons on each axle of the driving and trailing wheels; the

four coupled together are compensated so that there is the same weight on each axle ; the speed averages 20 miles an hour,—that is, about 25 miles between stations : their load is ten carriages on 1 in 50, and will go at that speed with 287 h.p.

5504. Are you satisfied with the general dimensions of the buildings for the accommodation of your engines and stock ? With what has been done, I am.

5505. And also with the provision for ashpits and water supply at watering stations generally ? Yes.

5506. You have informed the Commissioners of the weight of the engines—will you state their length over all ? I think they have 32ft. 10in. wheel-base and 40ft. over the buffers.

5507. What ashpits have been provided at the intermediate watering stations—at what part of the station is the water column placed ? At the end, a train's length from the platform.

5508. How do you water your engine coming from a contrary direction ? There are two water columns, one at each end of it, and two pits, one at each end of the station.

5509. These pits are about 25ft. in length ? Yes.

5510. The width of your engine sheds—can you tell us what that is for two lines of railway ? About 32ft., I think.

5511. Are any repairs carried on in those sheds ? None.

5512. You take the engines into the shops ? Yes.

5513. *By the Chairman.*—Supposing the Government had given you orders to abolish the system then in force—that is, working on the 5ft. 3in.—and take up working the line on the narrow gauge, what would you have had to do ?—supposing on the 1st of June next the Government gave you orders to abolish the present system of working and enter upon the new system of the narrow gauge, what would have to be done ? The first thing would be to order the new narrow-gauge stock. The next thing would be to lower all the platforms right through the line ; and, lastly, get all the broad-gauge stock in.

5514. How would you make arrangements for carrying on the traffic while the alterations were being made in the third-rail portion of the distance—would it not have the effect of stopping the traffic of the line for so many days ? Possibly you would have to stop the traffic.

5515. How long would it take ? That would depend upon the number of men put on ; but they would only have to take up one rail, and four to six days' loss of traffic is the outside that would result. The third rail would not be lost, and the system adopted was, under all the circumstances, the best.

5516. What was done was prompted a good deal by expediency, and if you had received *carte blanche* it would have been different ? Yes.

5517. And does not that apply to the working of the railways generally in Tasmania ? Yes.

5518. There are many things done that would not be done if you had more ample means and larger resources ? Certainly not.

MR. CRESSWELL'S *examination continued.*

5519. *By the Chairman.*—You have already stated your name, Mr. Cresswell, and the position you occupy in the Government Service, when giving evidence upon the Launceston and Scottsdale Railway. We are calling you now to receive whatever evidence you have to give with respect to that portion of the Deloraine to Formby line on which you were engaged. I commence by asking what portion of the Deloraine and Mersey Railway you had charge of ? From Deloraine to Formby, the whole length of the line.

5520. Did you make a survey of that line previous to the work being let ? No, I had nothing to do with the survey.

5521. Who prepared the plans and contract drawings ? I prepared the sections and the contract drawings, and the plans were prepared by Mr. Clerke.

5522. Under the superintendence of the Engineer-in-Chief ? I presume so.

5523. Well, tenders were called for the work, and in due course it was let. Who were the contractors ? Messrs. Fergus and Blair.

5524. Can you state the gross amount of their tender ? I think it was £95,000. There were some alterations made which reduced it to £95,000.

5525. Had you, previous to the work being let, made any estimate on behalf of the department as to what the cost of the work would be ? I ran out the quantities from the data supplied to me.

5526. And what you obtained from longitudinal and cross sections ? Yes.

5527. Did you reduce that to money value ? I brought it to £85,000, and put upon that an addition of 10 per cent.

5528. That is what was absolutely required ? Yes.

5529. Did you give that in any official document to the department ? I made it, and sent it down by the desire of the Engineer-in-Chief.

5530. When you commenced the line, will you state in what position you found the old tramway works between Coiler's Creek and the town of Latrobe ? With respect to the embankments, they were solid and in a fairish condition ; the cuttings were partly filled up by the material falling in ; the tramway itself as a tramway was simply rotten, and the line was up and down so that you could not run a trolley over it. It was not from the bridges being rotten so much as from the faulty design by which they had gone out of

shape. Generally speaking, it all required reconstructing except the cuttings and forming. The banks had to be raised and widened in places.

5531. Generally speaking, you had to reform the works? Yes.

5532. As to the culverts and bridges, in what condition did you find them? We had to reconstruct the whole of the culverts throughout, reconstruct the bridges, and add some new waterways where we found it necessary.

5533. Are there any culverts left by you in their original state? Only pipes.

5534. Then all the larger structures were entirely renewed? Entirely renewed, with the exception of the old walls.

5535. The three bridges crossing the Mersey are iron girder bridges resting upon piles? Yes.

5536. Were they so constructed on your recommendation, or was the design the Engineer-in-Chief's? I assume it was the instruction of the Engineer-in-Chief. The bridge below Latrobe was specially recommended to be constructed of masonry, and quantities were taken out for its construction in masonry, but Messrs. Ferguson & Blair refused from some quibble to carry that out unless an extra amount was given them.

5537. What is your opinion as to the life and durability of the piles carrying the girders on the three Mersey River bridges? Seeing the fine state of preservation of the old piles under the old bridges I should not have had the least hesitation had they been arranged to carry the girders to have placed them on top, the piles put in will last 30 years.

5538. Do you form that opinion from what you saw? Yes, I was so agreeably surprised with the condition of the old piles that I should certainly have put the bridge on them had they been arranged for it.

5539. Assuming the piles require renewal before that time, what provision is made? The piles are so arranged that they would form the nucleus of a coffer-dam and concrete could be cast in between them, letting the old piles stand as before. That was recommended by the Engineer-in-Chief.

5540. Is there any fear of these piles settling and so straining the superstructure? No, I am perfectly satisfied a good foundation is secured.

5541. It has been pointed out to the Commissioners that at Horsehead Creek the department left the originally projected line and made a detour around the head of the creek, thereby avoiding crossing an arm of the Mersey where the tidal water comes? That was done specially on my recommendation. I was not satisfied with the line. In the first place coming down the Horsehead Creek there was 14 chains of an embankment 14 feet high with very soft silt in the bottom of the creek, and a very uncertain bottom below that. I considered it better to keep higher up and save any danger from accident; and to reduce the cost of this very expensive embankment we would have had to sheet-pile the outside, and a dry stone wall put inside before the bank could be tipped in between.

5542. Did you make any examination of the formation below water level? Yes.

5543. I want to know what you did which altered your opinion with reference to this crossing? I was at it with a body of men, and drove stakes in, but we found soft silt for 6 feet, and soft puddle below that, and it is almost impossible to arrive at the amount it would swallow in an embankment.

5544. Did you try the locality with boring-rods? No we simply had a trial pit.

5545. I mean in the waterway? No. We had from 3ft. to 4ft. of water to contend with, and as much silt. I did not bore at all.

5546. Would not that be the more satisfactory way of examining a place where large marine deposits would probably be found? I should have done it had I been trying for a viaduct, but as it was simply an embankment I did not think it was necessary.

5547. The original plan contemplated an embankment? Yes.

5548. With an opening in the middle of it? A 10ft. culvert at the far end, to carry off the waters of a small creek which empties into the estuary. It was necessary to make provision for it.

5549. Are there not two creeks? Yes. There is another small creek, which passes through an 18in. pipe.

5550. For the purposes of comparison we must deal with actual facts. There are two culverts—one a large one, and the other an 18in. pipe? Yes.

5551. It has been alleged on behalf of the Department that the alteration at Horsehead Creek has saved the Government an outlay of £1500. On the other hand, residents of the locality say the Government lost a much larger sum by not following the original route over that level piece of country which is to be found both north and south of the creek? We certainly gained in direction by making the deviation,—I am perfectly satisfied of that.

5552. Would not the approaches to the table land show less work than the route now adopted? No. I could point that out on the plans, where the deviation is near the main road to Ulverstone. It is better to keep the high ground where you have a small embankment instead of one of 14 chains.

5553. What is the difference in length? Eight chains.

5554. Is the deviated line eight chains longer? Yes.

5555. What is your opinion as to the cost of the two schemes? In taking out the quantities the adopted line was the cheaper route.

5556. Did you base your estimate on the contractor's schedule prices? Yes. There was more rock in the cuttings, as it turned out in places, than was anticipated. We came upon sandstone in a part where we did not expect it.

5557. Comparing the two works where the creek is crossed, how does the present line contrast with the proposed original crossing? The deviation decidedly cost less money.

5558. How would the two approaches compare? On the original line the approach seemed tolerably direct and level.

5559. What was the heaviest cutting? Where we approached Horsehead Creek.

5560. How much was this embankment above the level of high water at spring tide? Seven feet.

5561. As compared with the original line, what cutting have you on the line constructed? As far as the cutting is concerned, it is much less.

5562. On the northern bank of the Horsehead Creek the constructed line shows more cutting than the original line? Yes, on the northern side.

5563. And an extra length of 8 chains? Yes.

5564. Taking these things into consideration, are you of opinion the constructed line is the cheaper of the two? Yes; and certainly the safest.

5565. Why the safest? On account of running on the edge of that difficult cliff.

5566. Did that show any difficulty? Yes; we would have had to construct an expensive retaining wall down near the water.

5567. Then, from your point of view, the alteration made in the original line has effected a saving, and certainly not incurred a loss? Up to Formby, yes. We were put to a large amount of expense in reclaiming a site for the station there, but that would have had to be done in any case.

5568. Previous to the construction of the Deloraine and Formby railway, do you remember the original position of the line in the neighbourhood of Latrobe as laid out by Mr. Human? Mr. Human went on the other side of the river. I have never been along that survey.

5569. Then you cannot make any comparison between that original survey of Mr. Human's and the line as carried out by the Government? No; I know the locality, but I could not compare the route with that adopted.

5570. As you know the locality, which would best serve the purposes of the country? The one now adopted will most benefit the country when we get further along the coast.

5571. Mr. Fincham, in his evidence, stated that that original line left the present line some distance south of the river, and bore away down the west bank of the Mersey, thus avoiding the three bridges over that river, and joining the present line near Latrobe. How would that line compare with the line adopted by the Government? It certainly would have been much cheaper.

5572. Would it have equally benefited the people of Latrobe? Had they had a branch line into Latrobe it would have benefited them equally well.

5573. The Engineer-in-Chief pointed out that on the original line the station would not have been further from the town of Latrobe than the present terminus at Hobart is from the centre of that city? It would just have been one mile from the post office in Latrobe.

5574. If that was so, do you think there was justification for the expenditure involved in the construction of the two Mersey bridges? No, I do not think so. I was sent down when the matter was first mooted to select a route at Sherwood. I believe a great amount of pressure was brought to bear and the route altered.

5575. To what do you attribute the alteration of the line? Outside pressure.

5576. Is that the representations of the people living in the district? The people of Latrobe.

5577. Did the people of Latrobe make any representations as to the supposed grievance if the line pass outside their town? There was a very strong feeling there, and at one time it was not considered safe for me to go into Latrobe, having been seen at work down the other side.

5578. What induced the Government to depart from the surveyed line at Formby and run along the Esplanade? That was done from outside pressure, I believe. At first it was contemplated to make the station on ground which I had reclaimed in the neighbourhood of the present jetty; but it was urged that the store built upon this ground would be a very convenient one for shipping produce from, and the Government was induced by the representations of certain people to take another place for the station.

5579. In the event of the line being continued westward from Formby towards Ulverstone, do you consider the Government has ample accommodation in the present station yard at Formby? I think the passenger accommodation is ample, and any goods coming to the station will merely come by cart.

5580. But for future extension? We have not much land for extending the building; but I do not think more passenger accommodation will be wanted. The goods-shed has not been used at all, everything going to the jetty. Jetty extension is what will be wanted, and we have ample room for that.

5581. The Commissioners' attention was attracted to the fact that a large passenger trade is now growing at Formby, through large steamers making it a port of call. Have you made any provision for loading and unloading goods at the jetty? The jetty is partly constructed, and a vote has now been passed for the extension of it.

5582. Is that where the *Balmain* berths? Yes.

5583. Was the cost of the land one of the reasons which induced the Government to abandon the original line at Formby? I believe so.

5584. Are you aware whether the landowners made exorbitant claims? I have been told so by Mr. Rodham Douglas, who acted for the Government in arranging the purchase. This is what induced us to reclaim that piece of land in the neighbourhood of the jetty.

5585. A suitable site—near Mrs. O'Mara's Hotel—was shown us as available for the station at Formby. It was pointed out that as soon as the railway was constructed this was sold for a large price, though offered to the Government at a reasonable rate? I only know from hearsay that a very exorbitant rate was demanded.

5586. The gentleman who told you was the government valuator? Yes.

5587. *By Mr. Stanley.*—Did you prepare the schedule of quantities upon which the tenders were based? Yes.

5588. And how were these quantities obtained? From the longitudinal sections and cross sections which were supplied me.

5589. Were they arrived at from actual calculation of earthwork as shown by the longitudinal and cross sections, as well as the contract drawings for the several works? Yes, but I made this proviso: when they were sent in, I found the levels had been taken in such a slovenly manner that I repudiated all responsibility. I found the stakes, some 6 inches, some 4 inches above the level of the ground, and the levels taken from the tops of these pegs. We went over the ground afterwards, and I told the Engineer-in-Chief that I would not be responsible for the quantities under these circumstances.

5590. In carrying out the actual work, did you find this caused an increase in the quantity of work to be performed? Yes, considerable increase in the embankments.

5591. Then your quantities were calculated on the understanding that the section was a correct one? Yes.

5592. On the other hand, would it not reduce the cuttings? It reduced the cuttings to a certain extent; but we had to widen our cuttings when getting down to Coiler's Creek.

5593. We have it in evidence from the Engineer-in-Chief that one cause of a large increase in the actual cost of the works, as compared with his original estimates, was due to the excess in quantities. Could you state generally in what that excess consisted? In the earthwork generally. I had to widen the earth to a 1 to 1 slope, and leave a bench, and in some instances when this was done we found the rock of such a loose nature that we had to flatten these off again, which considerably increased the quantities.

5594. That was caused by a difference in the material of the cuttings? Yes.

5595. As resident engineer on that line you are supposed to be intimately acquainted with the quantities? Yes.

5596. Can you state the actual excess in the earthworks as compared with the original estimate? From memory, I think there was 25,000 yards of earth more, and 10,000 yards of rock more. This is a statement I had prepared, on the completion of the line, showing the estimated quantities and the actual amount got out.

5597. Can you state by examining that return what was the total excess in the earthwork quantities? In Section 1 the actual quantity of earth was 59,570 cubic yards against 58,000 estimated; of rock, 31,817 cubic yards against 20,000 estimated. In Section 2 the work consisted chiefly of clearing out cuttings.

5598. Was there an excess in that? Clearing out the old cuttings, 6256 against 5603 cubic yards. Side cuttings for embankments, 10,077 against 20,730 estimated.

5599. That is a decrease? Yes, owing to the Engineer-in-Chief having decided not to widen the bank except where necessary. I estimated upon the bank being widened out to a uniform width of 14 ft. throughout. On No. 2 section there are 40,178 cubic yards of earth against 51,086 estimated.

5600. That is also a reduction? Yes, that is a reduction. In rock, there were 17,524 yards against 5545 estimated. This was chiefly caused by making a very wide cutting down near the jetty for station accommodation, which turned out to be nearly all rock.

5601. According to the figures you have just given, there appears to be a total increase in the quantity of cutting of 14,000? Yes, in three sections.

5602. And there is a reduction in the side cutting of 9653 yards? Yes.

5603. What is the price of the earthwork? On Section 1, 1s. 7d.; on Section 2, 2s. 6d.; and on Section 3, 1s. 7d.

5604. From the Engineer-in-Chief's evidence, there is a balance of excess in cost of something over £6000, said to be due to increased quantities. As the increase in the earthwork which you have just given would not account for anything like this, where are the other differences? There was a large increase in the quantity of ballast on Section 2.

5605. But I think in the statement of the Engineer-in-Chief he took credit for that apart from the question of increased quantities? There was a large increase of waterways.

5606. Who determined the waterways originally? They were based upon Mr. Human's survey.

5607. But, before preparing the contract schedule of quantities and drawings, did you take any steps to correct the information given by Mr. Human? I walked over the line, but it was summer time, and there were a great many dry watercourses which I afterwards found it was necessary to have an outlet for.

5608. Did you make an examination of the watersheds where you had any doubt of the waterways required? I had not sufficient time. I was in charge of the roads and bridges then, and was ordered to do this in addition to my other duties.

5609. Can you state what amount is represented by this increased waterway to which you have referred? I find in Section 1 there were 556 lineal feet of 3-in. earthenware pipes put down, against 20 ft. estimated. This was caused by having to provide water for a farm-house near the line. There were 110 lineal feet of 6-in. pipes against 20 ft. estimated, and 582 lineal feet of 9-in. pipes against 20 ft. estimated.

5610. Can you state in money the amount representing the increase in the waterways to which you have referred? There was £777 *ls. 6d.* in earthenware pipes alone.

5611. What other items of increased cost are there caused by excess in quantities? There was £174 *6s.* for fixing the girders.

5612. Was not that included in your original provision? I do not know who made out the weight of the girder. I think it was done in Hobart, but, through some mistake in taking out quantities, the girders came out considerably heavier than they had been ordered. I designed the girders from a sketch supplied by the Engineer-in-Chief. I made a pencil drawing, and left the clerk in my office to fill it in while I was out on other works.

5613. Are there any other items which would go to make up the £6000 which Mr. Fincham has stated is due to excess in quantities? There was the station.

5614. Mr. Fincham has taken credit for everything that was not contained in his original estimate. What we want now is the particulars of the excess in quantities of work done over that estimated. Can you prepare such a statement? I could compile a statement from this return.

5615. We have a statement here which was handed in by the Engineer-in-Chief showing the special items of excess in cost on the Mersey Railway, the total amounting to £49,416, and Mr. Fincham has said that the difference between this amount and the total difference in cost, which is £70,000, is due to an increase in quantities and a rise in the price of labour in the Colony,—the latter estimated at £15,000,—leaving a sum of something like £6000 to be accounted for by the increase in quantities. Can you prepare a statement, for the information of the Commissioners, showing what items in the schedule this increase in quantities arises from? Of course you must not include any of those items shown in the statement of the Engineer-in-Chief as having been credited to the account in consequence of never having appeared in the original plan or estimate, but simply taking the earthwork, bridges, culverts, and waterways? Yes, I will prepare such a paper.

SATURDAY, APRIL 3, 1886.

PRESENT:

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

MR. CRESSWELL'S *examination continued.*

5616. *By Mr. Stanley.*—I asked you if you would be good enough to prepare a statement showing the items of excess in cost due to the increase in quantities: have you done so? I have in abstract form; I have not gone into details of separate items. I can do that if the Commissioners require it.

5617. I observe from this statement that you make the excess in the item of earthwork to amount to £7608; according to the figures you gave me yesterday I make it only £3453, allowing for cuttings where a quantity was less? What I took out yesterday was simply cuttings and side cuttings; this statement includes all the excavations of foundations, inlets and outlets to culverts, and diversion of creeks.

5618. Then I understand in these items you have just mentioned, sufficient was not allowed in the original schedule for such work? No; many of these works were not anticipated at first, especially the widening of cuttings and some extensive outlets and deviations at Coiler's Creek.

5619. In what year was Mr. Fincham's original estimate made? I cannot say; the matter did not concern me at the time; it was about 1880 or 1881.

5620. And when was the contract let? In 1883.

5621. In the interval that elapsed between Mr. Fincham's estimate being made and the letting of the works, did any considerable rise take place in the labour market? A very considerable rise took place. I experienced that by letting small contracts on roads: every successive tender was increased by reason of the increased wages.

5622. What was the original rate of labour in 1880? We could get day labourers for from 5s. to 6s. per day.

5623. What was the increased rate when the contract was let? From 7s. to 8s.

5624. What would you say generally should be allowed per cent. for the increased rate of wages within that period? From 12 to 15 per cent. It was only now and again you could get men at that rate.

5625. It did not amount to 25 or 30 per cent.? I know in some cases it did.

5626. But did it in this contract? I have known it increase over 20 per cent.

5627. What would be a fair average per-centage? About 20 per cent. for wages; material increased more than that.

5628. When preparing the quantities for the Mersey line, upon what basis did you estimate the ballast required on the old tramway? By simply going over it and examining the old ballast, and taking into consideration the slacks on the line and estimating the ballast required.

5629. Did you allow for re-ballasting the whole line? No, we did not.

5630. Was it found necessary to re-ballast it all? After taking out the old sleepers it was found that a good deal of the ballast which looked well on the surface was of very little use.

5631. Then on this occasion a larger quantity of that part of the line was required than was originally provided for? Yes.

5632. Did you make any estimate of the value of the works on the tramway line which could be utilised for railway purposes? No, I was not asked to make an estimate.

5633. Do you consider the Government received full value in the tramway works that were utilised for railway purposes for the amount the Government gave—£6000? I think the cuttings and embankments on the line fully represent that money.

5634. I think you stated that the adoption of the deviation at Horse Head Creek resulted in a saving. Do you base that statement on the estimated cost of the deviation or upon the actual result? I was speaking of the estimated cost as far as the deviation joined the original line.

5635. Are you aware that the deviation cost more than £2000 above the estimate? I was not aware it cost more than that. I know we had two cuttings which turned out nearly all rock, which we did not expect, and we had a nasty slip.

5636. We have it from the Engineer-in-Chief that the deviation cost £2000 more than the estimate. That being the case there would then be a loss of £500, instead of a saving of £1500? I was convinced that the construction of the original line could not have been done for the money put down.

5637. Did you not, as resident engineer, make an estimate of the two lines? I did, I made the estimate myself entirely.

5638. Then if you are convinced the original line would cost more, why did you not state so when making this comparative statement? I simply took the figures set down. I gave the information to the Engineer-in-Chief that I was afraid the cost of the original line would exceed what was put down for it, and recommended the deviation.

5639. *By Mr. Lawder.*—Were you employed on the construction of the Mersey railway from its commencement? Yes.

5640. Up to its completion? Yes.

5641. Are you aware whether the accounts of expenditure for works on the tramway line exclusively have been kept separate from the other expenditure? No; I have nothing to do with the accounts, only the measurement.

5642. I presume your accounts were kept separately? Yes, they were kept separately for section 2.

5643. Could it be obtained? Yes, I have the account in my office.

5644. Can you supply that? Yes.

5645. Can you supply it showing the larger works on that section? Yes.

5646. Can you inform us what large works were carried out on the tramway, bridging particularly? The entire renewal of Coiler's Creek bridge was carried out.

5647. What is its span? Two 10ft. openings on the skew on a very sharp angle. We also carried out the renewal of the timber tops on the whole of the culverts; the entire renewal of Kimberley's Ford bridge, with two 66ft. and two 40ft. openings; and the substitution of an earthwork embankment at the east end at Kimberley's Ford for timber tressels.

5648. The Commissioners inspected all these works on their recent visit, and noticed that the mounting of the smaller timber bridges consisted merely of the wooden girders resting upon wooden bed-plates resting upon the bank behind the original dry masonry walls? The timbers rested on dry stone, filled in for drainage.

5649. Then the construction was essentially of the cheapest possible character? Yes; but it caused a considerable extra length of flooring.

5650. But it was essentially the cheapest kind? Yes.

5651. Did you satisfy yourself when constructing them that the original dry rubble walls had been carried down to a safe depth? I found they had scarcely any depth of foundation.

5652. Did you think it safe to construct a railway on them as a permanency? We put no weight on them.

5653. I allude more particularly to the scour of the water undermining those walls? They were constructed under instructions. I had very little to do with them.

5654. Under whose instructions? The Engineer-in-Chief's.

5655. Then you do not consider yourself responsible? Had I been acting on my own responsibility I would have renewed the whole of the walls. It was a matter of expenditure. I would have rebuilt the walls.

5656. With a better foundation? Yes; I consider placing the timbers as they were that the culverts were safe. I would consider them safe as retaining walls to keep up the embankment, but not to carry a load.

5657. Do you consider that the bank is amply protected by these walls, and that there is no risk to the bridges from the action of water passing through the bridges undercutting the walls? I consider them perfectly safe to support a bank, provided no load or vibration is put on them.

5658. Are you of opinion there is no danger of scour in the creek? I took into consideration the length of time they had stood all scour, and in some instances where I thought they were liable to scour I put in dry stone as an apron to prevent scour and protect the sides of the embankment.

5659. You know the site of the station at Whitefoord Hills? Yes.
5660. What is the character of the ground there—is it fairly level? The railway is on a grade of 1 in 51.
5661. Is the general character of the ground about the station flat? The station yard itself is fairly flat, but it begins to fall away very quickly.
5662. Would you call it of a mountainous character, or flat land, about the station? Flat land, not level, but fairly flat.
5663. Would it have been possible to have obtained, by putting in S or reverse curves, a level for the station yard, without any considerable expense or adding materially to the length of the line? It would have added considerably to the expense, because the ground commencing on the line to the east side of the station continues to rise, and then after you cross the Whitefoord Hills road on the side of the present station road it falls again very rapidly.
5664. But that was, I presume, a question of bank and cutting? Just so.
5665. What would have been the expense to make a tolerably flat station yard, roughly speaking? I could not say for certain what the expense would be.
5666. Would it amount to £1000? Without increasing the grade after leaving the station I doubt if you could get a level, for the ground falls naturally 1 in 50.
5667. Can you roughly inform the Commissioners what the cost of the alterations on the tramway was per mile? I could not reply to that for certain without going into the different items.
5668. Can you give the aggregate cost of the tramway—that will do equally well? The total expenditure up to November 25 last, on section 2, amounted to £29,404; that includes everything up to date. There are some claims put in which the Engineer-in-Chief dealt with entirely.
5669. Can you say what these claims were, and if they have been entered? I am not aware of the terms of the compromise between the Engineer-in-Chief and the contractors. When the work was done there I went and took up my duties on the Scottsdale line.
- Then the Engineer-in-Chief can supply all information with regard to the expenditure on this tramway—more than you can? Yes.
- (The Secretary was then instructed to write for the information in question.)
5670. With reference to the Chudleigh Road, Whitefoord Hills, Railton, Tarleton, and Spreyton stations, can you inform the Commissioners why these were not contemplated when the estimate for the line was made out? As far as I understood from the Engineer-in-Chief, he wanted to know the requirements of the traffic department, and did not include the stations in his original estimate.
5671. Was it foreseen at all that these stations would be required? Some of them were known to be required, but merely as flag or stopping stations. It was not considered that there would be any extensive station buildings at them.
5672. But, I presume, some station buildings were required? Stations were doubtless contemplated, but I never took them into consideration. I do not know why they were left out.
5673. Would it have been possible, with your knowledge of the country, to have taken the line further away from the river bank at Formby, without going into expensive construction? I do not think it could have been done. There would have been a great expense in acquiring private property, and the cuttings would have been increased and more extensive.
5674. In what way would they have been increased? In the last mile there would have been a great expense in acquiring private property on which so many dwellings and shops stand.
5675. That would be the main item of expense? Yes, that would be the main item.
5676. Would there be any reason for not taking it further in on account of its fitting in with the extension to the Leven? No.

HARRY NORTON TAYLOR, *examined.*

5677. *By the Chairman.*—What office do you hold under the Government of Tasmania? Inspector of Buildings and Public Works in the Northern District.
5678. How long have you been engaged in that capacity? I have been three and a half years in the service of the Government, and up to within six months of this date was in charge of the roads and bridges in the North as well as of the buildings.
5679. Are your previous duties now discharged by any other officer? Mr. W. Cousins is now Inspector of Roads and Bridges. I look after the whole of the buildings and contract works generally in the North, —such as schools, telegraph offices, police stations, &c.
5680. During the past three years is the manner in which the public works of the Colony have been carried out a satisfactory one? I think, on the whole, it is satisfactory.
5681. When a new road is contemplated to be made, what is your plan of preparation? It depends on circumstances.
5682. Suppose representations are made to the Department by the ratepayers in a locality that a certain road is essential and desirable, what course is entered upon to carry out the wishes of the inhabitants? The first step is to ascertain the quantity of land taken up for settlement in the locality, and the amount of funds available under the Waste Lands Act.

5683. Generally, you obtain such information as to find whether it is desirable for the Government to construct the road or not? Exactly.

5684. If you find it is desirable to construct the road, what is the next step? Should there be a certain amount available under the Waste Lands Act, the district inspector is instructed to meet the inhabitants, find out from one and another information to enable him to lay out the road, to study their convenience and the benefit of the Colony.

5685. The tenders are advertised and called for in the usual way? Yes.

5686. When roads are constructed through districts in which towns are located, is it usual for tenders to be deposited there for the convenience of residents? Always.

5687. As far as you know, has that always been adopted? Yes, since I have been in the service that has always been adopted.

5688. It came under our notice, when visiting the North West Coast of the Colony, that plans and specifications were advertised to be lodged at a certain place, but were not until the day before they were returnable? It has never occurred, to my knowledge. It may have occurred. There is a rule by which contractors are allowed to take the specifications from the office for a certain number of hours, on giving a receipt.

5689. Where this complaint has been made, what is your explanation? I can only give my previous answer.

5690. Having determined to construct a road, do you confer with the local authorities with regard to waterway, construction, &c.? The instructions are to consult the ratepayers as to the direction of roads. I do not know whether they are consulted with regard to construction.

5691. When I said construction, I did not mean the grades or the quantity of material to be moved, but the general purposes to which the road is applied, such as its particular direction, and whether it will be convenient for the public? The road trusts would be asked what traffic would, be likely to occur, and what portion of the district it would most benefit.

5692. With regard to waterways in sparsely populated districts that have not been settled for any length of time, how do you find that out? By travelling the country and finding it out for ourselves.

5693. Do you traverse the watershed intersecting the proposed road or calculate it from the maps? We learn from local knowledge and experience, and the people we meet. Of course we always find people ready to give information as to flood-water.

5694. You do confer with the local residents when there are any, as to their particular knowledge of floods? Yes, in every case; we are only too glad to get that information.

5695. Have you found that any of the culverts are insufficient to carry the water? Occasionally I have found that the culvert would have been better if it were larger, but it has always been my experience that as the land becomes more clear and settled the culverts are wanted larger; the land has more drainage and discharges water quicker.

5696. Are there any large bridges or other works in your district involving any novel principles of construction? We have one or two large bridges, large for Tasmania, but I do not think they are of any particular mode of construction,—they are simply pile and girder; they are Muddy Plains and King's bridges over the South Esk Rivers. One is in course of construction now within about 9 miles of here.

5697. We noticed in one or two bridges on the North-West Coast, now being erected, or which have been erected by the Department, that the footway overhangs the waterway, and is supported by braces; this roadway has now become depressed. Have you anything similar in your district? No, I do not know a bridge with a overhung footway.

5698. Have you any bridges where iron brackets support wooden parapets? Yes, in several instances.

5699. Do you consider that a desirable form of construction? I do not see any objection to iron brackets supporting a wooden post.

5700. Iron is practically imperishable, but wood has only a short life; does not iron add greatly to the cost without giving a longer life to the bridge? The wood would have to be curved, and iron would be the cheapest brace.

5701. In the Leven bridge nearly seven tons of iron brackets are used. The timber will be replaced many times before the brackets are worn out. Do you think that a profitable form of construction? I really can see nothing against it. Suppose the balustrade decays and the brackets are good, they can be used again and again and no loss is incurred. If we could have the whole balustrade iron it would be better. We must have some architectural feature in the work, and iron is actually the best thing you can put in. It is easily fixed, and light in effect. I do object to great solid weight in brackets.

5702. We wish to know the reason for using these brackets? Iron is much better than wood, and can be used again and again; it can also be treated architecturally at less cost.

5703. These brackets weigh about 1cwt. A piece of timber 4 by 3 and 5ft. in length would not cost a tenth part of the bracket: do you think such expense necessary. The timber would have cost more than the iron if architecturally treated.

5704. Cannot wood be cut in a suitable way? Not as compared to cast iron.

5705. These brackets cost from 25s. to 27s. each: would not that be ten times the cost of timber? It would be if you use a straight strut, but if you cut your wood at all it would cost more than iron.

5706. Do you know any other place where this mode is adopted? Not anywhere but in Tasmania.

5707. Do you approve of it for the reasons stated? Yes, I think the use of iron here is only in its first stage yet, and it will shortly be used much more largely.

5708. Do you think local bodies are now, and have been, sufficiently consulted by the department in reference to the construction of public works? I think they are consulted quite sufficiently.

5709. Have you had supervision of the Public Offices in Launceston up to within a certain time? Up to the present time.

5710. Under whose supervision are the new buildings now being erected? The Custom House and Post Office are being erected under the supervision of Mr. Corrie, Resident Architect, and he appoints his own officer. All the other buildings are under my charge.

5711. Those are the two principal buildings in Launceston? Yes.

5712. And you have nothing to do with them? Nothing.

5713. Have you anything to do with carrying on the harbour works in Launceston? Nothing.

5714. How are they supervised? The Marine Board have their own engineer.

5715. Does the Marine Board obtain a money grant from Government? Yes.

5716. What guarantee have the Government that the money is properly expended? The accounts are passed for payment with their officer's voucher, and if considered of sufficient magnitude to warrant such a step the Engineer-in-Chief or the officer he appoints examines the work before the money is paid over.

5717. Does the Marine Board send in a plan of the works which they propose to carry out during a particular time? All the plans are submitted to the Director of Public Works by the Marine Board.

5718. And then the vote may follow? The vote may follow accordingly.

5719. How is the expenditure of that money supervised? The expenditure is supervised by the Marine Board, with the assistance of the resident engineer and foreman of works.

5720. Does that engineer visit the locality to see that the works are being carried on in a systematic and workmanlike manner? I think he is always on the ground.

5721. You think the money is properly expended? I think they are very careful men; and several very competent men are on the Board.

5722. Contrasted with the Government system, how does that of the Board compare as to efficiency? The Public Works Department do not pay over any money without first calling on their officers for a report and examination. For instance, money is voted for Launceston for certain works. Before any money is paid over, the list of works is sent to the officer for his report, and he is supposed to visit all those works, and pass his opinion on them. The same course is taken in regard to the public reserves. All the money voted by Government and spent on them is spent through the report of the visiting inspector. Generally they come through me for Launceston.

5723. Do you think that the works of the Marine Board are carried out in such a way as will provide good and permanent results? I have not seen the plans, and am therefore not competent to give an opinion.

5724. Who is the officer in charge? Mr. A. Clerke, under the Marine Board.

5725. Do you know what it is intended to provide for post office accommodation in Launceston? I do not know, but I can get the information for you.

5726. Would Mr. Eldridge be able to explain? He can explain everything, having all the drawings, &c.

5727. Can you say whether, up to this day, there has been any want of public accommodation in Launceston? Yes, we had a growing want. As the work increases we feel the want more.

5728. What Departments are housed in the Public Buildings? Post Office, Telegraphs, Mines, and Lands Offices; the Works Department is an overflow.

5729. Do you find the accommodation insufficient? Quite insufficient.

5730. *By Mr. Stanley.*—Had you anything to do with laying out the road between Launceston and Scottsdale? As far as the 24th mile, about midway between here and Scottsdale.

5731. Previous to the formation of that road, did you make any survey yourself, or obtain the services of a surveyor for that purpose? Surveys of the whole country on the line to Scottsdale were made, and are in existence now.

5732. Did that include the longitudinal section of the ground over which the road is constructed? Yes.

5733. And upon that section were the proposed grades laid down? Yes.

5734. Has that generally been the practice in the department under your charge? Yes, where the country demands such a thing, and when it is for a road of sufficient importance—that is a main road—and the nature of the country demands a survey, it is made.

5735. Are you of opinion that sections of main roads, where practicable, should be made before constructing them? Yes, they should be.

5736. In travelling over the road between Launceston and the Piper, my attention was drawn to a rather long deviation in ascending a considerable rise called "Holloway's Hill": can you explain why the road was reconstructed there? In the first instance that had been a splitters' track, by which the people of the country travelled to town with drays, packhorses, &c. When we came to construct the road we arranged with the settlers to take the road the best way we could with the best grade we could find along the hillside.

5737. I observed along the road abandoned that some considerable expenditure must have been incurred in cutting and forming this road. Why was this done before the permanent road was decided on? Not a shilling of public money was expended on it. It was done by the settlers themselves before the Waste Lands money was available.

5738. Then the present line of road at that place is the only one on which the Department has expended money? That is the only one.

5739. Did you construct the present bridge over the Piper River on that road? No, it has been in existence for about 14 years.

5740. Can you speak of its present condition? It is very bad, indeed—unsafe.

5741. You think it advisable that a new bridge should be constructed? Tenders have already been called for that bridge, and the drawings are now lying on the table.

5742. Can you state if the bridge will be constructed at a higher level? The present bridge is carried level; the new bridge will be on a grade.

5743. That will have the effect of easing the present pinch at the Launceston end of the bridge? Yes, and the approach is surveyed in sections, and all the road will be levelled there.

5744. In the case of timber bridges constructed over tidal rivers, is it your practice to protect the piles in any way against the ravages of the marine worm? I have not constructed any bridges over tidal rivers.

5745. Does it form any part of your duty to supervise the maintenance of main roads? Yes.

5746. Is the money for such maintenance expended under your direct control, or by the Road Board? A certain number of the main roads are maintained departmentally, others are maintained by the Road Boards.

5747. Will you explain why that difference in practice exists? In some instances portions of main roads run through districts where no Trust of sufficient strength exists, and in others the Trusts have failed in their duties, and the road has been again taken over by the Government.

5748. In those places where the roads are maintained by Road Boards has it been part of your duties to see that the money has been judiciously expended? Yes, it is generally. We have no access to the accounts of the Trusts, but if we see any part of the work not being done in a proper manner our instructions are to report the same.

5749. From your experience in Tasmania do you consider it a better system to have these roads under Road Boards or under direct Government control? I think myself that the Road Boards are too small and too numerous. Either they should be amalgamated into much larger Boards or the roads should be under Government control. We have in some instances three Trusts in one road of a few miles long.

5750. How do the Road Boards obtain money necessary for carrying out the roads in their districts? They rate themselves. If they rate themselves 4*d.* in the £ they get 6*d.*, if they rate themselves 6*d.* they get 1*s.* The higher they rate themselves the more Government give them.

5751. With regard to cross and bye-roads, are they maintained solely by the Road Boards, or under Government supervision? Before the construction of bye-roads takes place the Trusts are asked if they will maintain these roads if constructed, and the consent of the various Trusts being obtained the work is carried out.

5752. Who determines the route of these cross roads, and makes the necessary surveys—is it the Department or the Road Boards? Neither; almost invariably the residents of the district indicate the route that they want the road to go.

5753. I presume that they generally follow existing tracks—is that so? Not always; for instance, there is a piece of bush and there may be a track through it; when the road is to be formed the inhabitants are asked for advice. Twenty of them will perhaps meet and thoroughly discuss the best route through the bush. Then the practical knowledge of the District Inspector is added to their local knowledge, and he almost invariably succeeds in placing the road where it will do the greatest good for the greatest number. Economy is the first law to be considered.

5754. When the land in the vicinity of these roads is surveyed, does the Survey Department adopt the roads as laid down by you, or do they survey roads as a basis for land surveys? I think we have been acting the part of putting the cart before the horse. Land was selected long before the road was surveyed. Now a better system is employed; it is to have the surveys effected and lay out the roads through the land before the land is thrown open for selection; that is the mode now adopted. The previous system was for the land to be selected, then a surveyor would come along and survey a road by blazing trees, which always causes difficulty.

5755. Now the roads are surveyed previous to the land being sold? Yes, prior to the land being surveyed for selection, roads are also surveyed.

WALTER COUSENS, *examined.*

5756. *By the Chairman.*—What office do you hold under the Government of Tasmania? District Inspector.

5757. For public buildings or roads? Roads.

5758. What is the extent of your district? A radius of about 37 miles from Launceston.

5759. That would include Longford, nearly up to Westbury? Yes, and to Bridport, Frankford, and George Town.

5760. What distance do you extend towards Scottsdale? About the 24th mile from Launceston.

5761. Coming round by way of the Corners? No, coming round by Piper, Longford, and the Everidge estate.

5762. Are there any large bridge works in your district contracted for during the last three years? Yes, two bridges at Longford.

5763. Is that the one at the junction of the South Esk and Lake Rivers immediately above the railway viaduct? Yes.

5764. What has been done there? A pile bridge on a low level has been constructed.

5765. Had the old bridge decayed? Yes.

5766. Did you construct that work by contract or under the immediate supervision of the Public Works Department? By contract, supervised by an officer in immediate charge of the works.

5767. Does the design of that bridge involve any new or novel mode of construction? It is altogether different to the old style.

5768. What is the description of the bridge? It is a pile bridge.

5769. How many openings are there? I do not remember.

5770. Is it on trusses, or is it a flat-topped bridge? It is a flat-topped bridge.

5771. Do you remember its cost? So far as my memory goes, it was £2250.

5772. Are you satisfied that the work has been carried out in a business-like and faithful manner? So far as the design goes.

5773. Do you approve of the design? It is a low bridge; the water tops the bridge by about 3 feet.

5774. Is it similar to the old bridge in that respect? Yes, it was intended to be a low level.

5775. Do you think it will answer the purposes of the district? It will always be liable to flood. It is not every flood that goes over it.

5776. During the course of the year how many days would the public be unable to use it by reason of floods? The last flood came up to about a foot above the footway of the bridge. It would take a very high flood to stop traffic.

5777. Then it suits public purposes? Yes, except that the approach has to be made.

5778. Are there any other public works in your district? At Muddy Creek there is a bridge.

5779. On what line is that? A branch road from here to Carrick. It branches off to Longford.

5780. Is there anything you would wish to say in regard to that bridge? No; that would appear to be above high flood mark, so far as I know.

5781. What stream does it cross? The Esk.

5782. In calling for tenders for these large works, what course do you adopt? That is done in the head office at Hobart.

5783. Are they designed at Hobart? Not without the particulars are demanded.

5784. Are the works properly advertised in the Hobart and Launceston papers? Yes, and specifications describing the work to be done are placed at certain places locally.

5785. Where would specifications be deposited for Longford bridge? At Longford, probably also at Westbury, Hobart, and Launceston.

5786. Have you constructed any roads in the colony, and to what extent? I have only been in the colony 2½ years, and have been in various parts of the colony. For the last seven months I have been in Launceston.

5787. Have you carried out any works in that time? Yes, we are carrying out the vote of last year.

5788. When works are determined on what is the mode of construction? When opening out bush country the land has to be considered and money voted for it.

5789. Do you apply to the local authorities for full particulars to make the road a useful one for the district? I should do so in every case, and have done so in every road I have carried out.

5790. Do you ask the local authorities about waterways? No, I have not here.

5791. How do you get the precise area a stream requires? You can only do that by consulting the local authorities.

5792. How have you determined these waterways? Having found out, from enquiry, that the road was a suitable one, I should get it cleared, and then ascertain from people what was required to be done in that way. There may be £1000 voted for 12 miles of road: the people want a road to be made there and you then lay it out.

5793. Take 5 or 6 miles of a certain road, what steps would you take? I should first get it cleared and grubbed, and then should go carefully over it and see how I could best grade it and get the waterway; we then would pick it out 10 chains at a time, grade it, make notes of particulars required in grading, whether formation of flat, and having fixed it in that way, we make a road through the bush.

5794. Would you consider it advisable to consult the local authorities before deciding on the character of the works? Yes, I should find out their opinion.

5795. Have you received any instructions which induced you to consult the local authorities? Yes, lately.

5796. Do you make it a part of your duty to consult them? Yes; I know we cannot do without their advice, but it is only lately we have received these instructions.

5797. When did you receive these instructions? In January.

5798. Previous to that were there no definite instructions on the matter? Not that I know.
5799. In event of any dispute between you and local bodies as to their taking over completed roads, what course do you follow? I would refer it to head quarters.
5800. Has any such dispute come under your notice? No.
5801. Generally speaking, do the officers of the department satisfy the road trusts? I think so, as far as the work is done.
5802. Are you satisfied that the most economical way of spending the public money is adopted? So far as taking pains and carrying out principles are concerned, I do the best I can.
5803. Have any complaints been made to you or against you to the department? No.
5804. Then may we infer that so far as you are concerned your work is carried out satisfactorily? Yes, so far as I have heard they have always been satisfied with the work done, although in some cases it has cost more than if done by the road boards; but then it is of a difficult character.
5805. Do you know any case in point which will confirm or disprove the assertion that specifications are not locally deposited in proper time? No, not in these districts; it might be on the West Coast, where the mails were not regular.
5806. It must be a dereliction of duty on the part of some one if such has occurred? Yes, or delay of mails in outlying districts.
5807. Do you know anything about the Post Office in Launceston? No.
5808. Do you know anything about the procedure of the Marine Board in Launceston? No.
5809. Is there any other duty entrusted to you which I have not brought under your notice? There is the maintenance of several roads; the Carrick road and Scottsdale road have recently come under your notice.
5810. Is the Carrick road part of a main road? Yes.
5811. Then how does it come under the department? On account of it not being properly maintained by the Road Board.
5812. Is there anything in connection with that road which it would be to the public advantage for you to state? I do not think so. We are doing the best we can with the money at our disposal to bring the road into proper repair.
5813. *By Mr. Stanley.*—Who effects surveys for new roads? The lying-out parties, generally myself.
5814. Do you make a survey and take longitudinal sections previous to entering upon construction? It depends upon the country.
5815. In rough or difficult country is it your practice to make a section along the line of road previous to construction? We do not take a regular longitudinal survey right through, but particulars are taken.
5816. What do you mean by particulars? Suppose we have £1000 to lay out on a certain road: the authorities are first consulted as to where and how the money shall be laid out, and having got to know their wishes on the matter, I use my own discretion. I then make a general survey by first clearing the line.
5817. If you have to construct a new road or improve upon an existing track through difficult country, is it your practice to have instrumental surveys made, or do you merely go over the ground and judge by the eye as to the best route to follow? As far as the route is concerned, practically the route is fixed by the survey of the old line.
5818. Who makes the survey? There is no instrumental survey made,—not as you put it.
5819. Where you have a certain elevation to rise to you must contour to get that elevation: how do you then lay out the line of road? I have laid out a road with the level, but it is not the usual practice.
5820. Do you not think that it would be a wise and economical practice to have proper surveys made in the case of main roads before entering upon permanent construction? Yes, provided they could be carried out. I should only be too glad to have such a system. Still the work is laid out according to the present *régime* as carefully as possible.
5821. Has it not occasionally been found that after constructing a road the route has been improved upon and money laid out on deviations? Yes.
5822. Would not a proper survey have saved this double expenditure? It would, if the route the authorities laid out would be the fixed line of route.
5823. Who furnishes you with specifications and particulars of contract for works carried out in your district? The specifications are provided, and then we take particulars which answer to the instrumental survey. We send in these particulars, provide plans and specifications, and state any conditions necessary for size of culverts &c.
5824. From whom do you receive the plans and specifications for bridges? For ordinary sized bridges we make them ourselves. The bridge at Longford would be done by the Engineer of Roads.
5825. For unimportant works you prepare them in your own office? Yes.
5826. And the conditions of contract, do you prepare them? Yes.
5827. Will you furnish us with a copy of those conditions? Yes, I hand it in.
5828. Is this the usual form of specification, conditions, &c., upon which works within your district are carried out? Yes.
5829. Can you furnish us with the conditions of general contract? Yes, I will.

5830. Do you find those conditions of a practical character, and adapted to the character of the works you have to carry out? Yes, as far as they go, they are.

5831. Has any objection been raised by the contractors to the general conditions of contract? Not so far as I know.

5832. Are there any things which you could suggest in regard to these conditions by way of improvement? No.

5833. Who supplies you with these specifications? They are supplied from the office of the Engineer of Roads.

5834. Do you find these specifications applicable to the work you have to supervise? Yes, so far as they go; sometimes we have to make additions in writing, but generally we find them correct.

5835. Have you erected any bridges over tidal rivers in Tasmania? No.

5836. Has it been your practice to lay metal over the timber decking of bridges in your district? Yes, generally it is done.

5837. Do you take any steps, and, if so, what steps, to protect the timber against decay where that is done? The decking is tarred over with hot tar, and the metal is mixed with tar.

5838. Do you find that sufficient to prevent the rapid decay of the timber? Scupper holes are laid from the foundations at the side.

5839. Have you found these provisions effective in preventing decay of the timber? Yes, so far as I know.

5840. Do you think it advisable to load the bridges by covering them with metal? I see no objection to it if used in small quantities; it saves wear and tear of the decking.

5841. Have you done it in the case of any large bridge of wide spans? No.

5842. Do you think it inadvisable to do it in the case of large bridges? Probably not; it never occurred to me.

LESLIE CORRIE, *examined.*

5843. *By the Chairman.*—Do you hold any position in the Public Service of Tasmania, if so, what? It was understood when I was appointed local supervisor of the Post Office and Custom House, that I was to become an officer of the department whilst the works in question were in progress.

5844. Were you engaged on account of being the successful designer? No, they were prepared in Hobart.

5845. How were you connected with them? I suppose it was thought desirable to have an officer in Launceston.

5846. Are you in a position to form an opinion whether these buildings will be suitable to the public of Launceston?

5847. Do you consider the form of construction suitable and efficient? That is a peculiar question to answer. The construction is suitable so far as construction, and suitable for the description of building, but another design might be preferred by others.

5848. Are they in your judgment economically designed? I do not know whether it is right for me to answer that—if I am answering as an officer of the department, I do not think I should criticise these plans.

5849. Unless these plans show a radical want of constructive skill I think you might pass your opinion on them? I can say at once that there is nothing radically wrong. The outside work is expensive, and there is a good deal of work about it. The finishing and carving (I am speaking of the post office) I have not quite understood yet. The Custom House is a much plainer building.

5850. You will bear in mind that public buildings are usually more elaborate than private buildings: your objection, therefore, has less weight? Considering the building with other buildings in the other colonies, I should think it is not in any way elaborate.

5851. Will they provide for the wants of Launceston? They will meet all present requirements.

5852. How will the new Post Office compare with the present? I should say it will give considerably more accommodation. This is a large building, and only for post and telegraph purposes.

5853. The present building is used by several departments, is it not? Yes, for Mining, Lands, and other departments.

5854. In reference to the details of the new building, have any novel principles of construction been introduced? No, the building is simple enough.

5855. Are the works being carried out by public contract? Yes.

5856. Were the tenders obtained for them in the usual way? Yes.

5857. What will be the total cost? The Custom House is £9500, and the Post Office, £15,700.

5858. Will the estimated cost be exceeded, or will it be within the amount voted by Parliament? That depends on what alterations are to be made; one or two alterations are now spoken of. The building is complete, and the cost should not be increased unless alterations are made.

5859. Are you satisfied the contractor is carrying out the work in a satisfactory manner? Yes, he is very willing; the foundations of the Post Office have to go a little lower than estimated.

5860. Do you go over the work? Yes, I make a return every week, and furnish it on the 15th of the month to the department, who keep 25 per cent. in hand. We carry that on from month to month, and call the attention of the department to anything thought advisable when making the return.

5861. Are you connected with any other public buildings? No; I had, indirectly, something to do with the Charles-street State School, but the department did not know me in the matter. Mr. Hunter was supervising officer, and I obliged him.

5862. As an architect residing in Launceston, are you aware of any failures in public buildings in this town? I have heard something about the sanitary arrangements of the hospital.

5863. Matters of detail? Yes; no public buildings have been erected here for many years.

5864. Will you explain the plans of the two new buildings? In the Custom House you will observe that the original plan contemplated covering the whole area with a slab of cement concrete, but after further consideration it was decided to build on piles.

5865. Was that abandoned before the tender? It was tendered for, and a tender accepted; then abandoned, and re-tendered for on a pile foundation.

5866. They are building on pile foundations? Yes; the building is on a pile foundation.

5867. Do you consider piling necessary? Yes, decidedly.

5868. Do you fill in concrete round the piles? Yes, 2 feet of concrete finishing at the top of the piles, and coming up to the foot of the planking. Here there will be a small extra. Under a couple of small cross walls single piles only were shown. To put planks on one pile there would be but one bearing, and by introducing a few extra piles we have managed to get a double row of sleepers, making a much better arrangement. That will be an extra.

5869. To what depth do you drive these piles? They vary, but are more even than was expected. The piles vary from 28 feet to 32 feet, and there has been cut off those about 2 feet 6 inches.

5870. What test blow did you give? A fall of 12 feet, with a ton monkey, gave a drive of half an inch for each blow for the last four blows. We were very careful with the observations of the piles driven by these tests.

5871. Could you not have sunk shafts at short spaces on the walls of the building, and filled these with concrete, and connected these piers by arches? We could if we got to a solid bottom, which we did not. They were all shod, and after getting down a certain distance they seemed to get on to gravel.

5872. Could you not have built the walls wholly in concrete, without going to the present expense? I think we could not: the present contract is a saving.

5873. Will you explain the Post Office plans—take the entrance first? There is one entrance from Cameron-street by which the public will enter and find themselves in a quadrangle, from which by doors access will be given to the different departments.

5874. *By Mr. Stanley.*—Have you found the specifications furnished you for the public buildings under your supervision sufficiently full and explicit? Yes.

5875. Are they so prepared as to avoid unnecessary extras arising? So far as we have gone I have not had any difficulty; they are so minute that they should not require extras.

5876. Do you approve of the way in which the general conditions of the contract have been prepared? Yes; the only thing that struck me was, that there is an awful lot of them; they are very complete.

5877. Are they prepared in such a way as to properly protect the department without being unnecessarily severe upon the contractor? Everything is left to the final approval of the Director of Public Works. I think if he carried them out arbitrarily in one or two instances they would be severe.

5878. Will you give an instance? Clause 17 reads—"Should the contractor at any time during the progress of the work refuse to execute without extra charge any work not literally set forth in this specification or on the drawings, but which may be considered by the Director of Public Works necessary for the proper carrying out of the works set forth in the most approved manner, it shall be lawful for the Director of Public Works to suspend the whole or any portion of the work until such work has been executed; or, if he should think it necessary, to employ other parties within three days of receipt of notice by the contractor to perform the required work, and the expense of so doing to be deducted from the amount of the original tender; due notice of such intention having been first given to the contractor in writing." That struck me as arbitrary because it did not give the contractor power to go on with the works. The contractor might want to understand if it were extra work.

5879. Such a clause might press very unfairly on a contractor, might it not? I think it might, but the contractor did not mind signing the conditions. He would always have legal power to protest against hardship.

5880. Have any objections been taken by the contractor to the conditions? No.

5881. What sanitary arrangements are provided at the Custom House and Post Office? At the Custom House nothing is shown. There is a sum provided for this work in the contract, to be expended as may hereafter be pointed out. There is no reason to go into the matter at present.

5882. Then there is space for closets which can be utilised, but they have not been provided? It is left to be done after. It is provided for.

5883. Are they provided for in the Post Office? Yes, closets, urinals, and waterpipes are provided.

5884. Is there anything in connection with sanitary arrangements that you would suggest altering? I would suggest a slight alteration in the size of ventilating pipes, but it will not affect the cost. It is simply in regard to the size of pipes.

5885. Is the closet accommodation sufficient, in your opinion, for a building the size of the Post Office? There are five water-closets in connection with the building, and four urinals.

5886. What staff will be employed? I should think there is sufficient accommodation. A couple more could easily be extended if necessary.

5887. Regarding the subway for mail carts, do you consider it a convenient one, and sufficient to meet the requirements of the service—is the subway wide enough? The subway is not wide enough to let the carts pass.

5888. Is there any place they could turn? No. If the despatch of mails will not clash with mails coming in, the subway is sufficient, not otherwise.

5889. Is there yard space provided? Not on the ground; there is one upstairs.

5890. Would it not be an advantage to get yard space? Yes.

5891. Could additional land be obtained to supply yard space? Yes, there is some adjoining.

5892. If purchasable, would it not be advisable for the Government to get it? Yes; if they had liked some time ago they could have got it.

WEDNESDAY, APRIL 7, 1886.

PRESENT:

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

AFTERNOON SITTING.

ROBERT KENNEDY *examined.*

5893. *By the Chairman.*—What is your name? Robert Kennedy.

5894. What are you? I am a shipbuilder and mechanical engineer.

5895. What length of experience have you had in mechanical engineering? About twelve years in Melbourne, and about sixteen months here.

5896. Have you had much experience in the construction of iron girders? No.

5897. What is the nature of your agreement with the contractors as to the construction of these girders for the Derwent Valley Railway? Our agreement is simply that we have to construct them according to the plans and specifications.

5898. As supplied by the Railway Department? Yes; they have the plans.

5899. Do these specifications contain any condition as to the quality of the iron? Yes; tests are provided for in the specification.

5900. Is any particular brand of iron specified? No.

5901. Then the only condition as to quality is the test provided in the specification? Yes.

5902. And if you satisfied the Government officers, the iron would be accepted? Yes, and at last it is. It is my contention that by the specification it is to be equal to Staffordshire iron, and to stand a certain test. I mean that it is to be equal to Staffordshire iron—not necessarily from Staffordshire.

5903. Does the Government Inspector examine the iron from time to time? Yes.

5904. And is he satisfied as to the quality? Yes, perfectly satisfied.

5905. Has he ever, during the course of construction of the girders, complained of the quality of the iron? Never; quite the reverse.

5906. Has any officer of the Railway Department complained? No one.

5907. Then, as far as the quality of the iron is concerned, no complaint has been made? No.

5908. Then as to the construction of the girders: what condition did the inspector impose on the construction of these girders? No condition whatever, excepting that they should be made according to plans and specifications. The only iron to be proved is the rivet iron. We make our own rivets, and, as far as we know, all has gone on satisfactorily. All the rivet iron has been tested by bending double. As each lot of iron came in it was cut off and tested, and when the rivets were tested the samples were left in the Railway Department.

5909. Did the Government Inspector examine the iron after it was marked and spaced out by you? Yes, they tried, and were satisfied that the rivet holes were properly placed in connection with the plates, and not merely cut to pattern.

5910. Were the joints planed down on the faces? No.

5911. How did you set the binding T irons? We made a wooden pattern of the shape, then made a cast-iron block and hammered the T iron into the block.

5912. We noticed that some of the T iron parts were short, that the ends did not butt to the base plates? That is easily accounted for. These T irons are all cut to one size, but when formed and placed in position it is almost impossible to get them all alike. It is not as if they were cast-iron.

5913. Did you build those girders to the camber of the specification? Yes, and they showed more.
5914. Then how do you account for the girders being down to the level line? They are not down.
5915. How do you test them? We sighted them.
5916. What did the result disclose? Fully half an inch more than the camber was supposed to be on the girders.
5917. Are you certain of this? Perfectly.
5918. How do you account for the plates being unequal in width and the lines slightly waved? I cannot account for it. Every web-plate in the girders is cut to a plan. Each web-plate and every girder would be cut from one plan, and they should fit into one another.
5919. Would not the reason be that the plates might be bent in coming from the punching machine? As you know, Mr. Zeal, they would be liable to be bent in coming from England. If done in the punching you could not get the bend out. It would be straightened by being rivetted when put together.
5920. All the iron was put through the rollers and straightened after punching? No, before.
5921. That might account for the wave? In some cases it might.
5922. Did the inspector call attention to it? No, it might be that the cover-plates of the girder when put on would bring it fair.
5923. Have you carried out your contract to the satisfaction of the inspecting officer? Yes, to the letter.
5924. Did he express satisfaction? Yes, he expressed satisfaction.
5925. Would you be prepared to state the brands of the iron? Perfectly so. All the angle and T iron is from R. Heath and Co., Staffordshire; all the web-plates from the Consett Company. The shield plates in the middle are of steel. We could not get a manufacturer in England to manufacture quarter-inch plates of iron that would stand the test imposed. Steel plate used are tested to 32 tons.
5926. As to the wrought iron casings for the No. 2 bridge being made by you, what is the quality of the iron? It is the same iron.
5927. And the bars? They are the same iron.
5928. Regarding the inspection of these cases, has the inspector seen the work from time to time? Yes, as it went along.
5929. And has he expressed approval? Yes, he has expressed his entire approval.
5930. In point of fact, no communication, written or verbal, has been received by you condemning any part of the works? No communication of any kind whatever.
5931. *By Mr. Stanley.*—Did you purchase this iron under any guarantee as to tensile strength? Yes.
5932. What was it? 24 tons to the square inch for iron, and 32 tons for steel. I had the tests made in England, which I paid for.
5933. Who are those tests certified by? The inspector to Messrs. R. Heath and Co., and the Consett works.
5934. Is he a Government inspector? No, only for these works, where all irons are tested before going out. I have a guarantee that the iron has been tested up to that strength.
5935. Then that is by a man appointed by the manufacturer? Yes.
5936. Is not one of the tests required a bending test? No; the only test is that it shall carry a weight of 24 tons to the square inch.
5937. No bending test required to the plate iron? None. There is to the rivet iron.
5938. Then no test is applied by the Government inspector here, excepting a certain test for rivet iron? That is all, sir.
5939. What does this test consist of? The iron has to be bent double without fracture.
5940. I presume no attempt has been made here to test the tensile strength? None.
5941. Do you think there would be any insuperable difficulty in applying such a test? There is a difficulty: we have not the means of doing it.
5942. Did you never see testing machines of a rough description for testing iron? No, I never did, sir.
5943. Has the department called upon you to produce the tests you obtained from England? Never; and I would not produce them. I only got the tests to protect myself, knowing whom I had to deal with.
5944. Did you satisfy the contractor? No, he never said a word to me.
5945. Then, as far as the department and the contractor are concerned, they have no proof of the tests? Neither of them.
5946. Are the girders you are manufacturing to be tested in the yards before being taken to the works? No.
5947. There is no stipulation that they are to be loaded or tested? No, none whatever.
5948. They are to be built to a camber of 1 inch, I think. Yes; I am satisfied that they have that camber.
5949. Are you satisfied that they are not less than that? One of the girders has only an inch camber. It was the first put up. We are satisfied we have done our part correct as to these girders, if they were to

break in two to-morrow. We are not responsible in any way. We have done our duty, and we are done with it.

5950. *By Mr. Lawder.*—You say that you consider that you have done your duty as a sub-contractor; but I presume your responsibility lasts until you have delivered these girders on the works? No, not after we deliver the girders at our works.

5951. Then, I presume, the chief responsibility rests with the contractor? Decidedly; we have to deal only with him.

5952. Then he is responsible for all the tests required by Government? Yes, for everything.

5953. I think you constructed, in addition, all the girders for the bridge over the Plenty? Yes.

5954. With the roadway on the lower flange? Yes.

5955. What is the span of that bridge? 64 feet.

5956. Is the cost of that one span, with roadway on the lower flange, much greater than with the roadway on the upper flange? Yes.

5957. Can you give the Commissioners an idea of the percentage of extra cost? I should say it was about a third more in value.

5958. The joints, the Commissioners observed, were not so close as they should be? Probably so.

5959. Was that from want of proper appliances to shear them off properly? No; we could shear them off to a hair's breadth, but you must remember in dealing with these sheets we are not handling a sheet of paper. If the holes are not drilled we cannot get those things perfect. The holes are only punched. If the holes had been drilled by hand we could have done it.

5960. You could have drilled the holes? Oh, yes; but it was a question of cost.

5961. How much more would it have cost? Half as much again.

5962. Would you give us some idea of the price? It is as the cost of machinery in the one case, and hand work in the other.

5963. But what would it be in value? About £56 per ton in drilled work, as against £24 in punched work.

5964. Is there nothing in the specification as to planing the girders? I could not say, but I think there is.

5965. Then, in not planing the girders in accordance with the terms of the specifications, you have waived those parts? Probably there is an oversight in that part of it.

5966. Then, in the event of the Government officer not passing the work afterwards, might he not fairly take exception to your not following the specifications? He could do so, but we consider the girders almost as close as if planed; he could do so, but he should have done so before, when we were putting the thing together.

MR. GEORGE HAY EDWARDS, *re-examined.*

5967. *By Mr. Stanley.*—Did you prepare the contract plans and drawings for the Fingal and the Scottsdale lines? I did.

5968. Were they done under contract with the Government? Yes; I made the offer to do the work for one and a quarter per cent. on contract price, and I received a reply from the Government after I had nearly completed all my arrangements here that I was to be paid on certain items only.

5969. And was that amount sufficient to cover the cost of preparing these plans and to leave you a fair remuneration for your labour? No; it was not sufficient.

5970. Then are we to understand that you lost considerably by carrying out the contract at that price? Yes; the per-centage has not paid for my own services.

5971. Have you represented this to the Government, that is, the loss that you have sustained in carrying out this work? I have mentioned it to the Engineer-in-Chief, and he told me that he looked upon me simply as a contractor.

5972. But have you made any claim for extra pay on account of your original prices having been altered without your concurrence? No, I have not made any claim. I should mention that I accepted the terms offered by the Government under protest, because then I had completed my arrangements for the necessary offices and staff.

5973. Had you to undertake any extra work in the preparation of these plans and drawings—work which was not contemplated by you when you accepted the terms proposed by the Department? I cannot remember the facts without referring to the papers, but I think it was the office work (with the exception of the clerical work). Of course I had to do a certain amount of clerical work, correspondence, and so on, for which I made no charge. I was paid for the working drawings afterwards. I considered my work completed when the contract for each line was accepted.

5974. Then have you been paid extra for any working drawings prepared since the original type drawings? For the working drawings of No. 2 bridge for the Derwent Valley line, and the working drawings of the Dogwood Gully viaduct on the Scottsdale line. I was not asked to prepare any working drawings for the Fingal line.

5975. With regard to the sections on the Fingal and the Scottsdale lines—were those graded when they were handed over to you? The sections were prepared and graded in my office.

5976. What information had you to guide you in fixing the culverts, bridges, &c.? The culverts, waterways, &c. were all fixed by Mr. Climie, the resident engineer.

5977. What line are you speaking of? The Fingal line. I supplied the Resident Engineers with tracings showing all crossings. They were sent to Mr. Climie, and he returned them with waterways marked upon them.

5978. What information had you to guide you in determining the waterways on the Scottsdale line? The waterways were determined by the Resident Engineer on the Scottsdale line.

5979. Was this previous to the sections being handed over to you? No; the sections showing the natural surface of the ground were previously plotted.

5980. Who plotted the sections? The sections were plotted in my office, from the surveyor's field-books. In fact the whole of the work was done in this way. The field-books were sent into me from the field, and all the plans and sections plotted from the information supplied.

5981. What I want to ascertain is, at what period were the waterways determined, and by whom? The waterway were determined immediately the natural surface of the ground was plotted in the usual way, and then cloth tracings were made of the sections, with all local information written on, and forwarded to the Engineer-in-Chief. Everything went through the Engineer-in-Chief's office.

5982. And upon those tracings of the longitudinal sections I understand that the Resident Engineer marked the waterways? Yes. With regard to the Derwent Valley line, I had nothing to do with preparing the sections. They were all prepared by Mr. Mault.

5983. I am asking you with respect to the Fingal and the Scottsdale lines? Yes, they were all determined by the Resident Engineers.

5984. Are you aware what alterations were made in the original designs for culverts on the Fingal line? I am not aware of any alterations having been made on the Fingal line, for after the contract was let we had very little work to do for that line. We prepared the land notice plans, which would be, I think, before the contract was let, as in the case of the Fingal and Scottsdale lines.

5985. Then you have not prepared any alternative designs for those culverts? None whatever on the Fingal line. I made no working drawings.

5986. Are you aware that concrete was substituted for masonry in the arches of many of those culverts? I am not. I have not been over the Fingal line since it was pegged out. Any alterations would probably be made by the Resident Engineer.

5987. Do you think it would be safe to construct arches of concrete without providing for any bond between the masonry and the concrete and the arch? I have never constructed culverts in that way. I should be in favour of making them wholly of concrete or wholly of masonry. I do not think the construction would be satisfactory.

5988. Would you be surprised to hear that the spandril wall slid forward on the top of the arch through the pressure of the bank? I take it that the wall, in that case, would not be thick enough.

5989. Is it a usual thing to design faces of culverts, such as those on the Fingal line, without having a batter provided? I should like to refer to the drawings of the culverts on the Fingal line. [Drawings referred to.] I have designed similar culverts in Victoria.

5990. Are you quite sure that, in the case you refer to, the wing walls were built without a batter on the face? I think that they were built similar to these drawings.

5991. Then, having no batter to the face, had they any set-offs in the back to increase the strength of the wall in proportion to the pressure? Yes, they would be stepped at the back.

5992. Do you consider that a culvert, designed such as those in the contract drawings, is sufficiently strong to resist the pressure of a bank 29 feet high, such as that at Stony Creek, on the Fingal line? There is no special drawing given for Stony Creek.

5993. It is 10 feet? The ground line in this drawing is shown very near the invert, but, as a rule, these culverts are sunk a good deal, and would not have so much walling above the ground as represented in these drawings.

5994. Then how do you account for the fact that several of the culverts on the Fingal line have failed, and the wing walls have been forced out by the pressure of the bank, and, in some places, cracked? It may be due to inferior workmanship.

5995. As far as the Commissioners have been able to judge, the workmanship appeared to be excellent, and the material good. The contractor, I may say, attributes the failure entirely to the faulty design and insufficient strength in the wing walls. Have you any explanation to give of that? I could not give any answer to that without seeing the work.

5996. Did you prepare the schedule of quantities attached to the contract for the Fingal line? Yes.

5997. Will you state generally how those quantities were obtained? They were estimated from the plans.

5998. Were the earthworks taken out from the longitudinal or from the cross sections, or from both? From both. The Avoca deviation would, of course, make a difference.

5999. Did you prepare the disposal of the earthworks which appear on the sections? Yes, if they are lithographed; if they are in manuscript, they must have been put on afterwards. You said the disposal.

6000. What you call the balance. Did you prepare the disposal of the earthworks? I could not say without referring to the plan of the Fingal line. [Plan referred to.] It was prepared in my office.

6001. By you? By my assistants.

6002. Can you explain the discrepancy that there is between the quantity of side cutting in the schedule, which is 12,000 yards, and the quantity shown by the disposal in the sections, which is 62,000 yards? I cannot, unless it is caused by the Avoca deviation.

6003. It is in the schedule upon which the contract was let. These schedules I understand represent the quantity calculated from the contract sections? Yes.

6004. Can you explain how this discrepancy arises? According to the disposal on the section there should be 60,000 cubic yards of side cutting? I cannot, without referring to the original papers.

6005. Will you do so, and submit to the Commissioners any explanation you can on the subject? I can do so.

6006. Referring to the quantities under the headings "concrete," "brickwork," "masonry," will you state whether these quantities are obtained from actual calculations, from contract drawings, or are they merely assumed to represent the different classes of work? Some of the items were assumed. In most cases the quantities were taken from the standard drawings—the amount of concrete and masonry, I mean. But these being schedule contracts, many of the items are assumed merely to get a price.

6007. That being the case, is it reasonable to suppose that the total amount of the tender, as calculated upon those quantities, can fairly represent the actual cost of the work? No, it does not. Schedule contracts never do.

6008. Is it not usual for these schedules to be calculated to such a degree of nicety as to represent approximately the actual work to be carried out under the contract? In Victoria it is usual to estimate the work as closely as you

can. In South Australia, I believe, many of the items in the schedule are approximate for the purpose of getting a price. In some cases one cubic yard or one cubic foot is given.

6009. I am aware that it is done in miscellaneous items in order to get a price for work which may be required in carrying out the work; but is it not usual for the bulk of quantities to be calculated as nearly as possible from the contract drawings, so that the amount of tender may fairly represent the probable cost of the work? Yes, it is usual to arrive at the quantities as nearly as possible.

6010. If the quantities are merely assumed for important works such as those under the heading of "concrete," "brickwork," and "masonry," is that not very liable to mislead the Government as to the actual ultimate cost of the works? It would be almost impossible to estimate some of the quantities.

6011. I am perfectly aware that it is usual to assume the quantities for certain items such as those generally classed under the head "miscellaneous"—but I refer to work which can be calculated from the drawings? The only quantities that can fairly be estimated will be the earthworks. The foundations would be variable quantities, and it would be almost impossible to estimate them correctly.

6012. Is there any difficulty in arriving at the total length of culverts, leaving the question of foundation out of account?—the balance of the work can, I presume, be ascertained from the drawings? Yes.

6013. So that if you leave out of consideration any extra work entailed on account of foundations, you would have no difficulty in arriving at a fair approximation of the actual work to be carried out? If proper time was given, no doubt it could be done.

6014. In the case of the Fingal and Scottsdale lines, was sufficient time not given you to prepare the schedule in the usual way? We were very much hurried. The Government was very anxious to get out the contracts by a certain time. I have no doubt that the schedule could be improved upon if we had more time.

6015. Did you ever receive any instructions from the Engineer-in-Chief as to the way in which the schedule was to be prepared, or as to the degree of accuracy which he expected? I do not remember any special instructions. I received a copy of the Mersey and Deloraine line contract as a guide for the other contracts, with a certain portion of the specifications in manuscript to introduce into those contracts.

6016. From our examination of the schedule attached to the Mersey and Deloraine line, and from the evidence which we took, the quantities, it appears, were obtained from actual measurement from the contract sections and drawings—in fact, very few quantities were assumed. Why did you not follow the same course in preparing the schedules for the Fingal and the Scottsdale lines? Was it in consequence of your not having had sufficient time? The specifications and schedules were the last things prepared, and I know that we were hurried on both lines. The quantities were taken from the contract drawings. I think that very few items were assumed, except in the case of the foundations.

6017. In the case of the items under the heading "masonry," have not most of the quantities been assumed? Some of the items under "masonry" have been assumed.

6018. Would the same remark not apply to concrete and brickwork? Brickwork is an assumed quantity in any case, and also some of the items under "concrete."

6019. Again, in case of pipe drains, have not these been assumed? At least five of the items in the case of pipe drains. The smaller sizes would be simply to get a price.

6020. Did you prepare the plans for the station buildings and yards, Mr. Edwards? That work was promised, but was not given to me. It was understood when I first came over that I should do all that work.

6021. Then you prepared no type drawings for station buildings or yards? I offered to, but I believe that the work was done in the Engineer-in-Chief's office.

6022. Was the class of fencing adopted on the Fingal line suggested by you, or did you receive instructions from the Engineer-in-Chief to provide for that—I refer to the wire fencing—Bain's patent fencing? It was adopted by the Engineer-in-Chief, very much against my own ideas.

6023. Did you approve of placing the posts so far apart as 50 feet. No; I do not consider Bain's fencing is a suitable railway fence. It is fit only for an inside fence, or for, say, a deer park.

6024. The Commissioners noticed where that fence passed over unequal ground that spaces were frequently left between the ground and the bottom wire? That is so with Bain's fence.

6025. That is unavoidable when the posts are so far apart? Yes. Cattle would be able to get under it in some places across broken ground. I consider Bain's wire fencing fit only for perfectly level ground enclosures.

THURSDAY, APRIL 8, 1886.

PRESENT:

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

MR. EDWARDS'S *examination continued.*

6026. *By Mr. Stanley.*—With regard to the office work and the preparation of plans and drawings, &c., which you undertook by contract from the Department, had you any regular agreement in respect of that work? I have all the documents in the office. I can produce my letters to the Government, and the replies which I received.

6027. And were those letters the basis of the contract, or was there an agreement—a formal written agreement? There was no formal written agreement.

6028. Do those letters show what work you had to undertake and the terms of payment? Yes.

6029. Would you describe generally the nature of the agreement as shown by those letters? I should prefer to hand in a written statement, because without referring to the written documents I cannot remember everything.

6030. Will you be good enough to supply the Commissioners with a copy of those letters, or a short statement giving the terms of the agreement upon which you entered? I can supply the Commissioners with copies, or with the original correspondence and the original documents.

6031. And you will do so? Yes. It will take me some little time, because this work has been going on now for nearly two and a half years. It will take some time to sort the papers out and put them in order.

6032. What I refer to chiefly is the original agreement into which you entered, either by letter or otherwise, with the department for the preparation of those plans and drawings? I understand.

6033. I do not desire to have all the correspondence which has passed between you and the department, but the terms of the original agreement? At the same time a great deal of the correspondence would refer to the agreement, because I pointed out on several occasions that the work was not profitable.

6034. Who suggested the designs for the bridges and culverts in the case of the Derwent Valley and Fingal lines? There were no designs for bridges given in the Derwent Valley line—merely types of piers.

6035. I refer to the contract drawings—by whose instructions were those designs prepared? These books do not embody any separate designs; they embody only culverts. The bridges are only shown upon a small-scale diagram.

6036. Then at whose suggestion were they prepared? They were prepared by me, and referred to the Engineer-in-Chief.

6037. Did he give you a general idea of the character of the designs which he wished to have prepared, or were they in the first place prepared only on your own responsibility? Will you allow me to look at the drawings? (Drawings referred to.) Drawing No. 4 was prepared by me and was approved by the Engineer-in-Chief. I am given to understand, however, that the retaining walls as shown here have not been carried out. I have not seen the works on the Derwent Valley line, but I am given to understand that the retaining walls, instead of being 3 feet at the top, have been made 18 inches. The batter, instead of being 1 in 4, has been reduced. I have not seen the work, however, and I am speaking only from hearsay. Drawing No. 5, showing the fencing and gates, was prepared by me, and approved by the Engineer-in-Chief. The fencing called Bain's patent fencing was suggested by the Engineer-in-Chief. I have already stated that I did not consider it a good suitable style of fence. Drawing No. 6, showing the level crossings, was prepared by me and approved by the Engineer-in-Chief. Drawing No. 7—the permanent way—was designed by me and approved by the Engineer-in-Chief. It was afterwards sent home to the consulting engineer for the Tasmanian Government in London, and he approved of it. The Engineer-in-Chief was satisfied with the drawings of the permanent way. I may mention that I am paid only on certain items and in giving designs for a permanent way, which I assume will be used for all lines. I charged merely the time the drawings took. I consider that I should have been paid the usual percentage as in the case of the other work.

6038. Were these matters specially excluded from the general agreement which you had? My original offer of one and a quarter per cent. was based on the actual contract price—that is, the actual cost of the work. I assumed that my percentage ought to be calculated upon the actual cost of the work. My agreement is on the contract price, which I take to be the actual cost of the work. Being a schedule of contract prices I do not consider that my commission should be estimated on the amount of the tender. Drawing No. 8, showing the masonry culverts, 1ft. 6in., 2ft., and 3ft., were suggested by the Engineer-in-Chief, and I think these drawings are a *fac simile*, or nearly so, of the drawings shown in the Mersey and Deloraine contract book, which I would like to refer to. I may have improved upon them, but these were embodied at the request of the Engineer-in-Chief. (Plans referred to.) Now that I have the detailed drawings of the Mersey and Deloraine line I should like to make a request that the Commissioners should compare the plans of the Mersey and Deloraine line as prepared by the Public Works Department with the plans prepared by me for the Fingal and the Scottsdale lines. I should also be glad if the Commissioners would be good enough to ascertain the cost of preparing the plans for the Mersey and Deloraine line in comparison with the work for the Scottsdale and Fingal lines. Drawing No. 9—masonry and concrete culverts—was prepared by me and approved by the Engineer-in-Chief. Drawing No. 10—hardwood culverts—was prepared in the same way. Drawing No. 11—box culverts—was the class of culverts suggested by me to be constructed of half sleepers and whole sleepers. I considered that there would be a certain percentage of condemned sleepers on the line, and I thought that that would be the best way of utilising them, and that it would be economical to use them. The Victorian Government purchases them in that Colony at a very low rate, and they make very sound culverts. They are sometimes called sleeper culverts. Drawing No. 12—showing masonry or concrete flat-top culverts—was prepared by me, and are similar to culverts which I have designed for the Victorian railways, such as the Sandhurst and Inglewood, and the Maryborough and St. Arnaud lines. I might mention that the then Engineer-in-Chief for Victoria, Mr. Thomas Higinbotham, highly approved of those culverts. Drawing No. 13—showing timber flood-openings—was prepared by me in the same way. Drawing No. 14 shows 30ft. openings; these drawings I think in some of the details were suggested by the Engineer-in-Chief—for instance these additional pieces or secondary struts. Drawing No. 15—showing 20ft. openings, timber flat-top—was prepared by me, and approved by the Engineer-in-Chief. We now come to the drawings for the bridges over the Derwent. Drawing No. 16 represents a skeleton diagram of bridge No. 1. It shows 8 openings of 64ft., and 6 openings of 24ft. I understand that that bridge has been shortened. This diagram is merely to give the contractor an idea of the number of openings, and is not intended for a working drawing. Drawing No. 16 is a skeleton diagram of the Plenty Bridge, in the same way. I understand that the waterways there have been reduced. It shows one opening of 64ft., and 5 openings of 24ft. The next drawing shows a skeleton diagram for No. 2 bridge,

with 5 openings of 64ft. and 2 of 24ft. It is proposed to make solid abutments in lieu of 24ft. openings. This is not intended as a working drawing, but to give the contractor the number of openings and the height of the piers. Drawing No. 19 represents a skeleton diagram of No. 3 bridge, with six openings of 64ft., and two openings of 24ft. The Public Works Department is preparing the working drawings for this bridge. They were started by me, but I could not go on with the work on account of ill-health. If you will allow me to go back to drawing No. 18, which represents a diagram of No 2 bridge, I should like to point out to the Commissioners that the piers are described as iron cylinder piers, but it does not say whether cast iron or wrought iron, or indeed what kind of piers are to be used. I should like that pointed out, and that the piers next to the abutments are given as concrete and masonry piers.

6039. Was the adoption of wrought iron caissons for those piers made at your suggestion afterwards, or was the decision arrived at by the Engineer-in-Chief? Immediately after the contract was signed I understand the ironwork was ordered by the Public Works Department. I am in ignorance of what was ordered at that time.

6040. Then, had you anything to do with the adoption of the wrought iron caissons which are now being manufactured for No. 2 bridge? No.

6041. Will you now proceed with the evidence which you were giving as to the drawings? In the same way the skeleton diagram for No. 3. bridge also gives iron cylinder piers, but it does not say whether they are to be of cast or of wrought iron. I have had nothing to do with ordering or suggesting the adoption of wrought iron caissons for the piers. I am under the impression that when I was asked to go over the Derwent Valley line with Mr. Mault, he spoke of wrought iron piers, but I would not be certain of that. The impression remains in my mind that something was said about wrought iron piers.

6042. Then who prepared the designs for the wrought iron caissons which are now being constructed for Nos. 2 and 3 bridges on the Derwent Valley line? I was asked to prepare the details showing the wrought iron piers with the larger base, that is, 14ft. down to the summer level of the river, then widening out, and lengthened to 20ft., I believe.

6043. When you say that you were asked to prepare details for these piers, did you do the work under the direction of the Engineer-in-Chief? Yes.

6044. Then, you do not hold yourself responsible for that design? Well, it was based on this drawing, No. 21. I desire to point out that the detailed drawings are not working drawings—they are merely drawings to get a price for certain classes of work; they were never intended for working drawings. When I was instructed to make alternative or amended wrought iron piers, by lengthening them at the bottom for a larger base, I would not be positive whether the caissons were being constructed: they may have been ordered; very probably they were.

6045. Who suggested drawing No. 21, showing wrought iron piers? It was prepared in my office.

6046. As it is an unusual form of construction, Mr. Edwards, the Commissioners would like to know who is really responsible for having suggested this peculiar design? I am responsible for the design, I presume. These drawings, if I remember rightly, were made when I was in Melbourne, and were being completed when I was there. The work was done by my principal assistant, but I am responsible.

6047. Did he take the idea from the Engineer-in-Chief, or was it done upon his own responsibility? I could not say whether it was suggested by the Engineer-in-Chief or not. As a rule, all the drawings were submitted to the Engineer-in-Chief. Drawing No. 20, showing cast iron bridge piers, was prepared by me. Drawing No. 20A represents cast iron cylinder bridge piers, 15 feet centres, with solid wrought iron bracing between, down to the lowest summer level, and was prepared by me as an alternative design. There was nothing said about the adoption of any particular pier at the time the contract was let. Drawing No. 21 represents the wrought iron bridge piers as they are now being constructed for Nos. 2 and 3 bridges. I have not compared the drawings with the piers in the foundry. I saw them only when I was with the Commissioners on one occasion. Drawing No. 22 represents the masonry or concrete bridge piers. This was also an alternative design, not intended as a working drawing, but merely to get a price.

6048. These piers, I observe, have been designed without any transverse batter. That is not usual, is it, for piers of any considerable height? We have built piers like that in Victoria for railway bridges.

6049. Can you mention any bridges with piers of that design? The bridge over the Loddon at Bridgewater is built somewhat similar, but with piers of greater height, for about 40 feet spans. These piers are shown 6 feet wide, but I am given to understand that at No. 1 bridge they were reduced by the resident engineer to 5 feet 3 inches.

6050. Do you think that that alteration is an undesirable one, considering that the piers are stated to be 45 feet in height? Had I been resident engineer I should have increased rather than have reduced them. If I were resident engineer I should make working drawings of everything.

6051. When you say if you were a resident engineer that you would prepare working drawings for all the different works, do you know whether it is an usual thing for a resident engineer to be called upon to undertake that duty? Well, as a rule, in the Government service the drawings are supplied from the office, but designs or alterations are very often suggested by the resident engineer. The fact is that every bridge or culvert has to be designed to suit local requirements.

6052. He might be called upon to make alterations to suit the circumstances of particular localities—but is it not usual for such drawings to be supplied to the resident engineer from the head office? I believe so. I was not asked to make working drawings for No. 1 or for the Plenty bridge. I do not know whether they were made by the resident engineer on the work. Drawing No. 23 represents wrought iron girders 64 feet long on the skew.

6053. How was it intended to fasten down the decking on to the top of the girders? There is no detail given in this drawing for that. It would be shown in the working drawing.

6054. Have you prepared any working drawings for this? For No. 2 bridge I have.

6055. And in that working drawing have you shown how the decking is to be secured to the top flange of the girders? In making these working drawings I very often leave the details of that kind, which would be the last thing done, till the work is pretty well advanced.

6056. The same remarks would apply to the next three or four; you had better take them together, I think? To drawings No. 24, 25, and 26 the same remarks will apply. They do not represent girders for any particular bridges, but are merely type drawings to get a price per ton.

6057. Then I understand generally that the drawings and types were prepared by you, and approved by the Engineer-in-Chief? All the documents submitted to the Engineer-in-Chief were approved by him.

6058. This is a tracing and photograph of bridgework executed in South Australia—did you receive similar designs from the Engineer-in-Chief, and adopt them at his request, for bridges Nos. 2 and 3? You are referring now to bridges Nos. 2 and 3 on the Derwent Valley Line. I am not aware that they are similar to any South Australian bridges. I have seen these photographs. They are certainly similar. I should like to inform the Commissioners of this fact, that I borrowed a book of detail drawings from Mr. Sheard. It was lent to him, I believe, by some one from South Australia. That was about six weeks ago, and I calculated the 60ft. girders and the 20ft. girders for a loose road, and assumed the same conditions as on the Tasmanian railways, the girders to carry a loose road with ballast, and made out that 60ft. girders were strained to seven tons—whereas the girders represented in this book are strained under four tons. The 20ft. girders in South Australia were strained a little over four tons, showing a very favourable comparison between the South Australian practice and the girders adopted in Tasmania.

6059. But my question was whether, in preparing designs for bridges Nos. 1, 2, and 3, you had been guided by the designs for similar bridges adopted in South Australia? I had not seen these photographs at that time.

6060. With regard to the drawings which you prepared for the Fingal line, were they got out under the same circumstances as those for the Derwent Valley line,—that is to say, did you prepare the designs and drawings, and obtain the approval of the Engineer-in-Chief to them, and will that remark also apply generally to the drawings in connection with Scottsdale line? Will you allow me to look through the drawings before giving my answer? The detail drawings for the Fingal line were prepared before they were prepared for the Derwent Valley line. When we were preparing these contract drawings for the Scottsdale and Fingal lines together, we were working sometimes, in fact very often, sixteen hours a day. The Engineer-in-Chief called and told me that he was afraid that he would not be able to get the contracts out for the Derwent Valley line. Mr. Mault was working single handed, and could not complete them so as to correspond with the others. It was at the eleventh hour that he asked me to get out the contract; and I was asked to take up the Derwent Valley line simply, as I said before, to correct any inaccuracies in Mr. Mault's original plans, and arrange them into sheets for lithographing, and have them all to correspond with the other contracts. The time was exceedingly limited, and the Engineer-in-Chief asked me to take the type drawings for the Fingal line and embody them with the Derwent Valley line, with the exception of the bridges; so that, taking drawings 5, 6, 7, and 8, my remarks with respect to drawing No. 8 will apply to the Fingal line. The drawing is a *fac simile* of one on the Mersey and Deloraine line,—masonry culverts of 1ft. 6in. and 3ft. Drawings Nos. 4 to 15 were embodied in the Derwent Valley detailed drawings.

6061. Then the same remarks which you made in regard to the Derwent Valley plans will apply in the case of the Fingal and Scottsdale plans? Yes. I should have given those for the Fingal line first. They were prepared first, and embodied in the detailed drawings for the Derwent Valley line.

6062. Have you been called upon since preparing the contract drawings for the Fingal and Scottsdale lines to make out any working detailed drawings for those lines, or any altered designs for any of the work? In the case of the Fingal line, I have never been asked to make any working drawings.

6063. And with regard to the Scottsdale line, have you made any detailed or altered drawings? I made the working drawings for the Dogwood Valley viaduct.

6064. The Commissioners noticed in going over the Scottsdale line that the design of the concrete culverts has been altered from those shown on the contract drawings. Was this done at your suggestion, or is it an alteration made by the Resident Engineer on the works? I could not say. I suppose that it would be an alteration made by the Resident Engineer. I have not seen the Scottsdale line since it has been in course of construction.

6065. The wing walls of most of the culverts run at right angles to the face, and the culverts generally built after a stronger design than on the Fingal and Derwent Valley lines. Are you aware of any alterations made in the design of the culverts? I am not aware of any alterations. The concrete culverts are different to those shown on the Scottsdale line. It is quite impossible for me in carrying out a lot of work of this kind to make every drawing myself. I did make this one.

6066. In the drawings prepared for the Scottsdale line you have shown an alternative design with wing walls at right angles to the face? There is no alternative drawing for concrete culverts.

6067. The design I refer to is for a concrete culvert, the design with straight faces is intended for masonry? Yes, of course; the Resident Engineer would use his own discretion as to wing walls parallel to or at right angles to the railway.

6068. Will you state what induced you to adopt this alternative design for culverts on the Scottsdale line, as I observe that it is not shown on the drawings for the Derwent Valley and the Fingal lines? The special drawing for the concrete culverts was shown on the Scottsdale line because good building stone could not be got, so I was informed.

6069. Was the alteration in this design made at the suggestion of the Engineer-in-Chief or the resident engineer, or did you take it upon yourself to make the alterations? What alterations do you refer to?

6070. I refer to having the wing walls at right angles to the face of the culverts? I should not consider that an alteration.

6071. I refer to this design being different from the designs for concrete culverts on the other lines for which you prepared the drawings, and I asked you whether you altered the designs for concrete culverts in preparing the working drawings for the Scottsdale line at the suggestion of the officers of the department or at your own instigation? I do not think that anything was suggested to me by the Engineer-in-Chief or the resident engineer. I used my own discretion.

6072. *By Mr. Lawder.*—With regard to the parallel wing walls adopted on the culverts on the Fingal line, did you yourself design these without instructions, or were they suggested to you by the Engineer-in-Chief? I do not remember parallel walls having been suggested by the Engineer-in-Chief.

6073. Then would you adopt parallel walls? I have designed numbers of culverts with straight walls.

6074. Then did you do so in the case of the culverts on the Fingal line? The drawings were prepared in my office for that line.

6075. Did you receive any suggestions or any sketch of double cased iron piers for bridge No. 2 over the Derwent from the Engineer-in-Chief or from Mr. Sheard, the resident engineer? I did receive instructions to prepare a sketch of a kind of double caisson, and I believe it was from the Engineer-in-Chief. I received my instructions from him.

6076. Did you receive any pencil sketch drawing with the instructions? I could not say, because I very often had sketches from the Engineer-in-Chief on note paper, but I should not be likely to keep them.

6077. Did you get out the drawing of the double caisson? I prepared an amended tracing showing a double caisson.

6078. You have stated that, as a resident engineer, you would expect drawings to be supplied from the Engineer-in-Chief's office; but had you occasion, as resident engineer, to design a drawing yourself, would you issue it to a contractor without receiving the Engineer-in-Chief's signature or authority for proceeding with the work as designed by you? I should, as resident engineer.

6079. You would not perceive it your duty to submit it for the sanction of the Engineer-in-Chief? Not for small work—small culverts or work of that nature. There I should do it upon my own responsibility.

6080. How do you define—what do you call small works? I am speaking now of general culverts.

6081. Of what construction and span? Such culverts as are shown on the drawings, for instance.

6082. In the type drawings? In the type drawings. In the smaller class of culverts I should not consider it necessary to bother the Engineer-in-Chief on very small matters of that kind.

6083. Would you not consider yourself bound to follow out the general lines adopted in the contract drawings? No, I should not. I should consider them merely as general drawings to indicate the character of the work, except in the case of such a drawing as the culverts represented in these by drawing No. 9, representing the concrete culverts in the Scottsdale line. I consider that sufficiently good for a working drawing, as there is really no detail about concrete culverts.

6084. Are the Commissioners to understand that drawings not supplied in the contract drawings should be expected from the resident engineer by the Engineer-in-Chief? I do not catch your meaning.

6085. My question is: do you consider that, as far as the contract drawings show distinctly the work to be performed that they are to be followed, but where they do not show distinctly the design to be followed in application to any particular locality that the resident engineer is to get out that design, and may fairly be expected to do so by the Engineer-in-Chief without reference to him? No; I think you misunderstood me. I think that all matters should be referred to the Engineer-in-Chief, but that it is impossible for the resident engineer to follow drawings of that kind, because it would not suit every locality. Every locality requires to be specially considered—I mean that he must exercise his judgment.

6086. I understood you to say that in giving out drawings for small culverts of a certain class it was not necessary to refer to the Engineer-in-Chief for his authority or sanction, and to bother him with these things? I think that the resident engineer should exercise his judgment upon all these points. He has not to follow blindly everything given into his hands if he does not consider that the work is suitable.

6087. Can you inform the Commissioners, then, on what lines of railway in either the other colonies or in Europe, or in any other country, a Resident Engineer is expected to prepare these plans and to issue them to the works without reference to his superior officer, the Engineer-in-Chief? On the Derwent Valley line in question Mr. Sheard has done it.

6088. I am alluding to lines other than those in Tasmania? On the Victorian railways the Resident Engineer often suggested and forwarded to me a sketch of culverts and other work.

6089. You say to you?—what position did you then occupy? I was then engaged by the Victorian Government. I was under a Resident Engineer at that time.

6090. Under a Resident Engineer! You say that the Resident Engineer sent the designs, or rather his suggestions, to you? I should say District Engineer. I was under Mr. Green, who was then District Engineer.

6091. And the Resident Engineer under Mr. Green sent these to you as Mr. Green's personal assistant, I presume, for the opinion of Mr. Green himself? Yes.

6092. Then, in that case, he did not issue plans upon the works without the sanction of his superior officer? No.

6093. Quite so. Then do you know of any railway in any country where it is the practice to issue plans upon the works without the sanction having first been obtained from the chief officer in charge of the public work under construction? I could not remember any particular case.

6094. Then do we understand that you do not know of any such case? I cannot remember any at the moment.

6095. Do you think that there are any? I do.

6096. Then, in the case of the Derwent Valley, or any other railways in this country, do you consider that the Resident Engineer is perfectly justified in issuing plans to the contractor without the authority of the Engineer-in-Chief? I do not say that. I believe that all the plans on the Derwent Valley Line have been approved by the Engineer-in-Chief. I do not know of any that have not. I understand that the Resident Engineer has made drawings which have been approved of by the Engineer-in-Chief. I understand, however, that the former Resident Engineer departed from the standard drawings of the retaining walls. I do not know whether or not it was done upon the authority of the Engineer-in-Chief.

6097. With reference to the Dogwood Valley viaduct upon the Scottsdale line, which, you say, you were called upon to design, were you afterwards at any time asked to strengthen the structure by the introduction of longitudinal bracing; or were you ever informed by the Engineer-in-Chief that he did not consider the structure sufficiently stable without additional longitudinal bracing? I supplied the working drawings of that viaduct in triplicate, I think; I am not certain, however. Copies were made for the Engineer-in-Chief, the Resident Engineer, and the Contractor, and forwarded to the Engineer-in-Chief. I am under the impression that when working drawings of the Dogwood Valley viaduct were sent to the Engineer-in-Chief, he had some additional pieces marked on the drawings. I think that they were shown in red. They were not marked on in my office.

6098. *By the Chairman.*—You spoke of type drawings. Are the drawings you made type drawings, or are they details for works in different localities? Not for particular localities. They are simply type drawings, to show the character of the work and enable the contractor to price his schedule.

6099. Well, are we to assume that these type drawings were adapted to the physical peculiarities of the particular localities in which such structures might, or might not, be built? I should consider them to be merely type drawings.

6100. Then, as a type drawing, it must necessarily be adapted by the engineer to the peculiarities and contour of the locality? Certainly.

6101. That is, if he saw the foundations as shown in the drawings to be not sufficiently deep, he would have to make them deeper? He would have to use his discretion in any work of that kind.

6102. Supposing that the engineer strictly followed the type drawings, and did not make any alterations in them which the peculiarities of the district warranted, would you consider he would be doing his duty? I should not.

6103. Did you see the localities of Nos. 1, 2, and 3 bridges on the Derwent Valley railway before you designed those works? I made no special designs for the Derwent Valley line bridges before the contract was let. Those diagrams represented in the book are not designs, they are mere skeleton diagrams.

6104. Then you imagine that the engineer would adapt them to the peculiarities of each locality? I should expect him to request the Public Works Department to furnish him with proper working drawings before starting any bridge.

6105. Have you followed the details of English contracts? I know that in contracts in England a working drawing is given for every culvert and every bridge. At such and such a mileage, for one culvert, say, the detailed drawing is given for that particular culvert. Here in a schedule of prices contract it is not necessary.

6106. Are you familiar with the English practice that standard drawings are made embracing every description of work from the smallest culvert to the largest bridge, and that they are photographed and sent out to every engineer? I do not remember. It is many years now since I left England. These are not intended to represent any particular culvert or any particular bridge.

6107. But some or the whole of them might be adopted as circumstances warranted? Yes, in the case of the particular drawings to which I referred to just now.

6108. Just answer my question. I want to find out who is responsible. Is that a type drawing, or is it the drawing for a particular locality? It is a type drawing.

6109. Would not the circumstances of the case be considered in connection with each locality? Certainly.

6110. The peculiarities of each locality are provided for by a special bridge? By a special working drawing.

6111. In providing this did you understand from the Engineer-in-Chief that you would design bridges for particular localities, or would merely give type drawings? In the case of the Derwent Valley line, the time was so limited that it was impossible to give special designs.

MR. FINCHAM, *re-examined.*

6112. *By the Chairman.*—We understand that the provisional control of the Public Works Department relating to roads, bridges, and public buildings, is under you as professional head? It is.

6113. In the designs of bridges and works for roads, are all the documents submitted to you previous to their being accepted? Yes, with very few exceptions, and those only of an unimportant character.

6114. We noticed some minor details of works on the bridges about which we should like some information, notably in regard to the bridge over the Leven. This bridge has an overhanging roadway, partly supported by stays, but principally so by the piles carrying the general superstructure. We noticed that the outside studs supporting the hand railings are provided in iron of an elaborate pattern. Did you approve of that form of construction, or was it a matter of detail which you left to the resident engineer? I approved of the overhang in several of our bridges for the mere footpath. The cast-iron ornamental stays for the hand-rail were added with my approval for the better appearance of a bridge close to a township.

6115. In the case of the Leven bridge, it has been given in evidence that the cost of these stays was about £175. For this sum additional piles might have been provided, which would have enabled the roadway to be permanently and rigidly supported. Do you not think that money would have been better spent in providing additional piles than in putting up this ornamental balustrade? I could not say without the plans, and without time to calculate whether that estimate would be correct.

6116. It was stated by the inspector of works that the weight of these stays was seven tons, at the rate of about £25 per ton fixed in position. Would that be an excessive estimate? Certainly; but the exact weight can be furnished to the Commissioners.

6117. We obtained the so exact details from the inspector. He provided the number of stays and their weight, which he makes seven tons for both sides of the bridge. Do you consider that an imperfect estimate? I certainly think that seven tons for ornamental cast-iron work is an excess.

6118. These stays are about 2ft. 6in. in height; he assumed them to weigh 1½ cwt. each. Would that be an excessive estimate for a stout iron stay? I am unable to speak definitely on that point, or to form any estimate of the weight of those stays, from memory.

6119. Practically we assured ourselves that his estimate is correct. Assuming it to be so, do you then think it prudent to provide iron stays instead of adding additional piles to make the pathway suitable and rigid? I really could not say that the additional pile, with the consequent extra work in the superstructure, due to widening the bridge, would have cost no more than the stays.

6120. The footway is now sagging on this bridge, and is several inches below the road line. Assuming that to be the case, do you still adhere to your opinion? I see no reason why the footway should, if the joists had been carried sufficiently back.

6121. But as it has sagged, to what reason do you attribute that defect? Really I could not say without reference to the drawings, which I have not seen for many months.

6122. Do you approve of the roadway of this bridge being weighted by metal? Yes.

6123. For what reason do you adopt that plan? The superstructure is protected by tarred metal, and the whole of the timber deck lasts much longer, and the foothold for horses and cattle is much better. The open decks in frosty weather are dangerous. The traffic of horses over open timber decks will fray the timber, and allow the moisture to saturate and rot the wood. The Corporation of Hobart took down the old bridge over the rivulet near the gas works in Macquarie-street, and the timber decking which had been protected with the tarred metal was as good as the day it was put down, and that was many years ago; had the deck been uncovered it would probably have been twice renewed.

6124. How do you assume that there would be danger to the traffic if metal was not placed on the planks? Because on frosty mornings the planks are very slippery.

6125. Is that the only reason? The better preservation of the timber is another reason.

6126. Are you aware that in the neighbouring colonies this practice is not followed? I do not know. I began my practice here with the uncovered bridges, and deliberately adopted the present plan with the concurrence of the Engineer of Roads.

6127. Take, for example, the Falls Bridge connecting Melbourne with the suburbs south of the Yarra, and providing for a population of 200,000: the authorities there have not provided any metal for the top of the planking at that bridge. Would not a practice which suits that locality,—a very wet and low-lying one, be equally applicable to the bridge over the Leven? The fact is that our open decks do not last, and what with bad weather, with frost, and with the traffic on the deck, the falling of bullocks is a common occurrence.

6128. But would there be additional danger to cattle passing over this bridge, as compared with those passing over a crowded thoroughfare in a large city where wooden pavement is laid down? Far more danger with short planks than with blocks placed end on with the grain.

6129. Take the large streets of London, where a huge traffic is carried over inclines, which is not the case at the Leven bridge; there the authorities do not place any metal over the paving—why should you then provide it for a small village bridge? There is no comparison between the two. I am well acquainted with the London paving. The blocks are in small blocks placed on end and provided with joints and with gravel and tar between. That is what gives the horses a hold.

6130. What hold is there when frost appears and the interstices of the blocks are filled? The horses have always a foothold with the joints.

6131. There the likelihood of cattle falling down is considered, but the authorities do not deem it necessary to have the metal you provide it? Perhaps not; but I should not willingly give up the present practice, which my experience here, and the concurrence of settlers in the country districts, have led me to adopt.

6132. But we noticed that you have issued instructions that all traffic over these bridges was to pass at a walking pace. That being so, why do you need this additional precaution? The instructions were issued at a time when none of the bridges were covered.

6133. But the notice still remains? But it is understood that such notices apply only to open bridges.

6134. In advertising for works for Local Road Trusts do you consult the residents of the locality before determining upon the works? Yes. All the District Inspectors have had instructions for some time past to consult the local authorities when laying out the works.

6135. Then have you had any complaints other than ordinary ones made to you by the local authorities as to the want of information with regard to such works? The complaints have been very few in number compared with the extent of the works laid out.

6136. Do you not think it would be an advantage in constructing these works to take the local authorities into your confidence and obtain their views as to the mode in which they think the works should be designed? We always listen with every respect to suggestions regarding road material or waterways, but the local authorities would not be consulted in connection with the design of any bridge. The desire as a whole is to throw that work and the responsibility entirely on the Government.

6137. Apart from suitability of design, do you give practical effect to the representations of the local authorities with regard to the size of the waterways? Yes, in many cases.

6138. Do you think that it has been to the advantage of the Department or otherwise in having accepted the suggestions? In some cases to their advantage, in others to their disadvantage.

6139. But generally speaking, how would the balance be? I think rather to their disadvantage.

6140. Why? Because so seldom you find really good practical men in these road trusts.

6141. Do you not think a resident of a district able to advise the Government or to indicate where good gravel or stone may be obtained? Yes, I should always respect information of that kind. But the Department is better able to judge whether for certain traffic gravel or broken stone should be recommended.

6142. As to providing money for these works, do you think the time in which the moneys for the various local works are spent is the most judicious and advisable? We have no fixed time for the expenditure of the money. It has always to be spent as soon as possible after the consent of the Road Trustees as to maintenance has been obtained. All the districts are clamorous for the prompt expenditure of the money.

6143. If you ignore the representations of residents as to gravel or metal, is it desirable to give way to them when they clamour for work to be done at an improper time? We do not give way to their representations without due consideration.

6144. It has been pointed out by many Road Trusts that the Government carry out road work either at an advanced part of the autumn or in the middle of winter. Could you not adopt a plan by which the roads should be made in spring or the early summer months? Most certainly; and there you would at once be met with another objection, namely, that you were taking the men away when they were required for harvesting, &c.

6145. Yes; but the harvest is in the autumn, not in the summer. Suppose you called for tenders between the commencement of October and the end of December? In some parts of the Colony that would be an advantage, but, in other parts, it is a matter of indifference whether you do the work in summer or winter.

6146. Can you suggest any plan by which public money can be more economically spent than under the present system? Does your question refer to the season of the year only?

6147. I mean combining all risks and advantages? No, I do not think so.

6148. As to the public buildings of the Colony, have you considered the plan adopted by the architect in designing the foundations of the new Custom House at Launceston? I have.

6149. Do you consider the provision suitable and necessary? It is a perfectly stable and sound design.

6150. Do you think such a structure as that requires the enormous mass of brick and wood that has been provided? I think all the brick and woodwork provided is necessary in such a bad foundation.

6151. Are you aware that the brickwork at the foundation under the portico is upwards of 8 feet in thickness? Very likely, but that width only runs up for a short distance, and it will have to take the returns and projections introduced for architectural effect.

6152. And under this is a massive timber floor supported on piles, around which a large body of concrete is placed? Around which will be placed concrete.

6153. No; around which concrete is now placed? Yes, some is now placed, but concrete will also be placed over and along the edge of the plank floor.

6154. Why did you adopt this very substantial form of construction? Simply because no bottom was obtainable.

6155. Would it not have been better to have sunk small shafts at different places to the solid ground and filled them in with concrete, and then have connected these shafts by relieving arches and have built the superstructure on them? No; I approve of the present design.

6156. But if it could have been done for a third part of the present cost, how would that affect your view? If you suppose that a substantial foundation with the excessive depth required could have been obtained at a third of the cost, I would have preferred the concrete open work to the timber; but I do not like supporting a building of any importance by relieving arches resting on piers, unless the piers rest on a first-class foundation.

6157. Suppose it did rest on a first-class foundation? If the cost were equal, I would prefer the brick and concrete to the timber.

6158. That is not the condition I attach to it. If shafts or piers, say 3 or 4 feet square, were sunk on the lines of these walls down to the solid ground and filled in with good concrete, and these piers connected

by relieving arches, would not that carry the superstructure you intend putting on the foundations at the new Custom House, Launceston? It would be perfectly practicable to have put the whole building upon concrete in the same way, on a small scale, as is done with the new Foreign Offices in London. I went into the question of cost and strength before directing the architect to adopt the present plan.

6159. But do you think there is any analogy whatever as to cost and strength between such buildings as the new Foreign Offices in London, designed to serve the purposes of a city with four millions of inhabitants, and a small Custom House for a country town in Tasmania with only 17,000 inhabitants? The plan to be adopted was the same, the difference being in the thickness of concrete required to carry the weight.

6160. Then you think the plan adopted is the best? I am quite satisfied with the present plan; it is both strong and lasting.

6161. In reference to the post office being built at Launceston, are you conversant with all the details of that building? Generally, yes.

6162. We noticed that the arches covering certain doorways in the foundations were built roughly, and without any centering. Is that a plan of which you approve? The whole weight of the work above is really taken by the iron lintels; the relieving arches are of little importance.

6163. Then, if they are of no importance, why place them there? Simply because it is the usual practice.

6164. But when relieving arches are placed in a building, it is generally in accordance with the plan: now these have been built in brickwork in an uncertain way; there has been no attempt made to use centering or outline? Yes, I noticed myself that the arches in one or two of these cases were roughly built.

6165. Who determines the quality of bricks used in these buildings? They are all subject to the approval of the architect in charge, and, in his absence, of the inspector.

6166. Are you satisfied that the bricks now used in the post office are of good quality? Yes, I am satisfied with the bricks in the post office.

6167. How, then, do you account for the vegetation which now appears on the bricks in the foundation of the walls of this building? I have not noticed it.

6168. But it is a fact patent to anyone. A green film has appeared on nearly the whole of the brickwork of the foundations of this building. Was your attention drawn to it? No, I have not seen it.

6169. If it is the case, could the bricks have been properly burnt and seasoned? It might occur from dampness after the bricks were placed in site.

6170. On the under face, exposed to sun and air, and on bricks that have been only recently laid? But not above ground—it is in the foundations.

6171. Of bricks only recently laid? I should suspect bricks having that appearance recently laid and exposed to the air.

6172. How long has the contract been let for the post office in Launceston? About from six to nine months.

6173. How long have the foundations been put in? I cannot remember?

6174. Taking all the circumstances into account, do you think it reasonable to assume that vegetation would have arisen from causes other than those I have described? I cannot say what is the cause, as I have not noticed it.

6175. *By Mr. Stanley.*—How are the surveys of new roads effected, Mr. Fincham, or alterations to existing roads? A line is generally roughly marked out by the District Inspector, and the survey is afterwards taken up by an approved surveyor.

6176. Before the construction of roads, especially through difficult country, is undertaken, are any sections taken over the line of road? Yes.

6177. By whom are they taken? Sometimes by the Engineer of Roads himself, sometimes by the engineers temporarily employed, sometimes by such of the district inspectors as are able to use a level.

6178. Then do such sections accompany the specifications when inviting tenders for the construction of new roads? Yes.

6179. Can you instance any cases where such sections are provided? I can produce any number.

6180. I think it would be as well to do so—the Commissioners wish to satisfy themselves as to the system pursued? The Engineer of Roads would be the best man to produce them.

6181. Are you well acquainted with the road from Emu Bay to Table Cape, and beyond towards Circular Head? I used to be well acquainted with it. I have not travelled over it officially for three years past.

6182. Has your attention been drawn at any time to several considerable detours made on the road between Emu Bay and Table Cape which might have been easily avoided with great advantage and convenience to the traffic on the road? Many suggestions have been made for shortening the road in several places, and some of them have been adopted; others have been rejected after examination and report has been made.

6183. There was one case to which my attention was drawn in travelling over the road. It lay between the 101½ and 103½ mile posts. I should think quite half a mile might have been saved if a straight course had been followed. The land through which this deviation would have passed is unimproved, and, as far as I could see, there could be no possible objection to the alteration. Do you recollect the place I refer to? I cannot recognise the spot by the mileage.

6184. Have you any plan in the office showing the lines of main road throughout the Colony? No; but I had a book prepared in which is noted the position of every culvert and bridge on each main road. I prepared that book in consequence of no map existing.

6185. Are there no district maps showing the lines of road? Only in short and disconnected portions, and then only to a scale which is useless for construction purposes.

6186. Do you not think it would be valuable to have maps prepared showing the main roads in the different districts? It would be very useful, not only for the Public Works, but also for the Lands Branch of the Department.

6187. Has your attention at any time been drawn to the new road that has been constructed from the main road to the Flowerdale Settlement? Yes, I am acquainted with that road.

6188. Do you think this road, as constructed, has been judiciously selected? No, not at its junction with the main road.

6189. Could not the steep hill which this road passes over have been avoided altogether by keeping along the siding? Yes, I think so.

6190. Who made the survey of that road? I think it was surveyed in connection with the Lands Department; it practically followed the reserved road.

6191. But before spending money in permanently constructing a road, is it not usual for an officer of the Department to visit the road and see if improvements could not be effected? Yes, he does so in the case of important improvements; but he is tied, and always has been, from want of means that would allow of any extensive re-alignments for the roads. Sometimes compensation and fences are the block; sometimes the necessity of joining his new work to a completed work already done under the local authorities.

6192. Were there any obstacles such as those you refer to in the case of the Flowerdale road? Yes, compensation and fences. That bush land which you saw there was sold only a few years since at about £4 per acre. There would have been compensation for severance and fences on both sides of the road.

6193. Was this considered before the road was permanently made? I do not think it was, but the suggestion for the deviation you refer to has since been made, with a view of constructing it out of subsequent instalments granted for the road.

6194. Has any survey been made of the diversion? I believe the District Inspector went over the line, but I think no survey was made.

6195. I may state, Mr. Fincham, that Mr. Cresswell's name was mentioned in connection with this road at Flowerdale: what had he to do with it, or did he make any report on the subject? No, I only remember Mr. Edward Atkinson, the Inspector at Table Cape, in connection with it. At that time Mr. Cresswell exercised a general supervision over the other inspectors on the North-West Coast. In that way he might have been connected with it.

6196. In the case of bridges over tidal rivers, in your experience has not the timber been affected by the marine worm—the timber in the piles? Yes, the piles of the old Leven bridge were very much affected.

6197. Has it never occurred to you that it would be desirable to protect the piles in such localities by sheathing them? Yes, it has.

6198. Will you state why this was not done in the case of the new bridge over the Leven? Because I think the precautions taken, which will be best described by the Engineer of Roads, will be equally effective. Proper charring and tarring constitute a good precaution. I know of piles in the sea-water at Hobart thus protected which have remained uninjured for eighteen years. Again, any small damage to the sheathing, in driving the piles for instance, would be quite sufficient to allow of the entrance of the worm.

6199. Then, in your experience, you find that charring and tarring effectually prevents the entrance of the worm? It does for a great number of years, if perfectly done.

6200. Has your attention ever been drawn to the advisability of using iron screw-piles where the bed of the river is suitable, instead of masonry or concrete piers? I have considered them.

6201. Do you not think they would be much more economical? I have considered them, as against timber piles. I do not know of any masonry or concrete piers to bridges on roads where iron screw-piles could have been substituted with advantage.

6202. Are the specifications and conditions for contractors for roads and bridges prepared in your office, or in that of the Engineer of Roads? They are prepared in the general office, under the direction of the Engineer of Roads.

6203. Have the general conditions upon which contracts are let received your general approval? Yes, we have altered them from time to time as circumstances required.

6204. Do you not consider that any of these conditions are calculated to be oppressive to contractors, and lead to higher prices being asked by tenderers with a view to protect themselves? No, not for one moment. I think strict conditions are necessary.

AFTERNOON SITTING.

Present.—All the Commissioners and the Secretary.

MR. JAMES FINCHAM, C.E., examination continued.

6205. *By Mr. Stanley.*—Look at clause 17 of the conditions of contract for roads and bridges. Do you not think that such a condition is calculated to press unfairly on a contractor. The section gives the

Director of Public Works power to suspend the whole or any portion of the work should the contractor refuse to execute extra work without charge? It is necessary to protect the department against obstructive contractors, but I do not know of one instance where it has been put in force.

6206. Then in that case you look on that condition as one to be enforced only in very special circumstances? It would only be used in extreme cases.

6207. Will you explain the 31st Section: "The Director of Public Works shall be entitled to terminate the present contract after giving ten days' notice to the contractor, and may complete the works at the contractor's cost and risk." That is rather arbitrary is it not?—there is nothing to show under what circumstances work can be taken out of the hands of the contractor? A few words have been omitted from the manuscript portion, the intention being that if contractors ignore the provisions of the clause the Public Works Department shall have power to punish them for it.

6208. Does that apply to sub-contracts? It does; we have found that provision necessary.

6209. With regard to security, what is the provision in regard to contracts, say, for large bridges?—do you require a cash deposit, or in what way do you obtain security? We take a small cash deposit with the tender, which is held until the completion of the contract.

6210. Is that deposit a percentage on the amount of the contract, or how is it fixed? It is fixed actually as a small percentage, but we treat the matter according to the importance or otherwise of failure to the Government. In the event of failure by the contractor to complete the work, the deposit would be forfeited.

6211. Is it your practice to provide a penalty for non-completion of the work in the contract time? Always.

6212. How do you fix the amount of the penalty—is it by a percentage on the amount of the contract? No, it is fixed arbitrarily according to the importance of the contract.

6213. As a rule, are these penalties enforced? Very rarely. I require, however, that a contractor who is likely to be over his time should make written application for an extension, and this, after having been referred to the local inspector, is submitted, with my recommendations, for the Minister's decision.

6214. Where a contractor cannot show good cause for delay in completing the work, is it the practice to enforce the penalties? Never to the full extent. It would mean simple ruin to many of our small contractors if it were done. In bad cases my practice has been to enforce the penalties up to the value of the additional supervision entailed on the department, by the time being lengthened.

6215. But do you think it is advisable to retain a condition in your contracts which is to all intents and purposes a dead letter? The conditions and specifications are, like others, more to protect the department against bad contractors than to harass good but, perhaps, unfortunate men. Unless we had strict provisions there are plenty of bush lawyers as contractors who would only too readily take advantage of us.

6216. But my question referred to cases where no sufficient or reasonable excuse could be given for delay. I understood you to say that in such cases the penalties were not enforced to the full extent. If in such extreme cases the penalty is not enforced, why retain a condition in the contract which is to all intents a dead letter? But the contractors do not know it is a dead letter.

6217. What is your practice in reference to tenderers who fail to take up their tenders?—do you disqualify them for any stated period, or what is done? The deposit is forfeited; and, unless there are extenuating circumstances, the contractor is disqualified for a certain period.

6218. And is that rule strictly enforced? Yes, unless there are special and extenuating circumstances.

6219. Is it the practice of the department to invite tenders for all important public works? Yes.

6220. Does the construction of plant for harbour improvements come within your department? Partly so, yes.

6221. Are you aware of any dredge having been let privately without tenders having been called in a public way? Yes; the dredge for the Mersey was so let by the Government.

6222. Under what circumstances was this done? It was not done through me, so I cannot say.

6223. I understood you to say that the letting of such work came within your department? It does; but the case referred to is the only one I know of in which we have required any dredging plant.

6224. To whom was the contract let? To Kennedy & Sons.

6225. And you cannot explain to the Commissioners the circumstances under which this was let privately? No, I cannot.

6226. Would you explain shortly, for the information of the Commissioners, what staff you have employed in connection with the Roads Department? I have, first, the Engineer of Roads, then District Inspectors.

6227. How many District Inspectors are there? I think there are ten. Under these, for special works, there are Clerks of Works, or Sub-Inspectors for the various districts, and in the office the work is carried on by Clerks and Draughtsmen employed for that and other branches.

6228. Are the several salaries provided in the Estimates? Only in the case of the Engineer of Roads and one District Inspector: all the others are charged to the several votes under which they are employed. I have repeatedly, in my annual reports, called attention to the necessity of some special provision being made both for the Roads and the Railway Staffs, as it is impossible to apportion with accuracy charges for time and travelling expenses of the various officers amongst the works upon which they may be engaged. The District Inspectors take the supervision of schools, police stations, and so forth, as well as the supervision of roads.

6229. Are the salaries apportioned and charged to the different works upon which they are employed according to the time they devote to the several works? Originally so; but the plan was found so unworkable that an annual percentage is now struck by the accountants.

6230. Then, according to that percentage, their salaries are charged to the various works: is that so? It is so.

6231. Can you state, approximately, what the total expenditure in your department is, under the head of "Roads, Bridges, and Buildings?" I can supply that.

6232. Will you do so, and also state what amount is paid annually under the head "Supervision" for the same works, and furnish that information for the last three years? I may inform the Commission that, for the satisfaction of Parliament, I prepared a statement showing the percentage of supervision to outlay, extending back for several years.

6233. What did that amount to?—do you remember? It averages $7\frac{1}{2}$ to 8 per cent., including all charges.

6234. That includes everything? Yes, and travelling expenses also, which, considering the scattered nature of the work, is very reasonable.

6235. What system is followed in keeping accounts of expenditure in this branch of your department? I must refer you to the accountant for that.

6236. Can you say generally if the expenditure is kept separately for each vote? Yes, certainly.

6237. Is the amount voted for any particular work necessarily spent upon that work, or are votes transferred under any circumstances? The money is necessarily spent upon the work for which it is voted?

Derwent Valley Railway.

6238. I wish to ask you a question in respect to the Derwent Valley Railway. We have it in evidence that Mr. Atkinson was employed in making a survey of a deviation of the line at Back River after the contract was let. Do you recollect the circumstances under which he was employed? No, I do not know if he was employed in making any survey there.

6239. He stated in evidence that he had been employed making a survey of a deviation of the line at Back River with a view of shifting the line on to the solid ground, and avoiding the necessity of having to build retaining walls. Can you furnish the Commissioner with a copy of his plan of the survey, or any report which you have from him on the subject? I know nothing about it. Mr. Atkinson was sent up to give general assistance to Mr. Sheard soon after he took charge. He was with him five or six weeks. I know that he surveyed the deviation at Ivanhoe, but never heard that he was employed near the Back River; it may have been so, but I was not aware of it.

6240. As Mr. Sheard, the resident engineer, is absent through illness, would you be good enough to ascertain through his office whether there is any record of any such survey having been made by Mr. Atkinson, or any report upon the subject? I will; but, although I am not aware of it, I think the survey to which you refer must be the present line to which the rails are laid, as Mr. Sheard's object was to shift that portion of the line as much as possible on to the solid ground.

6241. Can you say how much the centre line was shifted? Not from memory; it would vary.

6242. At the Back River culvert? I cannot speak sufficiently clearly.

6243. Can you ascertain? Yes.

Roads, Bridges, and Buildings.

6244. *By Mr. Lavder.*—Can you give the Commissioners an idea of the amount of control you exercise over the works on roads, bridges, and buildings generally? I have no executive control over them whatever now; my control is more of an administrative character.

6245. Since when has your control been restricted? Since the appointment of the Engineer of Roads.

6246. Can you give us the date of his appointment? It was two or three years since. I can supply the date.

6247. You can anyhow give us a description of the procedure which is followed in initiating works, projecting estimates, obtaining plans, &c. for carrying out the works? To begin with, the expenditure under the "Waste Lands Act" I submit from time to time through the Ministers for approval of the Governor in Council the amounts to be spent, or rather the amounts available, in the several parishes. Upon approval being obtained the Engineer of Roads is notified, and he then makes arrangements for the preparation of contracts in the several districts. With regard to the votes of Parliament and for special public works, I receive from the Minister an order to proceed with the expenditure authorised, he sometimes indicating the works that are considered to be of the most pressing importance.

6248. I presume you are allowed to originate new works? Exactly. The Engineer of Roads is again notified of this, and sets his inspectors to work. When the necessary particulars for contracts are sent in they are revised by the Engineer of Roads, necessary drawings attached, and they are then kept in readiness for the consents of the Road Trusts to the maintenance of the several works. When these are received, tenders are called, scheduled, and submitted for examination and recommendation to the Engineer of Roads. These, in turn, are all revised by me as the more directly responsible member of the Board of Tenders when dealing with public works. The Board having made their recommendation, the tenders are finally submitted for the approval of the Minister. I sign the notice of acceptance of contract, furnishing duplicates to the district inspectors. The whole matter is then in the sole charge of the Engineer of Roads, reference being made to me when disputes arise, or questions of extras or proposals for extension of time crop up. The same plan obtains in connection with such sections of the main road system as are maintained directly by the Commissioner of Main Roads. Where the roads are maintained by the local

Boards, a statement is submitted by them as to the proposed expenditure, and this is examined by the Engineer of Roads. With regard to the supervision of work done by the Main Road Boards with the Government subsidy, I have always made it an instruction to the inspectors to watch the expenditure, and to assist the Boards, without being obtrusive. At the same time, where technical assistance is required in the repair of the more important bridges of the main road system, the inspectors have been instructed to offer their skilled labour and assistance to the local Boards at any time.

6249. Are the inspectors called upon to directly supervise and carry out work for the local Boards? They are allowed in case of any special work.

6250. Generally speaking, are they generally called upon to give their assistance, or only in special cases? They are only supposed to actively interfere in special cases. The instructions they have are, that any complaints must be made through the head of their department, as it would be very undesirable if a district inspector were put in a position where he could come constantly in collision with the local Boards.

6251. It is not usual, I gather from your reply, except in special cases? Except in special cases.

6252. You have informed the Commissioners how the estimates are made out, and the consideration they receive, but would you inform them how a fair distribution of the amount to be spent upon road construction is arrived at, and the initiation of work upon these roads—how does the demand for these works appear, or how is it shown or brought forward? In the first instance, the district inspectors prepare their own statements of the necessary work in each district, and also report upon the various suggestions made by Members of Parliament and residents of the districts. These are examined by the Engineer of Roads, who submits them with a short report in each case to the Minister. The Minister then examines them in detail, and consults, where he requires more information, both the Engineer of Roads and myself. After this, the whole scheme is practically arranged by the Cabinet.

6253. Are the grants made simply in lump sums in the gross, or for each definite project separately? In instalments, upon the definite project.

6254. That is those referred to as being sent in by the District Inspectors? Yes.

6255. Then, the distribution funds in detail rests entirely with the Cabinet? Yes.

6256. Does this system work well, so far as you have been able to observe? I think so, but I have long felt that it has been a matter of the greatest difficulty to adjust the several proposals in a perfectly equitable manner. From my personal experience I know of the immense amount of trouble that has been taken to secure this equitable dealing.

6257. You have promised to supply the Commissioners with a list of your staff, showing the cost thereof; would you also, in supplying this, show separately the amounts expended by the local road trusts, and that expended under the direct supervision of the officers of the department? Does your question refer to main roads.

6258. It refers to the expenditure incurred under the road trusts? Then that would be necessarily confined to main roads.

6259. In preparing this return, would you show the expenditure carried out under the road trusts separate from that under the department, and also add a list of your own staff and that of the Engineer of Roads? Yes.

6760. By whom are the inspectors appointed? In each case on my recommendation.

6261. Do you generally satisfy yourself of their competency? Yes, by personal enquiry.

6262. Do you find it difficult to obtain duly qualified men? For general roadwork, yes, but not so difficult for any timber bridges. In selecting the men, I generally give preference to the skilled mechanic.

6263. It is in evidence that some of the inspectors of roads are not qualified, and are unable to use any of the necessary instruments for laying out a properly graded road. Is that so? One of the very best inspectors I have is unable to use an instrument.

6264. How does he lay out his roads, then?—how does he prepare the necessary sections? Where sections are required, in cases of men who are not engineers the sections of an important road are levelled for them.

6265. By whom? By an engineer temporarily employed.

6266. In the case of the road on the east side of the River Cam—the Mooreville road, I think—it has been stated in evidence that it was first taken at a very steep gradient, about 1 in 5 I think it was, and a certain amount of money was expended upon it. About seven or eight months ago the fact was reported to Mr. Duffy, who inspected it, and since that time nothing whatever has been done, though the work has been stopped pending the settlement of the matter. It was then pointed out, I believe by Mr. Duffy, that a much better gradient, of about 1 in 30, could be obtained, and I believe he adopted this in the altered alignment. Further evidence shows that some of the inspectors were unable to use even a boning-rod, and consequently had to do their alignments by guesswork. I need hardly say that where a large amount of money has to be spent in the construction of roads, that not only for the purpose of fairly grading the line, but for accuracy in the amount of work to be done under the contract, it is necessary to have proper sections and sometimes cross sections of the ground, and how can these be prepared without properly qualified men? I doubt the statement.

6267. You doubt the evidence? I doubt the evidence that any of the inspectors cannot use a boning-rod.

6268. Do you consider a boning-rod suitable for obtaining a proper section? No. As I have already stated, in the case of any important deviation of a road, an engineer or surveyor is employed to do that section where the inspectors cannot do it. The inspector at Emu Bay, in the neighbourhood of which the road you just referred to is situated, is an engineer by profession, and perfectly well able to use instruments.

6269. Then you cannot explain why the delay has occurred—the Engineer of Roads not having disposed of this matter within the time I have stated? No, I cannot.

6270. What do you consider would be the life of the timber piles in the Leven bridge? They should last perfectly well about 15 years.

6271. Not more? Possibly more. They are sound timber, cut free of heart or sap.

6272. You have stated that you consider the placing of metal and tar upon the wooden floors of bridges will save the frequent renewal of the flooring. Do you mean the frequent renewal caused by exposure, or by wear and tear of traffic? Both. It also saves the whole of the superstructure, as the main girders are protected in a way which would be impossible with an open deck.

6273. I presume the renewal of this tar and metal would form an important item, and will have to be seen to? In course of years it would want repair.

6274. With heavy traffic would it not go into holes? If properly made, no more than a well made metal road would.

6275. A metal road requires to be renewed, as it gets into holes in a certain time. How long do you allow for six inches of metal to be worn through with heavy traffic? I never attempt it with six inches of metal.

6276. How much do you place on when you renew? We have not renewed.

6277. It is in evidence that you have six inches over the Leven bridge? I doubt that amount. I did not say so.

6278. How long do you think six inches of metal would last? I cannot tell you.

6279. It has been brought under the notice of the Commissioners that wooden culverts have been put in under very high banks, on the North-West Coast, where pipe culverts might have been put in and have formed a permanent instead of a temporary structure involving the cost of repairs from time to time? No doubt they are used in many places.

6280. It is stated that pipe drains were specified in the contract, but wooden culverts put in nevertheless? I know nothing of the matter to which you refer. Possibly the Engineer of Roads can explain.

6281. You did not sanction the alteration? I did not. It is a matter that would not be referred to me.

6282. It has also been brought under the notice of the Commissioners that plans and schedules for works for which tenders had been called had not been placed in the public places specified for their exhibition up to within a very few days of the date fixed for the tenders being sent in. In the case of the Hellyer bridge, for which tenders were invited to be sent in up to the 17th March, the plans and specifications were not to be seen at the post office, Emu Bay, until the 16th March? I know nothing of it; but I do know this, that it is a common practice with some contractors to borrow the plans, &c. from some local office, as the post office, where they are exhibited, and keep them. The consequence is, that before others can be got to take the place of those stolen, the date for the tenders being sent in has often elapsed.

6283. Is there no means of preventing this? Except by cautioning postmasters and postmistresses.

6284. Do you think this is done with the intention of preventing others from tendering? Som etimes and sometimes from sheer indifference.

6285. Then, I presume, strict measures are essential that this should not obtain? We have sent circulars to those who have custody of the plans from time to time, requesting them not to allow the plans out of their possession unless upon a written receipt from the person applying for them.

6286. Through what agency are these plans and specifications forwarded to the various places? They are forwarded by post from the department.

6287. With reference to the Forth bridge now building, the Commissioners observed that the waterway of the original bridge was 125ft. single span. In the bridge now being erected there are two spans of 90ft. each, with a single pier in the centre of the river formed of wooden piles planked. Can you give the Commissioners any idea why the waterway was increased, and why it was decided to place the pier in the centre of the river? I believe the original span was considered unnecessarily large, and the pier was put in the centre of the river in order to economise the cost of the whole structure.

6288. Will the cost of two spans of 90ft., with centre pier, be less than one span of 125ft.? Although the one span was unnecessarily large as a span, more waterway was required, because when the original large span was built the present solid embankment on the west side of the bridge was filled in with timbered work throughout. It gives ample space for the flood waters.

6289. Do you mean that extra waterway is now provided under the west approach to the bridge,—because it did not seem so to the Commissioners? I mean that the whole of the flood flowing on the western side of the river having been originally spanned by a timber bridge, and this timber bridge having been to a large extent replaced by a solid embankment, it was necessary not only to be prepared for a backwater crossing at the extreme west end of the bridge, but to increase the waterway of the river itself. It was partly from that reason, and partly from motives of economy, that the bridge with two 90ft. spans was decided upon.

6290. It does not seem that the two spans now adopted would be cheaper than the single span. The Commissioners observed that there was no extra waterway in the west approach of that single span of 125ft., and from enquiries could not gather that any extra waterway is needed. With reference to the two spans of 90ft., it is in evidence that the single span of 125ft. has been sufficient within the last five years anyhow. There does not seem to be any reason for increasing the waterway? I think the fact of the pier having been put in for economical reasons fully justified us in increasing the total waterway over the river. The waterways to which I have referred, on the extreme west end of the bridge, do exist. The Commissioners

may not have observed them. They are constructed of solid logwork, and are covered with metal and gravel.

6291. The water did not flow there? It flows underneath.

6292. Where will the proposed railway crossing be? That is hard to say.

6293. Where do you expect it to be? Not far from the mouth of the river, near Williams's.

6294. Then it would not have been possible to have saved the cost of the bridge by having a combined road and railway bridge instead? No, certainly not, unless you divert the whole railway traffic. That has been suggested, but the plans of the bridge are not prepared yet. It has been suggested by residents near the mouth of the river that a railway bridge crossing where I proposed it should be, combined with a road bridge, would be suitable.

6295. Do you think a combined road and railway bridge could have been constructed? The railway bridge could not possibly serve the purpose of a new road bridge to the township.

6296. How far is it away? Two miles.

6297. During the inspection of the Fingal Railway the Commissioners also inspected the road bridge over the South Esk at Avoca. They observed that during floods the water rose to such a height that some thick branches of trees were caught in the struts of the bridge. We were also informed that the water rose within three or four feet of the floor of the bridge at its centre, and within about one foot of the floor at the entrance to it. Can you tell us why the planking was placed between the inclined struts of the roadway girders on the upstream side of the bridge? To prevent branches getting into the space that was left open.

6298. Do you not consider that the waterway has been constricted owing to these spandrels being blocked up in this way? It is, if the water gets above them.

6299. Do you not consider that if large logs and trees are carried down this stream, that the structure itself is endangered at the time of heavy floods, the water rising to the height I have mentioned? No; I do not think there is much danger, because the exceptional height of the floods there is due to the backing up caused by a large discharge from the St. Paul's River just below the bridge. Every precaution was taken when the bridge was designed; a surveyor was sent down to take a proper section, and get information as to the flood levels, and mark the same on the sections, and according to the information then received the bridge should have been amply high.

6300. But it is evident the bridge does not provide sufficient headway for trees and logs carried down to pass under it. Is there any reason why the roadway should not have been raised higher than it now is by adding height to the abutment and piers? As I have said the bridge is the proper height according to the levels upon which we had to rely.

6301. Then you consider that although the water rises so near the floor of the bridge, that it is perfectly safe? I do, because the water is to a large extent "dead water" when it gets up to that height.

6302. With reference to buildings in Launceston, you stated that you approved of wooden piling in preference to a concrete base. Do you consider this wood a permanent material, or how long do you conceive it will last? It will last, as it is below the ground and covered with concrete, as long as the building itself will last.

6303. I presume the building would last longer than the piling. The timber we observed was, so to speak, "between wind and water," about a foot and a half above water or spring level. Wood is at best but a perishable material; although we know that if the piles and timbered superstructure are placed below water level it will last, there is always a risk when it is above the water level, exposed to the atmosphere and the rise and fall of spring level. Would it not therefore have been better, even at some extra cost, to have adopted concrete, and distribute the weight by having a very much wider base if necessary? If it had been as you describe I would not have allowed the work to go on. The timber would not be between wind and water, but four feet below ground, and further protected on all sides by lime concrete. There is no fear of the timber decaying at that depth below ground. The bottom was frightfully bad, and the water came in with every tide.

6304. I presume the water will rise and fall in your foundation with every tide? And so it may, and the building will never move.

6305. You do not consider that the rising and falling of this water will affect the piles? Not in the least.

6306. The Chairman asked you about the width of some brickwork in the foundation courses between what are to be pillars in the superstructure. I presume the pressure of the walls will be distributed on the piles by the timbered flooring built upon them? Yes, perfectly.

6307. It is for that purpose the timbered flooring is put in, is it not? Yes, chiefly.

6308. Do you consider, then, it was a necessity to have such a great width in the lower courses of the brickwork to distribute the pressure of the superstructure? The great width is not put in for that purpose at all. If I had the plans to refer to, I have no doubt I could explain it clearly.

6309. In the portion to which I allude, the pillars alone have to be provided for—you will probably remember the elevation? I would look at the plans.

6310. Have we the plans here? The architect, Mr. Eldridge, will explain it satisfactorily.

6311. Then you say you are not in a position to reply? Not without the plans.

6312. With reference to the Post Office in Launceston, do you approve of the arches being provided with T iron lintels? I sanctioned it in the case of the Public Buildings in Hobart, and naturally repeated it in Launceston.

6313. What was the necessity for providing the lintels?—were not the arches sufficient, if properly constructed? It was to give additional security. If the arches had been built in cement, that would have taken the weight, no doubt.

6314. Would it not have been cheaper to have made them in cement, and in a more workmanlike manner? Still, in the way of architecture, it is satisfactory.

6315. You wished to secure the flat-head? Yes.

6316. I presume you could have got that with a flat-head arch, in the ordinary way? I would not use that.

6317. The plans and specifications had to receive your approval, I presume? No, the general approval was from the post and telegraph authorities. It was arranged to suit their views.

6318. I understand you simply had to judge as to the design? That is all.

6319. Do you consider that the wooden pavement of the floor of the centre hall is better than Minton tiling, or good hard stone flooring? I dare say Minton tiling would have been as good.

6320. Would it not have been handsomer, more lasting, cleaner, and less liable to danger from fire? I suggest that you ask the architect.

6321. I ask you? It is less combustible, of course.

6322. Then you have no objection to Minton tiles being used—or do you prefer the proposal of the architect? Yes.

6323. Do you also consider that the iron trusses to the roof in the centre hall are appropriate to the style of architecture? I cannot remember just now.

FRIDAY, APRIL 9, 1886.

PRESENT :

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.

HENRY CHARLES STANLEY, Esq.

ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

MR. WILLIAM DUFFY, *examined*.

6324. *By the Chairman*.—What is your position in the Public Service? Engineer of Roads and Bridges.

6325. Do you hold that as an independent position, or are you under the control of any person? I am under the Engineer-in-Chief.

6326. How long have you held your present position in the service of the Government of Tasmania? Since February, 1883.

6327. Previous to that time how was the work of the Roads and Bridges Department carried on? I do not know. I do not know how the department was managed previous to 1883.

6328. When a new road is requisitioned for, what is the course of procedure of the Roads and Bridges Department? I do not know that I can answer your question in the manner it is put, but I can explain what I know about the making of new roads. When a new road district is taken up there may be roads provided by the District Surveyors authorised by the Lands branch of Public Works, or there may be none. In my own experience I have found large settlements existing without any roads at all until the necessities of the people called for it through their wanting communication, and not being allowed to pass through each other's lands. The existence of roads is then for the first time thought of, and then we are instructed to go and make the best arrangements we can with the proprietors in buying the land for the roads. In other instances roads are laid out with straight lines and we have to have them altered. It is mainly the main or settled roads I have had to deal with.

6329. Then suppose the necessities of a district require a new road to be constructed across a country only shown on a map, what is the first step you take? Since I have been in the department I have not been really able to initiate anything, but I have four or five tracks through new country being opened at the present moment. Usually in that case I send out some experienced bushman to blaze the track first; I then examine it myself, or through one of the officers of the department, and if I recommend it, it is carried out by the department.

6330. To what extent do you consult local authorities and residents in the district? In regard to those roads of which we are now talking there are usually no residents to consult—settlement is just beginning. In the survey of other places, where a vote has been sanctioned by Parliament we generally see the chairman of the Trust and hear what he has got to say, but almost invariably we find that self-interest is guiding those gentlemen, and we are obliged in spending the money to lay it out according to our own judgment.

6331. In other words, the proprietor is too apt to recommend what is for the benefit of himself rather than view the matter for the good of the district? Yes; and often the larger proprietors "jump" the position of road trustees for that purpose.

6332. Do you think you sufficiently consult Road Trusts as to the use of material found in the districts, such as metal? Wherever we find, in our dealings with persons whom we consider reliable, we always take their advice, and are very glad to get it.

6333. Generally speaking, how does that work in the interests of the department? In some instances it works admirably well, in other instances they repudiate their former acts.

6334. Great complaints have been made as to the improper time at which tenders for contracts are called: can you give any reason or offer any suggestion how this can be remedied? As a matter of fact, the moneys that are voted by Parliament for the construction of roads are not available to the department until the commencement of the new year, in January; and from January until the end of April is the only time prior to the winter to get out the works. Last year I got out about one-third of the works and then stopped until August. I am doing the same this year.

6335. It has been pointed out that the works are carried out in winter, involving increased outlay? There has been loss, in my experience, and there will be, let us be ever so prompt, even if the work is let in January or February, because hitherto the contractors have taken a very long time, and delay their work through the winter, to their own loss and the loss of the department.

6336. Supposing the moneys were available in the spring, and you called for tenders early in the summer, how would that suit farmers and residents? If the moneys were available in midwinter—that is, the time that Parliament goes into Session—so as to give us time to get out particulars for the commencement of the summer, it would suit the farmers as a rule.

6337. It would not suit them, I presume, to call for tenders at midsummer, as that would prevent or interfere with harvest operations? Yes; but if they were called for in early spring or in the autumn they would not. Indeed, I can say that in nine districts out of ten that which you know as interfering with harvesting operations is non-existent in this country, because the cultivation is so small, except in potato growing. Harvest operations would not be an insuperable objection.

6338. From the experience you have gained, can you suggest a remedy for the consideration of the Government? The system we had adopted last year, and that I am pursuing this year, would meet all, I think. We let some contracts in January, February, and March, and again in July, August, and September. We did that last year with very good results.

6339. Are you satisfied that sufficient local publicity is given when tenders are called for? Yes; but there is a great deal of dishonesty on the part of intending contractors in taking away the schedule papers from the post offices to other places. We are obliged to send them to the post offices, but it is, perhaps, in the custody of a young lady or storekeeper; and intending contractors are constantly complaining of their disappearance, and their most mysterious re-appearance when the tenders are closed.

6340. Can that not be prevented? There is not always accommodation in the post office for contractors to go inside and take out quantities there, and the papers are generally lent for an evening with a promise to return them in the morning. If the borrowers are honorable and reasonable the present system would work right enough.

6341. Has your attention been drawn to the desirability of specifying the use of timbers cut to marketable sizes—that is, timber adapted for building purposes—or do you specify arbitrary sizes suitable for the needs of the Department? The only timbers I know cut for building purposes by the trade generally are house building timbers of slight scantling for the other colonies, and they are cut indiscriminately. Whenever we get a large supply of timber, or rather, whenever we are in want of it, we can get it cut to the size required at as reasonable a rate as market timber is sold at.

6342. You do not consider this an element worthy of consideration? No; in fact, it would be an injury.

6343. At Emu Bay it was pointed out to us that in the bridge over the Emu River the foundations of the north-west angle of the abutment had been built on piles somewhat above the level of the bed of the creek. Was your attention ever drawn to that matter? No, sir, it was before my time.

6344. Has it ever come under your notice? No, I have had no such work done, but know of a pile foundation under the stonework where unfortunately it is subject to wet and dry.

6345. Do you approve of loading the floors of the timbers with, say, 4 to 6 inches of metal? No; I put a tar asphalt of small metal.

6346. What width? 8 inches in the centre and 5 at the sides.

6347. Is that necessary? Yes; one of the greatest dangers is being subject to wet—injury is done to the face of the timber, and it works into a pulp, and after a few years becomes useless. The water lodged gets into the under timbers. The beams of the Deloraine Bridge a short time ago were found rotten owing to the water getting into the timbers and destroying them.

6348. Would it not be better to put a second timber floor? No, sir; because the water would get through the first one and saturate into the second.

6349. In passing over the Leven bridge we noticed that the overhanging road for foot passengers is commencing to settle or sag? That is not correct, Girders were allowed to be put into position that had a sag in them. Mr. Fogg was allowed to use two such girders. There was always a slight fall right across the bridge.

6350. It was more observable on the outer side? True, it would catch your eye there more readily than on the other part.

6351. Is it your opinion that defect has arisen from the causes named? Yes, and not from sinking at all; the work was unfortunately let to a botch. It has been a botched job.

6352. What officer supervised the construction? The District Inspector, Mr. Brown, and Mr. Groom who was a good practical bridge hand.

6353. Do you attribute that fault to laxity of supervision of the Government officers, or was it the fault of the contractor? The contractor was ignorant and obstinate in his work throughout; his bolts were only half-inch, with proper sized ends welded on. This was done to deceive.

6354. Do you think the inspector exercised due care in supervision? Yes, and very great forbearance added to it.

6355. Did he report those defects to you? Yes repeatedly, and I was up there some eight or nine times myself.

6356. What steps did you take with the contractor to compel him to remedy these shortcomings? I made him, as far as I knew, take out the defective work and replace the work correctly.

6357. Did you make any reduction on the amount of his contract? I did, but the contractor got a Member of Parliament to represent his case; there was an arbitration, and the contractor was paid for work I had cut out of the contract.

6358. Did you consider that was brought about by political pressure? I did.

6359. And that the contractor, entirely from this reason, obtained an amount he was not entitled to? Yes, to my mind.

6360. What conditions of arbitration were there in the specifications? I do not know that there was anything in the clauses of the specification or in the acceptance of his tender that enabled him to do so. In the acceptance of his tender the printed condition provides that a contractor shall give a schedule of prices for the purpose of additions or deductions. One of the deductions was the timber sheeting over the struts that sprung from the piles to the girders. These overlapped each other, as corbels, and required packing pieces; so I did away with this timber casing.

6361. These timbers crossed each other? Yes. The contractor never ordered the timber for the casing, and earthwork included in the original contract was also cut out by me, for which he was paid.

6362. That arose from circumstances beyond your control? Entirely, and very much against my most strenuous opposition.

6363. Have you power to enter upon private and Crown lands for obtaining material when required for use on the roads? Yes, by giving notice.

6364. Does that involve an arbitration or an assessment of damage? The Act provides that there will be a kind of assessment, but usually we pay royalty.

6365. Is there sufficient machinery under the present Act to enable you to take material with advantage to the public? I believe so.

6366. Can you take timber as well as stone? That is a question that has never arisen, because we have any amount of Government ground, and can always get timber by tender much more readily than by being at the trouble to go for it.

6367. Do you think it would be desirable to give greater powers to the Road Trusts, or to curtail them, or to continue the present system. I should like the main roads altogether taken from the Road Trusts.

6368. And held under the Government direct? Yes. They are more economically and infinitely better worked where we have charge of them.

6369. What do you say as to bye-roads? That is a very heavy question.

6370. Do you think it would be desirable to hand over the moneys to local trusts under an effective guarantee? I would hardly like to discuss that question; I would like to think it over. I know that there are some Road Trusts that are an honour to any country, and there are others that I do not care to describe.

6371. Do you think legal provisions could be introduced as would prevent wrong-doing in respect to the spending of these moneys? Well, I can give you an example, and you can draw your own inference. Last year I was instructed to grant a certificate for the outlying streets of Hobart. I went and examined the work, but my decision was objected to in Parliament, and the power is taken out of our hands.

6372. *By Mr. Stanley.*—How are your surveys of new roads, more especially through difficult country, effected? No survey is ever made.

6373. Have you road surveyors attached to your Department? None. Any piece of surveying I want specially done I have to do it myself.

6374. Do you not provide sections of new roads to contractors? Lately we have. There is only myself and two others of the gentlemen under me capable of doing it.

6375. It is not a general practice? No, sir.

6376. Do you not think it would be very desirable if you had one or more road surveyors attached to your department to enable you to give fuller information to contractors when tendering for road work? It would be better, but most of the works are surface forming. Our Inspectors generally contour the ground round the track; they have acquired a considerable amount of skill, and it is wonderful what they can do with their boning-rods. Most of our work is surface or sidelong work. Where cutting or banking is required, I either send one or other of the officers I have got, or go myself.

6377. Do you not think that by having a careful examination made of the country before laying out a new line of road, it would often save reconstruction and deviations afterwards? Yes, certainly.

6378. What powers have you for resuming land for road purposes? None.

6379. Is there not an Act providing for the resumption of land in such circumstances? There was an Act passed the year before last, but it is nearly a dead letter.

6380. Then do you mean that you are entirely in the power of landowners if you are obliged to resume land? Yes, in 99 cases out of 100.

6381. I presume you are well acquainted with the roads in Wellington district? Yes, sir.

6382. Especially that road between Emu Bay and Table Cape? Yes.

6383. Was there any survey made of that road before money was expended on its permanent construction? I do not think so.

6384. Are you aware that there are many places where considerable detours are made where the road might have been taken nearly straight with advantage? I am aware of it, but it was before my time, and is mostly the work of the road trusts to make very bad spots.

6385. You are not responsible for that? No.

6386. Is it your practice in the construction of bridges over tidal rivers to take any means of protecting the timber piles against the ravages of the marine worm? Except the bridge over the Mersey at the Leven, and the Formby bridge, I have had nothing to do with bridges. I should also mention the one I am going to do at Bridgewater.

6387. Have you had any experience in regard to the effect of this worm upon timber in tidal water? Oh, yes.

6388. What means do you think should be taken to protect the timber? Well, I am doing some experiments at the present time with timbers for this purpose, and perhaps when the bridge is complete at the Leven I hope to be able to do it by putting the casing of the box outside of it, and afterwards filling it in with composition of tar and cement, instead of copper and Muntz metal; I hope to make a better and more solid coating. I have put it on some timber, and I find it to answer very well.

6389. Do you not think that by sheathing the piles in the first instance with Muntz metal, it would be more economical and satisfactory? No, I do not.

6390. Is not that the usual means taken in other places? I know it was in Ipswich and at Brisbane; still, it was unsatisfactory.

6391. I think you said to the Chairman that you approved of covering the roadway timber of bridges with asphalt, and metal? Yes.

6392. Have you seen the roadway of the bridge over the Inglis River at Table Cape since it was covered with metal? I could not say that it was covered with metal when I last saw it.

6393. I had an opportunity of seeing this bridge lately, and I observed that the metal covering on the roadway had been wearing into ruts, so that, if it had been asphalted, it must have been insufficiently done? I cannot say whether it is asphalted. It is difficult to make men do the asphalt properly. We are a very conservative people. I have had to go and remain at a place two or three days before I could teach people. There have been some bridges done under my supervision, and I do not care who sees them. I put a new top on Brighton Bridge twelve months ago, and there is not the slightest appearance of the wear of traffic on it.

6394. What would the effect of the metalling be if not properly done? If it has been put on solidly and impervious to water it is a benefit.

6395. But supposing it is not properly done? Then it is like any other mud.

6396. Is the maintenance of main roads attended to directly by the officers of your department, or do you merely supervise the work done by the Road Board? Where the Government have taken control of the road, that is, taken it out of the hands of the Main Road Board, which is usually the Road Trust of the district, then the work is done directly by the officers of the department, and in the other case it is done entirely by the Main Road Board. They submit to us a generalised proposal of what they intend to do. We have, however, little or no control over them, in fact, none.

6397. Do you think it would be better if the maintenance of these roads was left in the hands of your officers? Most decidedly; they would be more economically and far more efficiently managed. The roads I have got under my own hands are invariably the best in the island.

6398. What staff do you employ in your department? I have one draftsman in the office I can call my own, and I get occasionally assistance from some of the architect's draftsmen.

6399. What out-door staff have you got? Through the colony, 12 district inspectors.

6400. Have they inspectors under them? No; but in one or two instances during the very busy time of the year they have an overseer to help them, but only in very busy times.

6401. How are the salaries of those district inspectors paid for? Out of the Road votes.

6402. Is the cost of supervision in your department charged directly to the votes for the public works? Except in two cases, my own and the district inspector here, in the Hobart circuit.

6403. In those cases how are the funds provided for? By the estimates. There is also the salary of one district inspector in Launceston; but it has been in abeyance for the last three years.

6404. Are the accounts of expenditure on the public roads or any of the special votes for works kept in your office? It is kept in the accountant's office.

6405. What check do you exercise upon this expenditure so that the votes shall not be exceeded? Office expenses and advertising, which is a very heavy item, is usually apportioned off first from 10 to 15 per cent., according to the vote. I then limit the amount of work according to the balance of the money, and instruct the inspector accordingly. Formerly we used to be always in debt as far as supervision was concerned when contractors exceeded the strict time for the work to be done.

6406. What percentage on the expenditure for work does supervision amount to on an average? Besides the supervision of the men outside I have also the men employed writing out the specifications and

preparing sections : in fact, all charges incidental to the cost, also the preparation of plans, where plans are required.

6407. What does that come to? As I said before, from 10 to 15, and sometimes 18 per cent. Sometimes works have to be advertised three or four times before we get tenders. I can give you an instance. Recently we had a £200 job, and the charges for advertising were £15, without producing a tender.

6408. Do you not think that that percentage, compared to the cost of supervision in other places, appears high? Yes, but then here we are compelled to advertise in every paper about the country, and they do not do that in other countries. In South Australia such advertisements only appeared in the *Gazette*.

6409. You think that if the same course was followed a considerable saving might be effected in your department? A good deal.

6410. Are the advertisements inserted in the local papers at full length? Yes.

6411. Do you not think it would be sufficient, instead of going to this expense, if a short notice calling attention to the full advertisement in the *Gazette* was put in each of the local papers? The papers would not put it in. Even now they complain of the advertisements not being explicit and full enough.

6412. What do you mean by saying the papers would not put such advertisements in?—have they combined against the Government in matters of that kind? No, but they are not going to advertise on the cheap for us.

6413. You think the newspaper proprietors would refuse to put in such advertisements? They have very broadly hinted at times that there is not sufficient information given,—meaning that the advertisement is not long enough.

6414. Who prepares the specifications and conditions for the works in your department? If it is an ordinary work, the Inspector who lays out the work prepares a rough draft. I examine them as a rule. I am responsible.

6415. You have, I think, printed specifications and conditions generally applicable to the works in your department? Yes.

6416. Do you find those conditions sufficient for the due protection of the interests of the department, and, at the same time, not unnecessarily harsh or arbitrary towards the contractor? I do not think they are harsh or arbitrary.

6417. Have any complaints reached you from contractors in respect to the nature of any of these conditions? Yes, certainly.

6418. What are the usual causes of complaint? I do not know, I am sure.

6419. Has your attention been drawn to Clause 17 as being liable to press rather harshly upon the contractor? No, I know of no instance where it was complained of.

6420. Can you refer to any of the printed clauses to which exception has been taken? Specially, no. I have heard them complaining now and then of harshness, but they are persons that require harsh measures to be dealt out to them.

6421. Your opinion is that those conditions are only such as are necessary properly to protect the interests of the department and the Government? In every other Government I have been under the clauses are more stringent.

6422. Referring to the roads in the Wellington district, has your attention been drawn to the way in which a portion of the Flowerdale road near its junction with the main road has been selected? The road was in existence some 8 or 10 years ago, and settled by a large population. There has been a new bridge to replace the old one built. I know one gentleman wants the road to start from the bridge because he bought a farm there within the last two years. The road was in existence, the bridge built, and money spent years before I came to the colony.

6423. I quite understand that; but I wish to ask you whether your attention has been drawn to this particular part of the road, because it appeared to me that the making of the road over two steep hills might have been saved? The only time my attention was called to it was as to the feasibility of immediately after crossing the bridge to make a direct road and, striking off two sides of a triangle, cut off a great distance. You must bear this in mind, the difficulties of the pioneers in opening that road. It was dense bush with thick timber and under scrub that was impenetrable.

6424. I quite understand the difficulties of selecting a road in the first place in such country, but before any considerable expenditure is laid out in permanently constructing such roads would it not be well, in your opinion, that a careful survey be made so that the department is sure that the best line of road is selected? You must understand that in the department we do not initiate new works—we can only take the roads as they are, and make the best use of them. To change the course or provide new roads means to buy the land or a right of way through it, and in many instances to sacrifice work already constructed.

6425. The land I refer to appears to be comparatively valueless? The moment they suspect the Government is going to buy it, it becomes wonderfully valuable.

6426. Do you not think that if you had powers under an Act of Parliament to resume land for road purposes on reasonable terms that it would be well, before expending money permanently on the construction of the main roads, to have such surveys effected as would enable you to determine satisfactorily which was the best line to take? Yes, if you also put in the Act a provision that the officer laying out the work, or some officer belonging to the Government, should be despotic and authorised to take up the land, and not refer to arbitration.

6427. My question was on the assumption that you had powers sufficient to enable you to resume the land in the same way, for instance, as is done in Queensland? Two years ago an Act was passed for that

purpose identical with that in force in South Australia. We have attempted to work it here, but arbitration comes in, and it is void. I will give you an instance of arbitration: A proprietor wanted £500; it went to arbitration, and the umpire gave £1500 as his award.

6428. *By Mr. Lawder.*—I understand you to say that you do not initiate works? No; we do not initiate works.

6429. Who, then, initiates works for new roads? The people generally. When they want a new road they call the attention of the Government. Members of Parliament bring the subject before the Minister, and the Engineer of Roads is told off to collate the different proposals, and they are submitted to Parliament.

6430. Are they submitted to Parliament in any order, or is there any equitable distribution of the available funds made by the Parliament for each district or locality? The Engineer of Roads prepares a list of the different roads, taking the different counties of the colony, and submits that to the Minister in charge of the Department every year. It is decided then what amount is to be voted, and the vote is submitted to Parliament. In many instances the vote is either augmented or lessened by Parliament.

6431. Do you prepare estimates beforehand for submission to the Minister before those votes are allowed? Yes.

6432. Are those estimates detailed ones, or simply approximates? Approximates.

6433. Do you require detailed estimates from your subordinates, and do they receive your sanction before they are carried into execution? Suppose it is decided that half a mile on a particular road between such and such a locality shall be formed and metalled, an approximate estimate is given of that. There is also a chart of the district obtained, and it is marked on the chart and submitted to Parliament. Afterwards, when the work is decided to be carried out, detailed particulars and estimates of cost are given by the inspector, and submitted to the Engineer of Roads prior to their being submitted for tender.

6434. I refer particularly to new roads? Those are new roads I am speaking of.

6435. Do you not demand from your subordinates the usual details required for an engineering project, such as sections for instance? As I said before, only two of my staff are fit to use instruments. The others generally make a contour of the road, and the work is done by boning.

6436. Then practically those inspectors are allowed to lay out the roads under construction as seems best to them? Under certain limits.

6437. Define those limits, and state the ruling gradient adopted by you in laying out roads? Well, the limits are these: I generally visit every district myself, and go over the roads to inform myself as to the gradients in the different parts of the country. I cannot give anything definite as to the gradients. People are now sending in and asking for a road that is 1 in 5.

6438. You do not prescribe any limits? I cannot do it. If I can get a gradient of 1 in 9 or 1 in 12 I try to get it.

6439. What do you consider should be the maximum gradient for a cart road? About 1 in 12 would be as steep as I would have if I could help myself.

6440. Do you not consider money expended in laying out roads with steeper gradients is, except for bridle roads, practically thrown away? No, otherwise the country could not be inhabited. There must be bullock roads for them to get their rations home.

6441. Do you not consider that if you had a more qualified staff of subordinates it would be possible to lay out the roads on favorable alignments and with better gradients—more suitable for cart traffic? Yes, in many instances; but we are bluffed in this manner: when we lay out the roads in many places we are met by vested interests, and our plans are frustrated.

6442. But in the interests of the public, whether local or general, do you not consider that to obtain a good gradient for travellers upon the road is a *sine qua non*? Certainly.

6443. And that in the face of having to maintain this road and traverse it for all time, that even at the cost of purchasing the interest of the proprietors in the land required, it would be better to obtain it where a good gradient could be secured? That is what we are doing every day.

6444. You think so? Yes, and we practice it every day.

6445. You stated to the Commissioners that you yourself had to inspect all the new roads laid out? Yes, generally. I go through the districts.

6446. Have you any duly qualified District Inspectors who can perform this duty for you? I have two out of twelve.

6447. Do you think it necessary and desirable to obtain other men equally well qualified? It would be better.

6448. Do you think it is necessary? I do.

6449. Do you think it would ensure proper gradients and alignment of roads were qualified men secured? When men first come here naturally they have to get acquainted with the country. Such men might increase the expense and do better work, but they would not have the tact the present men have acquired; they would require to be some time in the country.

6450. I presume that on the whole it would be better? You must bear this much in mind, that whether a man is a qualified engineer or only a bushman, he has first to get rid of the scrub. Perhaps a good road might be got within twenty yards and the men not see it, owing to the dense scrub.

6451. Would it not be possible to train those men to use a common clynometer? Most of them use a clynometer, and some the level.

6452. What pay do the district surveyors get? They are paid 12s., 15s., and 18s. a day.

6453. And your sub-inspectors under these? From 8s. to 10s.

6454. Who generally appoints these sub-inspectors? The Government.

6455. Is there not a Government officer that has power of appointment? The permanent ones that are in existence were appointed before my time. I have not made any appointments except in one instance. Where there is an officer or ganger required for special work, the district inspector usually recommends some person in the neighbourhood, and he gets temporary employment.

6456. Do I understand you to say that the present sub-inspectors have been in their appointments since before you came? Yes, only one has been appointed since, on the West Coast, on my recommendation.

6457. It has been brought under the notice of the Commissioners that on the main road from Rocky Cape to Circular Head it was specified that pipe drains were to be used but the contractor substituted wooden culverts. Do you know anything about this? I am not aware.

6458. It has also been stated that a portion of the road on the eastern side of the River Cam was being constructed on a very steep gradient where quite unnecessary. This was brought under your notice, I believe, through the Minister of Works, and it was said you inspected the road after that and ordered it to be laid out on the better grade. That was all arranged for, and the owner of the ground through which it would pass made no objection, but the road has not yet been made, although all this occurred some eight or nine months ago? I can explain that in a very few words. At the instance of the Road Trust I went up there, and Mr. Norton-Smith, the Manager of the Van Diemen's Land Company, kindly said that he would give any land required to make a better gradient going out to the main road by the Messenger Creek. There was a piece of road required to go through Mr. Walker's ground, and the contractor, who was road trustee in another district, anxious to further the road, was willing, as we had not other moneys, to let his contract lapse and so provide funds to be paid Mr. Walker for the land. The lawyers have not made out the deed, and until we get the deeds we cannot go on. I think there is still some £16 or £18 left as the residue of the vote. We are unable to go on. Unfortunately, the vote proposed for East Cam southwards was thrown out in Parliament, and I have been unable to continue the road there for want of funds.

6459. Did you make this known to the Chairman of the Road Trust? Considering that one of the gentlemen most interested was in Parliament and fought hard to have this vote passed—I allude to Mr. Norton-Smith—I did not think it was necessary to write any intimation to the Trust. The matter was well enough known. It is not usual to make known to parties what occurs in Parliament.

6460. Can you state to the Commissioners why an increased waterway has been given to the Forth bridge now being built. The original span was 125, but the new bridge has two spans of 90 feet, with a centre pier in the river? Have you noticed that the ground of the far shore—that is on the west side—is mud ground and snags, and I think it far better to keep the abutment well into the shore than build it on the edge of the river. About half of the river bed shows rock, and I have good driving ground where the pier is placed.

6461. But what was the necessity for a centre pier if a bridge of similar span to the old bridge could have carried all the water? The width of the span was not a consideration. The original plan—an old laminated structure—carried 125 feet, but I did not consider that the abutment on the west bank safe, being masonry on a timber foundation, and exposed to wet and dry; and I considered it would have been far better to make two spans than one.

6462. Would not a single span have been as economical as a double span? Not to my mind.

6463. And have saved you the necessity of putting a pier in the centre? If I had thought so I would not have put it.

6464. Did you make any comparative estimate? I did,—I made three or four estimates.

6465. Can you give the Commissioners a statement of the comparative cost of the two structures? Not now, but I will endeavour to get it from my office.

6466. Do you approve of laminated timber? No, decidedly not.

6467. What objection have you to them? They always decay and rot.

6468. Do the booms with the vertical laminæ decay as rapidly as those with the horizontal laminæ? I have no belief in laminæ for bridge purposes in any form.

6469. I merely ask your experience of vertical in comparison with horizontal laminæ? I can hardly say. We have some eight or nine examples, and they are all rotten. It was the same in Victoria and Queensland.

6470. Are you not responsible, then, for the design of the bridge over the Emu River? No, it was before my time.

6471. Was the bridge over the South Esk at Avoca erected in your time? No.

W. W. ELDRIDGE, *examined.*

6472. *By the Chairman.*—What is your name? William Waters Eldridge.

6473. What position do you occupy in the public service? That of Architect and Chief Draughtsman.

6474. Is yours a direct appointment under the Minister, or under any other authority? By order of the Governor-in-Council.

6475. Do you hold your office directly under the Minister, or under what responsible officer? Under the Engineer-in-Chief.

6476. How long have you been in the service of the Government of Tasmania? Eight years.
6477. I presume you had considerable experience before you entered their service? Yes.
6478. Your work is to design and supervise the construction of the various public buildings? Yes.
6479. What are the principal works that have been erected under your supervision? The new wing of the Launceston Hospital, all school buildings for about the last four years, and country post and telegraph offices, police buildings, and public buildings generally, including new Offices, Franklin-square, Davey-street, Hobart, and Post and Telegraph Offices and Custom House, Launceston.
6480. In submitting the works for public tender do you advertise in the usual way? Yes.
6481. Do you take out the quantities of the different works, or do the contractors prepare it themselves? The contractors, except in some cases where we have given them quantities. We always take quantities out for the Departmental Estimates.
6482. Are the works let at a schedule of prices, or a lump sum? At a lump sum.
6483. Supposing there are any extras to the building, what course do you adopt to obtain sanction for the additional expenditure? I send in a requisition to the Minister, through the Engineer-in-Chief, for authority.
6484. On that authority you have sufficient power to undertake the extra works? Yes.
6485. As a rule, have the estimates for the works undertaken by you been exceeded, or have you kept within the mark? The votes or the estimates?
6486. The estimates? As a rule they come very close.
6487. And as to the votes? In one case,—that of the Franklin Square building,—£17,000 was voted for the work; but it was impossible to do it for that sum, and Parliament voted £7000 extra.
6488. When these new buildings are finished which are now in course of construction, what amount of rent will be saved to the Government? I have not gone into that.
6489. Can you name what offices are rented by the Government? There are those in Davey-street, and one in Macquarie-street used by the Bank of Van Diemen's Land, for which they pay £264 per annum. There is a sum of about £5000 voted to build offices for those who are using the bank buildings, and for Government Analyst.
6490. Is it supposed that when these offices are completed the different departments will have ample accommodation? I cannot say they will have ample room. Certainly, they will have a great deal more; but, I should say they will want more still, now the railways and large public works are going on.
6491. Have you made provision for extension in case it is required? Yes, we have arranged that openings through the walls, bricked up, be constructed, so that the necessary extension can be made at any time.
6492. Take the cases of two offices now under construction, how will your estimates compare with the contract sum? Very close. In the Franklin Square building the estimate came to, I think, £200 more than the contractors' tender; and in the Davey-street building I think it was £300 more.
6493. Then as to the Public Works? I cannot say as to those.
6494. The contract as to the Franklin Square building came very close to your estimate? Very close; it was let to the lowest tenderer.
6495. Have you any occasion to complain of the manner in which the contractors for either of these buildings have carried out their work? I did have once with regard to the Franklin Square building. Some inferior cement or sand was used in some arches, but when I complained it was taken out and put in again in a proper manner.
6496. Do you find any difficulty in getting suitable material for building purposes? Not now; but I found difficulty with regard to labour and materials when I first took charge. They had got into a crude way of building here, but I think now we have got into a proper groove.
6497. As to the bricks, what quality is usually supplied? They are not what you would call first-class in England, but for inside work they would not be condemned anywhere.
6498. Are they machine or hand-made? They are all hand-made bricks where covered with plaster or cement.
6599. Do you consider they are well burnt and sound? I think so; I think most of them are as well burnt as they can be, but I do not think they are tempered enough.
6500. Where do you obtain the lime for your public buildings? From Bridgewater.
6501. Do you consider the quality—good or indifferent? It is good lime.
6502. And the sand? That is obtained in various places; good sand and plenty of it is got from Knocklofty, but that is private property. Very good sand is also got out towards Austin's Ferry.
6503. As far as we have observed there appears to be a want of sharp clean sand in Tasmania? Yes; the best sand and fit, were it not for the salt, would be the sea sand.
6504. Is there no way of treating that by washing? When using Portland cement I make them wash the sea sand.
6505. Is the result satisfactory? Yes, and using it makes the composition three times better.
6506. Are you satisfied that the result is an equivalent for the additional outlay? Certainly.
6507. How do you mix your mortar here? About two to one.

6508. Do you make it by machine? No, by hand.
6509. Have you used pugging mills? Not in this colony.
6510. Do you consider the material blends as well by hand as by machine? No, I do not.
6511. Are you satisfied you get a good sound mortar? Yes; I do not think we get any inferior mortar, but I think the contractor loses by the labour in it.
6512. Do you think all the particles of lime and sand are sufficiently well blended? Yes, I think so.
6513. With reference to the public buildings at Launceston, I understand that these are under your supervision? Yes.
6514. In charge of the local architect? Yes.
6515. Can you explain why the large expenditure was deemed necessary for the foundations of the Customs buildings, Launceston? There was no bottom, and to allow for all the *detritus* washing down from the Gorge piles had to be driven in in some parts. I think piles had been driven in 80ft. or 90ft. near the banks of the river. I was first of all going to put a cement concrete block all over, but before that was done I made another examination, and got a lot of local information, and found that by continually dredging the river the banks were rendered insecure and kept falling in, and it was therefore necessary to keep raising them. There is a leak right along the road and through the concrete floor of the T.S.N. Co.'s store. In close proximity there are some tall chimnies, which in the course of a few years get a list, and it becomes necessary to wedge them up; and I presume if I put the concrete block all over the ground that would have an inclination towards the river in course of time, and the building upon it get out of perpendicular. I therefore thought the best thing to do was to drive piles, planked and covered up with Portland cement concrete and earth on top.
6516. What depth have you driven these piles to? About 30ft.
6517. What stratum have you reached? There is supposed to be a reef there, but we did not find it. We reached some ground so solid that four blows of the ram would not send the piles any further.
6518. Before you came to this solid ground how deep was the shifting soil or vegetable matter? I do not think it would be more than 4ft. or 5ft.
6519. Would it not have been possible to have sunk shafts to the solid ground, and filled these with concrete, and built relieving arches from shaft to shaft? I thought of the same thing, but I did not think it could be done, because I could not get any really good bottom and abutments.
6520. On the goldfields in Victoria this plan is followed where large buildings have to be erected, and good foundations have to be obtained at a moderate expense; I do not see why it would not have answered here? We could have done it, but the construction of the outside abutments and great depths would have cost more than the way we went about it.
6521. Your walls, especially the front walls, are of considerable thickness? There are an additional number of piles there.
6522. Do you think it necessary to put such a large amount of brickwork there? I do not think there is any extra number of bricks there than we really required.
6523. From what we were able to see of the brickwork, it rather exceeded 8 feet in width under the portico? Just in that part it may be, but that extends no height.
6524. To what height does it go? I think it is only put in to distribute the weight over the whole of the planking.
6525. Did you consider any other plan than that adopted previous to building the foundations? I consulted the Engineer-in-Chief about the concrete block, and we found it would not do, and we only considered the other of using piles and planking. We came upon a pile which had been put down 40 years ago, and it was as sound as when it was put down.
6526. Supposing concrete piers 8 or 9 feet apart and 3ft. square were built, and arches built from pier to pier, do you not think you would get a cheaper foundation? I think it would cost twice as much.
6527. At what price do you reckon the concrete? Concrete put down in that way, including the sinking of shafts, and putting it all together, would cost from £4 to £4 10s. per yard or more.
6528. Is not that an unusual price for concrete? Concrete generally costs from 38s. to £2 a yard without the extra labour, &c. which would be entailed in this case.
6529. Is that the usual price for concrete in Tasmania? Yes.
6530. With us concrete costs about 15s. a yard? Portland cement?
6531. No, lime? I would not like to trust our lime in that way. If concrete were used, it would have to be of Portland cement.
6532. You think, then, it would cost the sum you have named? Yes.
6533. In point of fact, you considered the plan I suggested? Yes.
6534. In reference to the new Launceston Post Office, have you lately seen those works? Yes, about two weeks ago.
6535. Was your attention called to the quality of the bricks? Generally very good bricks are got there. There were some inferior ones, which I told the architect to have removed.
6536. It appeared to us there were indications of vegetable growth on the outside of the bricks in the foundation—did you notice that? Yes, I noticed it; but it all goes off in a short time.

6537. What is the nature of this growth? I do not know. It is not for want of burning the bricks.
6538. When vegetable fungus appears on the outside of the bricks it is generally regarded as a symptom of decay: do you think in this case it is not so? I do not think so. I was examining a church a few days ago for the same thing. I recollect its being built, when a vegetable fungus appeared; but now I can see no symptoms of decay.
6539. I noticed you had used iron under the relieving arches in the foundation lintels? Yes.
6540. Why were the arches not turned by centres? In building, as a rule, unless in exceptional cases, I never use centres for relieving arches. I always make the arch of some soft material, which gradually gives as the arches settle down until the material is pressed out and the arch settles down on its own basis.
6541. Do you not think it would be better to do so, so as to prevent a settlement? Certainly not.
6542. Do you think you can prevent that? I think all arches should be set in Portland cement.
6543. Are you satisfied with the way in which the work is carried on? Yes.
6544. Is there any other information you wish to give in connection with your department? No; I showed Mr. Lawder and the other members of the Commission all I could this afternoon, as far as office work was concerned.
6545. Are you satisfied that your officers carry on their duties efficiently? I think so, although we do not get the number of experienced men necessary in the department. I do not think they are paid well enough.
6546. To that effect have any representations been made to the Minister through the head of the department? I have said sometimes to the Engineer-in-Chief that I think the department ought to be better paid. I have never really gone thoroughly into the matter.
6547. Do you encourage the entry of younger men into your department? Not unless they come in at a certain age. They should first be in a private office to learn their duties, and come in at from 18 to 19 years of age.
6548. What steps are taken to obtain new officers? I do not know.
6549. By advertisement or examination? We have obtained two men not long ago by advertisement, testimonials being sent in, and so on; but as a rule I think that after a slight examination before the Engineer-in-Chief, if a man is competent he is given work.
6550. Is there no system of formal examination whereby applicants could obtain certificates of competency to entitle them to apply? No; we cannot have that unless we have a regular Civil Service Bill.
6551. *By Mr. Stanley.*—What control does the Engineer-in-Chief exercise over your department? Sole control.
6552. Does he give instructions in respect to the designs of public buildings? No, not as to what the design should be.
6553. You submit the designs for his approval? Yes; I submit them to the Minister through the Engineer-in-Chief.
6554. In the first place they have to be approved by the Engineer-in-Chief? Yes, as a matter of fact they go through him.
6555. Are the estimates for the buildings also submitted to him? Yes, the estimates are always submitted with the design.
6556. Is he in the habit of examining these estimates, or does he hold you responsible for their correctness? He holds me responsible.
6557. In the event of any disputes arising between you as architect and any of your contractors, are these disputes referred to and settled by the Engineer-in-Chief? Yes.
6558. Could you furnish the Commission with a copy of your conditions of contract—I presume they are printed? Yes.
6559. Are they generally satisfactory, sufficient for the due protection of the department, at the same time not unnecessarily arbitrary towards the contractors? I do not think you could have fairer conditions. The contractors seem well satisfied with them, and I think we exercise all the power we want through them.
6560. Are any serious complaints ever made by the contractors in respect to the conditions? No.
6561. They are generally satisfied? Yes.
6562. What staff do you employ under you? In the architectural department?
6563. Yes? At present, two full draughtsmen and several improvers.
6564. What are these improvers paid? About £120 a year. There is also a lad of about 18 years, who gets about £50 a year.
6565. At the present time how many draughtsmen have you? Five.
6566. What outdoor assistance is allowed you? I make use of the District Inspectors employed on the roads and bridges, as Inspectors of Buildings. There are Clerks of Works in the Northern Districts and here, and in Launceston there is a Resident Architect, who is specially employed for the two jobs there.
6567. He is only temporarily employed? Yes.
6568. Is he paid by a salary or a percentage? A percentage.
6569. He is merely employed for supervising the two jobs there? Yes.
6570. How are the staff employed in your department paid—do their salaries appear on the estimates, or are they charged to the different works? They are charged to the different works.

6571. What permanent staff is provided for in the estimates in your department? Only myself. We had two men as junior draughtsmen now sent on to the railways. I found very often that when preliminary drawings had to be made there was nothing to charge them to. I often have to do these things myself, when I ought to be doing something better. It is an important matter, when I cannot afford the time.

6572. Can you furnish the Commissioners with a statement showing the works carried out under you during the last three years; the cost of supervision employed in connection with these works, and the exact strength of the office staff, as well as the outdoor staff? Yes, there was only one new building.

6573. Can you state generally to what the cost of supervision amounts to on the average per cent. on the works carried out? I cannot say from memory.

6574. I presume the return you have promised will enable us to arrive at this? Very nearly.

6575. Is it usual for you to provide for penalties in regard to contracts in which the time may have been exceeded? Yes.

6576. Have you any rule in the department for apportioning the amount of penalty—is it by a percentage upon the cost? No, we have a sort of rule, generally by comparing one contract with another.

6577. It varies according to the extent and importance of the contract? Yes; very often a small contract will have a very large amount put down.

6578. Is it the practice in your department to enforce these penalties? I believe it is; I am not certain at this moment, as it is more generally regarded as clerical work.

6579. Do you know it is done? I have never been asked yet.

6580. Do you not report whether you consider there are extenuating circumstances why the penalty should not be enforced? I have never been asked to do so yet.

6581. Then, what control do you exercise upon this expenditure in seeing that the votes are not exceeded? I always get that, and know whether they exceed or not.

6582. Is it your practice, where the expenditure exceeds the amount of the vote, to obtain the sanction of the Minister to such excess? No; when it exceeds the amount of the tender, that is, for extra works above the contract, I get authority from the Minister to complete the work.

6583. Do you allow percentage for extras? Yes.

6584. Then, I presume, what you refer to is in cases where the percentage does not prove sufficient? Yes, except in trifling cases. Supposing I wanted to spend £50 or £60 beyond the amount of the contract, I would ask the permission of the Minister; but supposing it was simply a matter of £4 or £5, and I had the money, I should expend it upon my own responsibility. Very often little unforeseen things will occur.

6585. Where a pressure of work exists, and you employ additional assistance, have you authority to obtain that yourself, or must you apply through the Minister? I apply through the Minister.

6586. *By Mr. Lawder.*—With the exception of yourself, all the assistants in your office are temporary hands? Yes.

6587. Do you mean by temporary that there are certain periods of the year in which they are thrown out of employment? That has not been the case yet. One man has been there about 18 months, another man about 3 years, and another 7 or 8 months. Up to the present there has always been plenty of work for them to do.

6588. Are any of these men considered by you to be specially qualified for the work to be done: the getting out of details, &c., and the preparation of working drawings, requiring a certain amount of skill? We have three men capable of all that, one a lad, and the others are improvers.

6589. Do you consider these are valuable men? Well, yes.

6590. Do you consider, if these men were to go away you would have any difficulty in getting others as good? I could get as good, if not better, at any time. They only require writing for, and the men being paid properly. You can get any amount of professional labour at the present day.

6591. Do you consider there is any advantage in the system of employing men temporarily? No, I would rather see a Civil Service Bill.

6592. Do you consider there would be any advantage in having men permanently employed? Not too many.

6593. Speaking of young men? I don't know about that.

6594. Would you like to see experienced men permanently employed? I would like to see two men permanently employed, with the amount of work going on at present.

6595. At present in whose custody are the plans and drawings? In mine.

6596. As a matter of fact, do you have charge of these plans, or trust them to a temporary man? To a temporary man; but he is looked on as permanent.

6597. He is entrusted with the custody of these plans? Yes; I had permanent men who always have the custody of these plans.

6598. I understood you to say to Mr. Stanley that the men ought to be paid better? Yes.

6599. Inasmuch as you said it would be easy to get qualified men, I presume on the same pay, what am I to understand by these conflicting statements? I meant that I would rather see professional men or draughtsmen in the office rather than so many young fellows.

6600. Do you think it would be always possible to procure such men from the other colonies? Yes, without any delay, when required.

6601. With reference to the quality of the bricks, do you not consider that a better quality might be obtained by a more careful selection of the clay? I think the clay is all right, but the tempering is not attended to properly. I do not think that sufficient attention is paid to the making of the bricks.

6602. The Commissioners noticed, upon their inspection of the different works in Hobart and Launceston, that sufficient care had not been taken in moistening the bricks before putting them into the walls. On enquiry they were told that water was simply poured on the bricks. Do you not think it would be very desirable to secure good brickwork, by steeping the bricks before putting them into masonry? They are well watered and wetted before being put in, which answers just as well as steeping them. Not only that, if we had to steep every brick it would add considerably to the cost of the work.

6603. Would it add considerably to the cost of the work to have a tub near every mason, and a supply boy to throw his bricks into this, from which the mason could take them out as he wanted them? It would make the work one-third dearer.

6604. It is not found so in other places? I should think it must be.

6605. With reference to the foundations of the Custom House at Launceston, the Commissioners observed that the timbered framing on the tops of the piles was some distance above spring level. Do you not consider that this part is likely to decay? No, because there will be no timber exposed in any way. It will be all covered over with Portland cement and filled in with earth, so that no air can get at it.

6606. In what position was the old pile you said you found? That old pile was near the front of the building.

6607. Below the water level? I think it was. I cannot say with certainty.

6608. Are you not aware that the top was above ground? No.

6609. Have you reason to believe it was? We were preparing to drive piles and came upon it. I have reason to believe it was near the top.

6610. Do you know whether the piece that was sent you was cut off below or above the water level? I cannot say.

6611. Do you not know that the part from which the piece was cut was below water and sound, whilst that above water was entirely decayed away? I do not know that any part of it was decayed.

6612. The Commissioners noticed that it was decayed at one end, or gone between wind and water? I recollect a post being taken up at Richmond, where it had been in the ground 60 or 70 years, to make room for new posts, when it was found to be perfectly sound.

6613. Was the top of the pile sent you? I do not know. It was sent down by the superintending architect. I have since found out it was cut off at high-water mark.

6614. A disc was sent to you, was it not, and the top of the pile remained in Launceston? Of course I do not know.

6615. On what account did you consider it necessary to have iron strips put through the walls? On account of the earth tremors I consider it necessary, and have increased them since these vibrations have become so numerous.

6616. Do you not think they are objectionable on account of their getting rusty? No; in cutting away the old building we came upon some iron bars which were as sound as the day they were first put in there, 40 or 50 years ago.

6617. You know iron does corrode, to the disturbance of stonework? Yes, I know it does.

6618. Do you remember in the design for the Post Office at Launceston you provided for a vehicle passage 10 feet wide. Would it not have been possible to have given more room in the passage, that vehicles might pass each other? It was impossible.

6619. The passage will be blocked if a conveyance stands in it, will it not? No; one vehicle could draw down into the corner, and there would be plenty of room.

6620. I presume it would be rather an awkward proceeding if one vehicle had to pull up to the corner, and go backwards to its old place to allow of another one passing it in the same direction? Yes; but from the amount of business such a proceeding would not be necessary.

6621. In a few years might it not be? Yes, but I gave the Government all that they asked for.

6622. Would it not be possible to provide a few feet of additional width? No, unless a special Act were passed.

6623. To purchase additional land for the site? Yes.

6624. Would it not be worth while for the Government to purchase additional land for the convenience of mail carts, and to make more suitable provision for future demands? I do not think it necessary.

6625. Suppose the land is not purchased now, as the prosperity of Launceston develops will there not be much greater difficulty and expense in getting more land? Yes; but then they can load the mail carts from the outside. It was never thought of leading them inside the yard until I proposed it.

6626. But do you not think that it would facilitate the loading very much, and be a most useful provision for the future, if this extra land were purchased? Yes, I do.

6627. The Commissioners observed that you have provided a wooden floor to the centre hall, and iron trusses to the roof. Would it not be preferable to provide Minton tiling for the floor, as a cleaner surface, and less liable to damage or danger from fire? It is impossible for this wooden floor to burn, as there is no draught. It is laid upon a bed of concrete, and nothing that I know of could set it on fire. As for cleanliness, the rain cannot get in, and it is simply a matter of dust. I do not think it will ever be very dirty. I would not advise Minton tiling or Portland cement, because of the great traffic.

6628. Would not even flagging be preferable? Yes, but it is so difficult to get stones for it.
6629. Minton tiling is found very useful and to last a considerable time in other countries, where there is more traffic over them than is ever likely to obtain in the Launceston Post Office: why would you not consider it suitable? On account of the great noise that it makes. You cannot have anything quieter than wood.
6630. Then it is on the ground of noise you object to Minton tiles? Yes, they are much noisier, and wood is just as clean and more durable.
6631. Do you think that iron trusses are in accord with the adopted style of the building, or would it be preferable to have ornamental wooden trusses with octagonal base framing and hammer beams? The present style is much preferable, and much lighter. A wooden frame would be too heavy in appearance.
6632. Do you think that ironwork of the nature you have designed is in keeping with a building in the Queen Anne style? The ironwork might be put into any design.
6633. I presume your building is in the Queen Anne style? Yes.
6634. Whereas the ironwork in the roof is rather like a railway shed? Not exactly, it is better than that. It is of no particular style, except that it is a light iron roof, and I do not think you could have improved that iron roof much. It was intended to obstruct as little light as possible. Now all the light from the quadrangle comes through without obstruction.
6635. Might not the roof be constructed of wood in a way to obstruct as little light as possible? The roof would obstruct the light. We made it as light as we could to obstruct as little light as possible.
6636. The Commissioners made an inspection of the Hobart buildings, particularly the new Lands and Works Office. They observed that you had one part of the roof to the west constructed of strong Queen-post trusses, whilst the other wing to the east, with exactly similar span, was constructed of plain trussed rafters secured by nails. Would it not be preferable to have the same style of roof in one place as in the other? No, the spans are different. The trusses were put in to carry ceiling joists in place of the girders with columns underneath. We put in small iron rafters to take this principal on purpose.
6637. But the east wing is the same as the west one. The partition does not go up to the roof? It is a very long room, and the span is different.
6638. That division with the iron girders makes the west room the same span as the other one? They have the same span now.
6639. Why did you have Queen-post trusses for the one, and trussed rafters for the other? If we had not put these trusses in, we should have had to put beams with iron bolts in between, because they are a long bearing to take the ceiling joists.
6640. Do you consider the trussed rafters in the east wing are sufficiently strong to sustain the slate roof, wind pressure, &c.? Yes.
6641. Is this building to remain exactly as it stands with regard to architectural details in the front elevation? With one exception.
6642. What is that? We intend to cut off the terminals at top of pilasters.
6643. Do you not consider that a building of that sort requires some bold feature to throw it out? The pilasters must be finished with something, and I propose now to cut them back, and not have so much projection.
6644. Do you not consider the cutting of these back will be rather a disfigurement in a building of that kind, which requires some break in the front to give it a certain amount of shadow? I think it would be better to let them remain as they are. I don't think they are a disfigurement, but a very great improvement.

SATURDAY, APRIL 10, 1886.

PRESENT:

The Hon. WILLIAM AUSTIN ZEAL, Esq., M.L.C.
 HENRY CHARLES STANLEY, Esq.
 ARTHUR WM. LAWDER, Esq.

THOS. C. JUST, Esq., Secretary.

THE HON. NICHOLAS J. BROWN, M.H.A., *re-examined.*

6646. *By the Chairman.*—We understood, Mr. Brown, that you wished to give a further explanation as to certain questions on which your evidence has already been taken? Yes, I should wish to do so.
6647. With respect to question No. 7? In reference to that I wish to state that estimates were furnished by the Engineer-in-Chief when the tenders were received—that is to say, before any decision on the tenders was given. The Engineer-in-Chief then furnished me with more detailed estimates than those which were submitted to Parliament. This explanation will apply to question 8 also.
6648. Was that in the nature of a confidential estimate? Yes.
6649. In reference to question No. 9? The correction I wish to make is that when the question was put I thought it was to this effect: Was the money sanctioned for expenditure by Parliament on the Par-

liamentary plans and estimates only? The word Department escaped me. That answer is correct, and the explanation of it is the same as I have given in reference to question No. 7. It was carrying out what was before Parliament, but conditionally upon details furnished by the Engineer-in-Chief. The same explanation will apply to the subsequent questions.

6650. Then, in reference to question 31? I do not think it necessary to give any explanation as to that. It is probable the Commissioners have obtained all the information they desire from the Engineer-in-Chief. I do not think it necessary to make any further explanation as to my former evidence.

6651. We wish to ask you, Mr. Brown, how far the administration of the Engineer-in-Chief's Department is controlled by the Minister—that is, the professional administration of the Department? I should say just as any other professional department would be controlled under a Ministerial head. The Engineer-in-Chief is held responsible for the professional opinions and advice given to the Minister.

6652. Suppose the Engineer-in-Chief to object to or protest against carrying out a work in a particular way, would that protest relieve him from responsibility in the event of any failure of the work? Yes, if it was a formal protest.

6653. Suppose it were not exactly formal? I should say it would, to a certain extent. I should not consider a verbal communication sufficient. It would be the duty of the Engineer-in-Chief to have a formal protest placed on record.

6654. But suppose he verbally protests in reference to any particular matter, would you consider that of weight, if not backed up by a written protest? Oh, certainly I should consider it of weight, but unless a written protest was placed on record it could not relieve him of responsibility. No doubt any opinion of the Engineer-in-Chief, expressed verbally or otherwise, would be duly considered, and most likely would be so considered not only by the Minister, but by the Cabinet.

6655. Are there any instances within your knowledge where the Parliament or the Government overruled the opinion of the Engineer-in-Chief on a question of construction? Do you speak of railways?

6656. Yes, of railways? Only one that I can call to mind. That was in the case of the Oatlands and Parattah railway. The Engineer-in-Chief has always disclaimed responsibility for the cost of that line. He has represented from the first that nothing less than £12,000 would be sufficient for the work.

6657. Are there any circumstances in connection with the Derwent Valley line that would relieve the Engineer-in-Chief of responsibility for the execution of the works? Do you mean as to plans?

6658. As to plans and estimates? Nothing that I am aware of.

6659. Are you aware whether the Engineer-in-Chief was in any way overruled by the Government as to the construction of the Mersey Railway through the Town of Latrobe? I do not think it would be correct to say that the Engineer-in-Chief was overruled by the Government. The Government was overruled by the Parliament. It was a vote of Parliament which made it almost compulsory to take the line through that route.

6660. Are you of opinion that the Engineer-in-Chief made his protest sufficiently clear as to the construction of the line through the Town of Latrobe. He always made it clear to me, and I made it clear to the Cabinet, that the cost of going through the Town of Latrobe would be a very large amount. The Engineer-in-Chief's estimate, I may say, of the excess of cost was not concurred in by a gentleman who was a member of the Cabinet at that time, and who had some professional knowledge—I mean the late Chief Secretary, Mr. Moore. He disputed the accuracy of the Engineer-in-Chief's estimate, and his opinion carried weight.

6661. Then, as far as the Latrobe deviation is concerned, the Engineer-in-Chief was overruled by the Parliament? He was.

6662. There is another matter which has cropped up during our investigations—I mean the north deviation on the Fingal Line through the Town of Avoca. It is stated that in consequence of a petition sent in to Government by the inhabitants, which was referred to Mr. Climie and favourably reported on by him, the deviation was made through the Town of Avoca, thus adding largely to the cost of the line. Is that a correct statement of the case? It is a correct statement in so far as that representations were made to the Government from parties interested in the Town of Avoca and others that it would be very desirable to bring the line of railway near to Avoca if possible. Owing to that an alternative survey was ordered, but regarding the extra cost of that I cannot call to mind exactly what occurred; but certainly the impression on my mind is that the Government's action in sanctioning the alteration was taken in the belief that it would cost very little, if anything, more.

6663. It is alleged that the great difference in cost arises from the present crossing at St. Paul's River, which is nearly double the width of the originally proposed site? I was not aware there would be any material addition to the cost of the line by making the deviation.

6664. Did the Engineer-in-Chief protest against the deviation? I believe he did verbally, but he did not consider the matter of sufficient importance to urge his objections very strongly.

6665. Another deviation was pointed out at the Break o' Day river near the Mount Nicholas coal mine. The Engineer-in-Chief stated that the original line passed considerably to the south of its present position, and that, in consequence, a larger viaduct was required to cross the Break o' Day river, and more expensive works than would be justified by the traffic along the railway, the object being to serve the Mount Nicholas coal mine. Is that correct? I cannot at this moment recall all that occurred about that deviation. What I do remember is to the effect that it would not involve any great amount of extra cost, while the convenience it would give to those locally concerned would warrant the additional expenditure.

6666. If the Engineer-in-Chief had protested verbally or in writing would his protest have been acted on? Undoubtedly it would have been acted on, or some good reason given for disregarding it,—but there

was no formal protest, as far as I can remember, connected with it. It was dealt with as a matter not of very great importance, as far as I can remember.

6667. As to the preparation of plans and letting contracts, the Engineer-in-Chief has stated that he was very much hurried by Parliament and the Government of the day in preparing his plans and letting the various contracts: is that the case? You will find that stated by me on the occasion of my last examination, in my answer to question No. 37. I have nothing to add to that, and I now confirm it.

6668. Mr. Fincham was likewise asked, "Did you at any time represent to the Minister the desirability of your being placed in a position to check the correctness of the figures supplied by Mr. Edwards before accepting the tenders for the railway works?" That involves a contradiction as to the relative responsibility of Mr. Edwards or the Engineer-in-Chief for these designs. We wish to know as clearly as possible how far the Government consider the Engineer-in-Chief responsible for the plans prepared by Mr. Edwards? It is perfectly true that the Engineer-in-Chief did represent to me on more than one occasion that it was desirable he should have assistance in the way of a competent officer or officers to check these plans and estimates; and I urged this desire of the Engineer-in-Chief on the attention of the Cabinet, but was unable to obtain the concurrence of the Cabinet to the appointment of any officers of the kind. It was thought that the staff of the Public Works Department was sufficiently large, and I could not get any further salaries passed.

6669. Then, so far as your explanation is concerned, that would relieve the Engineer-in-Chief of responsibility? To that extent; but I am not aware that he has ever claimed exemption from responsibility further than that he should have had assistance in a matter of this nature.

6670. A question was put to the Engineer-in-Chief: "Do you not think it was incurring a risk to your reputation in trusting so implicitly a professional man of whom you had no previous personal experience?" And he says he trusted implicitly to Mr. Edwards, and could not do otherwise under the circumstances. Is that a correct statement? In what respect? That he never made more than one protest, namely, that he was hurried? I can say that the Engineer-in-Chief always expressed to me his great confidence in Mr. Edwards, and I should say that any mistake that has occurred, if any, has arisen from hurry in the preparation of the plans, to a great extent.

6671. It appears that a difference of opinion has arisen as to the nature of these plans, or the way in which these plans were to be regarded. Mr. Edwards seems to think they were type drawings which should be altered to suit the peculiarities of any locality, while the Department recognises them as suitable drawings for a particular work and locality. Which would be the correct interpretation? I should say they were drawings for the special localities for which the work was designed. I understand it so, except in cases of general work, such as culverts or bridges. In the case of any important or extensive work I should say the drawings were designed to suit the locality.

6672. If, for instance, there were three drawings of any particular work in a locality, and the choice rested with the Engineer-in-Chief as to which he should select, who would be responsible for the work? The Engineer-in-Chief, decidedly.

6673. Have any representations been made to you through the Engineer-in-Chief, on Mr. Edwards' behalf as to the insufficiency of the remuneration he received? Verbally, representations were made occasionally as to statements made by Mr. Edwards about the insufficiency of the terms made with him, but no formal application was ever made to me for any increase.

6674. And no definite result was arrived at? No, the matter was left to be arranged by the Engineer-in-Chief.

6675. *By Mr. Stanley.*—With respect to deviations from original Parliamentary plans, Mr. Brown, Mr. Fincham has stated that, in the case of two or three important deviations, he had adopted them without any formal authority from the Government. Do you consider that such authority should have been obtained before an alteration was made from the plan approved by Parliament? Certainly. I am not aware of any important deviations having been made without my authority, if not the authority of the Cabinet.

6676. I mean formal authority. Mr. Fincham stated he believed he had conversations with you on the subject of these deviations, but did not obtain formal authority. Should you not consider this necessary where Parliamentary plans were departed from? Yes, and more than once I have told the Engineer-in-Chief that he should have formal authority for his own protection. In minor matters of detail I know alterations have been made without authority, where it would perhaps add to the stability of the works and diminish the cost. In matters of that kind alterations may have been authorised in conversation, but I am certainly not aware of any important deviations having been made without proper authority.

6677. One of the deviations I refer to is between Piper's River and Scottsdale. The line is taken more direct than in the Parliamentary plans. Originally the line is shown as going round by the Denison gold field. Mr. Fincham said he had no formal authority for that deviation, but understood you to approve? That alteration was submitted by me to the Cabinet, and owing to the personal knowledge of the country that some members of the Cabinet had, it was agreed it should be made. No formal authority was given to the Engineer-in-Chief, but he was informed by me that the deviation could be made. I think I may add that this deviation was through a piece of country where no land had been alienated at all; at all events it was represented that no private interests would be affected.

6678. Another deviation to which Mr. Fincham referred was that mentioned by the Chairman at the Break o' Day river, on the Fingal line. He said he had no formal authority for that, but it was adopted after a verbal communication? I have no doubt I consulted the other members of the Cabinet about it, and conveyed the authority to the Engineer-in-Chief, which should certainly be in writing.

6679. To what extent do the Government expect the Engineer-in-Chief to control the works connected with the roads and bridges department? Originally the Engineer-in-Chief had the direct control of every one of those departments—roads, bridges, and buildings—inasmuch as there were no railway works being

done when he was appointed. When the railways were undertaken we appointed an Engineer of Roads for the purpose of relieving the Engineer-in-Chief as regards roads and bridges. Although he has the general supervision over them, he is practically relieved as regards roads and bridges. The same as to buildings: he takes the general supervision, but is relieved by the appointment of the Government Architect.

6680. His duties, then, with regard to those departments are more those of a consulting engineer to Government? Yes, they are.

6681. *By Mr. Lawder.*—It has been stated by the Engineer-in-Chief that traffic statistics concerning the railway prospects in districts through which lines are projected are got out by others than those in his department. In the case of the Scottsdale line I think he said a Commission was appointed? A Board of Commissioners was appointed to enquire into the probable traffic statistics of all these lines; it was not only for Scottsdale. Their report will be found in the records of the proceedings of the House of Assembly.

6682. Was the Engineer-in-Chief not consulted at all as to the physical character of the country through which these lines were projected? No doubt there were many consultations with the Engineer-in-Chief on the subject. He must have been consulted.

6683. Are you able to inform us if the question of the cost of working the lines after completion, the steepness of grades, or approximate cost per mile over different routes, were considered by the Commission or supplied by the Engineer-in-Chief? No; the Commissioners were only appointed to enquire into the probable traffic, and did not go into questions of construction.

6684. Were they advised by the Engineer-in-Chief on these matters? No; the enquiry was confined strictly to the probable traffic on the proposed lines of Railway.

6685. Then, I presume, the probable traffic on the various lines was compared with the cost of construction in getting up the report for Parliament? No doubt it would be discussed by the Cabinet, and by Parliament also, before the votes for the lines were assented to.

6686. Was it ever referred to the Engineer-in-Chief for a report,—with reference to the cost of construction, and the probable financial results of the lines when completed? The Engineer-in-Chief was required to furnish approximate estimates of the cost per mile of any particular line under discussion. As I have before stated, he could not give reliable estimates until the contract surveys were made, but in a general way he was consulted as to the probable cost of any particular line of railway.

6687. Are we to understand that all these matters were considered when the lines were projected, and the financial prospects got out clearly? Certainly, all considerations were taken into account. In addition to that, a consideration, which was a strong one in the minds of Ministers and Members of Parliament, was, that the lines would lead to the increased settlement of the Crown Lands.

6688. Have you found that these comparisons have been at all approached in the results? Not yet; we have had no opportunity of testing them, inasmuch as only one of the lines of railway is yet open for traffic—that is, the extension of the line from Deloraine to the Mersey. The results there have exceeded our expectations, and are most satisfactory so far.

6689. *By Mr. Stanley.*—The Commissioners wish for information as to the exact position Mr. Fincham holds under his appointment in the service—what is it? Engineer-in-Chief.

6690. Is he gazetted as Engineer-in-Chief? Yes, I presume he has been.

6691. We understood from his evidence that he was only nominally Engineer-in-Chief? I understand he is Engineer-in-Chief.

6692. *By Mr. Lawder.*—Mr. Fincham states: “The terms of my appointment are ‘Engineer for Government Railways and Public Works for the Colony of Tasmania.’” No doubt that is correct. I should have thought he was gazetted as Engineer-in-Chief. He was appointed about 8 years since, before I was in office.

MR. J. C. CLIMIE *re-examined.*

6693. *By the Chairman.*—We understood, Mr. Climie, from the Engineer-in-Chief, that you originally had charge of the Corners to St. Mary's railway. Looking over that line we noticed three culverts, one at 5m. 43ch., another at 8m. 25ch., and the other at 11m. 44ch., the parapet walls of which are showing serious signs of settlement. These walls are built of masonry, while the culverts themselves, the arch and abutments, are built of concrete? No; the abutments are of masonry.

6694. Are you aware whether any attempt at bonding was made between the concrete and masonry of the culvert? None, I think.

6695. What precautions did you take to guard against the settlement? The weight is sufficient for the masonry itself bonded on to the concrete arch.

6696. It appeared to us, when examining the work, that the arch was wholly built in concrete? There being no pressure, I simply thought that the weight of the masonry would be sufficient. I was not aware that the thing had moved.

6697. In one case the face wall has assumed a convex shape to the railway, curved some six to eight inches? It may have been through carelessness in making the abutments. I was not aware of it.

6698. That remark would apply to those three culverts. You are not aware of any peculiarity in the construction of the works? None at all. What you say might be due to the falling in having taken place since I left.

6699. Was the work done during your time? At the 5m. 43ch. the Stony Creek had just been finished.

6700. Was Stony Creek culvert complete? I do not think that the banks were quite finished at Stony Creek.

6701. As to the Avoca deviation, it has been pointed out the original line was surveyed south of the town? Three-quarters of a mile.

6702. And owing to a report from you, called for by a petition from the inhabitants, the Engineer-in-Chief was induced to make the deviation? The petition was sent in from the inhabitants first.

6703. And then the report was made? I examined and reported upon it. I found the line to be very nearly the same—if anything, shorter. I considered that it would be of less expense, and that the gradients would be much better. Upon these grounds I saw no objection to the alteration.

6704. Mr. Fincham estimates the excess cost of the deviation at about £3000 is caused principally by a longer bridge across the St. Paul's River? That is just exactly the amount that I always stated would be saved by the deviation.

6705. How do you arrive at that conclusion? The bridge over the St. Paul's River will be of less cost. Where we have driven now is, with slight exceptions, good driving ground: the other is very hard working bottom.

6706. Mr. Home handed in a plan showing the sections of the two localities, and the relative levels adopted at both. He also placed at our disposal the adopted plan, showing how many of the bays of the present bridge would fill up the valley. This drawing, signed by Mr. Fincham, represents the two designs: one is the bridge as built, the other is the bridge which would have been necessary supposing that the same design had been carried out as that on the original site. What have you to say? Of course I made the design myself, but I wanted to make it much shorter. We could have taken off four or five of these bays to much advantage. I do not know the reason why Mr. Fincham fixed one so much longer than the other.

6707. Were these additional bays put in by the Engineer-in-Chief on your recommendation? They were put in by himself.

6708. Inasmuch as the valley is wider there, did you represent to Mr. Fincham during the course of the construction of the viaduct that these bays were unnecessary? Yes.

6709. You did represent it? Yes.

6710. Verbally or in writing? I think verbally. I never understood why it was wanted. We had plenty of stuff to fill it in. I did not want to run the stuff to waste.

6711. Looking at these two plans, do you think that they correctly represent the different localities? I could not say.

6712. This is a section originally taken by you, the other is a section of the line adopted after the petition came in? Yes.

6713. As it is signed by the Engineer-in-Chief, would you not take it to be correct? I should take it to be correct. I have no doubt it was. I should not have taken four bays.

6714. Supposing it to be correct, how would that have affected the cost? It would have saved four bays. I had plenty of stuff. The designs were made out in detail.

6715. Were the representations which you made to the Engineer-in-Chief solely initiated by that petition, or what influenced you as a public officer to alter this line? It came out in the course of conversation before we began doing the work. His remark was, "It's just as well; have plenty of waterway."

6716. What I want to get at, Mr. Clinie, is how was this deviation initiated? By petition of the residents to the Minister.

6717. You are clear that you had nothing to do with it? Nothing—not in the slightest.

6718. And that report which you prepared on the matter was brought about by instructions which you received from the Engineer-in-Chief to make an alternative survey? Yes. I had no interest whatever in the matter. It did not matter to me which one it was.

6719. This is a plan of the railway and the sections prepared by you? (Plan exhibited.) I do not think so.

6720. These were stated to be your sections? I have never seen that before. I should be inclined to think that the gradient is somewhat lower than those shown there, because I had a long 1 in 40 in the section that I had. But I had nothing to do with the matter. It was done at the request of the Minister. I merely received instructions.

6721. As to the works at Vinegar Hill—in the contract survey retaining walls were provided, and it appears that these have not been built—will you explain why? They were not necessary, as far as I am able to judge. We were pretty well on solid ground. I did not consider them necessary.

6722. This was one of the cases where, in the exercise of your discretion, you thought that you might make an alteration in the works? Well, it would depend upon circumstances. It was quite time enough to build them if they were showing any signs of giving; but there were no signs here.

6723. At the time of your leaving the Government there were no indications of settlement? No; it seemed quite solid.

6724. Had you anything to do with the deviation at Break o' Day River for taking the line nearer to the Mount Nicholas coal fields, or was that a matter decided subsequent to your connection with the works? I recommended that the line should keep out of Malahide, and to keep out at the upper side, in order to meet the wishes of Mr. Talbot, the owner, and Mr. Parker.

6725. Where is that? It would be about 40 or 41 miles.

6726. How would that be crossing the Break o' Day River?—assuming the line running east and west, was your proposal to go more north or more south? I should have had to go on to the south, and kept on the right side of the main road; but the original Parliamentary plan was crossing the Break o' Day before we got to the new bridge and run away into St. Mary's, but by some petition from the owners of coal leases I suppose that the line was to be altered. That was in dispute when I went up there.

6727. This alteration was considered and allowed by the Government? I was specially informed, before I undertook the survey at all, that that deviation was to be made to the Mount Nicholas coal field. It was a very big, wide deviation.

6728. Do you know what would be the chainage opposite the Mount Nicholas coal fields? I should think about 42 miles, or about 43½ miles.

6729. *By Mr. Stanley.*—With regard to the culverts which have failed on the Fingal line, were you in charge of the works at the time the embankments were tipped over the culverts? At five and a-half miles—yes, and at Stony Creek.

6730. Can you state what precautions were taken to avoid unequal pressure from the bank? Equalising the pressure by casting it over in thin short layers. There was no heavy tip.

6731. Were the culverts backed up before the bank was tipped? They were all well backed up.

6732. And do you think that all necessary precautions were taken in this matter? I think so, as far as I am aware

6733. Then how can you account for the failure? I can't possibly say. I was not aware until this morning that any failure had taken place. The layers of earth were sufficiently wide at the masonry to keep them in position.
6734. Do you think that the face wall as designed is calculated to stand the pressure of the heavy embankment there is at Stony Creek? I presume so; there was very little pressure at the head of the culvert.
6735. It is not usual to build these walls with a batter? No, I do not think so.
6736. Were there any sets-off in the back of the wall or was it built vertically? Sets-off?
6737. Were the culverts built according to the original design shown on the contract drawings? I cannot say.
6738. Then the only alteration made was the substitution of concrete arches for masonry? I altered the thickness of the arch and the thickness of the buttresses.
6739. Will you state what alterations you did make? I could state as far as the arch is concerned. There was a 10ft. arch, and tarred concrete, from 15in. to 1ft. 6in. and 1ft. 10½in.
6740. And what difference did you make in the thickness of the side walls which are shown in the contract drawings—three feet? Six feet, I think.
6741. At the bottom? Yes.
6742. Did you make any alterations in the thickness of of the face walls? Yes.
6743. They are shown as 3ft.? There is the detailed drawing.
6744. The detailed drawings with the alterations and dimensions referred to? Yes.
6745. And that should be in the hands of the resident engineer? Exactly. It is a pity it is not here. I considered that it was out of all reasonable proportion.
6746. Do you recollect what increase you made in the dimensions of the face wall? Not less than 2ft. 3in. or 2ft. 6in. at the masonry, but altogether the increase was out of all proportion.
6747. Were you satisfied with the character of the masonry work? Quite satisfied.
6748. Do you consider that it was well and carefully built? Yes.
6749. The face walls are bulged out and cracked in various places, and in one case the crack extends round the arch. Is that not so? I have not the slightest idea, but I may have put it in too hastily. I think that there is sufficient weight of masonry there to resist any pressure that can possibly be brought against it.
6750. Were the alterations made in the original designs by the Engineer-in-Chief? Yes.
6751. Did he signify his approval? Yes; I certainly had much more masonry than he was inclined to allow.
6752. I think you stated, with regard to the Avoca deviation, that you considered the line as now carried out had better curves and gradients? Yes, I believe so.
6753. Was not the line originally very nearly straight? No. (Plans referred to.)
6754. Did the altered survey, as adopted by you, not introduce several curves of a very much less radius than those on the original line? Not to the best of my recollection. I think that one here (referring to plan) is one of the shortest on the line.
6755. Are there not a greater number of curves? There are a greater number, but they are not so sharp.
6756. In what respect do you consider the gradients better? Because I had one long 1 in 40, but these sections show no 1 in 40.
6757. Then, according to the sections furnished to us by the resident engineer, do you consider the gradients, as adopted, better than those on the original line? I do not consider them better, those sections—not the slightest.
6758. Do you consider that the position in which the station is placed at Avoca is not objectionable for the convenience of the working of the traffic? No, I think it rather a convenient station.
6759. Has it not involved the Department in a large expenditure for excavations and rock cutting? Well, it has. I calculated that the excavations were required to keep up the bridge at the crossing of St. Paul's River.
6760. But has not the placing of the station in its present position necessitated the construction of an expensive road approach? I suppose it has. People can now come down to that bridge, but had it not been made by the Railway Department it would have had to be made by the Roads Department, for they had built a bridge and there was no road to it. As a matter of fact, there was no approach to the bridge whatever.
6761. Does not the line as now constructed approach the station in both directions on sharp curves? Ten-chain curves, I think.
6762. Do you not think that objectionable? No.
6763. Are those curves not in deep cuttings? Partly in cuttings, but they have all been widened out. The position of the station is a good one for passengers and goods.
6764. Was not the station site as shown in the original survey on a straight piece of line? Oh, yes it was.
6765. *By Mr. Lawder.*—Was the alignment between 42 and 47 miles laid out by you or under your direction? Generally speaking, it was.
6766. Are we to understand that you approved of the alignment and the location thereof? Yes. It was laid out by Mr. Home. I walked over the ground with him, and he pointed generally where the line should go.
6767. Did you not think that the line was on very low ground? On very low ground altogether.
6768. Could you inform the Commissioners if you were induced to alter your alignment in that neighbourhood owing to the Mount Nicholas coal mine tramway being projected in that direction? and could you also inform them if in other circumstances you would have preferred to take the line either south or north along that valley with the view of getting out of the low ground? I think that the approach of the present road is preferable to the original Parliamentary survey.
6769. Are you aware whether it has been found necessary since the construction of the bank was started to increase the height of it by raising the formation about 3 feet, and to increase the waterway through the banks very considerably? Which bank?
6770. The one between 42 and 47 miles? I am not aware of it; not to increase them beyond the recommendation left by me.
6771. What was that recommendation? Putting in a number of 10 feet openings, as they were small culverts.
6772. Did you recommend any greater waterway than exists on the public road over which the water (from the evidence we have obtained) has not crossed? The public road?
6773. The road which runs parallel to the line of railway between those miles I mentioned? Oh, a great excess.
6774. And what was that great excess of water caused by? It would be the result of the very high floods that I saw there.

6775. Did you consider the watershed there, and did it fall to or from the road? It is a heavy fall there, and falls to the road.

6776. Then I presume that if the water did not cross the road—as we have it in evidence that it does not—that the waterways under the road would be a guide for the waterways under the line? Well, I don't think so. By following up parts of the country after a heavy flood you will see the remains where the road is flooded for a long distance. That is very well known.

6777. Are we to understand that the permanent alignment of this portion of the railway was made after the actual contract drawings were signed? Oh, no.

6778. Before? Yes. All the survey was got out at the same time, or nearly so. There were very few alterations; I think that there may be some. This Avoca deviation, as it is called, is really no deviation at all: it was a matter which had been recommended by the department and adopted in the contract survey. It has not been altered since the contract was let.

6779. Do you think that it was possible to obtain any alignment through the town of Fingal which would have avoided the low ground below the town where the line now runs? Yes; my special recommendation to Mr. Fincham was to go on the upper side of the town to keep away from the floody country. I should have gone to the back.

6780. Would that have been a more economical alignment? I think it would have been a safer line. I don't think that the cost would have been more.

6781. Would that location have accommodated the town equally well? Not so well to those situated in that particular street where the station is, but it would have taken in all the township at the back.

6782. That is, the town generally? Well, not the present population. The township is very large, and the line would have to go through about the centre of it, more or less.

6783. In your reply to the Chairman with regard to the Vinegar Hill wall, you stated that in your opinion from what you observed that the wall was not necessary. Did you not observe that a considerable portion of the steep railway cutting was through made ground forming the road? Very little of it, I think, as far as I can recollect.

6784. If you had observed that it had been in made ground, would you have adopted retaining walls? No, I don't think I should, unless the batter was too stiff. I think that when there is any stony ground the batter is a very considerable one,—say one in one.

6785. Do you consider that a slope of one in one is sufficient in made ground? Yes, if it is made of stone material. We had very little flood there. I may state in opening up a new country by a purely schedule contract it is quite competent to have them altered if there are any signs of giving. I was quite under the impression at the time that it was unnecessary to incur any further expense.

6786. With regard to that culvert at Stony Creek, we have been informed by the contractor, Mr. Bath, that you yourself inspected that work after the cracks appeared, and that you also gave instructions to have the face of the arch brought out with additional concrete or plaster so as to bring it flush with the wall that was pressed out? We had no special inspection, but there was a special inspector there. I was informed that there was a simple crack at the settlement. He told me that it could be put up in that way. I left instructions for that. I thought it would be enough.

6787. I thought you said that you had not observed any settlement cracks? No, and I do not know that there are any now. It was the only thing that my attention was drawn to. From the report which reached me from the inspector, I thought that it was nothing. I paid no attention to the thing.

6788. Then you recommended the repairs? I left the matter to the inspector. From the way in which the thing was told to me I thought it was a frivolous matter. I simply consented to its being done on the inspector's recommendation. I was not aware that either of the other culverts had been moved at all.

*Derwent Valley Railway, Tasmania,
Contractor's Office, New Norfolk, 13th April, 1886.*

FINGAL RAILWAY.

GENTLEMEN,

THE six-foot stone culvert at 5 miles 34 chains and 11 miles — chains were designed by me and approved of by Mr. Fincham. For Stony Creek I designed a 15 feet stone culvert, with brick arch and battering wings. Mr. Fincham objected to this design, and forwarded me a sketch of a double 10 feet, with vertical fronts and concrete arch; plans prepared by me, and built accordingly. Drawings for these culverts left in the possession of Mr. Home, Resident Engineer. The Avoca deviation was made after the contract survey had been completed, and was made by me at Mr. Fincham's request. The principal object for the deviation was to meet the wishes of the people of Avoca. Retaining wall at Vinegar Hill was not required when I left the works. At that time the works were in progress. I am not aware of the waterways being altered since September, 1885; but Mr. Fincham sometimes made alterations without communicating with me. I would state, before leaving I wrote to Mr. Fincham asking him to go over the works with me, which he promised to do, but afterwards informed me verbally that he would rather not go over the works with me, as it would wound Mr. Home's feelings. Mr. Fincham expressed himself satisfied with the works at that time. Anything that may have been done since I am not responsible for.

No plan was submitted for my approval. I am sure of this.—J. F.

I remember roughly sketching two 10 ft. arches on plan referred to by Mr. Climie, and telling him I would prefer that he should follow the style of the type culverts contracted for, but I never saw the drawing prepared for contractor from these instructions.—J. F.

See my evidence.—J. F.

Am not aware of any instance.—J. F.

Correct—in consequence of certain rumors as to Mr. Climie continuing to supervise work occasionally after Mr. Home took charge.—J. F.

I am,
Gentlemen,
Yours obediently,
J. C. CLIMIE.

The Chairman Royal Commission, Hobart.

MR. WILLIAM JOHN DUFFY, *examined.*

6789. *By the Chairman.*—What are you? Civil Engineer.
6790. You were the contractor's engineer for the Deloraine and Formby railway, I believe? Yes.
6791. Were you there through the whole progress of the works? From start to finish.
6792. Can you state in what condition the tramway works were from Coiler's Creek to Latrobe? I know the tramway.
6793. State as to the condition of the earthworks, culverts, and bridges on the tramway? The culverts were, from start to finish, in a very bad state, not fit to be used again, and we had to rebuild or put them up. We could not use them as they were. The waterways had to be renewed.
6794. As to the bridge over the River Mersey, was that an entire renewal? Oh, yes; it was a new bridge built. The old bridge was in existence when we were there, and we used it as a stage. It was merely a timber structure, and was very much decayed.
6795. The present bridge is an iron girder bridge, resting on piles? Yes.
6796. What state were the cuttings and embankments in? They were filled up in many places, and grown over with scrub. From Raitlon down it was in use. In the sections shown on the plan you will see what quantity had to be taken out.
6797. Had you to widen those cuttings, clean out and re-form the banks? Yes; the banks all wanted widening from start to finish.
6798. As to the line from Latrobe onwards, what did you do? That was an entirely new line.
6799. The original line was projected from Spreyton across the Horsehead Creek in a direct way: what was the reason for making the deviation? I fancy that it was thought a better line could be got round the side of the hill.
6800. As far as you know, have these expectations been realised: is it a cheaper and better line, or a more expensive one? I could not say that it is a cheaper line.
6801. In other respects is it better? Certainly it is a better line, because, instead of having a large bank across the tidal way it gets down further, where there is not so much water to contend against.
6802. Are not the earthworks heavier on the line as made when compared with the original line? I fancy they are, but you can see from the plans; I am speaking from memory.
6803. The first work you made on the deviation is a culvert crossing a branch of this creek; then you proceed through a rather shallow cutting and come to another creek, at the northern end of which a small culvert has been built: what would be the cost of these two works as contrasted with the original crossing of the Horsehead Creek? I could not say.
6804. From what you recollect, do you think they would be more or less expensive—I mean the two culverts and earthworks as compared with the larger crossing across the creek on the original line? That would certainly be less, but they would require to have heavier earthworks to cut round the side.
6805. Do you know if this deviation was initiated by the Engineer-in-Chief, or was it asked for by the inhabitants? When we first started to construct the line it was in the month of November. Mr. Cresswell went down and surveyed this deviation from the original contract. I do not think it was at the request of the inhabitants, because Mr. Kelsey on several occasions created a bother about it.
6806. From your knowledge of the locality, and having been connected with the railway, can you express an opinion whether the deviation was more or less costly when compared with the original line? I would say that the deviation should have been made from a Government point of view, but from a contractor's point of view I would sooner it had not been made.
6807. Do you know anything in connection with the deviation which was made through the town of Latrobe? No, that was before my time.
6808. Do you know if the line at Formby was projected to go through private property, keeping on the west side of the Esplanade, or did it follow the adopted route? It was kept to the original site as near as possible. It was extended a few chains, but nothing to speak of. At the time there was a great difference of opinion as to where the station yard should be, and also about an old store.
6809. Generally speaking, the same direction was followed? To all intents and purposes it is the same.
6810. How does the line affect the Esplanade—does it injure it or otherwise? If the line was not there the Esplanade would be no good for any purpose; before the line was there the Esplanade was hardly used.
6811. Coming to the works on the line, do you know if the bridges, as originally designed to cross the Mersey, were intended to be built of piles? Most decidedly they were; it shows that on the drawings.
6812. In that respect no variation has been made on the contract drawings? No; Messrs. Fergus and Blair were the contractors, and they suggested that cement concrete be used instead of stone. There was no suitable stone at Deloraine for bridge-building, and they suggested to substitute cement concrete instead of masonry, which was allowed. When the line was in course of construction the Government wished the other bridges or piles, and also the Lower Mersey bridge, to be made with concrete abutments. We had orders at one time to construct this bridge of cement concrete.
6813. Why was not that carried out? Our price for the concrete abutments was not sufficient for coffer-dams, and they being put in the middle of the river, we could not do it at the price.
6814. Did that induce the Engineer-in-Chief to alter his opinion and put in wooden piles instead of concrete piers? I do not know what his opinions were, but we would not do it for the money. I think we had £2 a yard.

6815. Who brought this suggestion under the notice of the Engineer-in-Chief—that is, putting concrete piers and abutments in these girder bridges? Mr. Dooley and some other prominent gentlemen at Latrobe were always agitating to get cement concrete instead of wooden piers, and they did all they could. I think the Engineer-in-Chief wished it to be done if he could have got it done for anything like the money.

6816. But you could not agree as to terms? No, it was not in our contract. We wanted a certain price, and the Government did not feel themselves justified in giving these prices.

6817. Do you know that the contract price of the railway was exceeded, and by how much? I could not tell you what was the last voucher we got from the Government.

6818. Do you remember the amount of the contract as taken by Messrs. Fergus and Blair? £97,000, including 10 per cent. provision.

6819. The works were not completed for that? No, for the last three months, when we were squaring up with the Government, we had some little disputes, and I think that during those three months we got no money at all.

6820. Did you ever hear the amount of the last certificate? No, I have never heard.

6821. Do you think it would be more or less than the contract sum? It would be certainly more than the contract sum.

6822. Considerably more? I should fancy the total amount would be £103,000 or £105,000. We had claims of one sort or another, but I suppose they compromised them.

6823. *By Mr. Stanley.*—Referring to the deviation of Horsehead Creek, can you state, on referring to the plans, whether the works on the deviation increased the cost of the line or not, and to what extent? I cannot say right off—I would require to work it up.

6824. Have you made no estimate of the two? No, from a Government point of view, I believe it was a saving, but the contractors would have made more if the work had been done according to the original plan.

6825. What effect has the alteration had on the gradients and the curves of the line? The curves were increased, but I think the gradients were kept at about the same. There is an eight-chain curve instead of going straight across the creek.

6826. As affecting the economical working of the line, do you think that the alteration was objectionable? I think so; I refer to the Horsehead Creek banks, as shown on the map, and I should say it was a more expensive deviation than the original line to maintain.

6827. You are not in a position to state the actual difference? No.

6828. From your own experience as contractor's engineer on the Mersey Line, can you state whether the quantities as scheduled fairly represent the amount of work which had to be carried out? In some instances some of the items agreed fairly well, but others were greatly exceeded, and some items were not touched at all, but were cut completely out of the contract.

6829. Were there any considerable discrepancies? Yes.

6830. State any of the items you found thus? Rock cuttings,—there being 33,000 cubic yards instead of 20,000.

6831. In what other items did you find considerable discrepancies? In the drain-pipes there was a great difference. They were put in instead of culverts. The masonry came up to the same amount as section 2. Post and rail fencing was greatly exceeded on section No. 2.

6832. To what extent? I would not like to say.

6833. Would it be double? Yes, more than that. The bottom ballast on the old tramway was also greatly exceeded.

6834. What is that to be attributed to? To the non-widening of the banks.

6835. Was the ballast you found on the old tramway of sufficiently good quality to be used? It had to be raised and lifted up, and a new top put on with other ballast.

6836. This was the cause of the large increase in the item of bottom ballast? Yes; the banks were not widened.

6837. In what other items do you find considerable discrepancies? Taking the items as a whole they were very good for a railway line.

6838. Did you find any great difference in the item of side-cutting in any of the sections? Yes, in sections 1 and 3 there was considerable difference.

6839. Can you state the difference in round figures? No; I would not care to speak from memory, as I might state what is not correct.

6840. Was the quantity double, do you think? I should say it would be more than double.

6841. To what do you attribute this increase in the item of side-cutting. Were the original quantities under estimated, or was it caused by any alteration which increased the earthwork? I think that when the quantities were taken out they did not allow enough for shrinkage. I think they calculated out exactly what the plan showed. In many instances side-cuttings had to be greatly increased. Another reason would be that the rock cuttings were not all taken down to the same batter; they were taken down to a less batter, therefore more side-cutting was needed.

6842. Did you find the setting out of the line and levels fairly correct? Yes, but in some instances there were mistakes.

6843. Were there any serious errors either in setting out the centre line or the levels? At first I found them wrong, but afterwards I got an amended list of bench-marks, and they worked fairly well. It was not a good survey of the line. The pegs were badly put in, and gave us a good deal of extra trouble.

6844. Was the increase in the quantities of earthwork due in any measure to errors in level in the original sections? No; I should not think that there was much difference in that. The man who levelled for the line was evidently not used to that sort of work.

6845. You were not aware of any increase in the earthwork being caused by errors in level? I do not think there was any great increase through errors in level; but the first lot of bench-marks we got did not agree with the plan by any means.

6846. Then you got a corrected list? Yes; that worked fairly well from the sections.

6847. Were there many additional stations put on that line beyond those included in the original contract? Messrs. Fergus and Blair had nothing whatever to do with the stations.

6848. I do not refer to the buildings, but to the station ground? I think that there was one additional one at Tarleton. There were no separate schedule prices for station work.

6849. Can you say whether there was any considerable increase on the earthworks or permanent way caused by the large increase in the number of stations? There was no increase in earthworks. The earthworks in all the stations together did not come to much; it is all level country. The earthworks would cost practically nothing.

6850. Would there be any increase by road approaches, metalling, and so forth? Not that could have been well avoided.

6851. Can these items account in any degree for the increase in the cost of the works generally? Yes, they certainly would all add up, but I do not think that they could have been done cheaper than they were. The metalling at the stations was the only expensive item.

6852. Would that form an important item in the extra cost of the works? No, I think it would not. Comparing the amount of the contract and the amount we got from the Government, I consider that there are very few works that come so near the estimate as this one has done.



APPENDICES.

(A.)

TASMANIAN GOVERNMENT RAILWAYS.

General Instructions to Resident Engineers.

1. The Resident Engineer will have the entire charge of the works over which he may be placed, and will be held responsible for the execution of such works in accordance with the contract. Should the magnitude or nature of the works require it, he will have under him one or more assistants, clerks of works, or inspectors appointed by the Minister of Lands and Works, but acting entirely under his directions. He will be held responsible for the proper discharge of their duties by these officers, and must immediately report to the Engineer-in-Chief any dereliction of duty or incompetency on their part.

Resident Engineer to have entire charge of works.
2. He shall personally inspect every part of the works under his charge as frequently as the due discharge of his other duties will admit, and shall keep a written record of the result of such inspection in his official diary.

Periodical inspection of works.
3. At the beginning of every month the Resident Engineer shall report generally to the Engineer-in-Chief on the progress of the works under his control; and should any matter requiring immediate attention arise in the interim, a special report shall be at once forwarded.

Monthly reports to be sent in to Engineer-in-Chief.
4. Clerks of works and inspectors must be instructed to keep a diary of their daily proceedings, and carefully to record therein every noticeable occurrence relating to the works under their care. They shall also report to the Resident Engineer in writing, at the commencement of every week, on the ordinary official form, and at the same time forward by post a duplicate of such report to the Engineer-in-Chief.

Clerks of works to keep diary and render weekly reports.
5. The Resident Engineer will be supplied with a copy of the special Act for the construction of the railway, and also of the contract drawings, specification, schedule of prices, and all other documents relating thereto; and he shall not allow any deviation from the contract terms, conditions, dimensions, materials, or prices, without authority in writing from the Engineer-in-Chief.

No deviation from contract to be allowed without special authority.
6. No authority shall be given for any additional work or alteration except by written order, duly countersigned and approved by the Engineer-in-Chief. In the event of any additional work or alteration being required, the Resident Engineer shall forward a report on the same, accompanied by an estimate of cost, and an order to the contractor, filled in ready for approval. In all cases where the price is not clearly provided for in the contract schedule a tender in writing for the additional work or alteration recommended must be obtained from the contractor, and forwarded with the order. When the absolute safety of the works requires immediate action, an undertaking may be given to the contractor that the order shall be forthcoming as soon as the approval of the Engineer-in-Chief can be obtained; but no additional work or alteration shall in any case be authorised except in the manner above described.

Authorities for additional works or alterations.
7. The Resident Engineer shall carefully examine all drawings furnished for his guidance, and report immediately on any discrepancy or omission which he may discover therein; or should any alteration appear to be desirable for the purpose of diminishing the cost, or adding to the stability of the works, he shall submit the same for the consideration of the Engineer-in-Chief. He shall also prepare, upon the basis of the contract drawings, all working drawings or sketches of minor parts which may be requisite.

Resident Engineer to report inaccuracies in contract drawings, &c.
8. The Resident Engineer shall also, previous to the commencement of the works, or as soon hereafter as practicable, carefully examine the general features of the country and the watercourses by which it is intersected, and submit to the Engineer-in-Chief a report on the drainage of the section of the line about to be proceeded with, suggesting therein such alterations as may appear to him desirable in the position of the bridges and culverts, or the dimensions of the waterway provided on the contract drawings.

Report on drainage of line to be submitted to the Engineer-in-Chief.
9. The Resident Engineer shall carefully check the setting out of the centre line and side-widths for the earthworks of the railway, and that of all bridges, culverts, or works of construction thereon. He may also render any requisite assistance to the contractor at his special request, but shall in no case undertake the responsibility or set out any of the works except in conjunction with, and as an assistant to, the contractor or his agent.

Setting out of works by contractor to be checked.

Foundations for masonry, abutments, &c. to be examined before masonry is proceeded with.

10. The foundations of all masonry abutments, piers, wing-walls, retaining-walls, or other important works shall be personally examined and approved by the Resident Engineer before the masonry is proceeded with; the date of such examination and approval, with a description of the character of the foundation, being recorded in his official diary.

Strength of centres, &c. to be attended to.

11. The Resident Engineer is required to assure himself of the sufficient strength of all centres, scaffolds, coffer-dams, or other temporary provisions for carrying out the works. He is also to superintend the striking of all centres, and operations of every kind demanding especial care.

Permanent bench-marks to be made for future reference.

12. A permanent bench-mark shall be made at, or adjacent to, every bridge or viaduct for the purpose of testing the levels thereof during its construction, and also at, or near, the site of every side cutting, or of any work the levels of which may have to be referred to hereafter.

Progress measurements.

13. Measurements for progress certificates must be made monthly, and each measurement shall include the whole of the works executed under the contract up to the date of entry. It is of the utmost importance that the correctness of the quantities shall be frequently verified by comparison with the contract drawings to prevent any error from creeping in. Measurements of extra or additional works should be kept distinct from those of works included in the contract drawings or specification, and entered as separate items at the close of the progress return.

Earthworks to be measured with decimal tape, &c.

14. Measurements of earthworks shall in all cases be made with a decimal tape, and the correctness of the levels must be verified by the instrument prior to the final measurement.

Inaccessible works to be measured before they are covered up.

15. All works which will ultimately become inaccessible shall be carefully measured by the Resident Engineer, in company with the contractor's agent, before they are covered up. In such cases it is especially desirable that the measurements shall be mutually agreed upon, and that the signature of the contractor's agent should be obtained to the same at the time of measurement. Detail sketches, showing the form and dimensions of all inaccessible masonry in piers, abutments, wing-walls, retaining-walls, or other works of construction, should also be made in the measurement book; and the depth below formation of the foundations, and at each set-off of the masonry, should be ascertained by the level, and recorded in the level-book, and on the office copy of the contract drawings, for future reference. The character of the foundations should also be specially noted and described.

Measurement of side-cuttings.

16. The site of all side-cuttings shall be carefully levelled at every half-chain, both longitudinally and transversely, before the excavation is commenced, and the measurement shall be ascertained by deducting the levels after excavation from the levels of the original surface taken at the same points. The height of buoys left for temporary measurements, or for the preservation of the original pegs, shall not in any case be depended on as giving a correct result, but the quantities shall be determined from the difference of level as above described.

Final measurements.

17. The final measurement of every contract shall be made in conjunction with the contractor or his agent, and the whole of the works must be entered in detail, commencing at the starting-point of the contract, and proceeding regularly to the end. In entering the measurements of inaccessible works taken previously, reference must be made to the number and page of the book containing the original entry, and the date and number of the authority for all extra work should also be quoted. After the dimensions are squared, an abstract sheet shall be prepared for each division of the schedule, showing in detail the quantities contained in each particular work, and the total quantity executed under each item of the schedule. A general summary of quantities shall then be made out, and forwarded, with the divisional abstract sheets, to the Engineer-in-Chief for the preparation of the final certificate.

Departmental forms, &c. to be supplied to clerks of works and inspectors.

18. Resident Engineers are required to supply their clerks of works and inspectors with such departmental forms, diaries, and measurement books as may be necessary for the efficient discharge of their duties. A receipt must be taken for every measurement or other book thus issued, specifying the number and the date of issue, and care must be taken that all such books are duly returned when filled up. All entered-up level or measurement books not required for reference should be at once forwarded to the head office.

Agreements for works or supplies subject to approval of superintending officer.

19. In all cases in which an amount is provisionally agreed upon between the Resident Engineer and a contractor, for the performance of any work or undertaking, or for the supply of materials, the contract shall be reduced to writing, in the form of a tender, and forwarded to the Engineer-in-Chief for approval; and every contract or agreement so entered into by the Resident Engineer shall be expressly made subject to such approval, a condition to that effect being inserted in the tender.

JAMES FINCHAM, *Engineer-in-Chief.*

Public Works Office, Hobart, January, 1885.

(B.)

MR. MAULT'S Estimate of Cost of Line from Bridgewater to New Norfolk.

ORIGINAL LINE.

	£	s.	d.
Clearing—say.....	350	0	0
1384 Chains Fencing, at 20s.....	1384	0	0
133,636 Cubic yards Excavation in earth, gravel, &c., including Side-cutting, at 1s. 6d.	10,022	14	0
7503 Ditto ditto in trap rock, at 10s.....	3751	10	0
3952 Ditto ditto in sandstone, at 5s.	988	0	0
890 Chains Ditching, at 8s.	356	0	0
933 Ditto Forming, at 20s.	933	0	0
5704 Square yards Rough-pitched Apron, at 3s. 6d.	998	14	0
126 Lineal feet 4-feet Culverts, at 30s.	189	0	0
119 Ditto 3-feet ditto, at 20s.	119	0	0
847 Ditto 2-feet ditto, at 15s.	635	5	0
569 Ditto 1-foot ditto, at 10s.	284	10	0
Bridges—Sorell (two), Lachlan, and New Norfolk	10,100	0	0
143 Chains Road Diversions, at £10	1430	0	0
4 Main Road Crossings, at £60	240	0	0
2 Public Road Crossings, at £50 ..	100	0	0
17 Private ditto, at £20.....	340	0	0
11 Miles 53 chains Permanent Way, at £1303	15,196	4	9
Stations and Sidings—South Bridgewater and New Norfolk	4000	0	0
Land	—	—	—
Telegraph	—	—	—
	<u>£51,417</u>	<u>17</u>	<u>9</u>

ALTERNATIVE LINE.

	£	s.	d.
Clearing	350	0	0
1588 Chains Fencing	1588	0	0
99,646 Cubic yards Excavation in earth, gravel, &c. (including 7805 of Side-cutting), at 1s. 6d.	7473	9	0
6431 Ditto ditto in sandstone, at 5s.	1607	15	0
970 Chains Ditching, at 8s.	388	0	0
1009 Ditto Forming, at 20s.	1009	0	0
608 Square yards Rough pitched Apron, at 3s. 6d.	106	8	0
91 Lineal feet 4-feet Culverts, at 30s.	136	10	0
157 Ditto 3-feet ditto, at 20s.	157	0	0
974 Ditto 2-feet ditto, at 15s.	730	10	0
1187 Ditto 1-foot ditto, at 10s.	593	10	0
34 Chains Road Diversions, at £10	340	0	0
40 Ditto Road formed for joint occupation, at £20	800	0	0
3 Public Road Crossings, at £50	150	0	0
46 Occupation Road Crossings, at £20.....	920	0	0
40 Chains examining and making safe along Hellgate Cliffs, at £25	1000	0	0
12 Miles 49 chains Permanent Way, at £1303	16,434	1	9
Stations and Sidings—North Bridgewater, Dromedary, and New Norfolk	5000	0	0
Land (additional)—say	1000	0	0
Telegraph	500	0	0
	<u>£40,284</u>	<u>3</u>	<u>9</u>

(C.)

6th December, 1884.

DEAR SIR,

IN accordance with your instructions I have examined the quantities for the Derwent Valley Railway prepared by Messrs. Edwards & Co., and attached to the contract conditions and specifications, and have now the honour to report to you the result.

Generally speaking, with the exception of the fencing, earthworks, ballasting, and permanent way, the whole of the items consist of quantities in round numbers that have not been arrived at except by roughly guessing, and that are quite useless except for the purpose of obtaining a schedule of prices by which the probable cost of the Railway can be estimated when accurate quantities are got out. In the meantime the examination I have made has shown that great errors exist in the present schedule; and to enable you to arrive at an approximate estimate I will proceed to point out the principal corrections that will have to be made.

Fencing.—Items 4 to 9 give a total quantity of about 83,000 yards of various kinds of fences. I estimate that only 77,000 yards will be required, of which 43,000 yards may be patent wire fencing, 31,000 yards post and rail or post and wire fencing, and the remaining 3000 yards paled fencing.

Level Crossings.—Items 14 and 15—6 gates and wickets will be required instead of 10. Item 17—20 gates will be wanted instead of 10. Items 18 and 19—In all 112 occupation gates or slip panels will be needed instead of the 40 provided. Item 19A—2920 yards of guard rail will be wanted instead of 300 as marked.

Earthworks.—Item 20—The actual quantity of earthwork in cuttings given on the longitudinal section is 172,436 cubic yards instead of 171,718 here provided. Item 21—8000 cubic yards will be required from side cuttings instead of the 1000 here provided. The total quantity needed from side cuttings will be 26,000 cubic yards; of which

Table and mitre drains will furnish	6500 cubic yards
Item 24 will furnish.....	1000 "
Item 27 " 	10,000 "
Item 29 " 	500 "
Leaving for this item to furnish...	8000 "
	26,000 "
As above stated.....	26,000 "

Item 30—As many miles of the railway are upon sideling ground it is evident that much more than 500 cubic yards of benchings to seats of embankments will be needed: I should estimate that 5000 would be nearer the mark.

Concrete, Brickwork, and Masonry.—Items 34 to 52—As it is not very practicable at present to say where one of these kinds of construction may be used in preference to the others, I think it best to consider them together. Messrs. Edwards show alternative designs for bridges and culverts, but as shown and described on their details they apparently intended to employ masonry piers for bridge No. 1, and cast or wrought iron cylinder piers filled with concrete for No. 3, and a combination of piers for No. 2. But they have not provided ashlar masonry enough for a single pier of No. 1. In fact, of about 5100 cubic yards of masonry of all sorts—concrete, brick, and stone—required, they have only provided for 2550 in items 34 to 40, 42 to 46, 51 and 52. To make up this deficiency I think the cheapest plan will be to include it all in the item 36 for cement concrete, making it 2750 cubic yards instead of 200. This will involve the use of iron cylinders for the bridge piers instead of ashlar masonry, reserving the item 45 of such masonry for the Back River bridge, which is contiguous to and will be a continuation of a stone bridge on the Main road. Item 54—1500 cubic yards of retaining walls will be wanted instead of 100 yards here provided.

Ironwork.—If the above proposition relative to the piers of the bridges be carried out, I should further suggest that cast iron piers of the type with flat sides and rounded ends be used where the foundation is gravel, and wrought iron where the foundation is rock. If so, items 78 and 78A would have to provide 275 tons of cast iron cylinders instead of 200, and item 79, 125 tons of wrought iron instead of 100 tons.

Items 79A and 79B.—The girders, as designed, would weigh over 498 tons instead of 300 as provided. As the stiffening plates on the 64 feet girders are shown 8 feet apart, and no stiffening plates are shown on some of the cross girders, I would suggest that 520 tons should be provided for.

Pitching and Metalling.—Item 85 should provide for 6500 instead of 1000 square yards of rough pitching; and item 92 needs to be 5800 cubic yards instead of 1000 of metalling and binding.

Carriage and Permanent Way.—1550 lineal yards of guard and check rails will have to be fixed, instead of 300 as provided. If, as I think will be necessary, guard rails be fixed along some of the bridges, this quantity must be still further increased.

The items I have not alluded to are either provisional quantities or are so nearly correct as not to require alteration.

I have, &c.

A. M.

The Engineer-in-Chief.

(D.)

DERWENT VALLEY RAILWAY.

Redlands Bridge.

DEAR SIR,

I HAVE noted your alterations for strengthening the abutment, and will give the necessary instructions to the contractor. I return the tracing No. 84. In reference to this and similar work I feel in a most difficult position in consequence of the manner in which the quantities are taken and the schedule is priced. Only 25 yards of dry stone backing are provided, and the contractor has taken advantage of this by asking 30s. a cubic yard for it. This is so monstrous that I have hitherto given no orders for its use. In this case I will ask you to allow me to put lime concrete instead—it is only scheduled at the same rate and much less will do. I should propose to do it as I have marked in pencil upon the tracing.

Back River Dry Walling.

This walling has given way near the bridge. I will thoroughly inspect it and send you a report.

Yours, &c.

The Engineer-in-Chief.

A. MAULT.

(E.)

DERWENT VALLEY RAILWAY.

*Dry Stone Walling.**New Norfolk, 16th April, 1885.*

DEAR SIR,

I HAVE received your letter of yesterday, in reference to the dry stone walling, and from it I suppose that I had omitted to tell you that I have already discontinued ordering any more to be done. This I did, not on account of the quality of the work, but its price. When I ordered this work to be commenced I had not the priced schedule; but on the first measurement, seeing its price, I determined for the future that squared masonry should be substituted, as this dry stone walling was one of the items Mr. Edwards only provided a nominal quantity of—25 cubic yards—and which consequently the contractor had taken advantage of to put an exorbitant price upon.

In reference to the quality of the work, I confess that it is not as good in appearance as it might be, but I have sacrificed appearance to strength. In the whole of the first part of the work, with sometimes 30 to 40 inches in thickness of walling, I have arranged with the contractor that only 18 inches should be measured, and the definitive measurements have been taken on this basis. In the other part, where limestone with natural cubical fracture is used, it was impossible to roughly square the stone otherwise than was done, and though in one or two places the inspector has not been sufficiently particular with the face bonding, the work has quite sufficient strength, and though done and backed up with its permanent weight before the last month's rains, shows nowhere any signs of giving way.

I will meet you on the arrival of the first coach; and have the honor to remain,

Yours, &c.

The Engineer-in-Chief.

A. MAULT.

(F.)

[Reply to a note of mine to the effect that I had been instructed to report, and that serious trouble was in store for him.—J.F.]

DEAR SIR,

THANK you very much for your letter of yesterday. In making your report upon the failure that has taken place at the Back River I must ask you to bear in mind the following considerations, that were the only ones that actuated me.

I was naturally anxious to carry out the work at something near the cost that you anticipated on accepting Falkingham's tender, but I found that the prices in his tender were so arranged that my work was beset with anxiety and difficulty. He has priced all large items in his schedule at comparatively moderate rates, so that his total amount was not very high; but all small items that do not much affect the total amount he has priced at exorbitant rates—double or treble their value. Unfortunately, two of these small items thus priced ought not to have appeared as small items at all, but as large ones:—Dry stone-walling, 38s. a yard, and dry stone backing to walls, 30s. a yard. Of each of these, only 25 yards are provided in the quantities, so that these unheard of prices do not appreciatively influence the total amount of his contract, but will greatly affect the total cost.*

Thus, on beginning work on the line between 13m. 2ch. and 17ch., when I found that if I adhered to the detail drawing given I should have in this part of the contract alone to spend £3800 on 2000 yards of wall—a sum out of all proportion to the real value of the work—and one that would seriously affect the cost of the line, I determined to take advantage of the fact that the embankments were being formed of stone to place on them a skin of dry rubble walling. This has stood perfectly as far as the stone-formed embankments were carried. When earth was substituted, I asked the contractor to continue to back up with stone from an adjoining cutting, as he might easily have done without extra cost to himself, but this he refused to do without payment at the above-mentioned rate of 30s. a yard. I determined therefore to try—as the work was too far advanced to then change it—whether I could do without the stone. This part of the work has not stood; but I maintain that what I have done was all the same worth doing. For this is how we shall stand in regard to all the work not done according to detail drawing:—

The work done has cost.....	£ 1070
That part of this that has to be rebuilt—say, 1100 yards at full price, 40s.—will cost	2200
Total.....	£3270

If the detail drawing had been adhered to the work would have cost..... £3800

Or if squared masonry (as the part to be rebuilt)..... £4000

We therefore lose nothing; and I think that I was justified in trying to save £2500, although I have only succeeded in saving a quarter of it.

Now, I have done everything in my power to save the contractor from unnecessary expense. The return I am getting is that he is doing everything in his power to force me to employ work and materials that are exorbitantly priced. I assure you that I pay precious little attention to the tales he dictates to the newspaper reporter here.

Yours, &c.

J. FINCHAM, *Esq.*

A. MAULT.

* As a matter of fact, Mr. Mault's cross sections show that *no walling would be required*, but only a pitched slope.—J.F.

(G.)

*Derwent Valley Railway, Resident Engineer's Office,
New Norfolk, 4th December, 1885.*

MY DEAR SIR,

Culverts required not yet ordered.

- ^{m.} ^{c.} ^{l.}
0 15 00.—Three 15-foot timber openings, with banks sloping down and hand-pitched, according to specification, $1\frac{1}{2}$ to 1.
1 14 50.—Three 10-foot openings, timber and piles slope-pitched 1 to 1.
1 41 00.—Two 10-foot openings, timber and piles slope-pitched $1\frac{1}{2}$ to 1.
1 62 00.—Put double sleeper culvert; use sleepers from 1m. 14c. 50l. and 1m. 41c. 00l.; this same level as the old one. Put double sleeper culvert where the water broke over line about a chain away. Kept the height of formation.
2 38 00 about.—Box, single sleeper, 2ft. 6in. by 1ft. 6in. Use sleepers from culverts pulled up.
2 76 00.—Two 10-foot openings on piles; let bank slope and pitch $1\frac{1}{2}$ to 1.
3 4 00.—Put one 15-foot opening, with bank sloped and pitched $1\frac{1}{2}$ to 1.
3 34 00.—Three 15-foot openings, with bank sloped and pitched $1\frac{1}{2}$ to 1.
Johnny's Creek.—Put double box, each 3ft. by 2ft., about 80 feet from stone culvert where turn in creek takes place.
7 62 00.—Put another double culvert the same opening as the other; take the present wings off, lay the new box alongside, put the old wings on, and face the two sides that are in front at the junction of the two boxes.
8m. to 8 26.—Put the boxes ordered in with a few rubble drains of the full size ordered before in the rock cutting. I should think three in between the boxes.
9 16 30 about.—Line of Boyer's old paling fence put half sleeper culvert, with inlet and outlet drains, the outlet to run down the outside of the old paling fence.
9 20 00.—Put half sleeper culvert where the drain has been cut and left open, with inlet and outlet.
Rock cutting opposite Sharland's hop-ground.—Put two boxes and two rubble drains.
16 20 00.—Half sleeper culvert, 2ft. 8in. by 1ft. 6in.
16 69 50.—Ditto, 2ft. 8in. by 1ft. 6in.
16 40 00.—Put 3ft. flat top already ordered.

I am, yours obediently,

CHAS. K. SHEARD, *Resident Engineer, D. V. Railway.*

J. FALKINGHAM, *Esq., Contractor
D. V. Railway, New Norfolk.*

J. FINCHAM.

*Derwent Valley Railway, Resident Engineer's Office,
New Norfolk, 8th December, 1885.*

MY DEAR SIR,

As arranged with Mr. Climie to-day, please construct the following:—

- ^{m.} ^{c.} ^{l.}
0 15 00.—Make this bank up, when ready, with first class material. I will pay extra rate.
0 25 00.—Cut open outlet for first pit, and put 6-inch pipe to drain second pit under road.
0 31 00.—About. Put half-sleeper culvert through line, and have the side ditches properly cut and graded.
1 36 00.—Put box culvert half-sleeper, using the sleepers from other culverts.
1 62 00.—Put the single sleeper culvert ordered 4-12-85, double; to be kept formation level.
2 18 00.—Cattle-guards to go about 1 foot or 18 inches deeper; put 18 inches concrete, 2 feet 6 inches wide, build walls half height 2 feet 3 inches—rest 2 feet; the sizes of the first pit to be determined when foundations are out; width of roadway between walls 33 feet; the road culverts three longitudinal side logs with four and a-half planking, leaving 6 feet clear waterway; road completed square across line of railway.
3 4 00.—Put one 15 feet opening instead of one 10 feet opening.
7 62 00.—Put double sleeper culvert additional instead of the single ordered 4-12-85.

I have, &c.

CHAS. K. SHEARD.

J. FALKINGHAM, *Esq., Contractor
D. V. Railway.*

J. FINCHAM.
6. 2. 86.

Derwent Valley Railway, New Norfolk, 4th December, 1885.

MY DEAR SIR,

Cattle-guards, 2 miles 18 chains.

THE foundations at this culvert are such that the cattle-guard must be constructed with piles and timber, according to standard drawings.

I am, &c.

CHAS. K. SHEARD, *Resident Engineer D. V. Railway.*

J. FALKINGHAM, *Esq., Contractor D. V. Railway, New Norfolk.*

PUT the two guards 35 feet in the clear.—C. K. S.

*Derwent Valley Railway, Resident Engineer's Office,
New Norfolk, 4th December, 1885.*

MY DEAR SIR,

Work requiring immediate attention.

SIDE-drains and table-drains cleaning and grading, where not done already :—

	<i>m.</i>	<i>e.</i>	<i>l.</i>	
	5	60	0	Road blocked partly by landslip.
	6	11	0	Pipes ordered put in.
	6	51	0	Faces and pitching done.
	1	23	0	Ditto.
	7	2	0	Inlet attending to at once.
	7	9	0	Ditto and pitching.
				Crossings all want completing. I will any time point out the side-cutting when Mr. Climie or any one will go down and arrange these.
Near	8	26	0	Temporary roadway put across, side cutting removed.
	8	40	0	Table drains ; the water is doing damage.
Near	8	58	0	Culverts ordered put in.
	9	50	0	This and other banks made up.
				Fencing round Pulpit Rock when formation is completed, as shown Mr. Falkingham.
				Road at rocks completed as shown, and verbally ordered from about 9m. 44ch. to new road culvert put in by Road Trust.
				Bank undermined 10m. 51ch. : this to be done and put right as shown.
				Road at Downie's crossing completed as shown.
	10	57	0	Culvert—this instead of pitching—to be filled in with rubble as a rubble drain, as arranged with you.
				Cemetery Road crossing : catch drain at this road cut the full width of road three feet wide and eighteen inches deep, filled with rubble so that it does not come on to line.
	11	23	20	The pipes filled up.
	13	36	0	Bank caved in.
	13	39	0	This inlet put right, and outlet ditch cut along the fence back to the paddock at 13m. 34ch., on the inside of fence, leaving 3 feet cress.
	13	70	0	Side-ditch grading.
	13	75	0	Ditto.
	14	13	0	Ditto.
	14	67	0	Ditto.
	14	74	0	No inlet cut yet from side-ditch to culvert.
	15	31	50	Fill hollow up alongside line on left.
	16	58	0	Side-ditch deepened to take water to 16m. 50ch.
	17	31	0	Side-ditch at foot side cutting slope deepened and graded.
	18	25	0	Occupation road slopes gone, to be made up.
	19	46	0	Side-ditch graded and proper depth water gone over bank, and bank is leaving the benching.
	20	71	0	Culvert outlet not cut yet ; the place swamped.
	21	50	0	Side-ditch too near top slope.
	21	60	0	Side-ditch no use until graded.
	23	22	0	Ditto.

Will you please have these small things attended to, so that no more damage will arise.

I am, &c.

CHAS. K. SHEARD.

J. FALKINGHAM, *Esq.*, Contractor D. V. Railway, New Norfolk.

(H.)

*Derwent Valley Railway, Tasmania, Contractor's Office,
New Norfolk, 4th May, 1885.*

SIR,

I AM sorry to inform you that a portion of the retaining wall near the east end of the Back River Bridge has fallen into the river.

At this point the wall is 24 feet high, is perpendicular, and is only 3 feet 6 inches at the base and 1 foot 6 inches at the top, being an average of 2 feet 6 inches, and it has to support a wall 24 feet high. According to the best authorities retaining walls to support good dry material should be battered, and have an average thickness of at least one-third their height ; it is needless to point out how far short of these conditions the design for this wall is.

The portion of the wall that has given way was examined and approved of by you, and you pointed it out as a pattern for the rest of the wall to be built by.

I would ask you before anything more is done with this work to instruct Mr. Mault to increase the thickness to the proportion stated above, as it is very unpleasant for me to have to build work to a bad design, and consequently have it falling down after completion.

I have, &c.

J. FALKINGHAM,
per E. L. P.

JAMES FINCHAM, *Engineer-in-Chief* Tasmanian Railways.

(I.)

Public Works Office, Hobart, 7th May, 1885.

SIR,

Derwent Valley Railway.

I HAVE now the honor to comply with your instructions contained in Memo. of this day's date, to the effect that I should report, specifically and in detail, as to any defective work which I may have observed in the construction of the Derwent Valley Railway, and whether such defective work is attributable to—

- (1.) Imperfect specifications.
- (2.) The want of skill or absence of due care and attention on the part of the Resident Engineer ;
- (3.) To disregard by the Contractors of directions given to them ; and, if such defective work has been caused by default on the part of any officer or officers employed by this Department, giving the name of such officer or officers.

The works which I found to be defective were—

- (1.) Back River Bridge walls.
- (2.) Retaining walls supporting the railway along the edge of the River Derwent and near the Back River.
- (3.) Strength provided in partially built abutment of No. 1 bridge crossing the River Derwent.

The Back River Bridge was built in squared-on-face masonry set in lime mortar, and its failure must be attributed to the insufficient thickness provided in the walls. I ordered this work to be rebuilt from foundation level in a stronger manner, the walls to be thickly backed with loose stone, and an arch to be turned between walls to further strengthen same in lieu of the timber deck originally proposed.

The retaining-wall along the River Derwent was built in dry rubble masonry. Its failure also was owing to insufficient thickness, and was precipitated by building a portion vertically (in order to join the vertical walls of the Back River Bridge) instead of with the normal batter which the rest of the wall has.

I first discovered the weak design of this wall when I inspected the Back River Bridge a few days after that failure, some three weeks since, and was given to understand that the embankment immediately behind it was composed chiefly of stone from the rock cuttings adjacent, but it then showed no signs of failure, and I decided to leave it for a time. On inspecting the fallen portion the other day, I felt it necessary to order the entire demolition of the wall (as far as there could be any possible doubt of its future stability), and its renewal in good masonry in a most thorough manner.

I cannot altogether acquit the contractor of blame in carrying out this work without some formal protest, for it was simply courting failure to build a wall of such thickness in dry rubble, and without any batter.

The abutment of the No. 1 bridge on the River Derwent will, when finished, be nearly forty (40) feet high. It is now about two-thirds complete. The style of the work is unexceptionable, but the strength is not adequate to the thrust of the great bank that will lie against it. It is built without provision for the massive wings that will be necessary.

This abutment will now be made perfectly safe by a backing of concrete, and wings of masonry and concrete, for the support of the slopes of the embankment, will be attached to it.

(The Resident Engineer explained that he proposed to enclose the railway bank within two high walls of dry rubble, but I did not deem this plan so satisfactory as that now ordered.)

It is now my painful duty to say that I can only attribute these failures to the want of practical skill and judgment in railway construction on the part of the Resident Engineer, Mr. Mault, and to his omission to be guided by the standards of strength for retaining walls as shown and described in the general type drawings attached to contract for the guidance of both engineers and contractors. I think that my judgment would be supported by any railway engineer of ordinary experience.

These failures are certainly not due to want of attention and interest in the work, for I have always found Mr. Mault most assiduous.

I have the honor to be,

Sir,

Your obedient servant,

JAMES FINCHAM, *Engineer-in-Chief.*

The Hon. the Minister of Lands and Works.

P.S.—I attach two drawings illustrating sections of dry rubble wall along the River Derwent, at the point where the failure took place, and where wall is deepest.

J.F.

(J.)

New Norfolk, 13th May, 1885.

DEAR SIR,

I have duly received your letter of the 11th instant containing directions as to the rebuilding of the walls near Back River and the bridge abutment there.

I have instructed the contractor in accordance with these directions for all that remains to be done at the bridge, one abutment of it being already nearly finished. It is in effect built as you direct, but the back part of the wall between the counterforts is in concrete instead of masonry, and it has a good stone backing. The abutment to be built will be in solid masonry, as you direct.

At the retaining-wall nothing is being done till the return of the contractor from Melbourne. I will then instruct him in accordance with your letter.

* * * * *

The Engineer-in-Chief.

A. MAULT.

(K.)

DERWENT VALLEY RAILWAY.

ABSTRACT of Cost of Alterations, Additions, &c., with full particulars annexed.

Mileage.			Particulars of Culverts, &c.	Amount.
m.	c.	l.		£ s. d.
0	15	00	3 15 ft. openings	236 2 10
0	31	00	Box culvert, 2ft. 6in. × 1ft. 6in.	11 16 2
1	14	50	3 10ft. openings	146 1 0
1	41	00	1 20ft. opening on cills	129 2 0
1	62	00	Removing culvert, 2 openings, 2ft. 8in. × 1ft. 6in. from 1m. 14ch. 50lks. to 1m. 41ch.	6 17 8
1	64	00	Ditto, 2 openings, 2ft. 8in. × 1ft. 6in. from 2m. 76ch.	6 3 6
2	8	00	15in. pipe and cement concrete	15 5 10
2	34	00	18in. × 9in. box drain	3 13 6
2	38	00	2ft. 6in. × 1ft. 6in. box culverts	14 13 5
2	41	00	18in. × 9in. box drain	3 12 11
2	76	00	3 10ft. openings	105 0 2
3	4	00	1 15ft. opening	70 1 10
3	34	00	3 15ft. openings	188 13 7
5	4	00	Altering existing box culverts, to be put on piles	69 13 5
5	23	00	15in. pipes and cement concrete	10 0 10
5	36	00	18in. × 9in. box drain	4 2 5
5	61	00	Ditto	4 1 5
5	77	50	Ditto	4 10 11
5	79	00	Grip drain—3, each 15s. 11d.	2 7 9
6	1	00	15in. pipes and cement concrete	8 16 2
6	12	25	Ditto	10 12 3
7	61	50	Hardwood culvert, 2ft. 8in. × 1ft. 6in.	17 13 9
8	18	00	Box drain, 18in. × 9in.	4 2 5
8	20	00	Ditto	4 2 5
8	21	00	Four rubble drains	3 3 7
8	24	00	15in. pipes and cement concrete	8 18 4
9	16	30	Box culvert, 2ft. 6in. × 1ft. 6in.	10 19 11
9	20	00	Box culvert, 2ft. 6in. × 1ft. 6in.	12 1 5
10	17	50	10ft. masonry and timber	£329 4 3
			Arch 4ft. 6in. ordered, C.	240 9 5
				88 14 10
10	35	30	8ft. open top culvert	22 4 3
			2ft. masonry ordered, C.	18 19 0
				4 5 3
10	57	00	5ft. masonry and timber top	155 1 10
			Ditto Road culvert, double box, each 2ft. 8in. × 1ft. 6in.	24 6 5
10	76	00	5ft. masonry and timber top	44 4 8
			2ft. masonry, flat-top, contract	36 17 10
				7 6 10
10	79	00	Cost of removal to 11m. 6ch.	4 2 2
11	4	00	Ditto to 11m. 12ch.	5 6 0
11	18	00	Ditto from 11m. 37ch. 50lks.	4 13 2
12	69	00	Back River, total cost, including dry wall pitching, &c.	10,128 10 2
13	16	00	Hardwood double box, each 2ft. 8in. × 1ft. 6in.	45 16 2
14	29	00	2 24ft. and 8 64ft., total cost to underside superstructure	6379 11 4
15	45	00	Constructing 5ft. arch	334 19 0
No. 1 bridge	60	00	Contract provided 3ft. flat-top	207 6 10
				127 12 2
16	20	00	Hardwood box culvert, 2ft. 6in. × 1ft. 6in.	11 5 7
16	39	80	3ft. masonry constructed	22 17 9
			18in. hardwood box ordered	9 3 1
				13 14 8
16	69	00	Hardwood box culvert, 2ft. 6in. × 1ft. 6in.	10 19 7
			Plenty bridge, cost without superstructure	1997 1 1
18	9	50	5ft. masonry timber top constructed	65 10 9
			Contract ordered 3ft. flat-top	52 19 8
				12 11 1

Mileage.			Particulars of Culverts, &c.	Amount.		
m.	c.	l.		£	s.	d.
18	56	20	15in. pipes additional.....		11	1 4
20	56	00	No. 2 bridge, cost, without superstructure.....	3648	5	6
21	45	75	18in. pipes increased to double pipes.....		32	17 4
			Total cost.....	65	14	3
21	78	50	10ft. cattle-creep to be constructed.....	191	10	7
			18in. pipes ordered.....	26	1	8
22	45	50	Contract 3ft. arch ordered.....	250	7	6
			Changed to pipes, waterway to river. Full report, dated 10th December, 1885.			
			Extra cost of sinking outlet and drain through private ground, say.....	200	0	0
22	59	00	Hardwood box culvert additional.....		50	7 6
22	63	00	Cattle-guard culverts.....	35	8	1
22	63	00	Gate-crossing, contract.....	£19	4	0
23	5	00	Pipes in cement concrete.....	30	6	1
23	5	00	3ft. masonry formation, very uncertain.....	39	0	0
				58	13	0
				65	14	2
				58	13	0
23	40	00	10ft. masonry cattle-creeps.....	235	14	9
			Pipes ordered, contract.....	28	1	1
23	51	00	18in. pipes in cement concrete.....	47	3	11
23	56	00	Ditto.....	30	3	2
				77	7	1
23	51	00	Arch culvert, contract.....	52	0	3
23	67	00	Flat-top masonry ordered, C.....	35	17	2
			18in. pipes in concrete constructed.....	26	0	8
			Decrease in Cost.....	9	16	6

CHAS. K. SHEARD, *Resident Engineer D. V. Railway.*
12th March, 1886.

(L.)

DERWENT VALLEY RAILWAY.

Estimate of Cost of three Centre (60ft.) Spans at Contract Prices.

BRIDGE OVER DERWENT—No. 2.

	£	s.	d.	£	s.	d.
Wrought-iron in Girders, 60 tons 2 cwt.....	30	0	0	1803	0	0
" " Piers, 28 tons.....	42	0	0	1176	0	0
" " Lewis bolts, &c., 1 cwt.....	46	8	0	2	6	5
" " Bolts, Dowels, &c., 1 ton 2 cwt.....	46	8	0	61	0	15
" " Gas Tubing, 130 lineal feet.....	0	1	3	8	2	6
Cast-iron in Bed and Bearing Plates, 14 cwt. 2 qrs.....	22	0	0	15	19	0
Cement Concrete in Caissons, 220 cubic yards.....	0	30	0	330	0	0
" " around Caisson, 100 cubic yards (assumed).....	0	55	0	275	0	0
" " Foundations to Masonry Piers, 23 cubic yards.....	0	55	0	63	5	0
Ashlar, 183 cubic feet.....	0	4	6	41	3	6
" (Circular Work), 756 cubic feet.....	0	6	9	255	3	0
Squared Masonry in Piers, 107 cubic yards.....	0	55	0	294	5	0
Hardwood Timber, 761 cubic feet.....	0	3	3	123	13	3
				£4448	18	6

N.B.—Two caisson piers and two halves of masonry pier calculated.

March 8th, 1886.

J. FINCHAM, *Engineer-in-Chief.*

(M.)

DERWENT VALLEY LINE.

Alteration in Grading of Section.

BY A. MAULT, ESQ.

<i>m. c. l.</i>	to	<i>m. c. l.</i>	
0 8 00	to	1 12 00	
1 40 00	to	1 55 00	
2 32 00	to	2 47 00	
3 41 00	to	3 59 00	
8 22 00	to	9 15 44	=9m. 14c. 5l. of Litho. Line changed.
9 74 00	to	10 49 18	Ditto.
13 19 00	to	13 32 00.	Slightly altered.
15 9 00	to	16 3 00.	Line changed—15m. 19c. 9l. to 15m. 65c. 4l.
16 40 00	to	18 25 00.	Ditto —16m. 39c. 2l. to 18m.

BY MYSELF.

0 11 00	to	0 23 00.	Mr. Mault's re-graded line altered.
9 68 00	to	10 50 00.	Alteration in line, and level raised one foot.
12 68 00	to	13 35 00.	Line changed.
14 31 68	to	14 64 00.	Ditto, and raised one foot in level.
18 79 00	to	20 56 00.	Ditto, ditto to higher level.
20 61 00	to	20 72 73.	Grade only changed, with vertical curve for change of gradient coming on to No. 2 Bridge.
21 71 00	to	22 5 00.	Grade only changed, to give a longer level for the Arundel Road Station.

CHAS. K. SHEARD, *Resident Engineer Derwent Valley Railway.*

6th March, 1886.

(N.)

DERWENT VALLEY LINE.

Derwent Valley Line, March 10th, 1886.

SIR,

HEREWITH I have the honor to forward particulars prepared by the Resident Engineer, by direction of the Commissioners, with regard to correct formation levels between Bridgewater and New Norfolk, and the reduced levels of registered flood-marks both above and below, as well as immediately at New Norfolk.

I also forward the original comparative estimate of cost of alternative line between Bridgewater and New Norfolk.

I have, &c.

J. FINCHAM.

The Hon. W. A. ZEAL, M.L.C.,
Chairman of Royal Commission on Railways.

Comparison of Contract and correct Levels where Bench Marks exist.

Contract.	Levels.	Levels, Dec. 1885. H. W. HARGRAVES, A.M. Inst. C.E.	Difference.				Remarks.	
B.M. 6.	100-18	100-20	0-20	at	<i>m.</i>	<i>c.</i>	<i>l.</i>	on wattle.
B.M. 17.	106-11	107-86	1-75	at	3	59	0	on stump.
B.M. 21.	98-92	100-17	1-25	at	5	0	0	on peppermint.
B.M. 25.	96-94	98-14	1-20	at	6	19	0	on lightwood.
B.M. 27.	109-12	110-44	1-32	at	7	19	0	on gum.
B.M.								
M.A. from 39.	93-24	94-40	1-16	at	9	66	0	on willow.

NOTE.—These were the only original B.M.'s left on the line to join with the Contract Levels for corrections.

CHAS. K. SHEARD.

Flood Levels.

Mrs. Piety's	opposite	<i>m.</i>	<i>c.</i>	<i>l.</i>	1863	111-90 R. L.	} Back River.
Mr. G. Inge	"	13	37	0	1863	111-63 R. L.	
Ditto	"		ditto		1884	108-53 R. L.	
Mr. Downie's	"	11	37	0	1863	102-94 R. L.	} New Norfolk.
Ditto	"		ditto		1884	99-51 R. L.	
Steamer Stores	"	11	30	0	1863	102-81 R. L.	
Ditto	"		ditto		1884	99-42 R. L.	} Rocks
G. H. Raynor	"	9	68	0	1863	98-80 R. L.	
						99-10	} Commencement.
Mr. John Wise.	Highest flood does not make above 2 inches at Bridgewater.						

Correct Formation Heights.

Lowest part of line from H. W. Hargraves' levels, December 1885 :—

	<i>m.</i>	<i>c.</i>	<i>l.</i>	
	1	68	0	Reduced levels 96·56.
	2	76	0	Ditto 96·47.
	5	72	0	Ditto 96·65.
	6	5	0	Ditto 96·30—above half a mile to the river, and highest water, from information from owner, R. W. Barwick; not within two feet of knoll, one foot below formation.
	9	66	0	Lowest level of rocks; bank, 101·16.

Levels taken by H. W. Calder, for Commission, to the Bridge :—Under side of girder, station side, 107·13, or opposite 11m. 32c.

CHAS. K. SHEARD, *Resident Engineer Derwent Valley Railway.*

9th March, 1883.

(O.)

DERWENT VALLEY LINE.

Altered Plans and Sections.

From	To	
<i>m.</i>	<i>c.</i>	<i>l.</i>
0	0	0
1	13	0
0	0	0
0	26	0
0	55	0
1	17	0
1	41	50
2	18	0
At 1	41	0
At 3	58	0
2	33	0
2	47	0
5	49	0
6	2	0
8	20	0
9	15	0
9	66	0
10	50	0
12	69	0
13	33	0

Section altered from one level grade to twenty-five grades. Tracing of altered section No. 14 received 1st April, 1885. Alteration made by Mr. Mault.

Second alteration, Tracing No. 41, received 22nd June, 1885. Alteration made by Mr. Sheard.

Plan and Section No. 95 of Road received 25th January, 1886. Ordered by Mr. Sheard.

Plan and Section No. 93, Road diversion, received 9th January, 1886. Ordered by Mr. Sheard.

Error discovered in levels of 3 feet on 24th January, 1885. List of altered levels No. 15A., received from Mr. Mault on 26th January, 1885.

Error of 3 feet in levels discovered on 26th February, 1885. Mr. Mault pointed out on the ground, on 27th February, how to make the grade. On 1st April, 1885, received altered Section No. 15 from 1m. 41c. 0l. to 3m. 59c. 0l., showing the natural surface and the formation raised 3 feet. On 11th April, found that this altered Section No. 15 was all wrong, informed Mr. Mault. No correct Section of this portion of the line has ever been supplied.

The line is constructed with an altered grade from 1m. 41c. to 1m. 48c. and from 3m. 51c. to 3m. 58c. The portion between 1m. 48c. and 3m. 51c. is made as per original section.

Altered section. Alterations shown in Tracing No. 15. Mr. Mault also gave altered levels on the ground, to which the line was built.

Section and cross-sections of road diversion Nos. 23 and 13 received 15th April, 1885. Ordered by Mr. Mault.

Deviation made by Mr. Mault, Plan and Section, No. 17, received 4th April, 1885, about two months after the clearing was done.

Deviation, altered Section No. 29, by Mr. Mault, from 9m. 75c. to 10m. 8c., received 5th May, 1885.

Continuation of altered Section No. 35, by Mr. Mault, from 10m. 8c. to 10m. 50c., received 13th May, 1885. Second altered Plan and Section No. 65, by Mr. Hargraves, from 9m. 66c. to 10m. 17c., received 3rd September, 1885. Second altered Plan and Section No. 61, by Mr. Hargraves, from 10m. 16c. to 10m. 49c., received 22nd August, 1885. Third alteration, from 10m. 12c. to 10m. 32c. 78l, made by Mr. Hargraves, field notes No. 97, received 11th November, 1885.

Contract work stopped at Derbyshire Rocks by Government commencing to throw down rocks by day-work, 15th May.

Portion of line taken out of the Contractor's hands, and work done by day-work, from 10m. 2c. to 10m. 19c.

Deviation made by Mr. Atkinson. No. 57 plan, section, and details received from Mr. Sheard, 28th July, 1885. Letter received from Engineer-in-Chief stopping work at Back River 18th June, 1885, but it had been stopped about six weeks previous to receipt of letter by Mr. Sheard's verbal orders. Altered Section, No. 6, from 13m. 18ch. to 13m. 33ch., received 25th February, 1885; made by Mr. Mault. Quantity of excavation made prior to Mr. Sheard's alterations, 8050 c. ft., at 2s. 3d.=£905 12s. 6d. Additional excavation caused by Mr. Sheard's alteration, about 8000 c. ft.

Note.—Line altered from 2 33 0 to 2 40 0 }
 See next item.
 2 33 0 }
 5 49 0 }
 8 20 0 }
 9 66 0 }
 Quantity of excavation on line done by Government—about 600 cub. ft., £67 10s.

m. c. l.	m. c. l.	
14 36 0	14 48 0	Road diversion Hayes' Rocks, Section and Cross sections, No. 27, received 24th April, 1885; Longitudinal section, No. 9, received 5th May, 1885; list of distances between road and line, No. 27A, received 30th March, 1885.
14 27 0	14 64 0	Deviation made by Mr. Hargraves. Plan and Section No. 90, received 10th December, 1885; work stopped. This has since been moved 3ft. further from the river at about 14m. 40ch.
15 0 0	16 0 0	Deviation—1st alteration, Section No. 8, received 5th March, 1885, made by Mr. Mault; 2nd alteration, reducing formation 4ft. from 15m. 28ch. to 16m., Mr. Mault's. No. 30 Section, received 6th May, 1885. Plan No. 96 of altered line from 15m. 19ch. to 15m. 65ch., prepared by Mr. Sheard, 9th July, 1885, and forwarded to Contractor, 26th January, 1886.
16 40 0	18 24 0	Deviation—Plan No. 37 received 5th May, 1885; Section No. 32 received 13th May, 1885. NOTE.—These alterations were made by Mr. Mault long after the clearing was done.
18 79 0	20 60 0	Deviation by Mr. Hargraves from 19m. 60ch. to 20m. 60ch. Plan and section received 28th August, 1885. Second alteration in formation levels by Mr. Hargraves from 19m. 60ch. to 19m. 75ch. List of levels No. 62A received 2nd November, 1885, alteration made by Mr. Sheard. Deviation from 18m. 79ch. to 19m. 60ch., made by Mr. Atkinson. Plan and Section Nos. 53 and 54, received 13th August, 1885. NOTE.—These alterations were made long after the clearing was done, and that Mr. Atkinson made a deviation from 18m. 79ch. to 20m. 60ch., and Mr. Hargraves again altered the line from 19m. 60ch. to 20m. 60ch., and a fourth alteration was made by Mr. Sheard altering the formation levels.
20 63 0	20 73 0	Alteration in formation levels by Mr. Sheard. Section No. 83 received 14th November, 1885. Letter received, stopping work.

This list was handed to Mr. Mault, who examined it, and stated it was generally correct.—W. A. Z.
5. 3. 86.

(P.)

Alterations in Waterways, &c.

m. c. l.	
10 57 0	—Built 1ft. 6in. pipe—by Mr. Mault. Altered to 7 × 5 flat top—by Mr. Sheard.
10 79 0	—Box culvert put in—by Mr. Mault. Removed—by Mr. Sheard.
11 0 4	—Box culvert built—by Mr. Mault. Removed—by Mr. Sheard.
14 27 0	—Built 4ft. 6in. arch culvert—by Mr. Mault. Extra double sleeper culvert—by Mr. Sheard.
15 44 0	—No. 1 bridge—waterway reduced by 4 24ft. openings—by Mr. Mault. Bridge lowered 4 feet—by Mr. Fincham.
15 60 0	—Ordered, 20th June, 1885, 3ft. flat top—by Mr. Sheard. Again ordered 8ft. stone wall, 20ft. timber top. } —by Mr. Sheard. Concrete arch. (disputed) Again altered to 3ft. flat top, 15th September—by Mr. Sheard. Again altered to 3ft. arch, 21st September. (disputed)—by Mr. Sheard. Ditto, 5ft. arch, now built—by Mr. Sheard. 27 July, 20ft. cattle-creep on tressels—by Mr. Sheard.
18 0 0	—Plenty waterway reduced to very great extent—by Mr. Mault. Slightly increased—by Mr. Sheard.
20 55 0	—No 2 bridge—alteration in iron piers.
About 22 45 0	—Masonry arch culvert done away with after stone was on the ground.
23 0 5	—Ordered 3ft. masonry culvert—by Mr. Sheard. Altered to 18in. pipes—by Mr. Sheard.
23 51 0	—2ft. arch ordered—by Mr. Sheard. Altered to 18in. pipes—by Mr. Sheard
23 79 0	—Ordered 2ft. flat top. } (disputed)—by Mr. Sheard. Altered to 18in. pipe. }
23 67 0	—Ordered 2ft. 6in. flat top—by Mr. Sheard. Altered to 18in. pipes—by Mr. Sheard.

(Q.)

DERWENT VALLEY RAILWAY.

Bridges Nos. 1, 2, and 3—Wind Pressure.

A wind force of 30lbs. per square foot of train and structure, or 50lbs. per square foot on structure alone, was adopted as an extreme force in calculations for Adelaide and Nairne Railway viaducts, in South Australia.

The Wind Committee in connection with the Tay Bridge, in Scotland, advised 56lbs. per square foot as the most extreme force likely to occur.

This latter force (which represents a tornado at 100 miles per hour), and acting directly square to the axis of the bridge, gives a pressure of 11 tons (64ft. \times 7ft. \times 56lbs.) against a structure weighing 30 tons, without weight of train or resistance due to bolts securing girders to bed-stones of pier.

The girders form, approximately, a box 7ft. 6in. wide and 6ft. high, and the resultant of the combined forces of gravity and wind pressure will fall well within the point of overturning.

The pressure due to a force of 30lbs. per square foot, on structure and train, would be—

$$\begin{array}{r} 64\text{ft.} \times 7\text{ft.} \times 30\text{lbs.} = 13,440 \text{ lbs.} \\ 1\frac{1}{2}\text{ft.} \times 45\text{ft.} \times 8\text{ft.} \times 30\text{lbs.} = 16,200 \text{ lbs.} \\ \hline 29,640 \text{ lbs.} = 13 \text{ tons.} \\ \hline \hline \end{array}$$

J. FINCHAM.
8. 3. 86.

(R.)

STRAINS ON GIRDERS.

Span 60ft. Depth 6ft. Combined dead and live load taken at $1\frac{1}{2}$ tons per foot run of bridge.

Formula used for top and bottom members $S = \frac{W L}{8 D}$

S = strain in tons.

W = total distributed load ($1\frac{1}{2}$ tons per foot run).

L = length in feet (60 feet).

D = depth in feet, for calculation (5.9ft.)

$$\text{Then } \frac{(60 \times 1\frac{1}{2}) \times 60}{8 \times 5.9} = \frac{5400}{47.2} = \left\{ \begin{array}{l} 114.4 \text{ tons at centre of bridge,} \\ \text{on the two girders.} \end{array} \right.$$

$$\frac{114.4}{2} = 57.2 \text{ tons at centre of each girder.}$$

Regulations of English Board of Trade fix the working strain on wrought iron at 4 tons per square inch, in compression, and 5 tons per square inch in tension:—

$$\left. \begin{array}{l} \frac{57.2}{4} = 14.3 \text{ square inch sectional area required for top member} \\ \frac{57.2}{5} = 11.4 \text{ square inch sectional area required for bottom member} \end{array} \right\} \text{At centre.}$$

Effective area in girders as designed:—

Top flange $18 \times \frac{5}{8} =$	<i>sq. ins.</i> 11.25
L iron $2(4 \times 4 \times \frac{1}{2}) = 2(7\frac{1}{2} \times \frac{1}{2}) =$	7.50
Portion of web $4 \times \frac{5}{8} =$	1.50
	20.25
Less rivet holes $2 \times \frac{3}{4} \times \frac{5}{8} =$	.94
$1 \times \frac{3}{4} \times \frac{5}{8} =$	.28
$4 \times \frac{3}{4} \times \frac{1}{2} =$	1.50
	2.72

Net sectional area provided 17.53 at top and bottom.

The additional strength afforded by continuity of girders is not taken into account.

J. FINCHAM.
8. 3. 86.

(S.)

DERWENT VALLEY RAILWAY.

Memo. of Dates of Protests of Contractor re Stability of Bridges.

1885—26th December. }
 (Ref. No. 2-118. 5.) }

Contractor acknowledged letter of Engineer-in-Chief (refusing to make an allowance for coffer-dam, or consider any alteration in prices, as contract was at a schedule of rates), and after reiterating his claims, called attention to design of No. 2 bridge, which he alleges to be faulty, stating it would not stand wind pressure nor the currents and floods of the Derwent; and finally protested against accepting any responsibility in building or maintaining bridge if built according to designs forwarded to him on 19th November, 1885.

1886.—11th January. }
 (Ref. No. 2-118. 13.) }

Protest from contractor against accepting responsibility for No. 1 bridge after girders fixed, on account of wind pressure.

J. FINCHAM.
 8. 3. 86.

(T.)

Total Cost of Works at Derbyshire and Pulpit Rocks, 9m. 68ch. to 10m. 35ch., by day-work under Schedule Rates of Contract.

Item.	£	s.	d.
104 Dynamite	2	17	10
105 Powder	262	6	9
106 Fuse	9	19	1
107 Ropes	10	19	4
108 Excavator, 25,990 hours at 1s. 6d.	1949	5	0
108 Ditto estimated, 500 hours at 1s. 6d.	37	10	0
108 Ganger, 1184 hours at 2s.	118	8	0
110 Boy, 1794½ hours at 6d.	44	7	3
116 Smith, 889 hours at 1s. 6d.	66	13	6
117 Striker, 889 hours at 1s.	44	9	0
121 Carting, as per arrangement, 15,326½ loads of cutting, at 2s. 3d.	1724	4	3
	£4271	0	0

CHAS. K. SHEARD, *Resident Engineer*
Derwent Valley Railway.

6th March, 1886.

(U.)

FINGAL RAILWAY.

Avoca, 24th May, 1884.

DEAR SIR,

As requested by your telegram, I have made a trial section and estimate of proposed deviation at Avoca, also an estimate of line at present staked out (both annexed). I also forward a tracing of trial section.

The deviation commences at a point on main line, 14 miles 63 chains, and joins it at 18 miles 3925 links. Total length of deviation, 3 miles 6511 links; length of main line, 3 miles 5625 links; deviation—additional length, 886 links.

Practically the lines are about equal. Although the deviation shows an increase in length of 8 chains 86 links, the cost of construction would not be increased, and by careful measurement the length would be reduced. The St. Paul's River Bridges would be about equal. In the estimate I have particularised the items of increased length and cost.

Yours respectfully,

J. C. CLIMIE.

JAMES FINCHAM, *Esq., Engineer-in-Chief, Hobart.*

FINGAL RAILWAY.

Comparative Estimates of Proposed Deviation at Avoca, and Line at present staked out, from 14 miles 63 chains to 18 miles 3925 links.

PROPOSED DEVIATION.

	£	s.	d.	£	s.	d.
14,297 Cubic yards Earthwork in Cuttings	1664	4	6			
8491 Cubic yards Earthwork in Side-cuttings	849	2	0			
	<hr/>			2513	6	6
Additional length of Proposed Deviation—						
886 Links additional Forming	8	15	0			
886 Links additional Fencing	17	0	0			
Culverts (additional)	27	0	0			
Drains ditto	4	5	0			
Side Ditches ditto	4	10	0			
Ballast, Sleepers						
Rails, &c. (additional)	160	0	0			
2 Road Crossings	50	0	0			
Bridge over St. Paul's River would not cost more than on line staked out.						
All other works not particularised would be equal.						
	<hr/>			271	10	0
	<hr/>			£2784	16	6
	<hr/>					

LINE AT PRESENT STAKED OUT.

	£	s.	d.	£	s.	d.
18,590 Cubic yards Earthwork in Cuttings	2438	0	6			
4896 Cubic yards Earthwork in Side-cuttings	516	16	6			
Forming (for comparison)						
Fencing " "						
Culverts " "						
Drains " "						
Side Ditches " "						
Ballast, Sleepers, Rails, &c.						
Bridge over St. Paul's River equal to Bridge on Deviation.						
	<hr/>					
Present Line				2954	17	0
Proposed Line				2784	16	6
	<hr/>					
In favour of Deviation.....				£170	0	6
	<hr/>					

NOTE.—You will observe that the deviation is 886 links longer than line at present staked out, but this could be reduced if permanently staked out.

J. C. CLIMIE.
24th May, 1884.

FINGAL RAILWAY.

Line at present staked out at Avoca between points of proposed Deviation.

Quantities of Earthwork and Estimate :—

	m.	c.	s.	d.	£	s.	d.
72 cubic yards from cutting at	14	63	at	3 0	10	16	0
1653 " " "	15	00	at	2 6	206	12	6
302 " " "	15	37	at	3 0	45	6	0
1146 " " "	15	65	at	3 0	171	18	0
3051 " " "	16	18	at	3 0	457	13	0
2431 " " "	16	70	at	2 6	306	7	6
755 " " "	17	05	at	2 6	94	7	6
406 " " "	17	19	at	2 6	50	15	0
7078 " " "	17	40	at	2 6	884	15	0
1676 " " "	18	15	at	2 6	209	10	0
	<hr/>				2438	0	6
<i>Side Cutting :—</i>							
2220 " " to bank at	14	70	at	2 0	222	0	0
219 " " "	15	20	at	2 0	21	18	0
521 " " "	15	33	at	2 0	52	2	0
93 " " "	15	60	at	2 0	9	6	0
749 " " "	18	15	at	2 0	74	18	0
1093 " " "	18	29	at	2 6	136	12	6
This last item from cutting.							
	<hr/>				516	16	6
	<hr/>				£2954	17	0
	<hr/>						

Proposed Deviation at Avoca.

Quantities and Estimate of Earthwork:—

	<i>m.</i>	<i>c.</i>	<i>at</i>	<i>s.</i>	<i>d.</i>		£	<i>s.</i>	<i>d.</i>
58 cubic yards cutting at	14	63	at	3	0	....	8	14	0
608	14	70	at	3	0	....	91	4	0
109	15	12	at	2	0	....	10	18	0
588	15	25	at	2	0	....	58	16	0
1581	15	40	at	2	0	....	158	2	0
1498	15	60	at	2	0	....	149	16	0
1895	16	10	at	2	0	....	189	10	0
326	16	20	at	2	0	....	32	12	0
2683	16	35	at	3	6	....	469	10	6
1182	16	60	at	2	0	....	118	4	0
411	16	73	at	2	0	....	41	2	0
296	17	14	at	2	0	....	29	12	0
468	17	25	at	2	0	....	46	16	0
1029	17	40	at	2	0	....	102	18	0
350	17	63	at	2	0	....	35	0	0
404	18	00	at	2	0	....	40	8	0
71	18	14	at	2	0	....	7	2	0
562	18	26	at	2	0	....	56	4	0
178	18	32	at	2	0	....	17	16	0
							<hr/>		
							1664	4	6

Side Cuttings:—

149 cubic yards to bank at	14	66	at	2	0	....	14	18	0
523	15	00	at	2	0	....	52	6	0
7819	16	50	at	2	0	....	781	18	0
							<hr/>		
							849	2	0
							<hr/>		
							£2513	6	6
							<hr/>		

NOTE.—The difference in rates of cutting on line staked out and proposed deviation is owing to nature of cutting and length of lead.

J. C. CLIMIE.
23. 5. 86.

(V.)

Public Works Office, Hobart, 22nd April, 1886.

FINGAL LINE.

SIR,

IN reply to your letter of yesterday's date, I have the honor to forward the information asked for.

Approximate length of Parliamentary line from Break-o'-Day Creek.....	8m. 06c.
Approximate length of constructed line (Killymoon deviation) from corresponding point.....	8m. 60c.
	<hr/>
Difference.....	0m. 54c.
	<hr/>

I have, &c.

JAMES FINCHAM, *Engineer-in-Chief.*

W. A. ZEAL, *Esq., Chairman Royal Commissioners.*

(W.)

FINGAL RAILWAY.

Expenditure to 9th March, 1886, and Estimate of Liabilities.

	<i>Expenditure.</i>			<i>Liabilities.</i>			<i>TOTAL.</i>		
	£	s.	d.	£	s.	d.	£	s.	d.
Contractor for construction, including accommodation works	68,421	3	3	15,385	17	9	83,807	1	0
Rails and fastenings	28,694	8	10	69	4	11	28,763	13	9
Sleepers	14,774	17	9	413	7	9	15,188	5	6
Points and crossings	419	14	1	582	14	11	1002	9	0
Stations (buildings, walls, fences).....	539	0	0	5461	0	0	6000	0	0
Turntables	641	0	0	815	0	0	1456	0	0
Water supply	1270	13	10	280	0	0	1550	13	10
Compensation for land and charges, exclusive of accommodation works	521	6	3	5748	1	0	6269	7	3
Advertising and sundries.....	274	8	6	399	17	9	674	6	3
Furniture, stores, and tools.....	..			500	0	0	500	0	0
Signals .....	..			500	0	0	500	0	0
Telegraph .....	..			1150	0	0	1150	0	0
Surveys.....	1027	3	5	..			1027	3	5
Supervision and plans.....	3282	19	7	896	15	0	4179	14	7
	119,866	15	6	32,201	19	1	152,068	14	7
<i>Rolling Stock.</i>									
Locomotives.....	..			6500	0	0	6500	0	0
Carriages and wagons.....	..			12,900	0	0	12,900	0	0
	£119 866	15	6	51,601	19	1	171,468	14	7

(X.)

Estimated Cost from Laurenceston to Scottsdale, via Upper Piper District. Distance 59 miles 33 chains. Sanctioned by Parliament.

4200 Chains clearing, at 45s.....	9450	0	0
9506 Chains fencing, at 20s.....	9506	0	0
251,120 Cubic yards excavation in clay, gravel, &c., at 1s. 9d.....	21,973	0	0
46,350 Ditto excavation in rock, at 7s.	16,222	10	0
43,200 Ditto excavation in rock, at 5s.	10,800	0	0
68,780 Ditto excavation in rock, at 3s. 6d.	12,036	10	0
119,700 Ditto excavation in side cutting, at 1s. 6d.	8977	10	0
6000 Chains ditching, at 8s.....	2400	0	0
4753 Ditto forming, at 30s.	7129	10	9
Culverts	6800	0	0
16 Bridges	8000	0	0
19 Chains road diversion, at £15	285	0	0
1 Main Road crossing, at £60	60	0	0
12 Public Road crossings, at £50.....	600	0	0
100 Private ditto, at £20.....	2000	0	0
59 Miles 33 chains permanent way (50-lb. rails), complete, at £1735	103,080	13	9
Telegraph	1350	0	0
Accommodation works.....	2000	0	0
Stations and sidings.....	9200	0	0
	£231,870	13	9
Land, compensation, and legal charges	£12,000	0	0
Rolling stock	30,000	0	0
Contingencies	26,129	6	3
	68,129	6	3
TOTAL.....	£300,000	0	0

JAS. FINCHAM, *Engineer-in-Chief.*

(Y.)

LAUNCESTON AND SCOTTSDALE RAILWAY.

Estimate of Cost and Liabilities—June 17th, 1885.

	£
Paid to date for surveys, plans, rails and fastenings, &c.....	53,667
Land (325 acres) and expenses.....	15,000
Sleepers.....	12,500
Rolling stock, including freight, insurance, and erection in the colony.....	28,096
Stations and appliances.....	12,000
Water-cranes, pumps, &c.....	850
Telegraph.....	1000
Plans, supervision, and office expenses.....	12,000
TOTAL.....	£135,113
Construction—Tender of Messrs. Boland & Scott.....	228,541
TOTAL.....	£363,654

LAUNCESTON AND SCOTTSDALE RAILWAY.

	£	s.	d.
Estimate for Parliamentary line could only be approximate, owing to the limited time at disposal, and to Parliamentary survey only being obtainable.....	300,000	0	0
The estimated excess over the sum voted is due to the fuller details afforded by the contract survey, the heavier works consequent upon shortening the line some 12½ miles, an allowance of £3000 extra on stations, £3000 on land, and £12,000 for plans, supervision, &c. not provided for, in addition to cost of trial and contract surveys, also not provided for.....	70,000	0	0

(Z.)

MERSEY AND DELORAINE RAILWAY.

	<i>Summary.</i>			£	s.	d.	£	s.	d.
Section 3. Formby to Latrobe.....				17,202	0	0			
„ 2. Latrobe to Coiler's Creek.....				28,392	0	0			
„ 1. Coiler's Creek to Deloraine.....				41,935	0	0			
Purchase of tramway.....							87,529	0	0
Rolling stock—2 new engines, 1 old engine repaired, 8 carriages, 2 brake-vans, 40 waggons, &c.....							6000	0	0
Clerks, draughtsmen, time-keepers, inspector, assistant engineer, further surveys, and supervision generally, say.....							12,000	0	0
Contingencies, exclusive of saving of earthwork contemplated by reduction in grades and curves.....							7000	0	0
							7471	0	0
							£120,000	0	0

(Z 1.)

MERSEY AND DELORAINE RAILWAY.

	£	s.	d.
Expenditure to 20th March, 1886.....	186,960	13	6
Liabilities (estimated)—Compensation for land.....	2984	4	0
Telegraph.....	600	0	0
Hire of L. & W. Railway trucks.....	638	14	1
L. & W. Railway Stock Account.....	572	10	0
	£191,756	1	7
Credit—Sale of sleepers and stores, say.....	1300	0	0
	£190,456	1	7

TASMANIAN GOVERNMENT RAILWAYS.

Mersey and Deloraine Line.—Cost of Line.

	Section 1.	Section 2.	Section 3.	TOTAL.
	£	£	£	£
Land arbitration, expenses, &c., (including cost of Mersey and Deloraine Tramway, £6000	—	—	—	13,453
Grubbing and clearing	2142	1015	1110	4267
Fencing	2960	1929	1514	6403
Removing old work on Section 2	—	614	—	614
Earthworks for single line	14,066	3628	8939	26,633
Provision for discharge of water, including bridges, culverts, ditches, &c.	10,057	16,425	12,362	38,844
Public road crossings	1040	309	1357	2706
Accommodation works for landowners	2154	378	271	2803
Permanent way in single line.....	17,006	23,541	9358	49,905
Mile-posts and gradient-posts	128	192	75	395
Stations, complete (not including cost of land).....	2808	4195	7319	14,322
	52,361	52,226	42,305	
Rolling-stock, locomotives, including supervision by Mr. Meilbek in England.....				9130
Ditto, carriages, wagons, &c., ditto.....				14,381
Part cost of wharf at Formby				292
Maintenance of line for six months				600
Telegraph				600
Furniture, &c.				573
Supervision and surveys, not including Mr. Meilbek's charges				5030
TOTAL				£190,951

(AA. 1.)

MR. GEORGE HAY EDWARDS'S ENGAGEMENT.

Précis of Correspondence relating to the Engagement of Mr. George Hay Edwards to prepare Plans, Sections, Specifications, &c. of Contracts for Tasmanian Government Railways.

1883.

September 18.—*Letter from Mr. Edwards to Mr. Fincham.*—Offering, in conjunction with Mr. M'Cormick, to submit an offer to "make surveys, prepare all plans, sections, specifications, &c.—in fact, everything necessary, including plans of buildings, for letting railway construction by contract."

September 24.—*Mr. Fincham to Mr. Edwards.*—Acknowledging receipt of above, and promising early attention.

November 15.—*Mr. Fincham to Mr. Edwards.*—Asking for information as to the authorised scale adopted by the Victorian Railway Department.

November 23.—*Mr. Edwards to Mr. Fincham.*—Enclosing a copy of the Victorian authorised scale of charges; stating that the railway surveys in that Colony are made by Departmental officers; suggesting that a rate per mile for surveys, to be determined by the nature of the country, should be agreed on, or if more satisfactory, a rate per diem; or suggesting further that Mr. M'Cormick should take charge of the surveys on a salary, the Government finding the necessary outfit.

1884.

January 4.—*Mr. Edwards to the Hon. N. J. Brown.*—Stating that he or Mr. M'Cormick would leave for Hobart by the *Flinders* on 11th inst.

January 26.—*Mr. Edwards to Mr. Fincham.*—Offering to undertake the plotting of contract plans and sections at £5 per mile, although he finds it a low rate; stating that a percentage is the fairest mode of charge, and offering to do the whole of the office work at the rate of 1½ per cent. on the contract price, progress payments to be made on the estimate.

Deductions for standard plans, &c. to be at the same rate, but of earthwork at the agreed rate of £5 per mile; stating that 1½ per cent. is less than the actual cost of preparing similar plans for 3ft. 6in. gauge railways on the Continent, and that the Victorian estimate for engineering is far in excess.

Stating he had taken offices in Macquarie-street, and would have his staff organised by about 10th February.

Stating that if a percentage rate does not meet approval, he will be happy to arrange any other satisfactory mode which may be proposed.

January 31.—*Mr. Fincham to Mr. Edwards.*—Acknowledging letter of 26th inst.; stating that he is prepared to recommend to the Minister the acceptance of “proposal for payment of contract plans and sections at the rate of £5 per mile for work as arranged when you were here, excepting the short Derwent Valley line, which was let before you arrived;” offering to discuss again the question of percentage “if we could first settle upon the items of work in estimates upon which it should be calculated;” enclosing copy of estimates.

February 29.—*Mr. Fincham to Mr. Edwards.*—Referring to letter of 26th instant, stating the acceptance by the Minister of “your (Mr. Edwards’s) offer to prepare all the office work of every kind (except clerical work) as may be required by me in connection with any of the proposed Government railways in this Colony for which provision was made by the Legislature during last session. Payment to be calculated at the rate of $1\frac{1}{4}$ per cent. on contract prices for the under-mentioned items only; viz.—

Fencing and gates,
Excavation and forming,
Culverts and drainage,
Bridges, tunnels, and viaducts,
Accommodation works,
Road diversions and crossings;

and to be subject to my certificate that the work has been performed to my satisfaction.”

As to terms of payment—

March 5.—*Mr. Edwards to Mr. Fincham.*—Acknowledging acceptance of offer, but stating that acceptance does not correspond with the offer of 26th January, which was based on the total cost of the lines. Stating that the plotting of longitudinal sections and plans would be at the rate of £5 per mile additional, and all lithographic tracings, &c. required for plans, sections, bridges, culverts, buildings, and other works, at the rate of £5 per mile, in addition to the $1\frac{1}{4}$ per cent.

March 5.—*Mr. Edwards to Mr. Fincham.*—(A private letter) reiterating the above, and stating that the terms named by Government would only cover actual expenses of self and staff at Hobart for 12 months. “Under the circumstances * * I am prepared to accept the terms, provided the mere plotting of plan and longitudinal section of line is paid for at an additional rate of £5 per mile, and of all lithographic tracings required in connection with the lines at the rate of £5 per mile in addition to the $1\frac{1}{4}$ per cent.”

1885.

August 7.—*Mr. Fincham to Mr. Edwards.*—Declining to certify for certain extra payments claimed by him.

(AA. 2.)

*Questions submitted to Ministers by Mr. Audley Cooze, M.H.A., with the Premier’s comments thereon:—
Hobart, 16th March, 1886.*

SIR,

I HAVE been requested by a large number of the constituents of the District of George Town to place the following questions before the Royal Commission on Railways, &c., now sitting in this City:—

Re Scottsdale Railway.

(1.) Is it a fact that the map placed before Parliament showing the proposed route as Mr. Climie’s was not Mr. Climie’s route, only in part of the distance?

(2.) Did the map referred to mislead Members, not only as to route, but also as to length of line?

(3.) Was Parliament also misled by the estimated cost of the proposed line being given at £5000 at per mile, or a lump sum of £300,000?

(4.) Is it the case that it is now found out by the Government that the cost of the line they have adopted will be £10,000 per mile or near about it?

(5.) Were the Government not long ago informed that the cost would be £10,000 per mile if they adopted the present route, as against one half that per mile along the longer route?

(6.) Is it the case that it has since been discovered that the line as selected will not pay until it has been further extended to Ringarooma, at a further cost of £150,000?

(7.) Is it the case that the line as now being constructed, compared with the alternative route, is against all engineering economy?

(8.) Is it the case that the longer route would not have cost so much as the present route?—that the longer route would have opened up more country, and have served more people, and also have benefited those living along the adopted route?

(9.) Is it the case that the line now being constructed has to travel to an elevation of over 1000 feet, and, to get to that elevation, has to traverse through long tunnels?

(10.) Is it the case that the line now being constructed as a “trunk line” of railway should never have been taken along its present route, but should not the other route have been selected, not only for the benefit of the two districts, but for the more economical working and maintaining of the railway for all time?

(11.) Is it the case that the longer route would have had an elevation of about 500 feet, and would also have avoided the tunneling altogether?

(12.) Is it the case that the Government signed the contract but a few days before Parliament met, well knowing at the time their adopted route would cost over £100,000 more than Parliament had been led to believe, and also had they not been informed that the longer route would be far and away better, and not cost anything like their adopted route?

(13.) Were the Government justified in going on before a second trial of Mr. Climie's route had been made, they having been informed that it could be very much shortened, and would not cost so much to construct or maintain?

(14.) Is it the case if the longer route had been selected it would not only have cost less, but have been able to carry almost half as much more per train load to that of the line now being constructed?

(15.) Is it the case that the present line will always be an unsatisfactory and costly line to work and maintain, and that its locomotive power will have to be heavier than usual?

(16.) Is it the case that the Government had been informed and cautioned as to all matters referred to in these questions before the plans were prepared?

(17.) Is it the case that the line will be one of the most expensive in Australia to work and maintain, and that the longer route would have been, comparatively speaking, easy of construction, and also of working and maintaining?

(18.) Is it the case that it is against all engineering economy to shorten a line for the purpose of taking it over a much higher grade, and in this instance that the question of first cost and after maintenance was not taken into consideration?

(19.) Is it the case that the hauling power on this railway must always be heavy and their train loads light?

As Mr. Climie's route and name has been referred to in the above questions, I think it is only right that I should state, so far as I am aware, these questions did not originate from Mr. Climie or from any other engineer.

I have the honor to be,
Sir,

Your obedient Servant,

AUDLEY COOTE.

The Hon. the Minister of Lands and Works, Hobart.

MEMORANDUM BY THE HON. THE PREMIER.

QUESTIONS 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 16, 17 appear to me to be quite outside the scope of the enquiry now being made by the Commission, and should not be permitted by the Government.

If Mr. Coote wishes to present a bill of indictment against Ministers, he must do it in the proper way and to the proper tribunal, viz., Parliament. It is no part of the duty of the Commissioners to compare the line now being constructed with a proposed alternative route, and that is what Mr. Coote evidently desires in order to show that his views, or rather the views of those who were prompting him, were right.

(10.) This question may be within the scope of the enquiry, but it is doubtful. The Commissioners might possibly be asked to say generally whether the route, from an engineering point of view, is a good one; but it appears to me that they cannot give an opinion that would be of any value as to whether the present route is better or worse than any other possible route without an examination of the whole surrounding country.

(15.) Is perhaps justifiable, as tending to show whether our engineers have properly advised us. But lines of railway through difficult country must always be costly, and Parliament having decided to construct a line through such a country, the Commissioners are not called upon to sit in judgment upon that body.

(18.) Similar observations will apply to the first part of this question. I do not see how the Commissioners can possibly decide as to the latter part (marked).

(19.) This is a legitimate question. It must be remembered that this Commission was appointed for the purpose of aiding the Government and Parliament with its opinion as to the mode in which the Public Works are being carried out, not whether such works were expedient or not. That question must be determined by Parliament itself.

J. W. AGNEW.

(AA. 3.)

PUBLIC WORKS.—ROADS AND BRIDGES.

THE Commissioners issued the following Circular to the Chairmen of 82 District Road Trusts:—

Launceston, 18th March, 1886.

SIR,

The Royal Commissioners appointed by His Excellency the Governor are now engaged in taking evidence as to the manner in which the Public Works of the Colony have been carried out during the past three years. It is hardly possible, without unduly prolonging the enquiry, for the Commissioners to visit every Municipal or Road District in the Colony, but with a view to make their report as complete and useful as possible, they will feel obliged if you will forward, in writing, any concise statement as to the manner in which Public Works have been carried out in your district during the period mentioned. If you think it necessary that the Commission should examine witnesses on points of administration and construction only, they will endeavour to make arrangements to meet your convenience.

I have the honour to be,
Your obedient Servant,

The Chairman ——— Road Trust.

THOS. C. JUST, *Secretary.*

REPLIES.

The following replies were received :—

*New Norfolk Road Trust,
New Norfolk, 24th March, 1886.*

GENTLEMEN,

I do myself the honor to acknowledge your favor of the 18th instant, asking for a "statement as to the manner in which Public Works have been carried out in this Road District during the last three years."

I have the honor to inform you that I am not aware of any works having been completed by the Public Works Department in this Road District, exclusive of main roads, during that period.

Parliament, the session before last, voted £200 for a deviation Lachlan road. This work is very necessary, and the Trust has repeatedly urged its completion, only to have its letters simply acknowledged.

In a proclamation forwarded by the Department, dated 1st March instant, there is a schedule of works completed, *inter alia*—

NEW NORFOLK ROAD DISTRICT.

From Road to Dry Creek Settlement, extending into Crown lands—
which work has not been done in this Road District during my term of office (two years and a half).

The greatest grievance and annoyance this Trust suffers is the divided authority in respect to the control of the streets of the Municipal Town of New Norfolk.

The Trust has to collect the rates, maintain the streets, repair and put down drains and culverts—in fact, stand all the abuse connected with that maintenance—but before the Trust can do anything whatever to the streets, it has to ask and obtain the sanction of the Municipal Council or their Town Surveyor. The Trust are elected by the same electors as the Council, and yet are placed under their servant!

The Trust sent a memorial to the Director of Public Works, in his capacity of Minister of Lands, before he brought in "The Roads Act Amendment, 1885" (49 Vict. No. 38), praying to insert a clause to either cause the Municipal Councils to be Road Trusts for the streets in municipal towns, or in the event of the Councils failing or refusing to act, to hand the control of them over to the Trusts—the receipt of which memorial has not even been acknowledged by the Minister of Lands. The Trust even published this memorial in the papers.

I have, &c.

J. A. MOORE, *Chairman New Norfolk Road Trust.*

The Honorable the Royal Commissioners on Public Works, Launceston.

P.S.—As a private individual, I think it would prove beneficial to the ratepayers of the Colony to abandon the works on the Derwent Valley Railway, and construct a line wholly on one side of the Derwent.

J. A. M.

Bushy Park, 25th March, 1886.

DEAR SIR,

In answer to your query as to how Public Works have been carried out in this district during the last three years, I beg to state several large road contracts have been undertaken in Dry Creek, Native Tier, and Monto's Marsh districts, and the work on the whole has been well and substantially done at moderate prices; but the cost of work is being materially increased because contractors cannot get their money promptly, owing to want of inspectors to pass work for payment.

The great fault of present system is a want of communication between the Government and the residents of the district, as represented by Trustees and others, as to locality and nature of works required. Important works are planned and carried out without reference to the Trustees beyond asking their consent to spend a certain amount, and then they are required to maintain expensive and unsuitable works at a great loss and injury to the ratepayers. And on this point I should very much like to give evidence any day after Thursday, 1st April, to the Commission, as I could give several instances of unsuitable roads being planned from above cause.

And I think the main roads require more local supervision.

Yours very truly,

W. E. SHOBRIDGE, *Chairman Upper Derwent Road Trust.*

THOS. C. JUST, *Esq., Secretary Royal Commission Public Works.*

South Glenorchy, 26th March, 1886.

SIR,

I am in receipt of your circular relating to the Government work done in the Road Districts of Sorell Creek and South Glenorchy.

In reply, I beg to say that a good deal of work has been done in the former district in the last three years, and the Trustees consider it was carried out in a satisfactory and economical manner. The only remark we would make is that we think it would be an improvement if the Government, before inserting a grant of money for a by-road in the Estimates, in consequence of the application of landholders, should obtain the opinion of the Trustees as to where money was most required, and ask their opinion of the necessity of the application.

I am, &c.

G. ARTHUR WALLER,

Chairman of the Road Trusts of Sorell Creek and South Glenorchy.

THOS. C. JUST, *Esq., Secretary Public Works Commission.*

Council Chambers, *Hamilton*, 24th March, 1886.

SIR,

The Chairman of the Hamilton Road Trust desires me to acknowledge your letter of 18th March *re* Public Works in this district during the last three years, and to state that your letter will be laid before the Trustees at next meeting on 30th inst.

Yours truly,

J. MACARTHUR, *Secretary Hamilton Road Trust.*

T. C. JUST, *Esq., Secretary Royal Commission Public Works, Launceston.*

Council Chambers, *Longford*, 25th March, 1886.

SIR,

In reply to your letter enquiring how Public Works have been carried out in this district, I am directed to inform you that all works performed during the last two or three years have given entire satisfaction.

One bridge has been completed, and in a substantial and satisfactory manner; another is being built, and, so far as can at present be seen, is as satisfactory as the first. The post office is only at present about half finished, and that seems to be quite satisfactory.

I have, &c.

T. C. JUST, *Esq.*

HENRY S. HUTCHINSON, *Council Clerk.*

Springlands, near Carrick, 25th March, 1886.

SIR,

I BEG to acknowledge the receipt of your communication of the 18th inst. *re* Royal Commission upon the Public Works of the Colony during the last three years.

In reply I beg to inform you during that time a considerable sum has been expended by the Government upon the branch roads within the Westwood Road District, the work having been constructed under the supervision of the Public Works Department, most of which has been performed in a permanent and satisfactory manner.

The present system of assisting Road Trusts to construct roads in remote parts where hitherto no roads have been is found to be a great assistance to residents and occupiers of land in those localities, and a decided improvement upon that previously in operation, when the expenditure was entrusted to local bodies who had not sufficient practical knowledge or time to attend to the works.

I have, &c.

JOHN MILLAR, *Chairman Westwood Road Trust.*

THOS. C. JUST, *Esq., Secretary Royal Commission.*

Latrobe, 25th March, 1886.

SIR,

IN reply to your Circular of 18th instant, I beg to state that at a special meeting of the Latrobe Road Trust it was resolved to draw your attention to the steep grade at the crossings (especially the Sherwood crossing) of railway running through this town, and the narrowness of the roads caused by the cattle-stops being placed in the road, instead of off.

The road, which was originally 66 feet, is now about 18 feet; and considering the large amount of traffic, said space is quite inadequate for the requirements.

As some comments have been and further ones are likely to be made in reference to siding now in course of construction to the Latrobe wharf, this Trust desires to state that the present route is the most convenient and suitable for those mostly interested.

I have, &c.

S. STERNBERG, *Chairman.*

T. C. JUST, *Esq., Secretary to Royal Commission, Launceston.*

Somerset, River Cam, 24th March, 1886.

SIR,

YOUR letter of 18th instant received to-day. In reply, I would beg to state that, so far as I know, the public works in this district, with one or two exceptions, have been fairly performed. Some of the small bridges and culverts should have been constructed of stone or pipes used, these being of course of a more permanent nature. I think, too, that the Inglis bridge would have been better without the metal covering. I would also mention that the roads might have been laid out with fewer curves.

I would take this opportunity of saying that I have been informed that the Royal Commissioners have had the road along the western esplanade of the River Cam pointed out to them as a useless piece of expenditure. Might I be permitted to state the following facts for their consideration?—First. That up to 1884 this road was the only means of communication along the coast. Secondly. That about one-third of this road is and will probably always be used by the public conveyances, as it is the road to the Post and Telegraph Offices. Thirdly. That along at least two-thirds of this road are stores and private residences, and it is the only road the occupiers have. Fourthly. That the amount expended by the Table Cape Board was £39 4s. 10d. in 1880, and £21 15s. in 1881; and as the road was and is necessary, I consider the Board were fully justified in expending that sum.

Any further information in my power I shall be happy to give.

I am, &c.

C. J. MACKENZIE, *Chairman Table Cape Road Trust.*

THOS. C. JUST, *Esq.*

Waratah, 24th March, 1886.

SIR,

IN reply to your communication of the 18th instant, I have the honor to inform you that some of the public works in this district have not been carried out in a satisfactory manner, and I beg to mention the following:—Road, Waratah to Rouse's Camp; road, Waratah to Corinna; and road, Emu Bay to Rouse's Camp. It would be almost impossible to convey in writing a correct idea of the manner in which the above works have been executed, and the Trustees are therefore of opinion that arrangements should be made by the Commissioners for the examination of witnesses.

I have, &c.

C. H. HALL, *Chairman Waratah Road Trust.*

THOS. C. JUST, *Secretary Royal Commission, Launceston.*

Waratah, 1st April, 1886.

SIR,

I HAVE the honor to acknowledge the receipt of your letter of the 29th ultimo, in which you ask whether the witnesses could make it convenient to put their statements in writing relative to the construction of roads in this district, so as to enable the Members of the Royal Commission to deal with them in their report on the public works of the Colony. In reply I have the honor to inform you that it would be a very difficult task to obtain statements in writing from all the witnesses, and Trustees are of opinion that verbal evidence would be more satisfactory than written statements.

I have, &c.

C. H. HALL, *Chairman Waratah Road Trust.*

THOS. C. JUST, *Esq., Secretary Royal Commission, Launceston.*

N.B.—The Chairman was informed that the Commissioners could not make it convenient to revisit Waratah, but would be glad to publish any written statement.

Speyside, Fingal, 25th March, 1886.

SIR,

I HAVE the honor to acknowledge the receipt of the Circular forwarded by you on behalf of the Royal Commissioners appointed by His Excellency the Governor for the purpose of reporting upon the manner in which the Public Works of the Colony have been carried out during the past three years, in which they will feel obliged if I will forward them, in writing, a concise statement as to the manner in which Public Works have been carried out in the Fingal Road District during the period mentioned.

In reply thereto, the Public Works carried out by the Public Works Officers in this district during the period mentioned are—

1st. The repairs and new top to the bridge over the South Esk at Fingal.

2nd. The erection of a new Public School-house and teacher's residence at Fingal.

3rd. The expenditure of £1000, voted by Parliament in 1883, for the purpose of making a road from Fingal to Mathinna.

With reference to No. 1, the work has been done as well as it was possible to do it, taking everything into consideration.

Of No. 2 I can only speak of it in admiration, both as to architecture, material, and construction under the supervision of Messrs. Bradley, junior and senior, who also supervise the repairs to No. 1.

Of No. 3, I am sorry to say I cannot compliment the Public Works Department, either upon its ability in laying out the road, drawing out the specifications of the work required to be done, or upon its supervision of the work until completion. The road has only been made twelve feet wide—not of sufficient width to allow two vehicles to pass each other without one going off the road. The road has not been formed at all, the gravel having been put on the grass, and, according to the specifications, the gravel was to be 12 inches deep all over the road (12 feet on No. 1 section, W. Rees's contract), instead of which there is not over from 4 to 6 inches on a great length of the road. Again, although the road (Sect. No. 1) has only been finished and taken off the contractors' hands for some six months, it now requires repairing, caused by insufficient drainage and also on account of there not being sufficient culverts. No. 2 Section (Clancy's contract) has been also damaged through a culvert not being above one-half large enough.

In conclusion, I can only say I look upon the matter as a most disgraceful job, and which I, as in duty bound, reported to the Minister of Lands and Works; but I might have saved myself the trouble, as nothing has come of it.

I have, &c.

JOHN STANFIELD, *Chairman Fingal Road Trust.*

T. C. JUST, *Esquire, Secretary Royal Commissioners.*

George's Bay, 25th March, 1886.

SIR,

I HAVE the honor to acknowledge the receipt of your communication of the 18th instant, requesting me to furnish you with a statement as to the manner in which the Public Works have been carried out in the Portland Road District during the past three years. In reply,—

1st, Bridge over Jason's Gates.—This structure is of a very substantial character, and the work has been well planned and faithfully carried out; the only objection that can be taken to it is, in my opinion,

that some unnecessary expense has been incurred in sheathing the piles with planking, which was of no advantage and cost a considerable amount.

2nd., Bridge over George's River.—I regret to say that in this work I find very serious and important defects, and which added very much to the cost without any corresponding advantage. The principal fault I find is that the bridge was erected on too high a level, and in consequence some two thousand yards of forcing had to be used in forming the southern approach. The deck of the bridge being ten feet above the level of the bank of the river, I hold that the height is quite unnecessary, and nearly all the forcing might have been saved, and much of the timber used in piles, had the work been carried out at a lower level, while the structure would have been perfectly safe from floods, and more convenient for all traffic purposes. I may also state that this bridge was erected without any road on the southern side being laid out leading thereto.

3rd., Jason's Gates to Boggy Creek.—A sum of £500 was voted in 1884 for the purpose of improving this section. I have to complain of the manner in which a cutting was completed on a portion of the work, and which, although very recently finished, a further outlay has been necessary owing to the faulty nature of the work.

These are the only works on the roads undertaken during the period named in my district. I cannot express an opinion upon the buildings that have been erected.

I have, &c.

JOHN C. MACMICHAEL, *Chairman Portland Road Trust.*

The Secretary Royal Commission on Public Works, Launceston.

Hastings, 26th March, 1886.

SIR,

IN reply to yours dated 18th instant, I have the honor to report that the public works carried out in this district have been of a most satisfactory character, and a credit to the department and its officers.

I have, &c.

JOHN HAY, No. 3, *Chairman Southport Road Trust.*

T. C. JUST, *Esq., Launceston.*

St. Paul's Road Trust, 27th March, 1886.

SIR,

IN response to your Circular *re* this Trust and works carried out under Lands and Works supervision, I have to remark, first, our Road Trust mileage is small—under 40 miles.

During 1885 certain works were conducted in our Trust by and under the direct supervision of the Lands Office, which works I may state on behalf of our Trust have been economically and faithfully carried out at least to our satisfaction, and also I believe to the satisfaction of the public.

I have, &c.

JAMES F. RIGNEY, *Chairman St. Paul's Road Trust.*

T. C. JUST, *Esq.*

Marydale, Stony Steps, 27th March, 1886.

SIR,

I HAVE the honor to acknowledge the receipt of your Circular of the 18th instant (which only reached me to-day), requesting me to forward a concise statement of the manner in which public works have been carried out in the Leslie Road District during the last three years.

During the aforesaid period a branch road to Kingston and another to Summerleas have been commenced, but as the work is not finished, and consequently the roads have not been handed over to the Trust, I am not in a position to report thereon.

A considerable sum of money has been spent by the Government in alterations and so-called repairs to culverts on the main road. One of the culverts has since been washed away by the late rains; and it is quite possible that had the culvert been left as constructed some years previously by the Board, it might have remained,—so that the amount expended, as well as the money now being expended, would have been saved for some years at least.

I have felt it my duty, as Chairman of the Board, to represent to the Minister of Lands that one of his subordinates, in reporting upon the condition of the main road, was guilty of wilful misrepresentation and evinced gross incompetency. My allegation has not been and cannot be refuted; and I have merely to add that so long as persons are appointed to fill offices and perform duties for which they are not qualified, the public service must suffer loss, and Road Trustees who are properly qualified will not feel disposed to undertake the responsibilities of their office with the risk of being supervised and subordinated to Inspectors who not only lack ability but show little or no regard for the truth.

I have, &c.

J. L. LIVINGSTON, *Chairman of the Leslie Road Trust and Main Road Board.*

THOS. C. JUST, *Esq., Secretary of the Royal Commission.*

Mount Stuart Road, Hobart, 27th March, 1886.

SIR,

IN reply to your Circular of the 16th March, Glebe Town Road Trust has only been nine months in existence, and the only works yet done are the construction of Edward and Glebe streets, the roadway metalled, footpaths formed, and channels and kerbing laid down.

I am, &c.

T. C. JUST, *Esq.*

ALEX. STRATHERN, *Secretary.*

Council Chamber, Bothwell, 30th March, 1886.

SIR,

I AM instructed by the Chairman of the Bothwell Road Trust to acknowledge the receipt of your letter of the 18th instant, relative to the public works carried out in this district during the past three years; and, in reply, to say the Government called for tenders for the erection of a bridge over the Clyde River at Bothwell. The tender of Mr. Oates was accepted, and the work was satisfactorily completed, and passed by the Engineer.

The works carried out by the Bothwell Main Road Board for the past three years on the 9 miles and 22 chains between Bothwell and Melton Mowbray, amounting each year to £231 17s. 6d., has been judiciously expended and to the satisfaction of the travelling public.

The Bothwell Road Trust, on the 7th April, 1883, fixed a rate of one shilling in the pound on all private property, and sixpence in the pound on all Crown land under lease in the road district, which rate amounted to £938 8s., out of which £935 1s. 6d. was collected and supplemented by a similar amount by the Government; the total amount now nearly expended by the Road Trust on the cross and by-roads in the district where most needed.

I am requested by the Chairman to thank you, and to say that he does not consider it at all necessary for the Royal Commissioners to examine witnesses, as the works have been carried out faithfully.

I have, &c.

SIMON ARNETT, *Secretary Bothwell Road Trust.*

THOS. C. JUST, *Esq., Secretary Royal Commission, Launceston.*

Office of Road Trust, Richmond, 27th March, 1886.

SIR,

I HAVE the honor to acknowledge the receipt of your letter of the 18th instant, enquiring how the public works have been carried out for the past three years.

In answer thereto, the Trustees of this district would rather not comment on the mode of construction of such works; but cannot let this opportunity pass without remarking on the most extraordinary discrepancy that exists between the first estimate and ultimate cost of the works carried out, and beg leave to bring under your notice the two following cases, where such has been the case to a most glaring extent; viz.—

1st. The deviation on Jerusalem road, Richmond to Campania Railway Station: estimated cost of same £2000; cost when completed about £4000, for 2¼ miles of road through a level country.

2nd. Repairs to bridge over Coal River at Richmond; estimated cost £600; cost when completed, £1000.

Leaving these two facts to speak for themselves,

I have, &c.

S. T. DICKSON, *Chairman.*

THOS. C. JUST, *Esq., Secretary to Royal Commission.*

Forth Road Trust, 29th March, 1886.

SIRS,

IN reply to your Circular of the 18th inst., I have the honor to state:—

1. That, generally speaking, the construction of roads in this district has been carried out satisfactorily.

2. That some two years ago 48 chains of road on the East Castra, from Mr. Shaw's mill southwards, was completed for the Government by Messrs. Crawford Bros. The Trust of that time were not satisfied with the road, and declined to take it over. A lengthy correspondence was entered into between the Minister of Works and the then Chairman, Mr. A. M. Reid. This lasted about twelve (12) months, without any decision being arrived at. During all this time no repairs were executed on this portion of road, and it was estimated by competent authorities that one hundred pounds (£100) would be required to put it in fair order. I may add the major portion of this amount has already been spent.

You will observe in the above I offer no opinion on the work, and have only stated so much as I believe will show the Commissioners the necessity of making such a recommendation as the following:—That when the representative body (Road Trust) of a district, rating itself for the maintenance of properly constructed roads, refuse to take over work for any reason whatever, the Department of Works should maintain such work till the dispute is settled, when, if the local authorities are shown to be in error, the cost of maintenance should be deducted from the grant-in-aid.

3. That there appears to be a great amount of bungling in the Office at Hobart, as will be seen from the following:—Some weeks ago a local contractor submitted a communication to me, signed by an officer in the Hobart office, informing him that his was the lowest tender for a piece of work in this district, and that as soon as the Road Trust agreed to maintenance his tender would be accepted. Further, he added, that he had again written the Trust on the matter. After waiting two days for this second letter that was said to have been written, I wrote the Minister explaining that no communication on the subject had

reached me, and informing him we would be willing to maintain the road in question. In answer to this I am told the letter was posted in December, 1885. Why an important letter like this should remain unanswered so long, without a reminder being forwarded, I cannot understand. Together with this reply I received a list of roads for Trustees' signatures. Here we found a road that was not in our district. This we struck out, signed for the remainder, and forwarded. An acknowledgment came, dated the 16th inst., asking why this road was struck out, and adding, "all works delayed pending reply." Wired my reply, to say it was out of our district, and that I trusted there would be no further delay. Since I forwarded the telegram, and seven days after the date of letter to me acknowledging the list, I find a contractor has received telegram from the office stating the Trust had not yet consented to maintenance.

The above shows serious bungling, and in this case is a positive injury to the district and the contractor, it being far better for both to have the work done during summer. It will at once be plain, that if this is usual, contractors must put in a higher tender to cover risk of having to do work in winter that should and could have been done in summer.

4. It has been usual, I understand, for the District Inspector to make annual recommendations to the Minister quite independent of local Trust. Information on this matter is withheld from the Trust. The members of the Forth Road Trust view with disfavour any arrangement of this kind, there being, to their minds, no good object to be served by secrecy.

Unless the Department deny any of the more important statements made above, there would be no necessity to examine witnesses.

I have, &c.

J. M'CALL, *Chairman Forth Road Trust.*

To the Royal Commissioners on Public Works Department.

Kingston Road Trust, 30th March, 1886.

SIR,

I HAVE the honor to acknowledge the receipt of your letter of the 18th instant, requesting, for the information of the Public Works Royal Commissioners, a statement as to the manner in which Public Works have been carried out in this district during the last three years.

Before replying to your letter I deemed it advisable to submit it to the consideration of a meeting of the Trustees. Having done so, I am in a position to say that, in the opinion of the Trust, the new Brown's River and Margate bridges are both substantial structures, and a credit to the Department; that the Kingston and North-West Bay jetties are also substantial structures, although the former requires extension, but this is not the fault of the Department, but owing to the insufficiency of the amount voted by Parliament for the purpose.

The work done on the main road from Kingston to Oyster Cove, with one trifling exception, gives entire satisfaction to the Trustees. There is a little dissatisfaction regarding the length of time the new road between Kingston and the Huon road has been on hand, but difficulties with the contractors have occasioned this.

The money voted for branch roads has been expended judiciously, and with the concurrence of the Trustees.

It appears to the Trust to be unnecessary for the Commission to examine witnesses in this district on points of administration and construction, and I am happy to be authorised to say that the Public Works Department has the confidence of this Road Trust.

I have, &c.

EDWD. INNES, *Chairman.*

The Secretary Public Works Royal Commission.

Appledore, Formby, 27th March, 1886.

SIR,

IN answer to your letter of the 18th inst., requiring information for the Royal Commission on Public Works, I beg to state that the West Mersey Road Trustees, with the little funds at their command, have made the *worst* part of the roads, that have lasted good for 10 to 15 years. After waiting six years for the Government to replace the bridge over the Don, we borrowed money and built the present bridge, which, though too narrow, is now as good as when erected nine years ago.

For the past four years we formed the "*West Mersey Main Road Board.*" We found the Government contract work very defective, all the roads requiring a new coat of metal within three years after completion. We object to 12 feet as too narrow, and bad policy, as vehicles go in one track, or in passing injure the edges of the metal; also to the main road being *reduced* to 18 feet wide at the railway crossing, Spreyton,—an expensive and unsightly proceeding, and dangerous to the public.

In our district I had all the scrub and trees cleared for at least half a chain on each side of the road, thus giving it more sun and air.

There are complaints that the metal roads made under Government supervision are not "blinded." This is a serious defect.

The roads generally are laid out by incompetent people—*vide* that from Railton to Sheffield—a disgrace to the country.

We resigned at the end of last year, giving as our reasons for so doing the paltry manner in which the "maintenance" was dribbled out—the first payment having been made in *April*, allowing us only *one* month before the *winter* set in, which, as I have repeatedly asserted, causes all contracts and works to cost the country at least 25 per cent. over work done in *proper* season.

We also object to the manner in which the Esplanade at Formby has been unnecessarily destroyed by

the railway works, and the dangerous state in which the entrance to a public ferry has been left, despite the protest of the Road Trustees.

I beg to state that I have had over 60 years' hard experience between Hobart and Circular Head, and seen most of the Public Works of the Colony during that period.

I am, &c.

B. W. THOMAS, *Chairman.*

T. C. JUST, *Esq., Secretary to Royal Commission on Public Works.*

St. Mary's, 29th March, 1886.

SIR,

I have the honor to acknowledge the receipt of your Circular of the 18th inst. in reference to Public Works constructed in the St. Mary's Road District.

I may mention that a portion of road recently constructed by the Government on the road from St. Mary's to Dublin Town, *via* German Town, the Trust declined to take it over from the Government owing to the exceedingly ill construction of the same.

I may state that I wrote the Hon. Minister of Lands and Works last week in reference to the matter, stating many of the defects in the construction, who has replied that the matter shall receive early attention. This was just previous to my receiving your Circular.

Probably your Commissioners will receive some instructions from the Minister of Lands and Works respecting the matter.

I have, &c.

JOHN LADE, *Chairman St. Mary's Road Trust.*

THOS. C. JUST, *Esq., Secretary Royal Commissioners, Launceston.*

Kentishbury, 29th March, 1886.

SIR,

IN reply to yours *re* Public Works in this district, I laid your Circular before the Trustees for their opinion. They consider that the whole of the Public Works done in this district for the past eight years are a credit to the Public Works Department.

I am, &c.

JOHN HOPE, *Chairman Kentishbury District Road Trust.*

T. C. JUST, *Esq., Hobart.*

Clarence, 31st March, 1886.

SIR,

IN reply to yours 18th March *re* Public Works, I beg to inform you that the only works done by the Government in this Road District within the last three years have been a public school, a causeway, and two jetties. The material and work in causeway are good, but alterations had to be made in original plan. Work and material in jetties good, but a great blunder was made in placing them where they are. The one at Muddy Plains is only available at certain stages of the tide, although, had it been placed about 150 yards from its present position, it would have been into deep water. The one at Rokeby is perfectly useless, as at low water it is perfectly dry, it being 10 feet to edge of water from end of jetty. I may add that the Road Trust had nothing to do with their erection, never having been consulted either before or since their erection in any way by the Government.

I have, &c.

WILL. YOUNG, *Chairman Clarence Road Trust.*

T. C. JUST, *Esq., Secretary Royal Commissioners, Launceston.*

Green's Creek, 1st April, 1886.

SIR,

I am in receipt of your favour of 18th ultimo *re* Public Works of the Colony. The East Mersey Road Trust are quite satisfied as to the manner the votes of money have been expended on the roads in the district, but would suggest that the works, where practicable, should be commenced at an earlier period in the summer season.

I have, &c.

ROBERT BEVERIDGE, *Chairman East Mersey Road Trust.*

THOS. C. JUST, *Esq., Secretary Royal Commission on Public Works of the Colony.*

Sandfly Basin, 1st April, 1886.

SIR,

IN reply to your communication of the 18th March, the Longley Road Trust state concisely that only three public works have been carried out here during the past three years. The contractors are not to blame for two of the works, as they did their part; but none of them were completed in a satisfactory manner, though the burden of permanently maintaining them was thrown on the limited resources of the Trust. Further information may be obtained on the spot.

I have, &c.

DOMINIQUE LUDBEY, *Chairman Longley Road Trust.*

T. C. JUST, *Esq.*

Chudleigh Road District, Deloraine, 1st April, 1886.

SIR,

I HAVE the honor to acknowledge the receipt of your Circular of the 18th. of last month, which came to hand only this day, or it would have been answered before.

I beg to state that all the Public Works within the last three years done in the above district have been carried out faithfully. Before the work has been laid out I have been consulted to make the most of moneys voted, and also those persons who are directly benefited by such expenditure, that advantage may be taken of local knowledge.

I consider it would be quite unnecessary for the Commissioners to call any witness in this district for the purpose you mention.

I have, &c.

JAMES LOVEJOY, *Chairman.*

THOS. C. JUST, *Esq.*

Lake River, 2nd April, 1886.

THE Trustees Lake River Road Trust do not think it necessary for the Commission to examine their roads.

If you require the expenditure for the past three years it can be furnished to you.

Yours faithfully,

THOMAS GATENBY, *Chairman.*

THOS. C. JUST, *Esq., Launceston.*

St. Leonard's, 27th March, 1886.

GENTLEMEN,

I HAVE the honor to inform you that I am in receipt of your Memorandum *re* Public Works in this district, and in answer thereto, I beg to inform you that the only work answering the description of those therein referred to was the formation of a new road from St. Mary's Railway Station to the township of that name, which was assisted by a Parliamentary vote of £1000, and which was most successfully carried out under the supervision of Mr. Leonard Dowling.

My Trustees now wish me to call your especial attention to the condition of the bridge over the South Esk River at Corra Linn, of which they truly state that passage over it is perilous to life and limb. We have already asked to be relieved of the charge of this bridge, of which our ratepayers make no use, and regard it as a fair exercise of your powers as Commissioners of Public Works to decide whether, in the interest of the Tasmanian public, it shall be repaired by the Government or whether it shall be closed by my Trustees.

Trusting that you will be able to hear my evidence, and that of the Trustees of the St. Leonard's and North Esk Road Districts on this subject,

I have, &c.

WILLIAM C. GRUBB, *Chairman St. Leonard's Road Trust.*

The Commissioners Public Works.

FORWARDED for the information of the Engineer-in-Chief, especially with reference to Corra Linn Bridge. When noted, please return this letter.

THOS. C. JUST, *Secretary Royal Commission
Railways and Public Works.*
31. 3. 86.

FORWARDED to the Engineer of Roads for perusal and return, and for any remarks he may consider it necessary to make.

JAMES FINCHAM, *Engineer-in-Chief.*
per A. H. H.
1. 4. 86.

THE Corra Linn Bridge was built between 20 and 26 years ago by the Road Trust, and has ever since remained under the authority of the Road Trust; and as to its condition, that is a matter solely pertaining to the Trust, who have levied rates and enjoyed the revenue and controlled the expenditure, unhampered by the central Government. In September, 1885, the Chairman of the North Esk Road Trust, H. R. Trethewie, Esq., and Chairman of St. Leonard's Road Trust, William C. Grubb, Esq., wrote to the Hon. the Minister of Lands stating that the Corra Linn Bridge was unsafe, and that it would be an act of injustice to the district for their funds to be taxed in renewing the bridge, seeing that foreign visitors and non-residents in the district used the bridge in common with the ratepayers. I attach reply sent to the Chairman of the Trusts interested in the Corra Linn Bridge.

WILLIAM DUFFY, *Engineer of Roads.*
3. 4. 86.

NOTED and returned as requested.

J. FINCHAM.
5. 4. 86.

T. C. JUST, *Esq., Secretary Royal Commission on Public Works.*

Public Works Office, Hobart, 21st October, 1885.

GENTLEMEN,

I HAVE the honor to inform you that the matter referred to in your letter of the 26th ultimo, as to the condition of the bridge over the North Esk River at Corra Linn, must at present be dealt with by the Road Trusts having control of the structure.

The subject brought under my notice in your letter will, however, be noted for future consideration and enquiry, as it is not possible to deal with it during the present Session of Parliament.

I have, &c.

NICHOLAS J. BROWN, *Minister Lands and Works.*

Messrs. W. C. GRUBB and R. H. TRETHERWIE,
Launceston.

Loinah Road Trust, New Town, 1st April, 1886.

SIR,

I AM directed by the Chairman of the Trustees to inform you that inasmuch as the Trust has only recently been formed they have not had any works done.

I am, &c.

JNO. D. PALMER, *Secretary.*

T. C. JUST, *Esq., Secretary Royal Commission, Launceston.*

South Arm, 2nd April, 1886.

SIR,

IN reference to your Circular of the 18th March, I have the honor, for the information of the Royal Commission, to inform you the only Public Work constructed in this district during the last three years is a small jetty, which has, I believe, given general satisfaction.

I have, &c.

GEO. GELLIBRAND, *Chairman Road District South Arm.*

T. C. JUST, *Esq.*

Geeveston, 3rd April, 1886.

SIR,

IN reply to your enquiry of 18th ultimo, I beg to say that the Public Works of this district have during the last three years been of a useful and practical character, and have contributed much to the improvement of our district. Upon the whole, considering the difficulties that have to be overcome, the works have been managed satisfactorily.

There are many settlers yet who cannot participate in the works so carried out with advantage until the roads are further extended in several directions; and if such works were done it would lead to further settlement upon Crown lands.

I have, &c.

O. GEEVES, *Chairman Liverpool Road Trust.*

T. C. JUST, *Esq., Secretary Commission on Public Works.*

Frankford Road Trust, Frankford, 31st March, 1886.

SIR,

IN reply to your communication dated 18th March, 1886, I have to state that this being a new district, little in the shape of Public Works has been undertaken since the formation of the Road Trust, two years ago. All works, with the exception of contract No. 9, have been carried out in a manner satisfactory to the Trust. In No. 9, completed a short time since, the drain on the upper side of the road is in several places above the level of the crown of the road, and has very little fall, hence in a heavy rain the water flows over the road, and with less rain soaks on to the road where it is an embankment; and the crown, consequent upon the work being done in midwinter, is too flat. Several portions of road have been more than once laid out prior to tenders being called; and tenders have, as a rule, been called too late in the season. Roads have been begun in four different directions, and the main one through the district from East Tamar to Kermode is not much further advanced than the two by-roads. The main road from Frankford township westwards, which the majority of the inhabitants will use, and which they requested the Government to push on with first, has scarcely received any attention; all available moneys have been spent on the road eastward to the Tamar. These complaints would to a great extent be done away with if local Trusts had a little say as to where public moneys voted for roads in their several districts should be spent. The Public Works Department did send a Circular to this Trust informing them (Trustees) that an officer of the Department would be sent to consult the Trust as to the manner in which the last grant of £1000 should be expended. Since then the work has been laid out by the Engineer of Roads, without his having gone over the whole of the road to see what was most needed, and without the Trust being consulted in any way. I would respectfully submit that in this district gravel be used wherever practicable, it being cheapest and best suited to the requirements of traffic; and that tenders be called, as far as possible, in October, November, or December.

I am, &c.

NORMAN SMITH, *Chairman*

T. C. JUST, *Esq., Launceston.*

Upper Piper, 5th April, 1886.

SIR,

IN reference to your letter in respect to the manner in which Public Works have been carried out in this district for the last three years, I beg to state that, as far as we, the Trustees, are concerned, we are quite satisfied. The officers in charge have always done their best to lay the money out to the best advantage, and make the most of it. There is one part of the business, however, we would like to see altered, viz., when money has been voted for the district the work should be let as soon as possible, so that it would be finished before winter. As it is now, the work is generally left till winter, when the roads are impassable; the consequence is, the contractors are much higher in their price, and a deal of the works have to be taken off; and, as I have before stated, the sooner it is done the more work we get for the money, and the better it is. Otherwise we are satisfied.

I remain, &c.

JAMES PHILLIPS, *Chairman Tankerville Road Trust.*

THOS. C. JUST, *Esq., Secretary Royal Commission, Launceston.*

Office of the Horton Road Trust, Stanley, 30th March, 1886.

GENTLEMEN,

By direction of the Trustees, I have the honor to transmit the statement required by your letter of the 18th instant.

In the District of Horton the Main Road Board has had frequent occasion of complaint as to mode of road construction and supervision; in proof of which reference is made to—

First—Contract by Fenton (the first under the present system), where, between Myrtle and Wiltshire Creeks, the metalling, which should have been nine inches in depth, was found deficient by more than half, necessitating extensive repairs by the Board immediately after construction.

In this same contract carelessness was shown in defining the road between Detention River and Crayfish Creek, where a straight line might have been run from bridge to bridge; also in the unnecessary deviations further west. Neglect was shown in supervision of the work in the forests between Detention River and Black River, where the stumps were not grubbed, but cut off just below the surface; the roots were not run, and reefs of rock were left in the forming.

(This contract was completed prior to "three years ago," but reference is made to it in consequence of it being the first under the present system.)

Second—Contract by Dallas, where, in Cassidy's Forest, the road was made with rotten clay slate instead of quartzite gravel, easily obtainable. Shortly afterwards, under the same Inspector, and under a separate contract, an attempt to repair the error was made by covering the rotten slate with the quartzite gravel available in the first instance.

Third—Contract by Dallas, through a portion of Mr. Ford's farm on the Peninsula. When the construction of this portion of the main road was under consideration the Engineer-in-Chief was interviewed at Stanley by a deputation from the Board, who pointed out that the line was unsuitable, as the sea was rapidly encroaching, and advised the making of the road further inland. This advice was not taken, the Engineer-in-Chief replying he could protect the road by a wall if necessary, and if that failed he could then take the road further inland.

In a short space of time the sea threatened the destruction of the road, and several means were adopted for its protection by the Government District Inspector, who first sought to stay the action of the tide with a brush fence, subsequently by the erection of a stone wall on a plan suggested by Engineer of Roads after personal inspection. These experiments failing, the road was abandoned to its fate, and speedily destroyed.

The result has been to increase the inconvenience and danger to traffic during the past two years; to necessitate a second appeal to arbitration; the construction of another road in the line originally advised by the deputation from the Board; and to delay the completion of the road to Stanley, for which a vote of £1000 was passed two years since.

Fourth—Contract by Dallas, Rocky Cape Plains, where the culverts were specified to be earthenware; the metal to be put on in two layers—5 in. foundation, and 4 in. of 2½ in. top metal.

During the construction of this work complaints from unsuccessful tenderers and others reached the Board that wooden culverts were being put in, and that stone was being carted on and knapped over. (The Minister of Lands and Works stated in the House that pipes were in all cases used for culverts.) The presence of Engineer of Roads afforded the Board an opportunity to bring the matter before him. Extracts from his letter will best explain the result:—"The culvert on Dallas's road, Rocky Cape Plains, is a 3ft. timber culvert, and substituted in the place of the earthenware pipe culvert, as it was found that the earthenware pipe specified would not afford waterway sufficient to carry off the ordinary stream, to say nothing of flood waters. I examined the culvert as well as I could, and am of opinion it is a substantial log culvert, and more costly to the contractor than a pipe culvert such as specified would be." "Both Mr. Dallas and Inspector Atkinson deny the metal is 5in. and 4in. stone broken over on the surface, but is of two sorts—5in. pitchers, and 2½in. broken metal."

Were the Board willing to admit the correctness of the Engineer's arguments touching the ordinary stream and flood water, and the more costly nature of the culvert, his remarks do not apply to two other similarly constructed culverts to be found in the same section.

Fifth—Contract by Morton in Dallas's Forest. A large timber culvert was put in under a high embankment. Information was given to the Board that old decayed material had been used by the contractor. The Engineer's attention was drawn to it, and his reply follows:—"During my conversation last evening with the Chairman of your Trust and Messrs. Ford and Wells (Trustees), amongst other matters brought under my notice, the embankment and the material of the culvert, more especially the covering planking under said embankment, was named and objected to as old and otherwise objectionable. I have

to inform you that the said culvert was condemned both by Inspector Atkinson and Overseer Mr. Peart some time since, and will be taken up by Mr. Morton when he resumes work.

This work has been completed, and the culvert complained of has not been taken up.

(This section not having been handed over to the Board, no exception to the culvert could be taken.)

Sixth—Contract by Anderson—Bridge at Falls Creek.—Specification did not provide for sufficient wall to protect at flood-time the embankment forming the east approach. The work was completed according to specification. The Board, fearing that the approach would be washed away at flood-time, proposed taking measures for its protection, when the contractor stated that the Government Inspector had arranged with him to protect the embankment, and that payment for the work would be made either by the Inspector out of his own pocket, or out of a future vote.

The Horton Road Trust has had as much, if not more, difficulty and unpleasantness with the Department, in consequence of the carelessness or incompetency of the Government District Inspector, clearly proved by the correspondence open to inspection.

Within the last three years the Trust has on several occasions been compelled to decline to accept the maintenance of certain works in consequence of the faulty construction and glaring deviations from specifications, and would instance particularly Bourke's contract, South Road.

During the construction of this section the Chairman of the Trust received information that the work was not being executed in a satisfactory manner. He communicated with Government Inspector, who promised the matter should receive attention. Construction was completed, and rumours were current as to deficiency of metalling.

On the 21st April, 1885, the Minister was requested to furnish the Trust with copy of specification, and to state when the road would be in the hands of the Trust for maintenance. On May 15th reply was received that the road had been handed over verbally by the Inspector, and that the specification asked for would follow. On the 8th June the Trust reminded the Minister that the specification had not been sent as promised, and denied that the road had been handed over in any way. The Minister was also informed that careful examination had proved that complaints had not been made without foundation—the metalling was deficient in width and quantity, the culverts were broken, and the road had not been sufficiently cleared and grubbed.

The Trust courted official enquiry, and declined to accept the maintenance until the contract was completed according to specification.

(The specification was not received until the first week in August.)

On the 15th July, 1885, the District Inspector reported contract under Thomas and Edward Breheny completed. The section was examined by the Trustees, and the maintenance declined for the same reasons as in the case of Bourke's contract.

On the 20th August the Engineer of Roads thoroughly examined the sections in question, and on Bourke's the metalling, which should have been 12 feet by 9 inches, proved to be not more than 11 feet to 11 feet 6 inches by 5½ inches, and found the other matters as reported: on Breheny's contract the metalling deficient and construction incomplete. Subsequently the Engineer stated to the several trustees present that they would be quite safe in taking over Breheny's section, as the road was fairly well constructed, though not up to specification, and that as to Bourke's section, the less said about it the better.

The trustees offered to complete the works according to specification out of the Trust's funds, and to accept the maintenance immediately, provided the Government guaranteed to return the money expended.

On the 17th October the Minister of Lands and Works wrote:—"The Engineer of Roads recommends as follows: 1st—As to South Road, that the sum of £120, being the unexpended balances of votes, be authorised to be expended through your Trust in works on this road (Bourke's contract), and that the resolution passed at the meeting of your Trust on 21st August, and forwarded to the Engineer of Roads, be deemed to be fully complied with by the payment of this amount. 2nd (Breheny's contract)—That your Trust be allowed to expend a sum not exceeding £50 on this road prior to your Trust taking it over for the purpose of maintenance. I have approved of these recommendations, which I hope will be satisfactory to your Trust."

The Trust accepted the £50, but declined the £120 as insufficient to carry out the works.

On the 1st February, 1886, the Minister wrote regretting the Trustees' refusal *re* the £120, and "that as the sum referred to was the only amount available and that can be sanctioned. Unless the Trust reconsiders its decision there is no alternative but for the road to remain as it is." A duplicate of the letter was enclosed, with a request "that the Trust would be good enough to forward the same to the residents more particularly interested in the South Road, or consent to the Department forwarding it."

The Trustees replied, on the 8th of the same month, informing the Minister that they had learnt of other unexpended balances of votes amounting to £140, and suggesting that the sum, if available, should be placed at the disposal of the Trust, in addition to the £120 offered. The request *re* the duplicate letter was declined, but the Trustees intimated that if the money asked for were not available they would offer no objection to the matter being submitted to the whole of the ratepayers who were equally interested in the expenditure of moneys derived from rates. The Trust has had no reply.

(About this time an informal meeting of certain residents of the South Road was held, at which the Government District Inspector was present.)

The Trustees refused to accept the maintenance of works admitted by the Engineer of Roads to be faulty in construction; pointed out the wrong perpetrated through the carelessness of the District Inspector in sanctioning payment for works not actually performed, though constructed under his personal supervision.

On Bourke's Road the metalling almost immediately gave way, though no load carted over it could possibly have hurt a well-made road. Of the 5000 feet of blackwood brought from the locality, the Trust has no reason to believe that a single log traversed the line of road, the teams merely crossing it at Stony Forest *en route* to the beach.

The £120 offered by the Department for expenditure on Bourke's Road is the unexpended balance of a

sum voted in 1881 for a road from South Road eastward into Crown Lands, and the £140 asked for is made up out of the balances of votes passed for South Road construction in 1881, 1882, 1883.

On the 9th October, 1885, the District Inspector wrote: "Messrs. Lovell & Burns' contract for grubbing and clearing at Duck River is now completed. Will you inform me if you are prepared to take the work over? I may mention that in my opinion it would be advisable to deviate a little (about the centre of the work) before any construction is taken, as a considerable amount of cutting and filling would thereby be saved. I took the line straight at the suggestion of your member, Mr. Wells, who assisted in marking it out."

(Mr. Wells declines to accept any responsibility *re* deviation from surveyed road—the line was marked by him as an employé, not as a trustee.)

On the 16th of October the Trust applied to the department for specification of works, and, after examination, informed the District Inspector that as the stumps were not grubbed on the 20 feet, and as the timber left standing on the chain wide had not been cut down, they declined to take the work over.

On the 18th the Inspector wrote: "I have to thank you for the information *re* Duck River Road. The contractor had not carried out my last instruction. The matter will be set right at once."

On the 24th December the work was reported by the Inspector as completed.

The deviation from a line of road surveyed by the Trustees, and used for over twenty years was injudicious, and had the Inspector consulted the Trust he would have been informed that the line he proposed adopting had been condemned as one involving an unwarrantable expenditure without any appreciable benefit.

Having given a detailed statement, in as concise a manner as is possible in dealing with a subject of so much local importance, I will conclude by respectfully calling attention to what I venture to consider the weak points in the present system.

Construction and maintenance of the Main Roads place the responsibility of maintenance upon those exercising little or no authority in the matter of construction, and defective construction entails increased expenditure.

The maintenance money as apportioned absolutely confines the fixed amounts to the several sections, and precludes the appropriation of a possible balance in the case of the one section being devoted to meet the urgent requirements of the other.

If the construction and maintenance were under the same head, the question of maintenance would in all cases lead to a more careful supervision and to a more faithful execution of the work.

Arguments in favor of a combination under local bodies:

Local experience and knowledge of district requirements.

The interest, that as residents, such bodies feel in the advancement of all reproductive works.

£1460 unexpended balances of votes to the credit of this district would not have been allowed to remain for years in the Treasury.

The check on injudicious expenditure and misdirection of funds exercised by the public on a body directly responsible.

The advantage conferred by local knowledge in selecting the fittest season for the execution of works.

The avoidance of the vexatious delays and inseparable expenditure invariably associated with departmental routine,—to wit, the inconvenience to the Board in having to accept tenders subject to the approval of the Minister,—the frequent cause of the work being given up altogether by the contractor not being in a position to remain idle for weeks awaiting decision, in many instances resulting in being indefinitely postponed or abandoned in consequence of wet weather.

I have, &c.

H. G. SPICER, *Chairman.*

To the Royal Commission, Hobart.

DEAR SIR,

I BEG to acknowledge receipt of your Circular of 18th ultimo, asking for information as to how Public Works have been carried out in our district during the last three years.

In reply, I have to state that, unfortunately, the Augusta Road District has not been favoured with any expenditure of Public Works money during the period mentioned, so cannot report thereon.

I have, &c.

R. HICKMAN, *Chairman Augusta Road Trust.*
5th April, 1886.

T. C. JUST, *Esq., Secretary Public Works Commission, Launceston.*

Council Chambers, Westbury, 7th April, 1886.

SIR,

THE Chairman of the Westbury Road Trust requests me to acknowledge the receipt of your circular of the 18th ultimo, and, in reply thereto, to say that he is not aware at present of any Public Works in this district requiring the attention of the Commissioners.

I am, &c.

T. C. JUST, *Esq.*

FRED. L. T. BOWDEN, *Secretary.*

Tea Tree, 8th April, 1886.

SIR,

IN reply to your Circular, dated 18th March, 1886, enquiring as to the manner the Public Works constructed in this Road District have been carried out, I have much pleasure in saying that the various works carried out have been constructed and completed to the entire satisfaction of this Trust and the public generally.

I am, &c.

JOSEPH BARWICK, *Chairman of Tea Tree Road Trust.*

THOS. C. JUST, *Esq., Secretary to Royal Commission
upon Public Works, Launceston.*

Gould's Country, 8th April, 1886.

SIR,

To answer your Circular of the 18th March, even in a concise manner, would take some time and trouble.

From the Portland boundary to Weldborough, and for $2\frac{1}{2}$ miles beyond, $13\frac{1}{2}$ miles of road have been formed, 11 of which have been metalled or gravelled. Three bridges and a great number of culverts have been constructed on this road. Last year on this road 1 mile and 10 chains of the old slabs were taken up, and part so taken up was metalled to a width of 10 feet.

Nearly all the above work was done by money voted by Parliament

By-road from Groom bridge to George's River Settlement.—About 10 miles of this road have been formed where necessary, but not gravelled. There have been three bridges and several culverts constructed on this road, and most of the work done has been under the Waste Lands Act.

Generally speaking, most of the works mentioned above have been done in a satisfactory manner.

For the last three years the Road Trust has expended about £1200, principally in keeping the roads in repair and clear of timber. I do not know of any reason why a witness should be examined on the above road construction.

I have, &c.

A. JOHNSTON, *Chairman Gould's Country Road Trust.*

The Secretary Royal Commission.

New Norfolk, 10th April, 1886.

SIR,

IN reply to your favor of the 18th ultimo, I have the honor to inform you that owing to various causes I was unable to lay its contents before the Trustees of this Road District until last Thursday, and I now hasten to forward you their answer to your enquiry.

The Public Works carried out in the Lower Derwent Road District during the past three years appear to be confined to roads and bridges, and the construction of that part of the Derwent Valley Railway line which passes through this Road District. As regards the road work, the quantity appears to be on the whole satisfactory, (the notable exception being the construction of a deviation caused by Derwent Valley Railway line on the Hamilton Road, at a point known as Golden Point, near John Hay's Rocks) but at too high a cost, caused to a great extent by imperfect supervision over part of the day labour on the main road (Hamilton); and they believe that much better results would be obtained by contracts in much of that portion of main road work which entails the services of day labourers, some of them being far apart from the others.

As regards that part of the Derwent Valley Railway line which passes through the Road District, the Trustees are reluctantly obliged to express their regret that there have been doubtless serious mistakes made, which have caused a heavy useless expenditure which might have been avoided.

I have, &c.

ROBT. J. WILLS, *Chairman Lower Derwent Road Trust.*

T. C. JUST, *Esq., Secretary Royal Commissioners
of Public Works, Hobart.*

Coppington, 12th April, 1886.

SIR,

A SPECIAL Meeting of the Bream Creek Road Trustees was held on Saturday, 10th instant, to consider your Circular of 18th March, and I am instructed by the said Trustees to say that they do not think the money voted for this district has been judiciously laid out. The road between Bream Creek proper and Dunally, more particularly that portion known as the Beach Road, is now impassable, although scarcely twelve months made. The roads are as a rule formed with the material taken from them in forming, and which is principally clay, and covered over with so-called gravel taken from the adjacent surface; no rubbing over metal, consequently no foundation, only in a few cases. The consequence is, the first traffic after rain the roads are all but impassable. The Trustees also believe there must be a considerable sum altogether unexpended, as the contracts that have been taken could not have absorbed all the money voted.

I have, &c.

RICHD. COPPING, *Chairman Bream Creek Road Trust.*

T. C. JUST, *Esq., Secretary Royal Commission, Launceston.*

Upper Huon, April 12th, 1886.

SIR,

IN answer to your letter of the 18th of March, asking how the Public Works have been laid out in this district during the past three years (which is very unsatisfactory), there has been £2000 expended in this district. The first grant (£1000) was laid out on the road, the contractor being Denis D'Arcey. The work was done, and passed by inspectors. There was one small culvert in the contract done three times.

The second grant was £500. The work was done by Stubbins Brothers. There was £70 10s. cut off their section. The money was brought back to finish the work that D'Arcey ought to have done. The Road Trust had to pay £70 10s. to the Director of Public Works so that Stubbins might finish the work he had taken, and since the Road Trust had to expend £21 on the part of the road done by D'Arcey, as it was impassable.

The third grant was expended on the road leading to the Tiers, which was £500 in amount. This was also unsatisfactory.

If you think it necessary that witnesses should be examined, we are quite ready to meet your request.

I am, &c.

To the Honorable Commissioners on Lands and Works.

W. ALBURY, *Chairman.*

Ravenscroft, Upper Ringarooma, 12th April, 1886.

SIR,

IN reply to your circular letter of the 18th ultimo *re* Public Works in this district, I beg to inform you that they have been principally carried out by contracts, in a satisfactory manner. At the same time I would recommend that for the future the Government invite tenders so that the works can be executed during the summer, as the rainfall here during the winter is so heavy, which, together with the deep rich soil, adds considerably to the cost of construction then.

I have, &c.

A. R. WETTENHALL, *Chairman Ringarooma Road Trust.*

THOS. C. JUST, *Esq., Secretary Royal Commission, Hobart.*

Winton, Campbell Town, April 8th, 1886.

SIR,

I AM in receipt of your Circular of the 18th ult.; and as to the manner in which Public Works have been carried out in this district, desire to report as follows, viz. :—

In the matter of road construction, all works are carried out under contract. It is usual to invite tenders for the different works, though, in some cases, contracts are entered into without this being done. The Trust keep no regular staff of workmen, and the system of paying by the day is never adopted. An overseer of works is not employed. Each trustee takes the inspection of a fair share of the work.

The trustees find great difficulty in obtaining suitable material in some parts of the district, the old gravel pits being worked out; and the question arises whether it would not be more economical to use metal broken by machinery.

Earthenware pipes are used for culverts. Open drains across roads are put in with hand-broken metal.

I gladly take this opportunity of expressing the opinion (shared by all members of the Trust) that Road Boards should neither be expected to build bridges nor keep them in repair. If compelled to do so, they are at a disadvantage as regards every requirement for such purposes.

Feeling sure that if the Government were to build and keep in repair all bridges a great saving of public money would be effected,

I have, &c.

JOHN TAYLOR, *Chairman North Macquarie Road Trust.*

T. C. JUST, *Esq., Secretary Royal Commission, Launceston.*

ADDITIONAL APPENDIX.

DERWENT VALLEY RAILWAY.—Reply to Mr. Fincham's letter of 7th May, 1885, as to Back River wall—(see question 1998).

*Derwent Valley Railway, Tasmania, Contractor's Office,
New Norfolk, 7th May, 1886.*

SIR,

IN reply to your letter of this day's date, asking if the paragraph in mine of the 4th instant implied that the portion of the retaining wall that has fallen down near the Back River bridge was pointed out by you as a pattern both as regards the facework and also the thickness and strength, I may state that it was intended to apply to the facework and joints only, and not to the thickness and strength.

I regret that you view the paragraph as an attempt on the part of my agent to relieve me of a responsibility that you justly never threw upon me, as it was not intended for such, but to show you that the portion of the wall that gave way was well built as ordered by the Resident Engineer.

I may state that the letter referred to was written and posted before your visit to the works.

Enclosed you will find the copy of the letter as requested by you to be sent.

I have, &c.

J. FALKINGHAM, *per E.L.P.*

J. FINCHAM, *Esq., Engineer-in-Chief Tasmanian Railways.*

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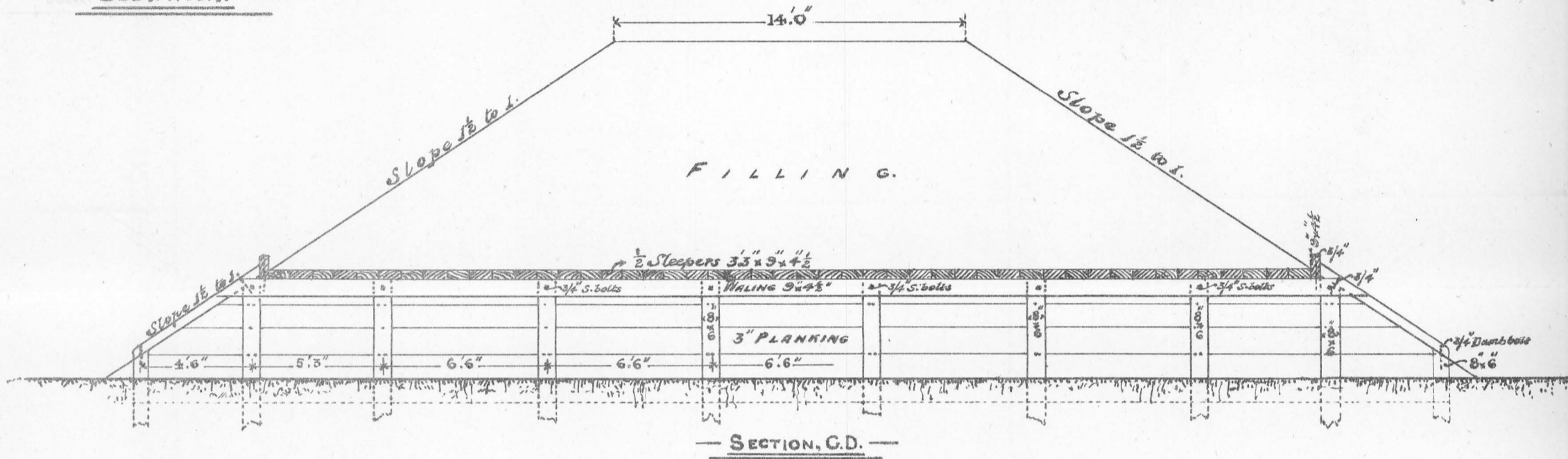
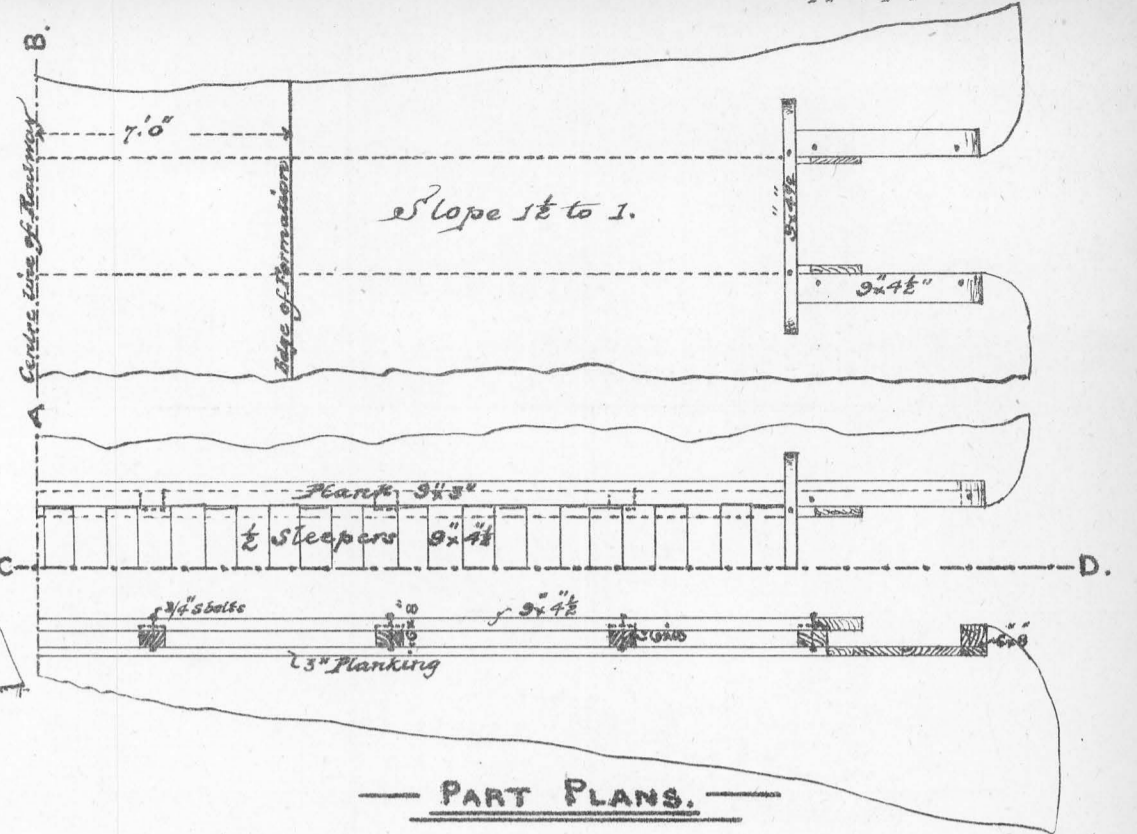
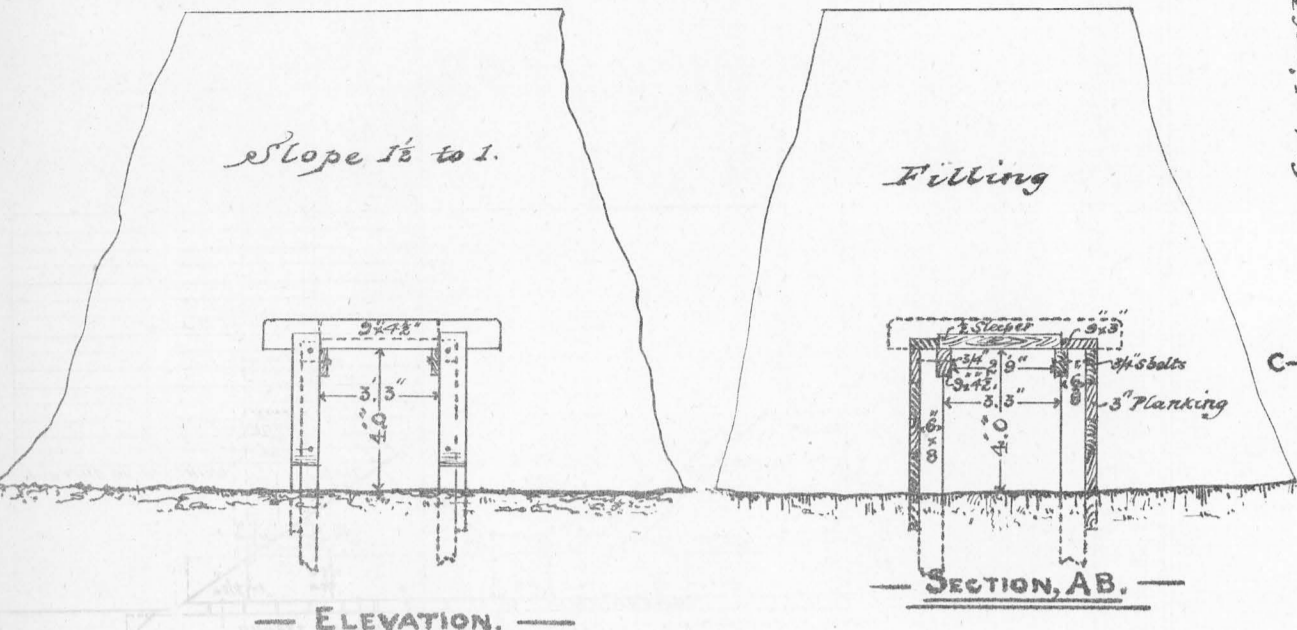
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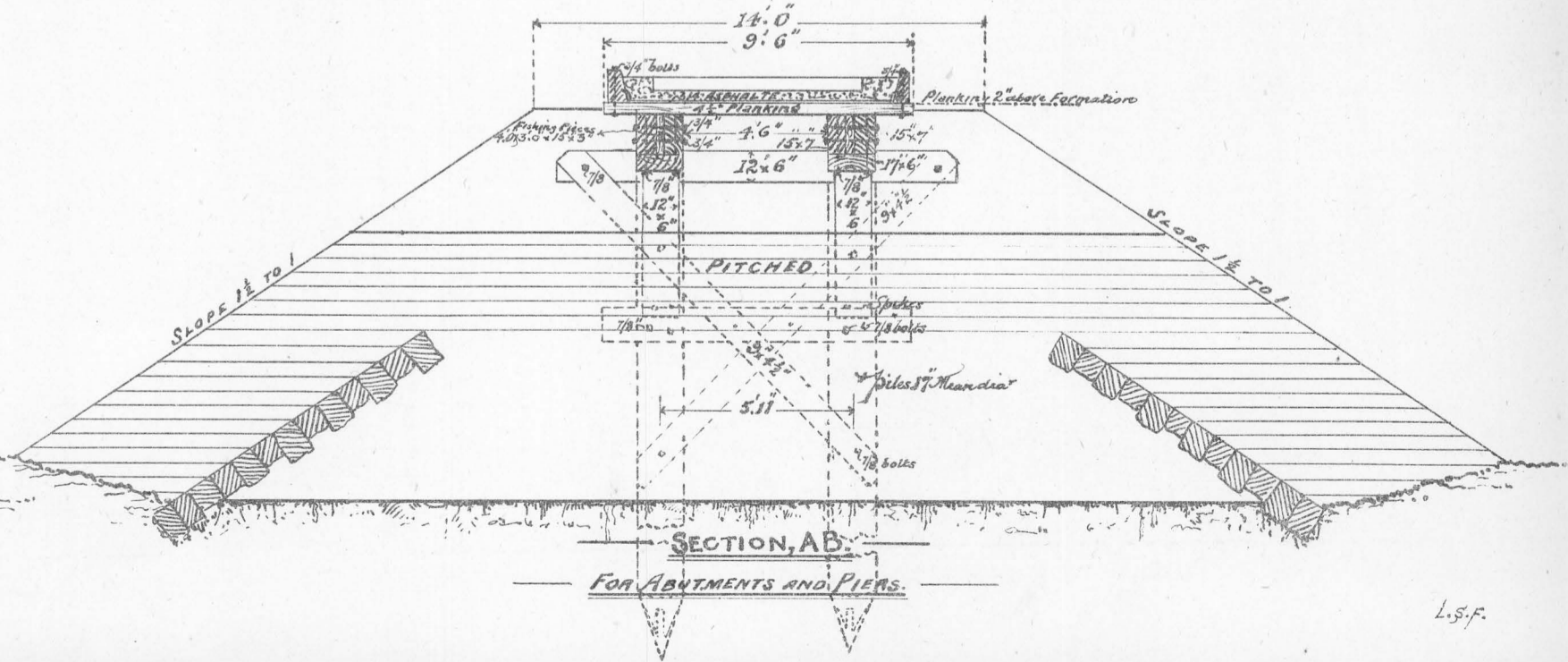
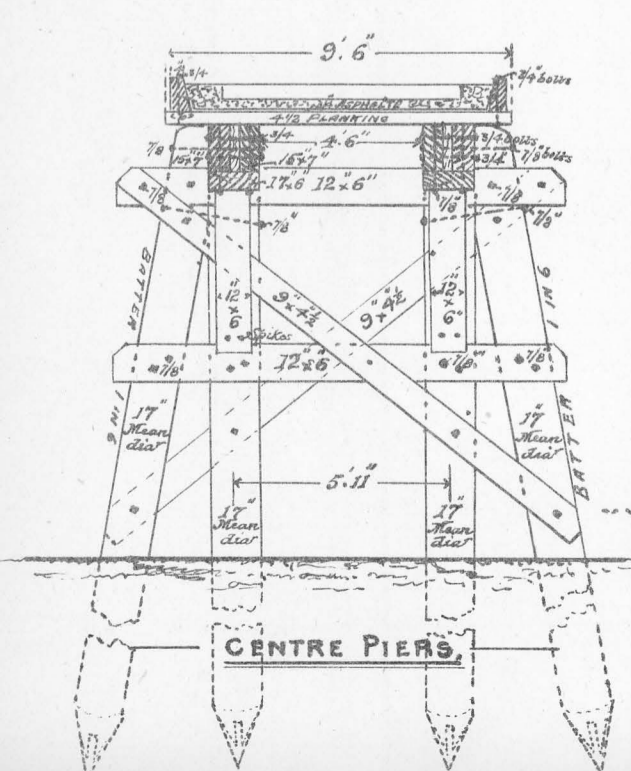
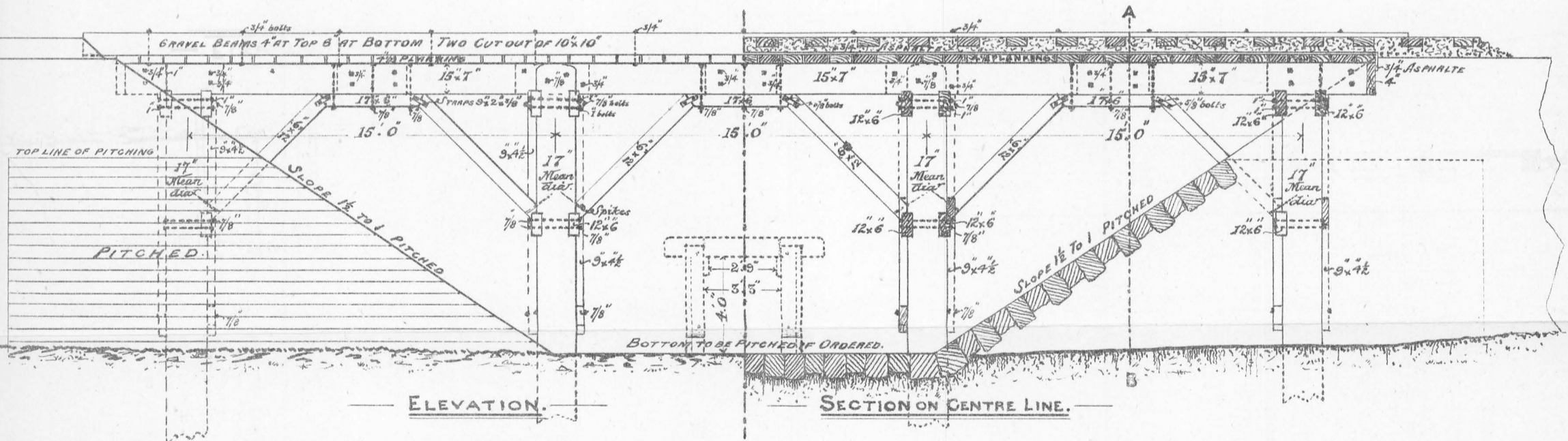
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As Now BUILT.

No. 1A

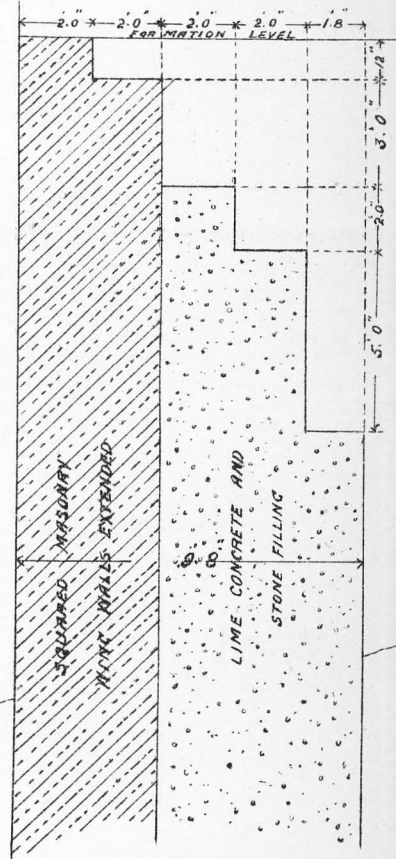
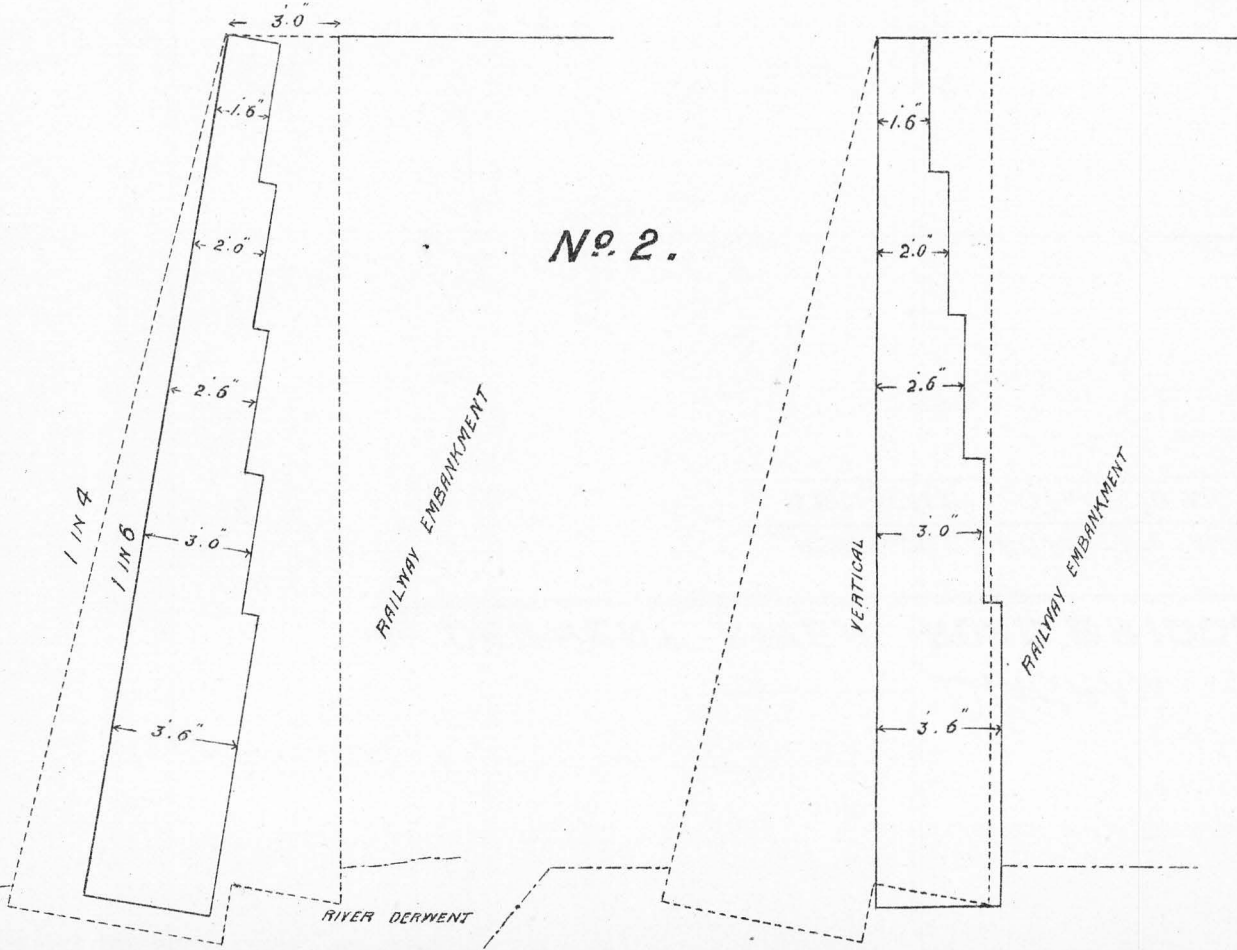


DERWENT VALLEY RAILWAY
RETAINING WALL AT BACK RIVER
Scale 3/16" to one foot.

WALL AT ITS DEEPEST PART CLOSE TO BACK RIVER BRIDGE.
 viz: ABOUT 24 FEET (WALLS GENERALLY AVERAGE 10 TO 15 FEET.)

WALL AT ITS JUNCTION WITH BACK RIVER BRIDGE.
 (WALL HERE WAS MADE UPRIGHT TO JOIN UPRIGHT WALL OF BRIDGE)

No 2A



WALL AS ORDERED TO BE BUILT BY RESIDENT ENGINEER SHOWN IN FULL LINES

WALL AS IT SHOULD BE BUILT ACCORDING TO STANDARD OF STRENGTH FIXED IN CONTRACT DRAWINGS - SHOWN IN DOTTED LINES

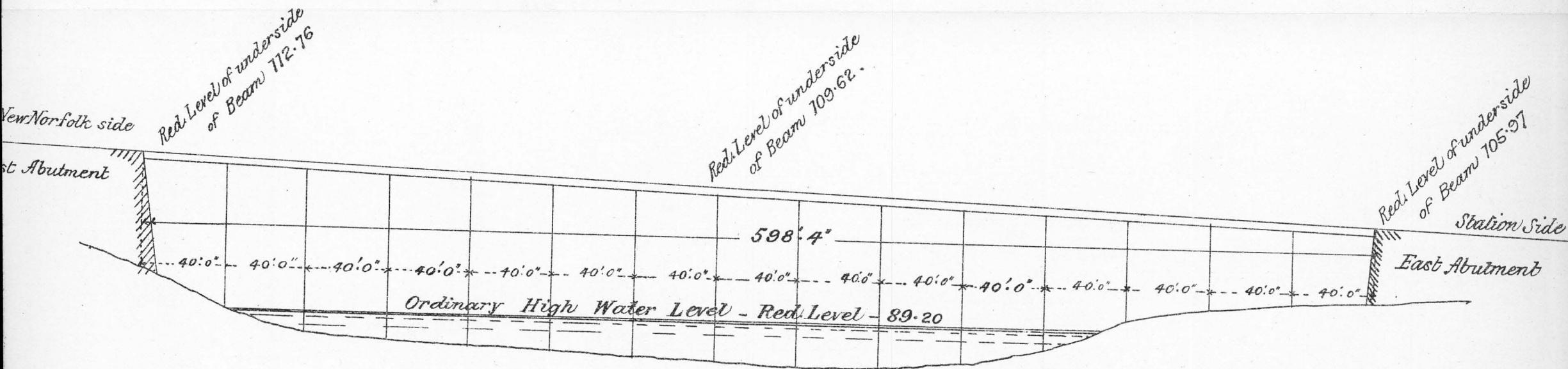
WALL AS NOW BEING BUILT.

Note: Contractor actually built Wall about 5.0' at bottom without extra claim as Stone was plentiful.

DIAGRAM
OF DERWENT RIVER ROAD BRIDGE AT NEW NORFOLK

APPENDIX
No 8.

HOR: SCALE: 60 FEET TO AN INCH. -
 VER: SCALE: 20 FEET TO AN INCH. -



Formation Level where prolongation of line of bridge intersects Centre Line of Railway - 110.00.

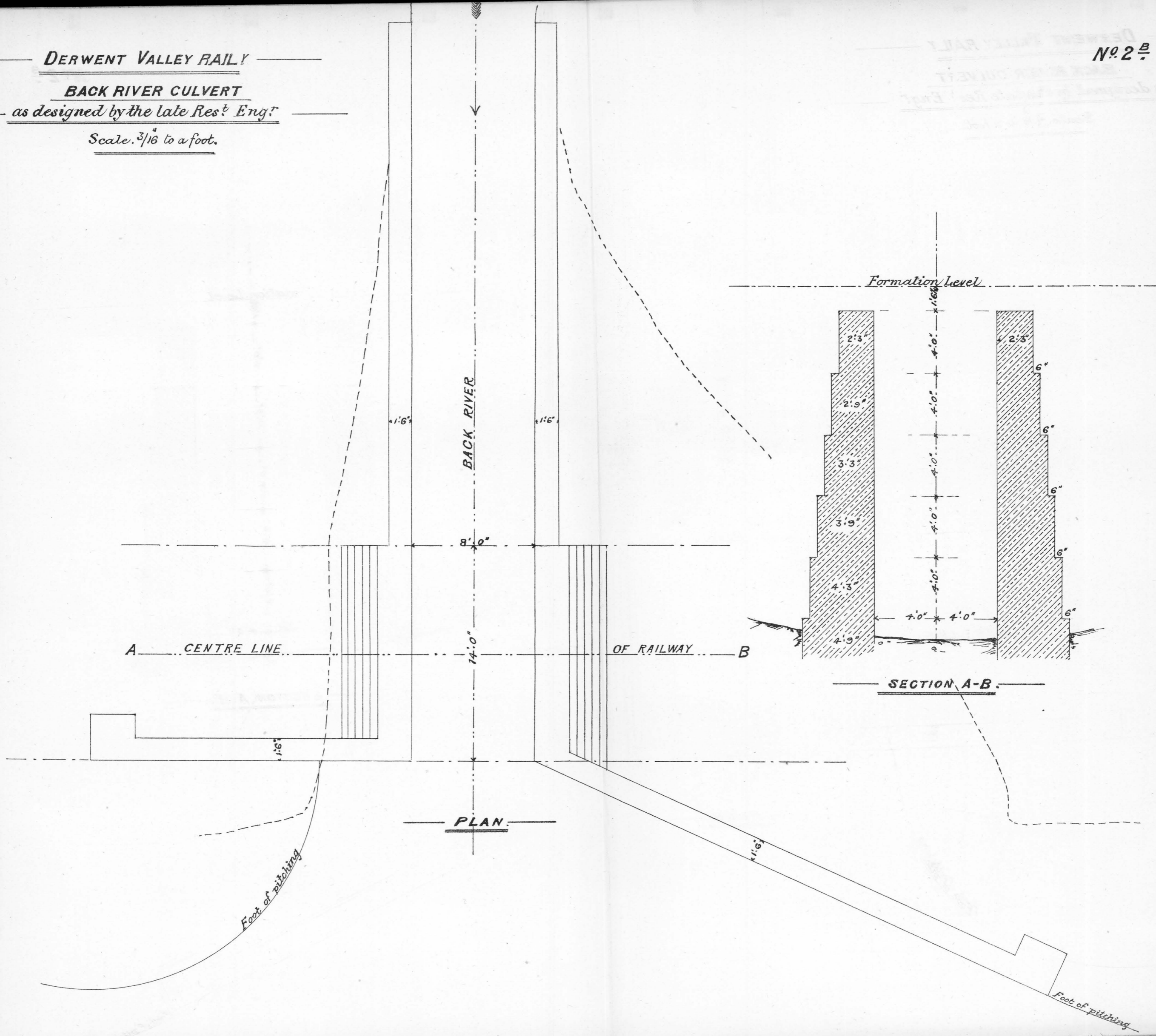
DERWENT VALLEY RAILWAY

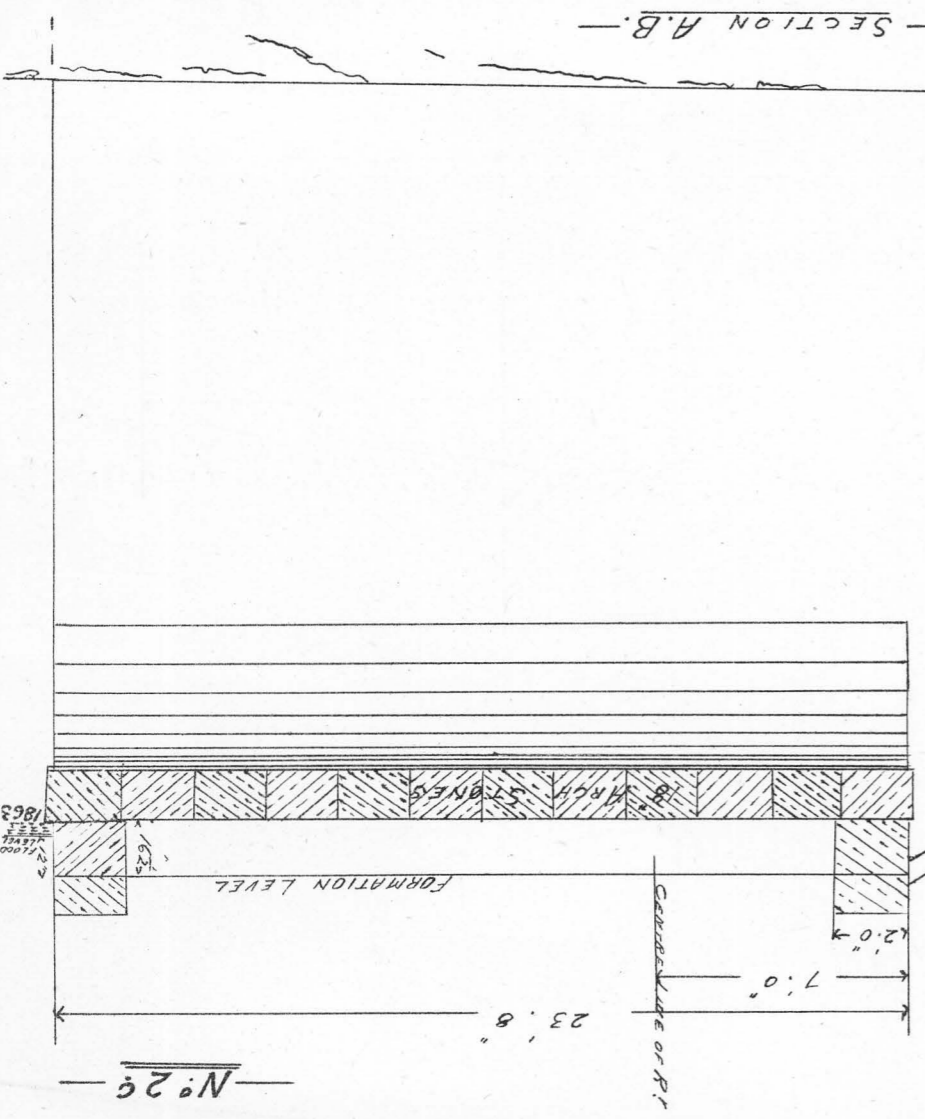
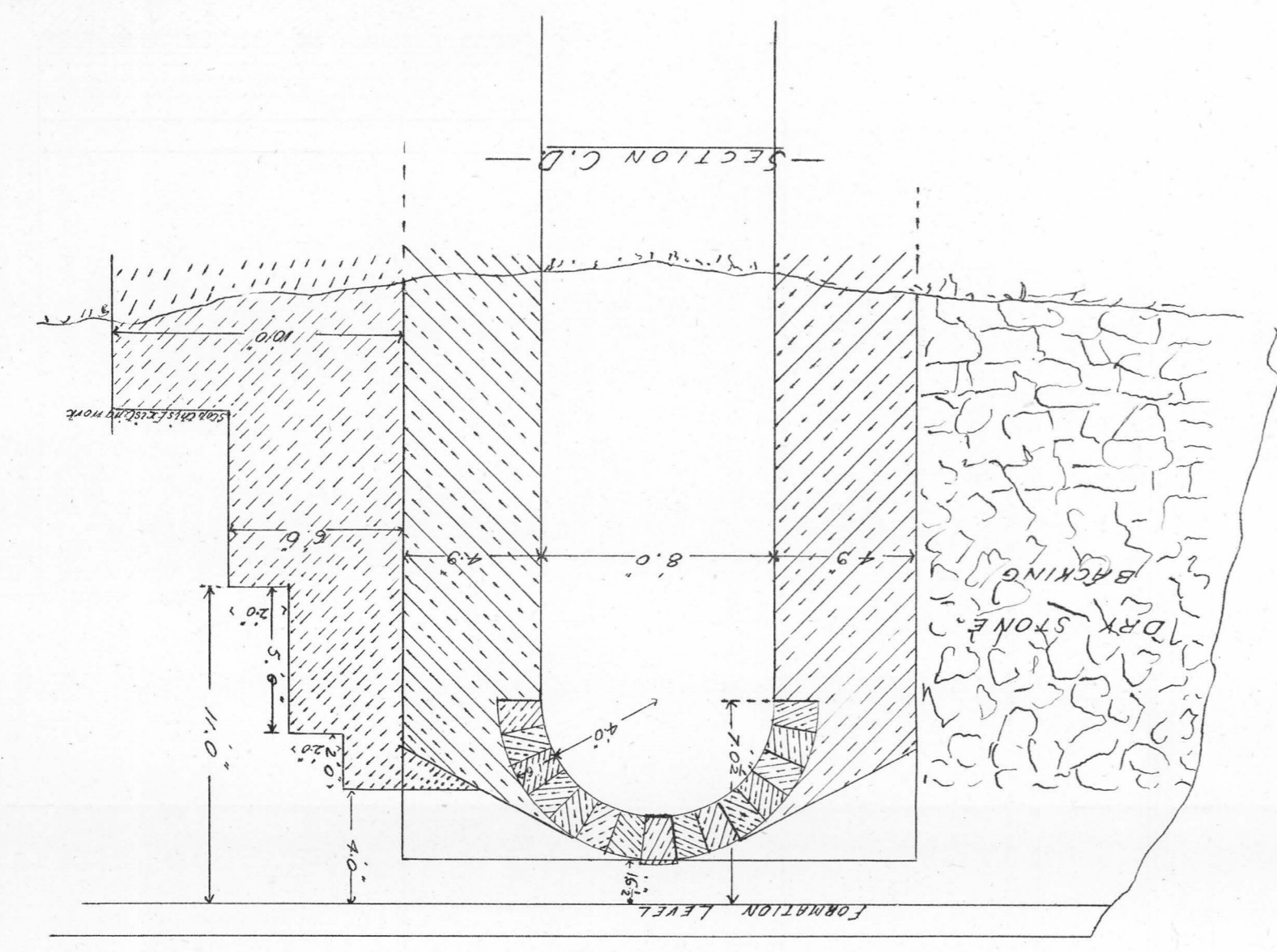
BACK RIVER CULVERT

as designed by the late Res^t Eng^r

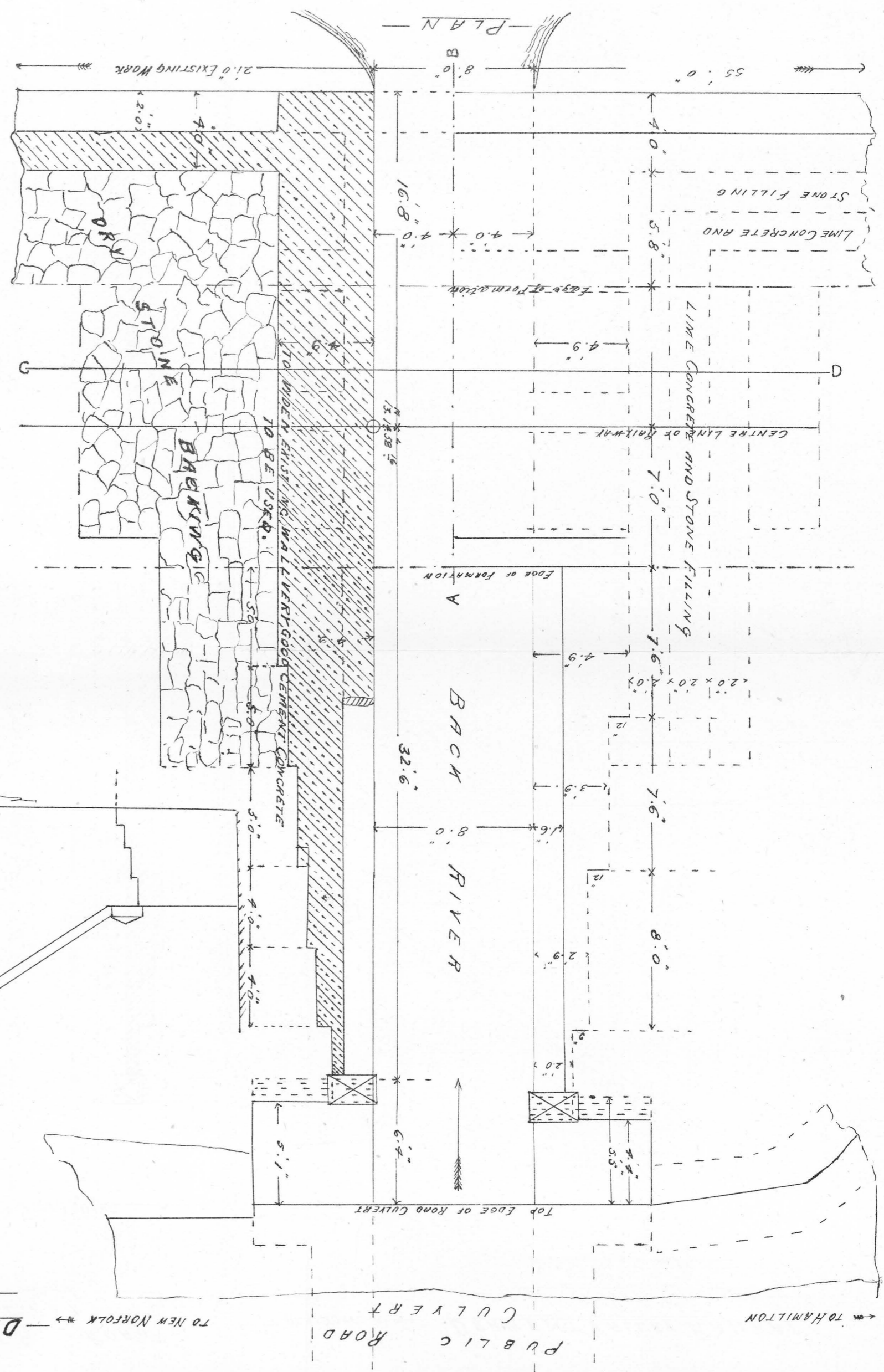
Scale $\frac{3}{16}$ " to a foot.

No 2^B





DERWENT VALLEY RAILWAY
BACK RIVER CULVERT
Scale 3/16" to a foot

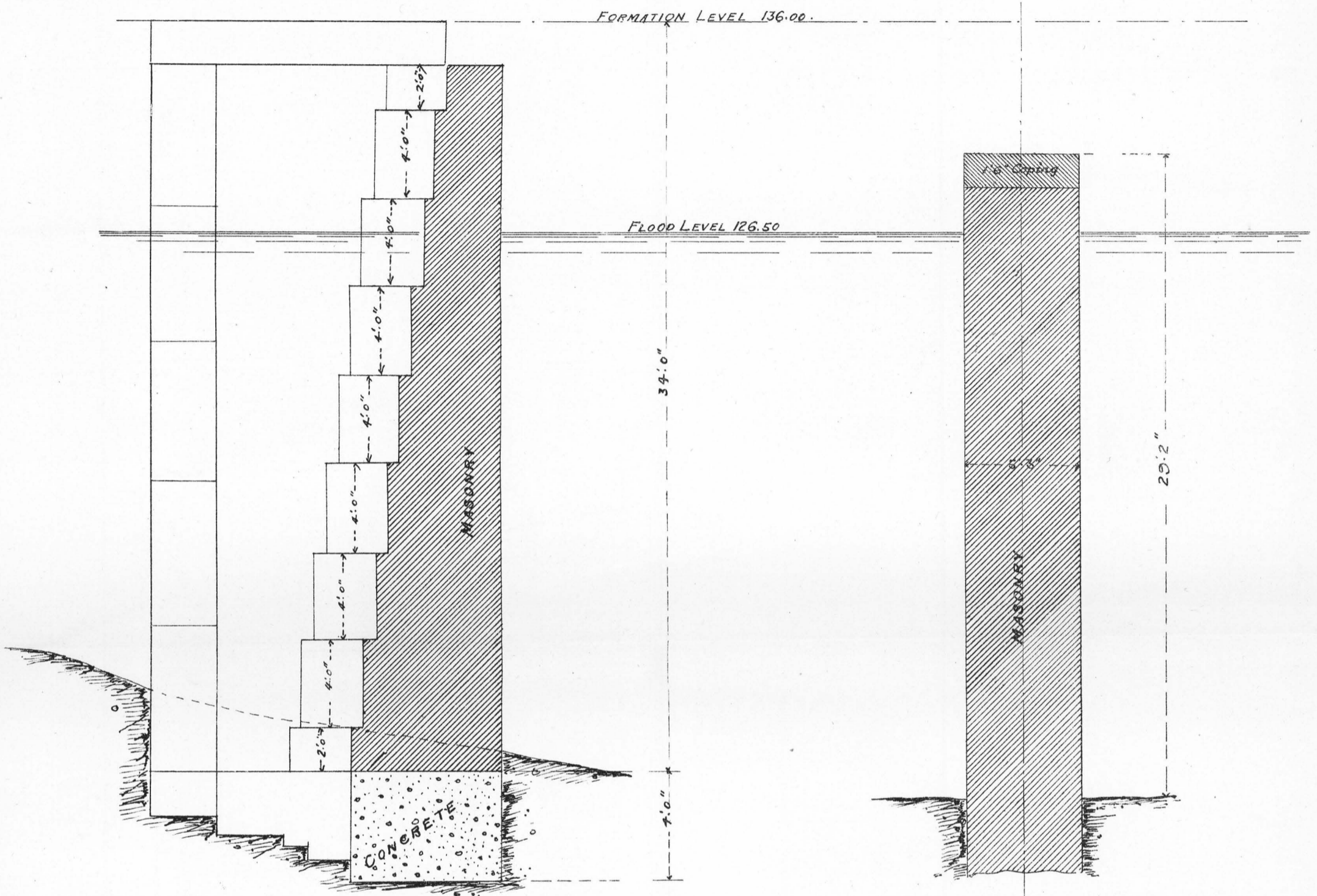


BRIDGE Nº1, OVER RIVER DERWENT.

EAST ABUTMENT & PIER Nº7.

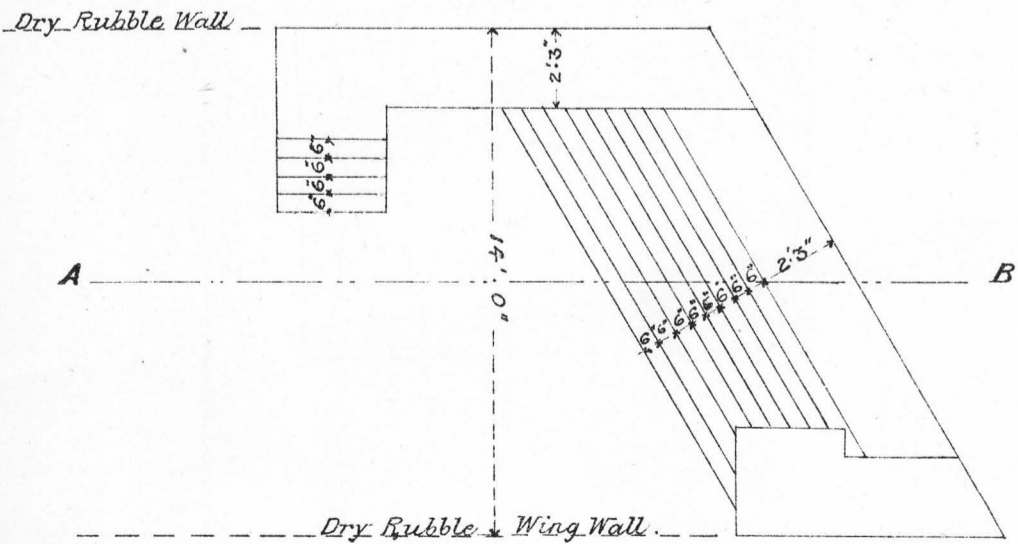
as designed by the late Res^t Eng^r.

Scale $\frac{3}{16}$ " to a foot.

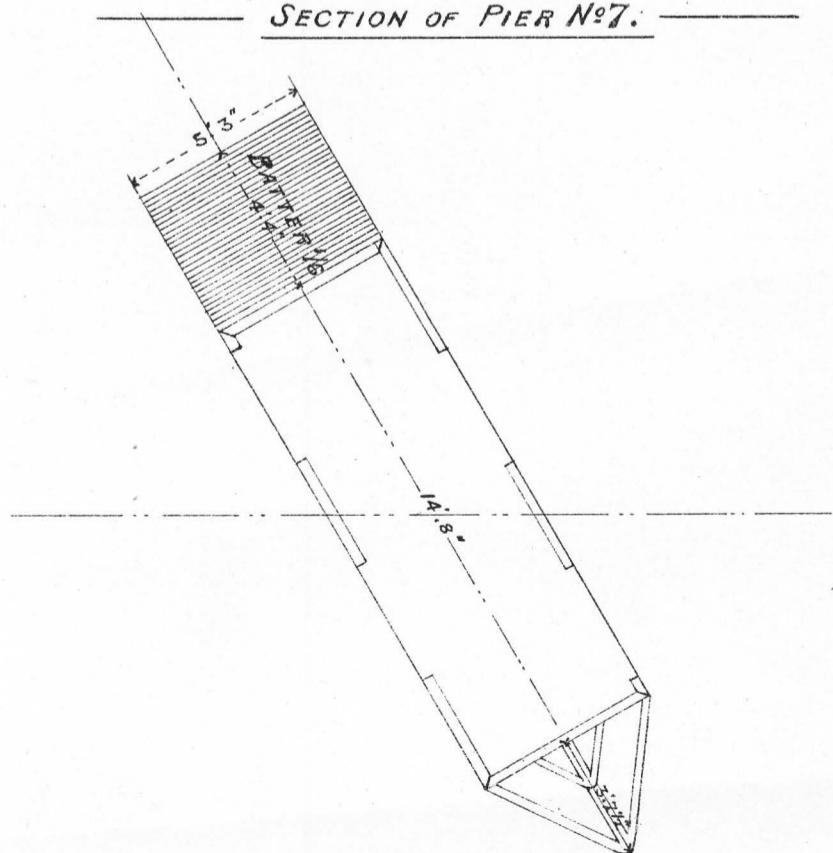


SECTION A-B OF EAST ABUTMENT.

SECTION OF PIER Nº7.



PLAN OF EAST ABUTMENT.



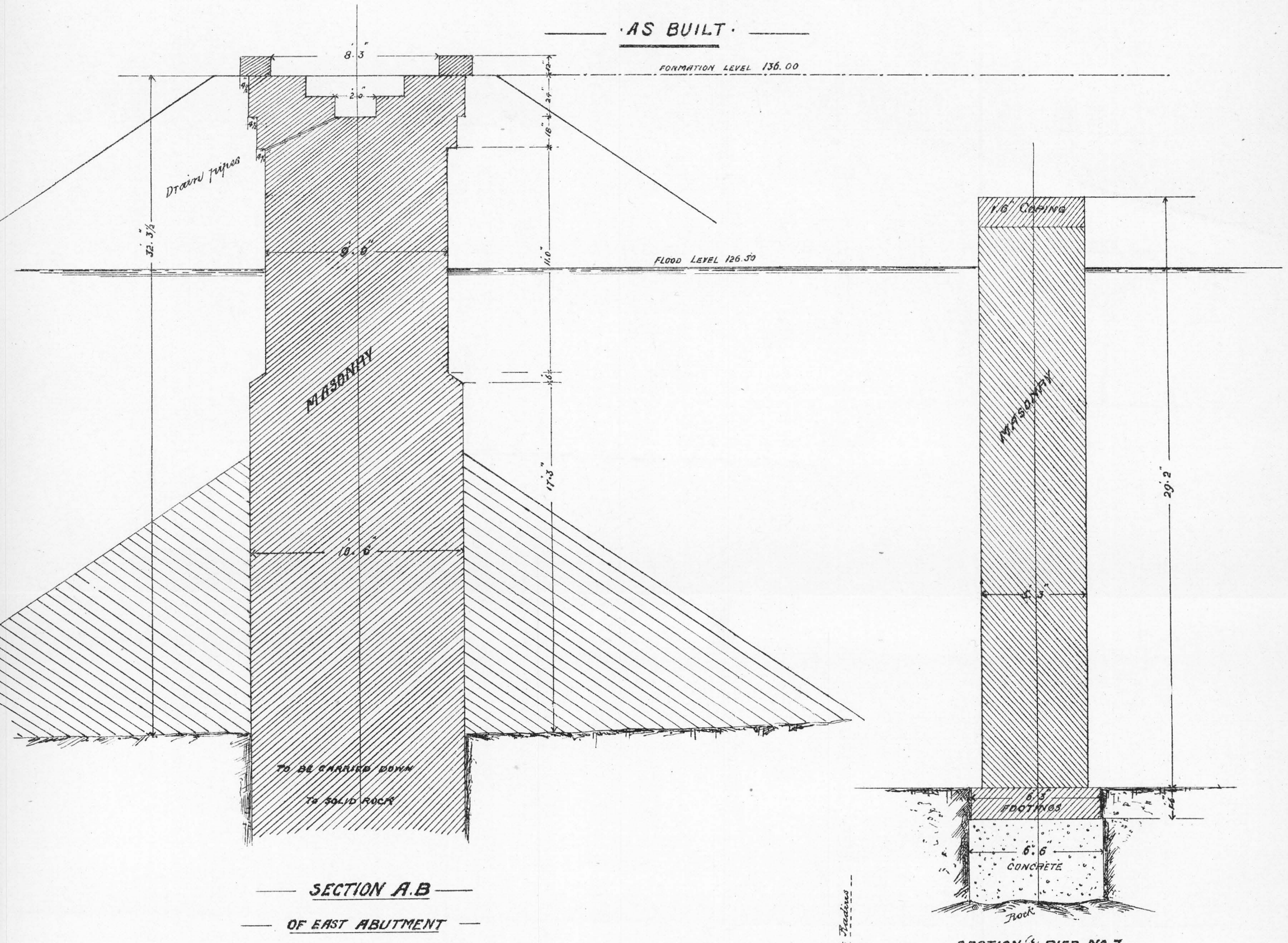
PLAN OF PIER Nº7.

DERWENT VALLEY RAILWAY
BRIDGE NO. 1 OVER RIVER DERWENT
EAST ABUTMENT AND PIER NO. 7

Scale $\frac{3}{16}$ to one foot.

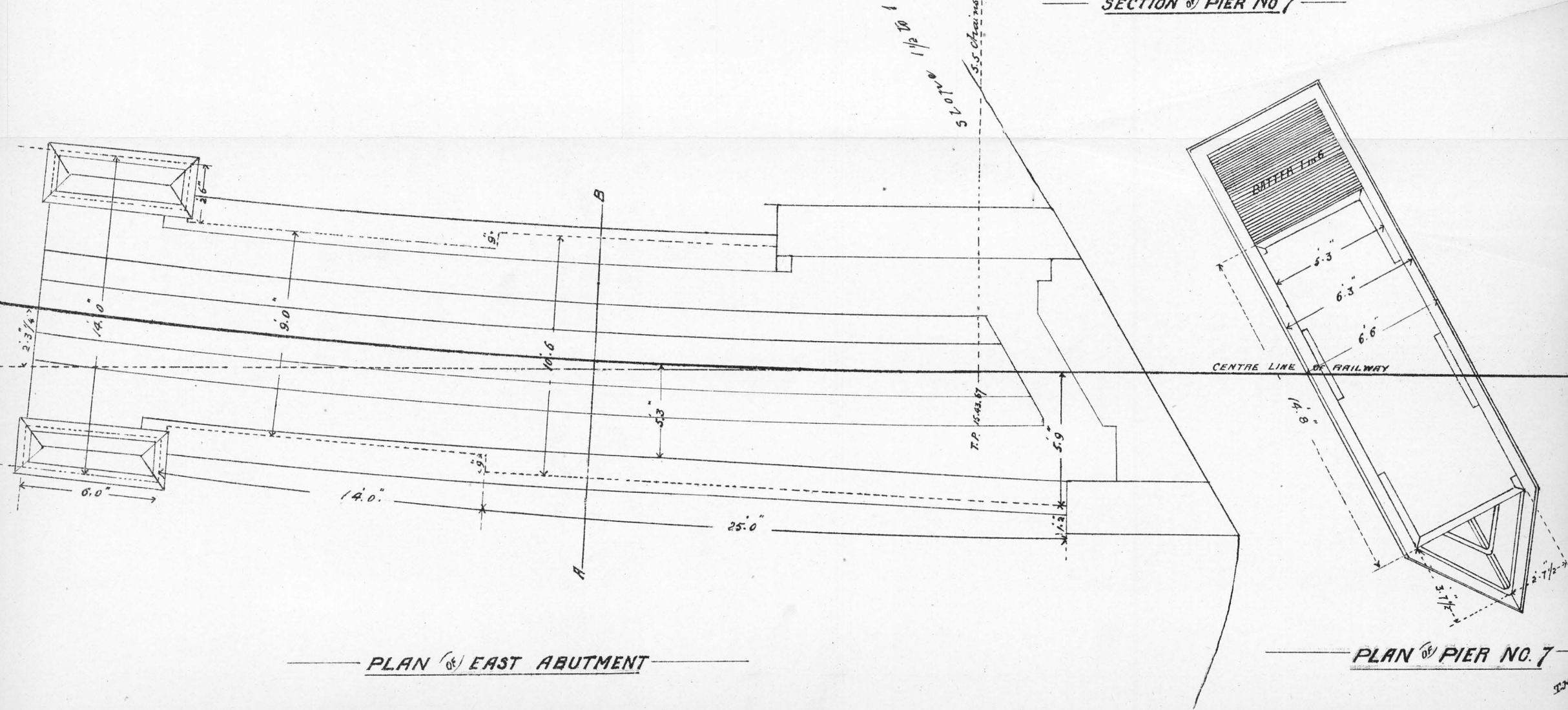
No 3 A

AS BUILT



SECTION A.B
OF EAST ABUTMENT

SECTION OF PIER NO. 7



PLAN OF EAST ABUTMENT

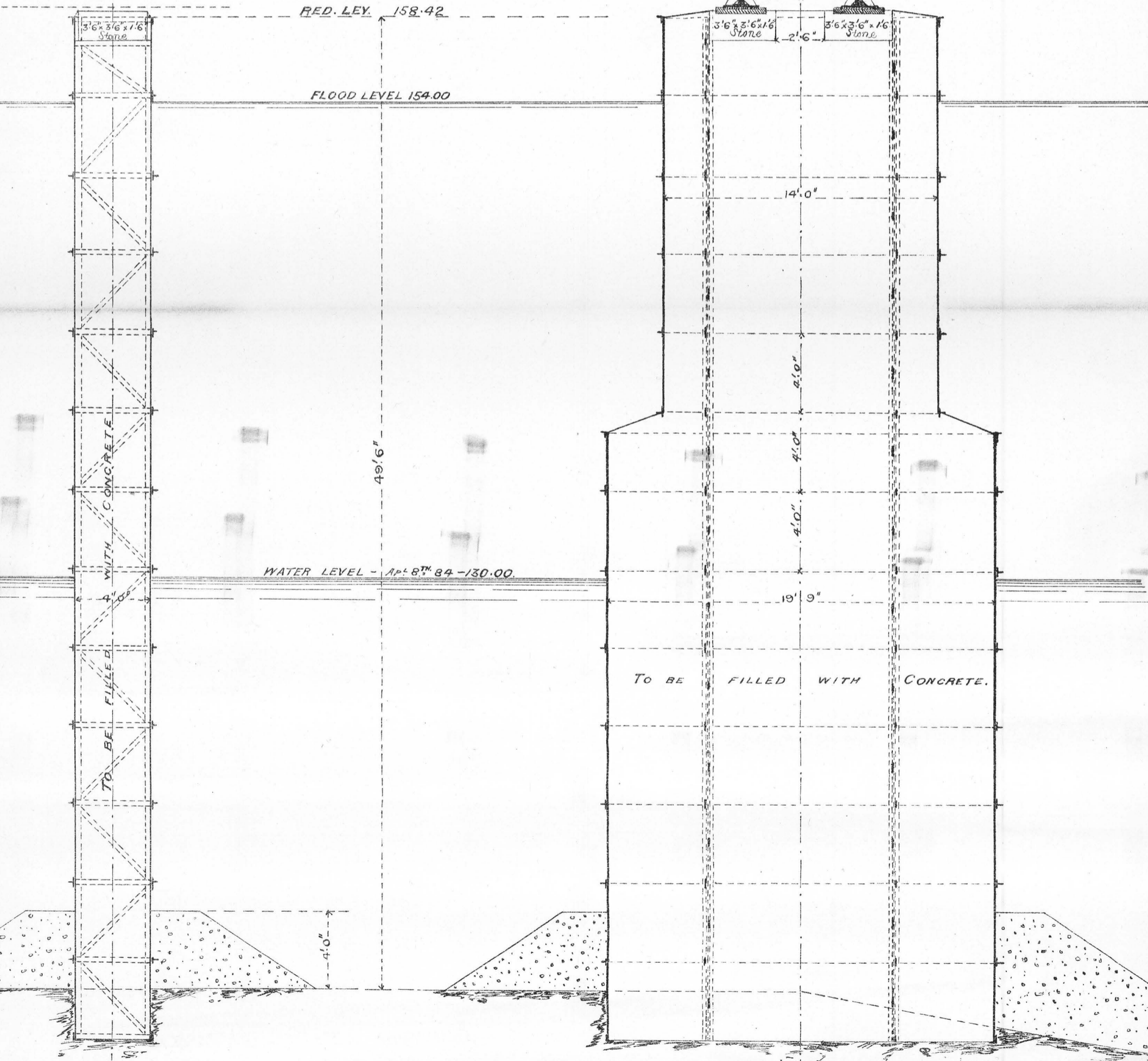
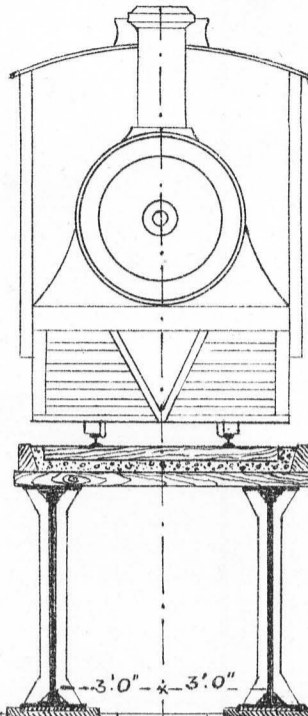
PLAN OF PIER NO. 7

DERWENT VALLEY RAILWAY

BRIDGE N^o 2 OVER DERWENT RIVER

MIDDLE PIER

Scale - 3/16" to one Foot



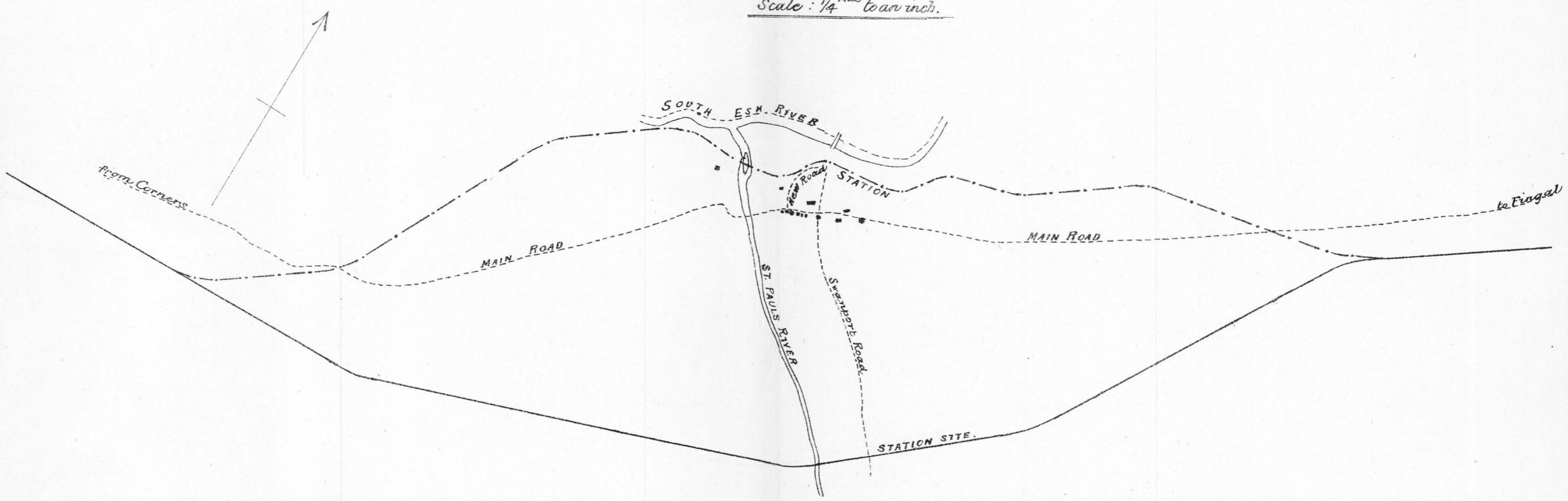
Depth of sinking in the rock foundation to be determined during construction.

CORNERS TO ST. MARYS.

Original Route shown in full lines.
Deviations d: dotted "

AVOCA DEVIATION.

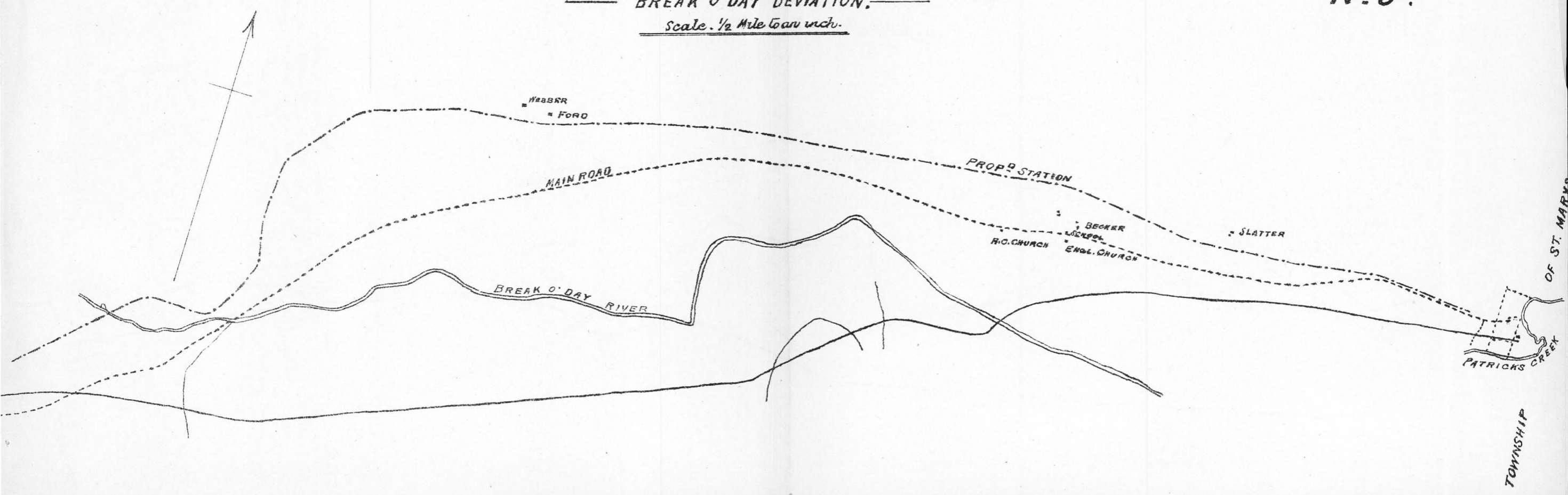
Scale: $\frac{1}{4}$ Mile to an inch.



BREAK O'DAY DEVIATION.

Scale: $\frac{1}{2}$ Mile to an inch.

No. 5A





LAUNCESTON AND SCOTTSDALE RAILWAY

Scale Two Miles to an Inch

Original Route - shown in Full Line

Deviation authorised by Parliament shown thus

Line being constructed shown thus

MERSEY & DELORAINIE RAIL:

N: 7.

— EXTENSION FROM LATROBE TO FORMBY.

Original Route - shown in full lines.

Deviations " " dotted "

FORMBY

SPREYTON STATION

STATION

DEVIATION

MAIN ROAD

TARLETON STATION

DEVIATION

STATION

LATROBE

RIVER MERSEY

OLD TRAMWAY

Sherwood

