Macquarie Heads Road – Pavement Investigation

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1. Introduction

The State Government has committed \$5 million under the Community Roads Program for road improvements at Strahan to support the expansion of the aquaculture industry through the development of an aquaculture hub at Smiths Cove. The Department of State Growth has engaged **pitt&sherry** to design the road upgrade works required to support the operation of the hub.

To inform the pavement design for the project **pitt&sherry** has conducted field investigations and analysed the results using known information regarding the existing traffic that uses the roads and the additional traffic that is expected to be generated through operation of the aquaculture hub.

This report discusses the findings of the field investigations, describes the methodology that has been used to develop the pavement design, outlines the construction work required to provide a pavement with a 20 year design life and documents the findings of an assessment into the availability of materials that comply with Department of State Growth Standard Specification G6 in the vicinity of the site.

2. Field Investigations

The following investigations were undertaken to assess the existing roads conditions:

- Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section): Deflection testing
 using the Deflectograph and nine excavation tests pits.
- Macquarie Heads Road (unsealed section): Deflection testing using a Benkelman beam and eleven excavation test pits.

Figure 1 shows the location of the roads involved on the project.

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Figure 1 – Location of the roads involved on the project

The Deflectograph testing results are included in Appendix A and the Benkelman beam testing results are included in Appendix B. The test pit logs including the results of Dynamic Cone Penetrometer (DCP) testing were available are included in Appendix C.

3. Traffic Calculations

Appendix D provides details of the methodology used to calculate the design traffic. Table 1 below summarises the design traffic for a twenty year design life taking into account the traffic expected to be generated by operation of the aquaculture hub.

Table 1 - Design traffic: 20 years design life

Road (Section)	Design Traffic Loading (ESA)
Harvey Street (Lyell Highway to Andrew Street)	1.4 x 10 ⁶
Harvey Street and Ocean Beach Road (Andrew Street to Macquarie Heads Road)	1.1 x 10 ⁶
Macquarie Heads Road (Airport entrance to Smith Coves Road)	1.1 x 10 ⁶

Further details regarding the traffic volumes can be found in the Concept Options Report prepared by pitt&sherry in February 2014.¹

4. Design Deflections

Using the design traffic loading described in Section 3 the following design deflections were obtained using the methodology in the *Austroads Guide to Pavement Design – Part 5*.

Table 2 – Design Deflections

Road (Section)	Design Deflection (mm)
Harvey Street (Lyell Highway to Andrew Street)	1.10
Harvey Street and Ocean Beach Road (Andrew Street to Macquarie Heads Road)	1.13
Macquarie Heads Road (Airport entrance to Smith Coves Road)	1.13

¹ Macquarie Heads Development Road – Concept Options Report (Doc. Number HB13604H002 – Rev. 00)

5. Methodology

5.1.1 Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section – Chainage 0.0km to 3.55km)

Deflection data was obtained for the Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section) on November 2013 using **pitt&sherry**'s Deflectograph. The deflection testing results were used to identify homogeneous sections of road. As recommended in the *Austroads Guide to Pavement Design — Part 5* the sections were selected by identifying sections of the deflection results where the coefficient of variance was below 0.25.

The design deflections indicated in Section 4 were used to identify sections of the road where the Characteristic Deflections were higher than the limits indicating pavement distress in need of intervention. Test pit locations were correlated where possible to high deflection areas.

The characteristic deflection adopted for each homogenous section of road was the highest value obtained between the Outer Wheel Path (OWP) and Inner Wheel Path (IWP). This approach was adopted due the constructability advantages of rehabilitating or reconstructing an entire lane instead of specifically over an OWP or IWP. The deflections and curvatures were adjusted using the procedures in the *Austroads Guide to Pavement Design – Part 5*.

Where the road needs to be widened an estimated California Bearing Ratio (CBR) value of 6% was used to design the pavement from chainage 1.25km to 1.95km while an estimated CBR value of 8% was used from chainage 1.95km to 3.55km (end of the seal). These were the lowest estimated CBR values found on those chainage intervals for the subgrade when analysing materials from the test pits excavated on the sealed section (TP1 to TP9).

For the sealed section chainage 0.0km is located at the junction of Harvey Street and Lyell Highway/Reid Street and chainage 3.55km is located at the end of the seal on Macquarie Heads Road. A set of drawings has been provided in Appendix F showing chainages and test pit locations.

5.1.2 Macquarie Heads Road (unsealed section – Chainage 0.45km to 2.20km)

A Benkelman beam was used to obtain deflection data on the Macquarie Heads Road (unsealed section) during January 2014. Test pits were also undertaken to facilitate an estimation of CBR for the existing road materials. The estimated CBR values for the materials excavated from the test pits were also compared with the Benkelman beam deflections results using a chart from TMR (Queensland) which correlates deflection, subgrade CBR and traffic volumes. This chart is included in Appendix E.

Where the road needs to be widened an estimated California Bearing Ratio (CBR) value of 8% was used to design the pavement. This was the lowest estimated CBR value found for the subgrade when analysing materials from the test pits excavated on the unsealed section (TP10 to TP20).

The unsealed section for Macquarie Heads Road starts around chainage 0.45km extending to chainage 2.20km with chainage 0.0km located at the junction of Ocean Beach Road and Macquarie Heads Road. A set of drawings has been provided in Appendix F showing chainages and test pit locations.

As the estimated CBR values of the existing pavement materials vary along the road, the road has been divided into sections to calculate the pavement thicknesses required over the existing unsealed road material. The sections were selected using the test pit locations illustrated in Figure 2*.

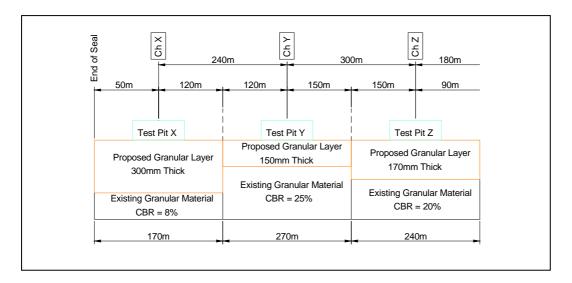


Figure 2 - Methodology used to estimate pavement thicknesses

6. Deflection Results

6.1 Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section)

6.1.1 Deflection Tests – PD Direction

Table 3 presents the deflection results for the Airport Bound Lane (PD). Chainage 0.0km is located at the junction of Harvey Street and Lyell Highway/Reid Street and chainage 3.55km is located at the end of the seal on Macquarie Heads Road. A set of drawings has been provided in Appendix F showing chainages and test pit locations.

Table 3 - Deflection Tests Results: Airport Bound Lane (PD)

Deflection Tests Results							
Harvey Str	eet/Ocea	n Beach Roa	d and Macquari	e Heads Road			
Airport Bo	und Lane	(PD)					
Chainage (km)		Design	Characteristic	Characteristic		
From	То	Extension (m)	Deflection (mm)	Deflection (mm)	Curvature (mm)		
0.00	0.30	300	1.10	0.95	0.17		
0.30	0.55	250	1.10	1.23	0.20		
0.55	0.70	150	1.10	0.76	0.14		
0.70	1.00	300	1.10/1.13	1.18	0.19		
1.00	1.25	250	1.13	1.25	0.21		
1.25	1.53	280	1.13	1.90	0.25		
1.53	1.95	420	1.13	1.27	0.22		

^{*} Distances, names and values used on Figure 2 are indicative only.

Deflection Tests Results								
Harvey Str	Harvey Street/Ocean Beach Road and Macquarie Heads Road							
Airport Bo	und Lane	(PD)						
Chainage (km)		Design	Characteristic	Characteristic			
From	То	Extension (m)	Deflection (mm)	Deflection (mm)	Curvature (mm)			
1.95	2.10	150	1.13	1.92	0.27			
2.10	2.25	150	1.13	1.16	0.27			
2.25	2.30	50	1.13	2.94	0.32			
2.30	2.65	350	1.13	0.77	0.16			
2.65	2.80	150	1.13	2.74	0.25			
2.80	3.05	250	1.13	0.99	0.17			
3.05	3.15	100	1.13	3.01	0.33			
3.15	3.25	100	1.13	0.71	0.20			
3.25	3.30	50	1.13	2.21	0.34			

1.13

6.1.2 Deflection Tests – CD Direction

3.55

3.30

Table 4 presents the deflection tests results for the Lyell Highway Bound Lane (CD). Chainage 0.0km is located at the junction of Harvey Street and Lyell Highway/Reid Street and chainage 3.55km is located at the end of the seal on Macquarie Heads Road.

0.95

0.19

Table 4 – Deflection Tests Results: Lyell Highway Bound Lane (CD)

250

Deflection	Deflection Tests Results								
Harvey Str	Harvey Street/Ocean Beach Road and Macquarie Heads Road								
Lyell Highv	way Bound	d Lane (CD)							
Chainage (Chainage (km) Design Characteristic Characteristic								
From	То	Extension (m)	Deflection (mm)	Deflection (mm)	Curvature (mm)				
0.00	0.20	200	1.10	1.17	0.17				
0.20	0.40	200	1.10	1.52	0.19				
0.40	0.60	200	1.10	1.09	0.18				
0.60	0.70	100	1.10	0.77	0.15				
0.70	0.90	200	1.10	1.25	0.20				
0.90	1.30	400	1.13	1.15	0.20				
1.30	1.50	200	1.13	1.68	0.26				
1.50	1.90	400	1.13	1.09	0.22				

Deflection Tests Results Harvey Street/Ocean Beach Road and Macquarie Heads Road								
Lyell High	way Bound	d Lane (CD)						
Chainage (Chainage (km) Design Characteristic Characteristic							
From	То	Extension (m)	Deflection (mm)	Deflection (mm)	Curvature (mm)			
1.90	2.35	450	1.13	2.10	0.27			
2.35	2.65	300	1.13	0.59	0.15			
2.65	2.80	150	1.13	2.99	0.29			
2.80	3.05	250	1.13	1.10	0.18			
3.05	3.10	50	1.13	4.03	0.35			
3.10	3.25	150	1.13	0.86	0.22			
3.25	3.40	150	1.13	1.43	0.30			
3.40	3.55	150	1.13	0.94	0.17			

6.2 Macquarie Heads Road (unsealed section)

6.2.1 Benkelman Beam Tests

Table 5 summarises the deflection results obtained with the Benkelman beam for the south and north bound lanes. The Benkelman beam test results for each chainage tested along the road is included in Appendix B.

The unsealed section for Macquarie Heads Road starts around chainage 0.45km extending to chainage 2.20km with chainage 0.0km located at the junction of Ocean Beach Road and Macquarie Heads Road. A set of drawings has been provided in Appendix F showing chainages and test pit locations.

Table 5 – Deflections Tests Results – Macquarie Heads Road

	Deflections Test Results – Benkelman Beam Macquarie Heads Road			
	South Bound Lane		North Bound Land	
	OWP CL OWP			OWP
Average Deflection (x0.01mm)	36.2	34.9		36.0

7. Pavement Analysis

7.1 Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section – Chainage 0.0km to 3.55km)

7.1.1 Pavement Analysis – PD Direction

Table 6 indicates the required overlay (asphalt or granular) thicknesses for the Airport Bound Lane (PD) expected to provide a twenty year design life.

Table 6 – Required Overlay Thicknesses: Airport Bound Lane (PD)

Required Overlay Thicknesses Harvey Street/Ocean Beach Road and Macquarie Heads Road Airport Bound Lane (PD)									
Chainage (Extension	Asphalt Overlay	Granular Overlay					
From	То	(m)	(mm)	(mm)					
0.00	0.30	300	-	-					
0.30	0.55	250	15	50					
0.55	0.70	150	-	-					
0.70	1.00	300	20	30					
1.00	1.25	250	20	60					
1.25	1.53	280	80	>150					
1.53	1.95	420	65	60					
1.95	2.10	150	85	>150					
2.10	2.25	150	85	30					
2.25	2.30	50	130	>150					
2.30	2.65	350	-	-					
2.65	2.80	150	120	>150					
2.80	3.05	250	-	-					
3.05	3.15	100	135	>150					
3.15	3.25	100	-	-					
3.25	3.30	50	100	>150					
3.30	3.55	250	-	-					

The following test pits were excavated in the PD direction:

- TP1 (Ch. 0.307km)
- TP2 (Ch. 0.600km)
- TP5 (Ch. 2.000km)
- TP7 (Ch. 2.470km)
- TP8 (Ch. 2.670km)

Test pits TP1 and TP2 indicate a gravel base course with thickness around 150mm and an estimated CBR value of 80%. Gravel was also identified as the subgrade material with an estimated CBR of 30%. The deflection results in the vicinity of these two test pits were relatively low reflecting the adequate pavement configuration.

The pavement at TP5 consists of two gravel layers on top of the subgrade with approximate thicknesses of 180 and 150mm. A CBR value of 25% has been estimated for both layers. Curvature values were high in this area possibly due to the low CBR value for the granular layers used as base course.

TP7 and TP8 indicate presence of the asphalt seal directly on top of the subgrade with no base course layer. In both test pits gravel was found as subgrade material with an estimated CBR value of 30%. Higher deflections were recorded in the vicinity of TP8 compared to TP7, possibly due to different moisture content levels.

7.1.2 Pavement Analysis – CD Direction

Table 7 shows the required overlay (asphalt or granular) thicknesses for the Lyell Highway Bound Lane (CD) expected to achieve a twenty year design life.

Table 7 – Required Overlay Thicknesses: Lyell Highway Bound Lane (CD)

Required Overlay Thicknesses Harvey Street/Ocean Beach Road and Macquarie Heads Road Lyell Highway Bound Lane (CD)									
Chainage ((km)	Extension	Asphalt Overlay	Granular					
From	То	(m)	(mm)	Overlay (mm)					
0.00	0.20	200	15	30					
0.20	0.40	200	40	130					
0.40	0.60	200	-	-					
0.60	0.70	100	-	-					
0.70	0.90	200	20	65					
0.90	1.30	400	5	20					
1.30	1.50	200	85	>150					
1.50	1.90	400	-	-					
1.90	2.35	450	85	>150					



Requ	uired O	verlay 1	「hickn	esses	
		. 10			

Harvey Street/Ocean Beach Road and Macquarie Heads Road

Lyell Highway Bound Lane (CD)

Chainage (km)			Asphalt	Granular		
From	То	Extension (m)	Overlay (mm)	Overlay (mm)		
2.35	2.65	300	-	-		
2.65	2.80	150	135	>150		
2.80	3.05	250	-	-		
3.05	3.10	50	>200	>150		
3.10	3.25	150	-	-		
3.25	3.40	150	95	110		
3.40	3.55	150	-	-		

The following test pits were excavated on the CD direction:

- TP3 (Ch. 1.000km)
- TP4 (Ch. 1.360km)
- TP6 (Ch. 2.280km)
- TP9 (Ch. 3.400km)

Test pit TP3 indicated a 200mm thick gravel base course with an estimated CBR value of 30% followed by a 350mm sand sub base with an estimated CBR of 10% and a sand subgrade with an estimated CBR of 8%. TP9 indicated a 100mm granular base course with a CBR value around 25% over a 600mm gravel base course with an approximate 25% CBR value. The subgrade characteristics are the same as described in TP3. Relatively low deflections were recorded in the vicinity of these test pits.

TP4 and TP6 show a similar structure with a granular base course around 400/500mm with an estimated CBR value around 25/30% over a sand subgrade with approximate CBR of 6%. Despite the significant thickness of the granular base course deflection values in the vicinity of these test pits were relatively high.

7.2 Macquarie Heads Road (unsealed section – Chainage 0.45km to 2.20km)

7.2.1 Pavement Analysis (unsealed section)

The estimated CBR values from the test pit materials vary within a range of 8% to 50% and possibly correlate with the low values obtained for the Benkelman Beam deflections. The approach adopted for the pavement design along the unsealed section of Macquarie Heads Road was to use the existing granular material on the road as a subgrade and add a quality subbase (if applicable) and base course on top. The calculated granular material thicknesses shown in Table 8 allow for the removal of approximately 100mm of the existing granular material for grading and levelling purposes prior to placement of the new pavement material.

Table 8 indicates the required granular material thicknesses for the new pavement in conjunction with the location of the test pits, chainages and CBR values adopted. Chainage 0.0km is located at the junction of Ocean Beach Road and Macquarie Heads Road. The set of drawings on Appendix F indicates the chainages and test pit locations along this section of the road.

Table 8 - Required Granular Material Thicknesses: Macquarie Heads Road (unsealed section)

Required Granular Material Thicknesses Macquarie Heads Road Unsealed Section									
Test Pit	Chainage (km)	CBR Value (%)	Required Granular Material Thickness (mm)						
TP10/11	0.660	8%	315						
TP12	0.900	25%	150						
TP13/14	1.200	12%	240						
TP15	1.380	30%	135						
TP16/17	1.560	20%	170						
TP18/19	1.860	12%	240						
TP20	2.040	30%	135						

8. Pavement Recommendations

8.1 Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section – Chainage 0.0km to 3.55km)

Figures 3, 4 and 5 in the sequence below indicate areas of pavement distresses. Sections in yellow require asphalt overlay between 5 and 20mm and can be considered non-priority areas while sections in red require asphalt overlay higher than 40mm and should be prioritised. The development of these figures is based on the data from Tables 6 and 7. The non-priority areas (yellow) can be monitored and included in a maintenance program.

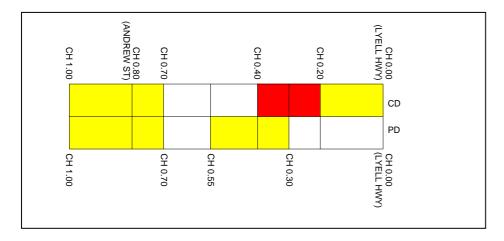


Figure 3 - Pavement distress areas (Ch. 0.00km to 1.00km)

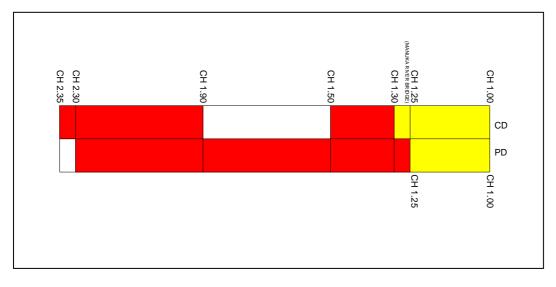


Figure 4 - Pavement distress areas (Ch. 1.00km to 2.35km)

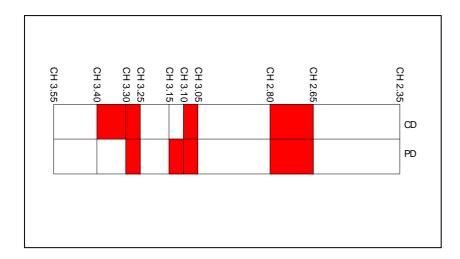


Figure 5 - Pavement distress areas (Ch. 2.35km to 3.55km)

The pavement rehabilitation based on the analysis of deflection tests results (Section 7.1) indicated that high values for asphalt overlay (>40mm) or granular overlay (>150mm) is required in the priority areas (red) for the pavement. Considering the low traffic volume environment and also the reasonable performance of the existing pavement observed during a visual inspection from **pitt&sherry**, the pavement design approach uses the existing good quality granular material on the road as a subgrade adding a granular material on top.

Table 9 indicates the recommended treatments for the priority areas on Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section) using the design approach described above.

Table 9 - Pavement Recommendation: Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section)

Pavement Recommendations Harvey Street/Ocean Beach Road and Macquarie Heads Road Sealed Section								
Chainage (km)	Direction	Recommendation						
0.20 to 0.40	CD	Mill off existing seal and apply a 40mm asphalt wearing course						
1.25 to 2.35	PD and CD	Remove existing seal and place a 150mm Base Class B granular overlay						
2.65 to 2.80	PD and CD	Remove existing seal and place a 150mm Base Class B granular overlay						
3.05 to 3.15	PD and CD	Section subjected to new road alignment (no rehabilitation works required)						
3.25 to 3.40	PD and CD	Remove existing seal and place a 150mm Base Class B granular overlay						

Despite the existing pavement having adequate structural capacity between chainage 1.50km and 1.90km in the CD direction (see Figure 4) it is recommended for practical construction reasons to rehabilitate the pavement in both directions from chainage 1.25km to 2.35km. The estimated CBR values for the existing pavement along this section indicate that a granular overlay of 150mm is adequate for the predicted traffic.

A granular overlay of 150mm is also recommended for the section between chainage 2.65km and 2.80km. Similarly to between chainage 1.25km and 2.35km the CBRs of the existing pavement along this section indicate that a granular overlay of 150mm is adequate for the predicted traffic.

The section between chainage 3.05km and 3.15km indicates structural deficiency. However, an upgrade of the junction between Ocean Beach Road and Macquarie Heads Road requires a new alignment for both roads which will result in the construction of new pavement consequently eliminating the need to rehabilitate or reconstruct the existing pavement in this section.

A granular overlay of 150mm is proposed between chainage 3.25km to 3.40km. The estimated CBR values for the existing pavement in this area indicate that a granular layer of 150mm is adequate for the predicted traffic.

8.2 Macquarie Heads Road (unsealed section – Chainage 0.45km to 2.20km)

The estimated CBR values for the existing granular material varies along the road as shown on Table 8. A pavement thickness of 315mm is required based on a CBR value of 8% for the subgrade. This thickness could be reduced when considering CBR values of 12 and 20% located in different sections of the road. However, a pavement thickness of 315mm is proposed along the road extension for CBR values from 8 to 20% to improve constructability, avoiding changes in layer thickness. Considering this approach two pavement structures are proposed:

- 315mm of granular material for CBR values: 8, 12 and 20%
- 150mm of granular material for CBR values: 25 and 30%

Table 10 indicates the required pavement structures to upgrade Macquarie Heads Road.

Table 10 - Pavement Structure (Macguarie Heads Road)

Pavement Thicknesses – Macquarie Heads Road (Unsealed)										
Chainages* (m)	Interval length (m)	Required Pavement Overlay Thickness (mm)	Proposed Layer/Material Configuration							
450** to 780	330	315	165mm Sub Base 1 and 150mm Base Class B							
780 to 1050	270	150	150mm Base Class B							
1050 to 1290	240	240	165mm Sub Base 1 and 150mm Base Class B							
1290 to 1470	180	135	150mm Base Class B							
1470 to 1710	240	170	165mm Sub Base 1 and 150mm Base Class B							
1710 to 1950	240	240	165mm Sub Base 1 and 150mm Base Class B							
1950 to 2040	90	135	150mm Base Class B							

^{*} Chainage 0 is located at the junction of Ocean Beach Road and Macquarie Heads Road

Placement of Sub Base 1 material is recommended where the required pavement overlay thickness is greater than 170mm.

^{**}Chainage 450 is located approximately at the end of the sealed section of Macquarie Heads Road

8.3 Pavement Widening

8.3.1 Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section – Chainage 0.0km to 3.55km)

As mentioned in Section 5.1.1 two different estimated values for the subgrade CBR were considered for the road widening on this section based on the test pits results:

- From chainage 1.25km to 1.95km CBR = 6%
- From chainage 1.95km to 3.55km CBR = 8%

Where pavement widening is required the proposed Base Class B thickness for the road widening should match with the thickness of the proposed Base Class B on the new pavement layer (on the existing road) for construction reasons. No pavement widening is required from chainage 0.0km to 1.25km.

Figure 6 indicates the pavement widening configuration for chainage 1.25km to 1.95km. Figure 7 indicates the pavement widening configuration for chainage 1.95km to 3.55km (end of the seal).

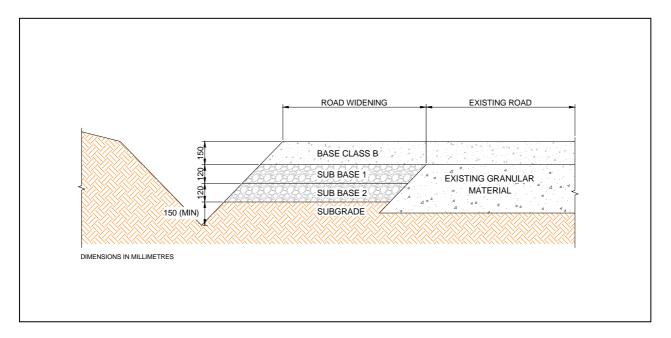


Figure 6 - Pavement Structure Proposed for the Road Widening (Chainage 1.25km to 1.95km - sealed section)

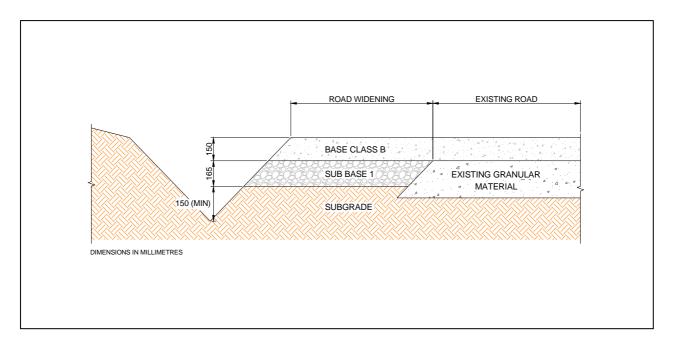


Figure 7 - Pavement Structure Proposed for the Road Widening (Chainage 1.95km to 3.55km - sealed section)

The extent of Base Class B, Sub Base 1 and Sub Base 2 material required will need to be determined in conjunction with development of the geometric design.

8.3.2 Macquarie Heads Road (unsealed section – Chainage 0.45km to 2.20km)

Figure 8 indicates the widening configuration for an estimated subgrade CBR value of 8%. This widening configuration has been extended for the existing road in locations where the existing granular material has an estimated CBR range from 8 to 20%.

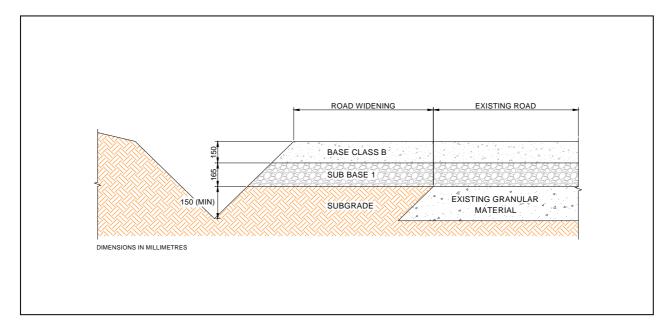


Figure 8 - Pavement Structure Proposed for the Road Widening (CBR 8 to 20% - unsealed section)

Figure 9 indicates the widening configuration for an estimated subgrade CBR value of 8%. This widening configuration does not apply through the entire extension of the existing road as the existing granular material in some section has an estimated CBR value varying from 25 to 30%.

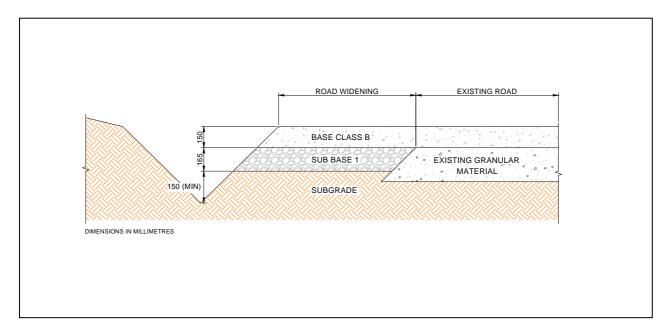


Figure 9 - Pavement Structure Proposed for the Road Widening (CBR 25 to 30% - unsealed section)

The extent of Base Class B and Sub Base 1 material required will need to be determined in conjunction with development of the geometric design.

9. Pavement Recommendations - Summary

9.1 Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section – Chainage 0.0km to 3.55km)

Table 11 summarises the pavement recommendations for the Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section).

Table 11 - Pavement Recommendation (summary): Harvey Street/Ocean Beach Road and Macquarie Heads Road (sealed section)

Pavement Recommendations (Summary) Harvey Street/Ocean Beach Road and Macquarie Heads Road (Sealed section)							
Chainage (km)	Recommendation	Figure					
0.00 to 1.25	No pavement widening or upgrade needed. Repairs as determined in contract as required.	-					
1.25 to 1.95	Removal of existing seal 150mm Base Class B on existing road. 390mm of granular material for road widening (150mm Base Class B + 120mm Sub Base 1 + 120mm Sub Base 2)	10					



Pavement Recommendations (Summary) Harvey Street/Ocean Beach Road and Macquarie Heads Road (Sealed section)								
Chainage (km)	Recommendation	Figure						
1.95 to 2.35 2.65 to 2.80 3.05 to 3.15 3.25 to 3.40	Removal of existing seal 150mm Base Class B on existing road. 315mm of granular material for road widening (150mm Base Class B + 165mm Sub Base 1)	11						
2.35 to 2.65 2.80 to 3.05 3.15 to 3.25 3.40 to 3.55	No rehabilitation of existing road. 315mm of granular material for road widening where required (150mm Base Class B + 165mm Sub Base 1)	12						

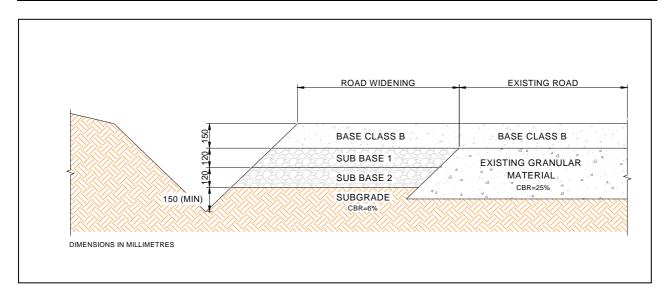


Figure 10 – Pavement Recommendation (Chainage 1.25km to 1.95km)

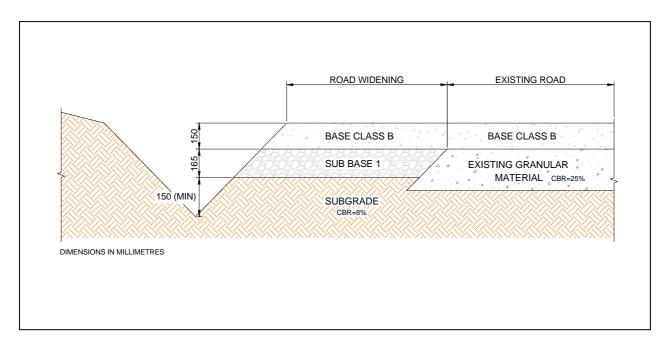


Figure 11 – Pavement Recommendation (Chainage 1.95km to 2.35km; 2.65km to 2.80km; 3.05km to 3.15km; 3.25km to 3.40km)

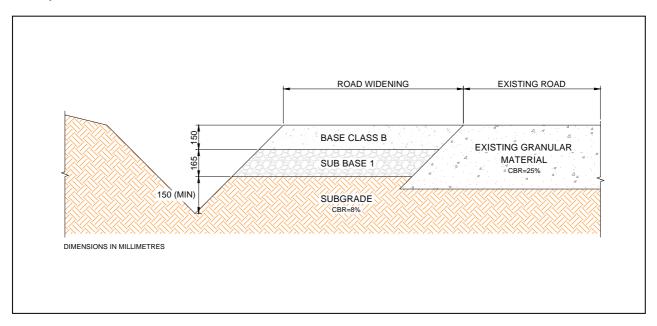


Figure 12 – Pavement Recommendation (Chainage 2.35km to 2.65km; 2.80km to 3.05km; 3.15km to 3.25km; 3.40km to 3.55km)

9.2 Macquarie Heads Road (unsealed section – Chainage 0.45km to 2.20km)

Table 12 summarises the pavement recommendations for the Macquarie Heads Road (unsealed section).

Table 12 - Pavement Recommendations (summary): Macquarie Heads Road (unsealed section)

Pavement Recommendations (Summary) Macquarie Heads Road (Unsealed section)								
Chainage (km)	Recommendation	Figure						
0.45 to 0.78 1.05 to 1.29 1.47 to 1.95	315mm of granular material for road widening and also as upgrade to the existing road (150mm Base Class B + 165mm Sub Base 1)	13						
0.78 to 1.05 1.29 to 1.47 1.95 to 2.04	150mm Base Class B on existing road. 315mm of granular material for road widening (150mm Base Class B + 165mm Sub Base 1)	14						

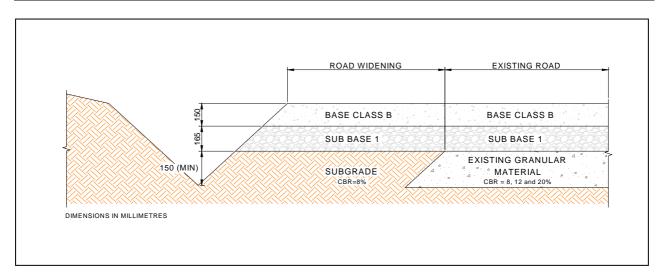


Figure 13 - Pavement Recommendation (Chainage 0.45km to 0.78km; 1.05km to 1.29km; 1.47km to 1.95km)

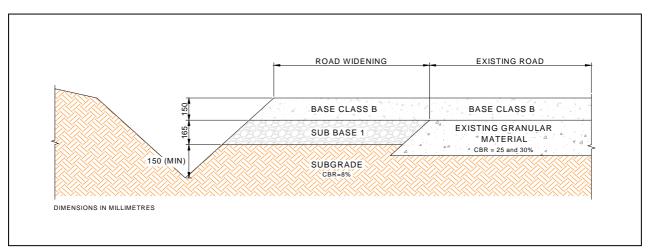


Figure 14 - Pavement Recommendation (Chainage 0.78km to 1.05km; 1.29km to 1.47km; 1.95km to 2.04km)

9.3 General Recommendations

Sections with high values of deflection on the sealed portion of Harvey Street/Ocean Beach Road and Macquarie Heads Road were identified as priority areas (Section 8.1). Moisture ingress on the pavement layers is likely to be the main cause of the high deflection values. Therefore, it is recommended to improve the existing drainage system when upgrading the pavement. The minimum vertical distance between the bottom of the table drain and the bottom of the lowest pavement layer shall be 150mm as indicated on Figures in Section 9.1 and 9.2.

The construction of a new pavement is required as part of the intersection upgrade between Ocean Beach Road and Macquarie Heads Road. This new pavement will be located approximately between chainage 2.85km and 3.15km and will consist of 150mm of Base Class B and 165mm of Sub Base 1 for an estimated CBR value of 8%.

10. Availability of Pavement Materials

Mineral Resources Tasmania has provided **pitt&sherry** with a list of the leases for category 3 (construction minerals) located on the West Coast. The following lease holders have been contacted to determine the availability of Sub Base 1 and Base Class A pavement materials complying with Department of State Growth Specification G6:

- K J Bailey
- Stornoway Projects Pty Ltd
- Gaspersic Contracting Pty Ltd.

The quarry production from K J Bailey is only suitable for Sub Base 2 material. Stornoway has advised that their quarry located in Queenstown is able to provide shoulder gravel. Gaspersic Contracting is the only member of Cement Concrete & Aggregate Australia (CC&AA) on the West Coast and a quarry inspection report from November 2013 was sent to **pitt&sherry**.

The test results in the inspection report show data from 2003 to 2013 revealing aggregates complying with the requirements of Department of State Growth Standard Specifications for Wet/Dry Strength variation, Atterberg limits and Flakiness Index. However, the quarry has not provided relevant documentation stating the material compliance with G6 Specification or evidence of a quality management plan that is used to control the quality of the product supplied from the quarry. The Gaspersic Contracting quarry is located at the Mt Lyell mine site approximately 40km from Strahan.

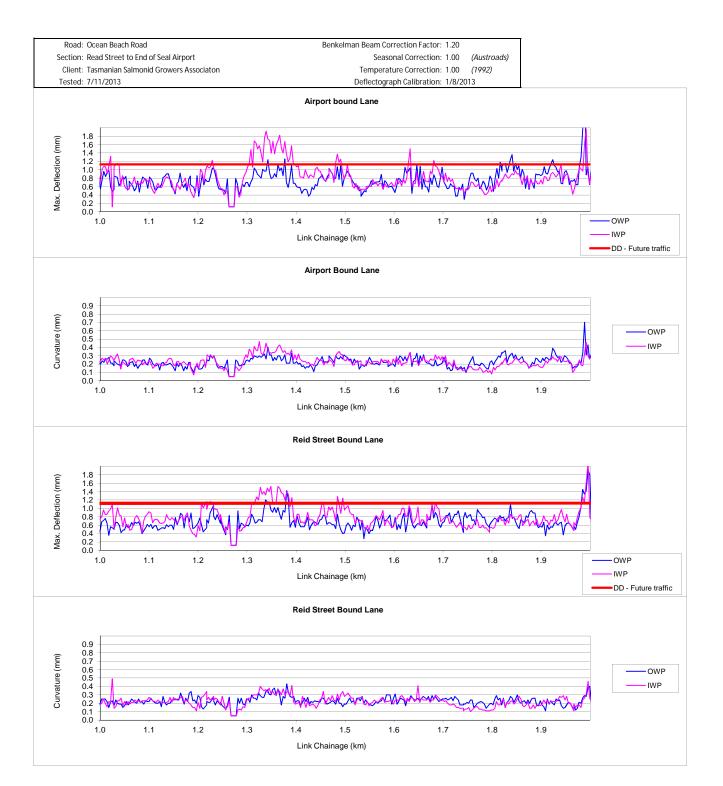
During development of the preliminary design further assessment of the Gaspersic Contracting quarry should be undertaken including verification of the ability to source the quantities of material required for the project.

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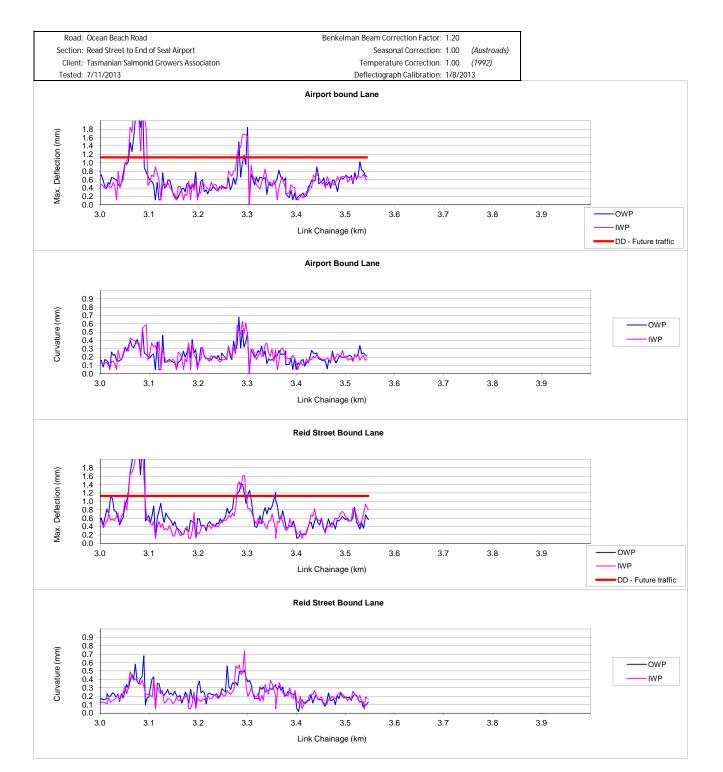
Appendix A

Deflectograph Test Results

Road: Ocean Beach Road Benkelman Beam Correction Factor: 1.20 Section: Read Street to End of Seal Airport Seasonal Correction: 1.00 (Austroads) Client: Tasmanian Salmonid Growers Associaton Temperature Correction: 1.00 (1992) Tested: 7/11/2013 Deflectograph Calibration: 1/8/2013 Airport bound Lane 1.8 1.6 1.4 1.2 1.0 0.8 0.6 0.4 0.2 0.0 Max. Deflection (mm) 0.0 0.1 0.2 0.3 0.6 0.7 0.8 0.9 OWP IWP Link Chainage (km) DD - Future Traffic Airport Bound Lane 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 Curvature (mm) OWP IWP 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 Link Chainage (km) Reid Street Bound Lane 1.8 1.6 1.4 1.2 1.0 0.8 0.6 0.4 0.2 0.0 Max. Deflection (mm) 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 OWP IWP Link Chainage (km) DD - Future traffic Reid Street Bound Lane 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 Curvature (mm) -OWP IWP 0.1 0.2 0.3 0.4 0.5 0.7 0.8 0.9 Link Chainage (km)



Road: Ocean Beach Road Benkelman Beam Correction Factor: 1.20 Section: Read Street to End of Seal Airport Seasonal Correction: 1.00 (Austroads) Client: Tasmanian Salmonid Growers Associaton Temperature Correction: 1.00 (1992) Deflectograph Calibration: 1/8/2013 Tested: 7/11/2013 Airport bound Lane 1.8 1.6 1.4 1.2 1.0 0.8 0.6 0.4 0.2 0.0 Max. Deflection (mm) 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 OWP IWP Link Chainage (km) DD - Future traffic Airport Bound Lane 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 Curvature (mm) OWP IWP 2.0 2.1 2.2 2.3 2.6 2.7 2.8 2.9 Link Chainage (km) Reid Street Bound Lane 1.8 1.6 1.4 1.2 1.0 0.8 0.6 0.4 0.2 0.0 Max. Deflection (mm) 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 OWP IWP Link Chainage (km) DD - Future traffic Reid Street Bound Lane 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 Curvature (mm) OWP IWP 2.1 2.2 2.3 2.5 2.6 2.7 2.8 2.9 Link Chainage (km)



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Appendix B

Benkelman Beam Results

PITT & SHERRY LABORATORY AND FIELD TESTING SERVICES REBOUND DEFLECTION TESTS - Test Method T104B

Road	Macqua	arie He	ads Roa	ad	Sectio	n	Airport to	Smiths	Cove	Road	Job	HB136	04
Start Chai			460m		End C		-	1960m		<u>-</u> -	Date	15/01	/2014
Reference	_		Ch 00 =			_				-		1 of	
Direction	South	n Bound			n Bound		Direction	South	n Bound	Lane		h Bound	
Wheel Path	OV	VP	С	L	OV	VP	Wheel Path	OV		С		OV	
Chainage	ı	F	I	F	I	F	Chainage	I	F	I	F	I	F
740	22	44			5	10	1500	14	28			19	38
720			19	38			1480			18	36		
700	20	40			14	28	1460	8	16			11	22
680			12	24			1440			7	14		
660	13	26			20	40	1420	7	14			16	32
640			14	28			1400			10	20		
620	13	26			20	40	1380	9	18			16	32
600			18	36			1360			7	14		
580	14	28			12	24	1340	18	36			19	38
560			16	32			1320			8	16		
540	17	34			17	34	1300	16	32			19	38
520			18	36			1280			7	14		
500	16	32			19	38	1260	7	14			11	22
480			26	52			1240			12	24		
460	9	18			14	28	1220	14	28			13	26
440							1200			12	24		
420							1180	8	16			10	20
400							1160			9	18		
380							1140	20	40			19	38
360							1120			17	34		
340							1100	20	40			15	30
320							1080			14	28		
300							1060	21	42			26	52
280							1040			17	34		
260							1020	46	92			18	36
240							1000			12	24		
220							980	17	34			25	50
200							960			26	52		
180							940	13	26			30	60
160							920			38	76		
140							900	14	28			27	54
120							880			25	50		
100							860	17	34			23	46
80							840			13	26		
60							820	15	30			19	38
40							800			7	14		
20							780	9	18			11	22
0							760			12	24		

Axle Weight = 8.2 Tonnes (by weighbridge)

Note* Dial gauge reading 100div = 1mm

Tested By: Neil Johnson Russel Guest

PITT & SHERRY LABORATORY AND FIELD TESTING SERVICES REBOUND DEFLECTION TESTS - Test Method T104B

Macqua	arie He	ads Roa	ad	Sectio	n	Airport to	Smith	s Cove	Road	Job	HB136	604
nage		460m		End Cl	hainag				=	Date	15/01	/2014
Point					_				-	Page		
South						Direction	Sout	h Bound	Lane			
OV	۷P	С	L	OV	VP	Wheel Path	0\	NP		CL	0'	WP
I	F	I	F	I	F	Chainage	1	F	1	F	I	F
						3000						
						2980						
						2960						
						2940						
						2920						
						2900						
						2880						
						2860						
17	34			12	24	2840						
		40	80			2820						
32	64			20	40	2800						
		12	24			2780						
21	42			20	40	2760						
		15				2740						
28	56			24	48	2720						
		26	52			2700						
16	32			26	52	2680						
		25	50			2660						
37	74			18	36	2640						
		30	60			2620						
26	52			23	46	2600						
		21	42			2580						
27	54			28	56	2560						
		30	60			2540						
25	50			26	52	2520						
		22	44			2500						
10	20			11	22	2480						
		15	30			2460						
24	48			19	38	2440						
		28	56			2420						
38	76			17	34	2400						
		19	38			2380						
14	28			13	26	2360						
		10	20			2340						
12	24			14	28	2320						
		11	22			2300						
16	32			17	34	2280						
		17	34			2260						
	17 32 21 28 16 37 26 27 25 10 24 38	Point South Bound OWP I F I F I 7 I 7 I 7 I 7 I 7 I 7	Point 460m South Bound Lane OWP C I F I I F I I I </td <td> Point Equation Equation </td> <td>Point 460m End Circle South Bound Lane North Bound OV I F I F I I F I I F I I F I I I F I I I F I I I I I I I I I I I I I I I I I I</td> <td>Point 460m End Chainage Point Lane Docum Beach Road South Bount Lane OWP I F I F I F I F I F I F I F I F I I F I<!--</td--><td>Point End Chainage South Bount Lane Direction South Bount Lane Direction OW Processor South Bount Lane Direction In Formation In South Bount Lane Direction In Journal Date of the Internal Date of t</td><td> Point Poi</td><td> Point Find Find</td><td> Point Poi</td><td> Point Poi</td><td> Point Poi</td></td>	Point Equation Equation	Point 460m End Circle South Bound Lane North Bound OV I F I F I I F I I F I I F I I I F I I I F I I I I I I I I I I I I I I I I I I	Point 460m End Chainage Point Lane Docum Beach Road South Bount Lane OWP I F I F I F I F I F I F I F I F I I F I </td <td>Point End Chainage South Bount Lane Direction South Bount Lane Direction OW Processor South Bount Lane Direction In Formation In South Bount Lane Direction In Journal Date of the Internal Date of t</td> <td> Point Poi</td> <td> Point Find Find</td> <td> Point Poi</td> <td> Point Poi</td> <td> Point Poi</td>	Point End Chainage South Bount Lane Direction South Bount Lane Direction OW Processor South Bount Lane Direction In Formation In South Bount Lane Direction In Journal Date of the Internal Date of t	Point Poi	Point Find Find	Point Poi	Point Poi	Point Poi

Axle Weight = 8.2 Tonnes (by weighbridge)

Note* Dial gauge reading 100div = 1mm

Tested By: Neil Johnson Russel Guest

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Appendix C

Test Pits and DCP Results

PITT & SHERRY - Field Testing Services PAVEMENT TEST PIT RECORD



Job Name Harvey Street - Pavement Investigation Job No HB13604																				
											Link Number				_					
									m from c					IS_		s	ide			
Grade	1.5	%	Cros	sfall	2	2	%	Se	eal W	/idth	ç	9	m		Seal Type flush se					eal
Grade1.5 % Crossfall 2 % Seal Width 9 m																				
											1311	oiue		<u> </u>						
	Pavement Drainage <u>Kerb and Gutter</u> Table Drains																			
Pavement Condition NDI Rut Depth B.B. Deflection																				
		ī																		
•	Depth (mm)		Materials Description												av. & mp	Mois Cond	sture dition	Nu	mple mber	
<u></u>	15		; Flush	n nedium	- augr	tz 000	udor v	uith oo	ndy fin	00 00	017				1/	D				A1 A2
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×6×	200	GRA\ brown		oarse,	quartz	, roun	ded,sli	ightly c	layey	sandy	fine, g	ırey			M	1D	٨	Л	,	A3
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$\times \bigcirc \times$	700											Estima								
\circ		Still G	oing 7	700mm	'															
\times O×																				
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INSITU CBF	R Depth	n (mm)	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
Agg Blows (_																			
CBR (Dynar Farnell - CI																				
Farnell - CI		2																		
Farnell - CI/2																				
Remarks an	d Sketo	ches				*Note	upper	r layer	CBR b	ased	on san	nple, ir	nsitu C	BR m	uch hiç	gher.				
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			N. P. C.	San Control																
	ولم																			
	1																			

Pit Details

Job Name	Harvey Street - Pavement Investigation										
Job No	HB13604										
Ref Point	Lyell Highway										
Link Number											
Pit No	TP1										
Pit Ch	307										
from CL	1.4										
side	LHS										
Grade	1.5										
Crossfall	2										
Seal W	9										
Pavement Type	flush seal										
Shoulder LHS	1										
Shoulder RHS	1										
Cut/Fill LHS	AG										
cut / fill											
Cut/Fill RHS cut / fill	AG										
Pav Drainage	Kerb and Gutter										
Table Drains	Nois and Guille										
Pav Condition	NDI										
Rut Depth											
BB Deflection											
Exc Method	Excavator and Auger										
Log By	NJ RG										
Date	24-Jan-14										

DCP Results											
depth	blows	cbr									
0											
50											
100											
150											
200											
250											
300	6	6	30								
350	7	1	3.5								
400	8	1	3.5								
450	9	1	3.5								
500	10	1	3.5								
550	11	1	3.5								
600	13	2	8								
650	14	1	3.5								
700	15	1	3.5								
750	16	1	3.5								
800	17	1	3.5								
850	18	1	3.5								
900	19	1	3.5								

L	₋ook ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		

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PITT & SHERRY - Field Testing Services PAVEMENT TEST PIT RECORD



Job Name Harvey Street - Pavement Investigation Job No HB13604																					
Reference Point (Cl 0.0) Lyell Highway (+)												Li	Link Number								
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Grade	9	%	Cros	ssfall	2.	.5	%	Sc	eal W	/idth	Ĩ	7	m		Seal Type flush se					eal	
	Grade9 % Crossfall2.5 % Seal Width 7 m Left Shoulder _1.0 _ m Right Shoulder <u>1</u> .0 _ m LH Side <u>_1 _ m</u> _																				
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	Pavement Drainage Kerb and Gutter Table Drains																				
Pavem	Pavement Condition NDI Rut Depth B.B. Deflection																				
Graphic Log	Depth (mm)		Materials Description													av. & mp	Mois	sture dition		mple mber	
	10		.; Flush							***	-							_		A4	
- 🗸 -	┢	GRAV	/EL; m	nedium	, quart	z, ang	ular, sı	lightiy	plastic	; with s	sandy i	fines, g	згеу		V	'D	Λ	И	·	A5	
<u> </u>	100											l Class Estima									
5 / (<u>140</u>	GRAI	/EI · C	oarse,		round	dad eli		-lavav	dv	fine o	***************************************			⊢ ,		\vdash		\vdash		
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	800			300mm	1										<u> </u>						
	CBR Depth	, ,	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	
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Farnell -	· CI/20 = CE	BR																			
	s and Sketo	ches				*Note	upper	r layer	CBR b	oased (on san	nple, ir	nsitu C	BR mu	uch hig	jher.					
	318	4	<u> </u>		 			\vdash			 			\vdash		 	<u> </u>	 			
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Job Name	Harvey Street - Pavement Investigation
Job No	HB13604
Ref Point	Lyell Highway
Link Number	
Pit No	TP2
Pit Ch	600
from CL	1.3
side	LHS
Grade	9
Crossfall	2.5
Seal W	7
Pavement Type	flush seal
Shoulder LHS	1
Shoulder RHS	1
Cut/Fill LHS	1
cut / fill	
Cut/Fill RHS	1
cut / fill Pav Drainage	cut Kerb and Gutter
Table Drains	Reib and Guilei
Pav Condition	NDI
Rut Depth	
BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14

DCP Results													
depth	blows		cbr										
0													
50													
100													
150													
200													
250													
300	6	6	30										
350	7	1	3.5										
400	8	1	3.5										
450	9	1	3.5										
500	10	1	3.5										
550	11	1	3.5										
600	13	2	8										
650	14	1	3.5										
700	15	1	3.5										
750	16	1	3.5										
800	17	1	3.5										
850	18	1	3.5										
900	19	1	3.5										

L	₋ook ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		

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Job Na	ob Name Harvey Street - Pavement Investigation Job No HB13604 Reference Point (Cl 0.0) Lyell Highway (+) Link Number																			
Refere	ence Poi	nt (C	0.0)	Lyel	ll Hig	hwa	V				(+)			Li	nk N	lumb	er		
	mbe _l T			-													HS_		s	ide
Grade	1	%	Cros	ssfall		4	%	Se	eal W	/idth	6.	.1	m		5	Seal 7	Гуре	fl	ush s	eal
				-									•		Seal Type flush seal RH Side _ 0 _ m					
				_		Hour	1C1	<u>, ,, ,</u>	_ '''-							1711	Side		<u>'''</u>	
	ent Drain	•		Good	<u> </u>				•		able	Drain	ıs	Poor						
Pavem	ent Cond	ition		NDI			ı	Ru	ıt Dep	pth			•	B.E	3. De	flecti	ion			
Graphic Log	(mm)		Materials Description													Excav. & Moisture Comp Condition			Nu	mple mber
	10	_	SEAL; Flush GRAVEL; fine, limestone, angular, slightly clayey, with fine sandy D M A9																	
- \(-	—		ines, grey																	
	100		Soil Classification GC Estimated CBR 30																	
	200		AND; medium with some coarse to cobble sized rounded quartz gravels, (20%) L MD																	
$\cdot \times \cdot \cdot$	⊢	yellou	ellow brown. MD																	
	300																			
	\vdash																			
$\cdot \times \cdot \cdot$	400																			
	\vdash															ļ	i		i	
$\cdot \times \cdot \cdot$	500										Soil	l Class	ificatio	n SM		ļ	i		i	
											ŀ	∃stima	ted CE	3R 10		ļ	i		i	
	 	SANE); med	lium gra	ained,	brown	,								L		٨	И	1	A11
$\cdot \times \cdot \cdot$	600		,	-												ļ	i		i	
	1															ļ	i		i	
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V.	700															ļ	i		i	
$\cdot \times \cdot \cdot$	\vdash										Soil		ificatio ated C			ļ	i		i	
	800	Still C	oi <u>ng 8</u>	300mm	ı <u></u>							ESum		,BR 0	<u> </u>		ł		l	
	CBR Depth	h (mm)		50		150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
	ws (Dyn Co		igwdapprox	igwdapprox		igwdapsilon	 -	 	igwdapprox	<u> </u>	 		 	 					 	
,	ynamic Cor · CI Scale	ne) 1	\vdash	$\vdash \vdash \vdash$	ightharpoonup	\longrightarrow	\longrightarrow		\vdash	\vdash							-	 		
	· CI Scale		\vdash	\vdash	\sqcap	\Box	\sqcap		$\vdash \vdash \vdash$									$\vdash \vdash \vdash$		
Farnell -	· CI/20 = CI	BR																		
Remarks	s and Sket	ches				*Note	upper	·layer	CBR b	ased (on san	nple, ir	nsitu C	BR mu	uch hig	jher.				
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Job Name	Harvey Street - Pavement Investigation
Job No	HB13604
Ref Point	Lyell Highway
Link Number	
Pit No	TP3
Pit Ch	1000
from CL	2.3
side	RHS
Grade	1
Crossfall	4
Seal W	6.1
Pavement Type	flush seal
Shoulder LHS	0.8
Shoulder RHS	1.5
Cut/Fill LHS	0
cut / fill	
Cut/Fill RHS cut / fill	
Pav Drainage	Good
Table Drains	Poor
Pav Condition	NDI
Rut Depth	
BB Deflection	
Exc Method	Excavator and Auger
Log By Date	NJ RG 24-Jan-14
Date	24-7aii-14

DCP Results													
depth	blows		cbr										
0													
50													
100													
150			[
200													
250													
300	6	6	30										
350	7	1	3.5										
400	8	1	3.5										
450	9	1	3.5										
500	10	1	3.5										
550	11	1	3.5										
600	13	2	8										
650	14	1	3.5										
700	15	1	3.5										
750	16	1	3.5										
800	17	1	3.5										
850	18	1	3.5										
900	19	1	3.5										

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Job Na	Job Name Harvey Street - Pavement Investigation Job No HB13604 Reference Point (Cl 0.0) Lyell Highway (+) Link Number																			
Refere	ence Poi	nt (C	0.0)	Lyel	ll Hig	hwa	<i>y</i> _	_	_		(+)			Li	nk N	umb	er	_	
	mbe			_			. – – –					_				RI			s	ide
Grade	0	%	Cros	sfall	2	,	%	S	eal W	/idth	6	.1	m		Ş	Seal 7	Гуре	fl	ush s	eal
				-			ļ						-		Seal Type flush seal RH Side _ 0 _ m					
				_		Hour	1Cı	0.0	_ !''_							1711	Side		<u> </u>	
	ent Drain	_		Fair					•		able	Drain	ıs	Poor		. – – -	:			
Pavem	ent Cond	lition		NDI				Ru	ıt Dep	pth				B.F	B. De	flecti	ion			
Graphic Log	Depth (mm)		Materials Description													av. & mp		sture dition	Nu	ımple ımber
$\overline{\mathcal{I}}$	15		SEAL; Flush GRAVEL; fine to cobble sized, quartz, rounded, with fine sandy fines, VD D-M A13																	
XO>	\vdash	grey																		
0×0	100	3 ,																		
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\times \bigcirc \rangle	1	grey r	ey brown																	
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	L											l Classi					i		i	
\times	500										E	Estima	ted CE	3R 30	i		i		i	
	500	SANE	D; medi	ium gr	ained,	slightl	y claye	ey, org	anic b	lack.				$\overline{}$	L M				A14	
$\cdot \times \cdot \cdot$	<u> </u>			-		_		•							İ		İ		İ	
	600													ļ	İ		İ		İ	
	600														İ		i		i	
	\vdash														i		i		i	
	1														i		i		i	
$\cdot \times \cdot \cdot$	700														i		i		i	
	1										Soi	l Class	ificatic	ın SM	İ		i		i	
$\cdot \times \cdot \cdot$											00		nated C				i		i	
'VIOLELL	800		oing 8			150	220	250	200	250	100	150	500		200	250	700	750	200	250
	CBR Depthws (Dyn Co	,	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
	ynamic Co		\vdash	$\vdash \vdash \vdash$		\Box		\vdash	\vdash	\vdash	$\vdash \vdash$	$\vdash \vdash$			\vdash		$\vdash \vdash \vdash$	 		
	· CI Scale	1																		
	· CI Scale																			
	· CI/20 = Cl s and Sket			$oldsymbol{ol}}}}}}}}}}}}}}}}}}$		*Note	unnei	r laver	CBR I	pased o	on sar	nnle ir	ositu C	BR m	uch hic	aher			Ш	
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1000																				

Job Name	Harvey Street - Pavement Investigation
Job No	HB13604
Ref Point	Lyell Highway
Link Number	
Pit No	TP4
Pit Ch	1360
from CL	1.2
side	RHS
Grade	0
Crossfall	2
Seal W	6.1
Pavement Type	flush seal
Shoulder LHS	0.5
Shoulder RHS	0.5
Cut/Fill LHS	0
cut / fill	
Cut/Fill RHS	0
cut / fill	
Pav Drainage	Fair
Table Drains	Poor
Pav Condition	NDI
Rut Depth BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14

depth	blows		cbr
0			
50			
100			
150			
200			
250			
300	6	6	30
350	7	1	3.5
400	8	1	3.5
450	9	1	3.5
500	10	1	3.5
550	11	1	3.5
600	13	2	8
650	14	1	3.5
700	15	1	3.5
750	16	1	3.5
800	17	1	3.5
850	18	1	3.5
900	19	1	3.5

	Look ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		
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Job Na	Job Name Harvey Street - Pavement Investigation Job No HB13604 Reference Point (Cl 0.0) Lyell Highway (+) Link Number																			
Refere	nce Poi	nt (Cl	0.0)	Lye	II Hig	ı <u>hwa</u> j	Y_ _ .				(+)			Li	nk N	umb	er		
	mbe																		s	ide
Grade	5	%	Cros	sfall	()	%	Se	eal W	/idth	6	.6	m		9	Seal 7	Гуре	fl	ush s	eal
	oulder	_																		
	ent Drain								•											
Pavem	ent Cond	ition		NDI				Ru	ıt De _l	pth		2		B.E	3. De	flect	ion			
Graphic Log	Depth (mm)		Materials Description													Excav. & Moisture Comp Condition				mple mber
9	20		EAL; Flush A15 RAVEL: coarse, quartz, sub-rounded slightly plastic, with medium VD D A16																	
-0-	400		RAVEL; coarse, quartz, sub-rounded slightly plastic, with medium VD D A16 andy fines grey brown																	
0-0	100																			
-0-			Soil Classification GC Estimated CBR 25																	
\circ – (200		Estimated CBR 25																	
)	- 700		GRAVEL; coarse to cobble sized, quartz, rounded, with sandy fines, VD D-M A17																	
-0-		slighti	ghtly plastic, grey brown. Soil Classification GC																	
\bigcirc – (300		Soil Classification GC Estimated CBR 25																	
-0-																				
		SANE	SANDSTONE; moderately weathered, yellow. (Insitu) VD																	
	400																			
	500																			
	600																			
	700																			
INICITLL	800	. ()	0	5 0	400	450	200	250	200	250	400	450	500	550	000	050	700	750	000	050
	CBR Depth ws (Dyn Co		0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
	/namic Co																			
	CI Scale	1																		
	CI Scale	2																		
	CI/20 = Cl and Sket					*Note	upper	laver	CBR k	hased	on sar	nnle ir	neitu C	BR mi	ich hid	nher				
Nemark	s and Skel	CHES	a color			NOLE	ирреі	layei	CDICE	Jaseu	OII Sai	iipie, ii	isitu C	DIX IIII		Jilei.				
Salar Salar	-																			
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Job Name	Harvey Street - Pavement Investigation
Job No	HB13604
Ref Point	Lyell Highway
Link Number	
Pit No	TP5
Pit Ch	2000
from CL	0
side	Centre
Grade	5
Crossfall	
Seal W	6.6
Pavement Type	flush seal
Shoulder LHS	0.5
Shoulder RHS	0.5
Cut/Fill LHS	8
cut / fill	cut
Cut/Fill RHS	0
cut / fill	Week and million
Pav Drainage Table Drains	Kerb and gutter
Pav Condition	kerb and gutter NDI
Rut Depth	0
BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14

depth	blows		cbr
0			
50			
100			
150			
200			
250			
300	6	6	30
350	7	1	3.5
400	8	1	3.5
450	9	1	3.5
500	10	1	3.5
550	11	1	3.5
600	13	2	8
650	14	1	3.5
700	15	1	3.5
750	16	1	3.5
800	17	1	3.5
850	18	1	3.5
900	19	1	3.5

Excav & comp very loose -VL loose - L medium dense - MD dense - D very dense - VD very soft - VS soft - S firm - F stiff - St hard - H	Mosture dry - D moist - M wet - W	cut fill cut fill

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Job Name	lob Name Harvey Street - Pavement Investigation Job No HB13604												3604						
Reference	Point (C	0.0)	Lyel	ll Hig	hwaj	v	_			(+)			Li	nk N	umb	er	_	
Pit Numbe			_								-							si	ide
Grade 4	4 %	Cros	ssfall	()	%	Se	eal W	/idth	6	3	m		ξ	Seal 1	vpe	fl	ush s	eal
Left Shoulde			-									•							
			-												1111	اماد	- - -	<u></u> -	
Pavement D	•		Fair								Drain	· ·	Fair		. – – -				
Pavement C	ondition		NDI				Ru	ıt Dep	oth	2	0		B.E	3. De	eflecti	on			
		_		_															
Log (m					N	1ateria	als Des	criptio	n						av. & mp	Mois Cond		Nui	mple mber
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	200																		
0-6																			
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\circ – d		Soil Classification GC																	
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Agg Blows (Dy CBR (Dynamic		 	0	0	0	0	0	0	0	0	- 0	3 14	5 8	10 25	14 20	16 8	-	_	
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Farnell - CI So																			
Farnell - CI/20 Remarks and				لــــــا	*Note	unner	r layer	CBR F	esed.	on san	oole ir	ositu C	DD mi	ich hir	aher				
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Job Name	Harvey Street - Pavement Investigation
Job No	HB13604
Ref Point	Lyell Highway
Link Number	
Pit No	TP6
Pit Ch	2280
from CL	0.8
side	RHS
Grade	4
Crossfall	0
Seal W	6
Pavement Type	flush seal
Shoulder LHS	1
Shoulder RHS	1
Cut/Fill LHS	0
cut / fill	
Cut/Fill RHS	0
cut / fill	
Pav Drainage	Fair
Table Drains	Fair NDI
Pav Condition Rut Depth	NDI 20
BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14

DCP Results												
depth	blows		cbr									
0	-											
50	-	0	0									
100	-	0	U									
150	-	0	0									
200	-	0	0									
250	-	0	U									
300	-	0	0									
350	-	0	0									
400	-	0	0									
450	-	0	0									
500	3	3	14									
550	5	2	8									
600	10	5	25									
650	14	4	20									
700	16	2	8									
750	-	-16	0									
800	_	0	0									
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900	0	2	0									

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Job Name Ha	arvey S	Stree	t - Pa	<u>aven</u>	nent l	Inves	stiga:	tion_			. – – .					Job	No	HB ₁	1 <u>3604</u>	
Reference Po	int (C	0.0)	Lyel	II Hig	hway	Y				(+)			Link Number						
Pit Number	TP7	CH:	- (+)	<u></u>	2470) <u> </u>	m	<u></u>	_3_		m fr	om	<u>¢</u>		LF	IS		s	ide	
Grade0	%	Cros	sfall	2	2	%	Se	eal W	/idth	5	.7	m		5	Seal 7	Гуре	fl	ush s	eal	
Left Shoulder	_		-																	
Pavement Drai			Fair								Drair									
Pavement Con	_		NDI								o				flecti					
avement con	aition		וטוו				- IVu	ונ טכן	J.111			i	D. I	J. DC	Heck	1011				
Graphic Depth Log (mm)					N	/lateria	ls Des	scriptio	n					Excav. & Moisture Comp Condition				Sample Number		
10		.; Flush													•			A	A21	
$\times \circ \times $		VEL; co brown.		quartz	r, round	ded, w	ith me	dium s	sandy	fines, s	slightly	claye	/	V	'D	D-	М	A22		
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Agg Blows (Dyn C CBR (Dynamic C		-	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	
Farnell - CI Scale						U		0	0	- 0	0	0	0	0	0	0	0		U	
Farnell - CI Scale																				
Farnell - CI/20 = 0 Remarks and Ske					*Note	upper	laver	CBP F	ased	on car	nnle ir	neitu C	BP mi	ich hic	her					
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Job Name	Harvey Street - Pavement Investigation
Job No	HB13604
Ref Point	Lyell Highway
Link Number	
Pit No	TP7
Pit Ch	2470
from CL	3
side	LHS
Grade	
Crossfall	2
Seal W	5.7
Pavement Type	flush seal
Shoulder LHS	1
Shoulder RHS	1
Cut/Fill LHS	1
cut / fill	cut
Cut/Fill RHS	0.5
cut / fill	<u>cut</u>
Pav Drainage	Fair Pair
Table Drains	Fair
Pav Condition	NDI .
Rut Depth BB Deflection	0
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14
	2100111

DCP Results												
depth	blows		cbr									
0	-											
50	-	0	0									
100	-	0	0									
150	-	0	0									
200	-	0	0									
250	-	0	0									
300	-	0	0									
350	-	0	0									
400	-	0	0									
450	-	0	U									
500	-	0	0									
550	-	0	0									
600	-	0	0									
650	-	0	0									
700	-	0	0									
750	-	0	0									
800	-	0	0									
850	-	0	0									
900	0	0	0									

=		
L	ook ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		

.



Job Name Harvey Street - Pavement Investigation Job No HB1360												3604							
Reference Poi	int (Cl	0.0)	Lyel	ll Hig	hway	/				(+)			Li	nk N	umb	er		
Pit Numbe ₂ _7	P8	CH:	- (+)		2670		m		2.5		m fr	om	<u>¢</u> _		Lŀ	IS_		si	ide
Grade 8	%	Cros	sfall	3	3	%	Se	eal W	/idth	5.	.2	m		5	Seal Type _ flus				eal
	_														RH Side <u>0</u> m				
Pavement Drain			Fair									- <u>-</u> -							
	•															. 			
Pavement Cond	ition		NDI				Ku	t De	otn	(<u> </u>		D.I	5. De	flecti	ion			
Crankia Danth														-	0	Maia	4	Ca	
Graphic Depth Log (mm)					N	/lateria	ls Des	criptio	n						av. & mp	Cond	sture dition	Nui	mple mber
20		; Flush /EL; m		to col	bble si	zed. ai	ıartz. ı	rounde	ed. with	h medi	um sai	ndv		V	'D	٨	1		123 124
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$\circ \times \circ$																			
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$\times \bigcirc \times$																			
0×0																			
× 600																			
$0 \times d$																			
XOX																			
700										Soil	Class	ificatio	n GM						
												ted CE							
201	C+iII C	oina 0	200																
NSITU CBR Dept		oing 8 0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
Agg Blows (Dyn C		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CBR (Dynamic Co Farnell - CI Scale	ne) 1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Farnell - CI Scale																			
Farnell - CI/20 = C	BR																		
Remarks and Sket	tches				*Note	upper	layer	CBR b	oased (on san	nple, ir	nsitu C	BR mı	uch hig	gher.				
	Sie en e																		
4																			
																		 	
1																			

Job Name	Harvey Street - Pavement Investigation
Job No	HB13604
Ref Point	Lyell Highway
Link Number	
Pit No	TP8
	2670
	2.5
	LHS
Grade	8
Crossfall	3
Seal W	5.2
Pavement Type	flush seal
Shoulder LHS	0.3
	0.3
Cut/Fill LHS	1
cut / fill	
Cut/Fill RHS	0
cut / fill	
Pav Drainage	Fair
	Fair
	NDI
	0
BB Deflection	Forester and Augus
	Excavator and Auger NJ RG
- 3	NJ RG 24-Jan-14
Date	24-JdI -14

DCP Results										
depth	blows		cbr							
0	-									
50	-	0	0							
100	-	0	U							
150	-	0	0							
200	-	0	0							
250	-	0	U							
300	-	0	0							
350	-	0	0							
400	-	0	0							
450	-	0	0							
500	-	0	0							
550	-	0	0							
600	-	0	0							
650	-	0	U							
700	-	0	0							
750	-	0	0							
800	_	0	0							
850	_	0	0							
900	0	0	0							

	Look ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		



Reference Point (Cl 0.0) Lyell Highway (+) Link Number Pit Numbel TP9 CH:-(+) 3400 m 2 m from (c) RHS side Grade 0 % Crossfall 2 % Seal Width 4.6 m Seal Type flush seal Left Shoulder 1.0 m Right Shoulder 1.0 m LH Side 0.5 m fill RH Side 1 m Pavement Drainage Fair Table Drains Fair Pavement Condition NDI Rut Depth 0 B.B. Deflection Graphic Depth (mm) Materials Description Excav. & Moisture Comp Condition Number GRAVEL; redium sized, quartz, rounded, with medium clayey sandy fines, Soil Classification GC Estimated CBR 25 Sandy fines grey brown. GRAVEL: medium to cobble sized, quartz, rounded to sub rounded, sandy fines grey brown. A25
Pit Numbel TP9 CH:-(+) 3400 m 2 m from t Seal Type flush seal Grade 0 % Crossfall 2 % Seal Width 4.6 m Seal Type flush seal Left Shoulder 1.0 m Right Shoulder 1.0 m LH Side 0.5 m fill RH Side 1 m Pavement Drainage Fair Table Drains Fair Pavement Condition NDI Rut Depth 0 B.B. Deflection Graphic Depth (mm) Materials Description Excav. & Moisture Comp Condition Number GRAVEL; Flush GRAVEL; medium sized, quartz, rounded, with medium clayey sandy fines, Soil Classification GC Estimated CBR 25 Sandy fines grey brown. GRAVEL; medium to cobble sized, quartz, rounded to sub rounded, sandy fines grey brown.
Left Shoulder 1.0 m Right Shoulder 1.0 m LH Side 0.5 m fill RH Side 1 m Table Drains Fair Pavement Drainage Fair Table Drains Fair Pavement Condition NDI Rut Depth 0 B.B. Deflection Graphic Depth (mm) Materials Description (mm) Condition NDI SEAL; Flush GRAVEL; medium sized, quartz, rounded, with medium clayey sandy fines, Soil Classification GC Estimated CBR 25 Sandy fines grey brown. GRAVEL; medium to cobble sized, quartz, rounded to sub rounded, Sandy fines grey brown. A25
Left Shoulder 1.0 m Right Shoulder 1.0 m LH Side 0.5 m fill RH Side 1 m Table Drains Fair Pavement Drainage Fair Table Drains Fair Pavement Condition NDI Rut Depth 0 B.B. Deflection Graphic Depth (mm) Materials Description (mm) Condition NDI SEAL; Flush GRAVEL; medium sized, quartz, rounded, with medium clayey sandy fines, Soil Classification GC Estimated CBR 25 Sandy fines grey brown. GRAVEL; medium to cobble sized, quartz, rounded to sub rounded, Sandy fines grey brown. A25
Pavement Drainage Fair Table Drains Fair Pavement Condition NDI Rut Depth 0 B.B. Deflection Graphic Depth (mm) Materials Description Excav. & Moisture Comp Condition Number 20 SEAL; Flush Soil Classification GC Estimated CBR 25 Soil Classification GC Estimated CBR 25 Sandy fines grey brown. GRAVEL; medium to cobble sized, quartz, rounded to sub rounded, sandy fines grey brown. A25
Pavement Condition NDI Rut Depth 0 B.B. Deflection Graphic Depth (mm)
Graphic Log (mm) 20 SEAL; Flush GRAVEL; medium sized, quartz, rounded, with medium clayey sandy fines, Soil Classification GC Estimated CBR 25 GRAVEL; medium to cobble sized, quartz, rounded to sub rounded, sandy fines grey brown. GRAVEL; medium to cobble sized, quartz, rounded to sub rounded, sandy fines grey brown. A25 A25 A26 A27 A27 A28 A28 A28 A29 A29 A29 A29 A29
Log (mm) 20 SEAL; Flush GRAVEL; medium sized, quartz, rounded, with medium clayey sandy fines, Soil Classification GC Estimated CBR 25 GRAVEL; medium to cobble sized, quartz, rounded to sub rounded, sandy fines grey brown. D-M A25 D-M A25 D-M A26 D-M A27 D-M A28 D-M A28 D-M A29 D-M A29 D-M A29 D-M A29 D-M A29 D-M A29 D-M A29 D-M A29 D-M A29 D-M D-M D-M D-M D-M D-M D-M D-
SEAL; Flush GRAVEL; medium sized, quartz, rounded, with medium clayey sandy fines, Soil Classification GC Estimated CBR 25 GRAVEL; medium to cobble sized, quartz, rounded to sub rounded, sandy fines grey brown. D-M A25 A25 A25 A26 A27 A27 A28 A28 A28 A29 A29 A20 A20 A20 A20 A20 A20
Soil Classification GC Estimated CBR 25 GRAVEL; medium to cobble sized, quartz, rounded to sub rounded, sandy fines grey brown. A25 A25 A26 A27 A28 A28 A28 A29 A29 A29 A29 A29
GRAVEL; medium to cobble sized, quartz, rounded to sub rounded, sandy fines grey brown. A25 A25 A26 A27 A27 A28 A28 A27 A28 A28 A28
200 -
- O - C - 300 - O - C - 400 - O - C - 500 - O - C - 500
- O - C - 300 - O - C - 400 - O - C - 500 - O - C - 500
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[™]
Soil Classification GC
SAND; fine grained grey Estimated CBR 25 L D-M A26
Soil Classification SP
Estimated CBR 8
NSITU CBR Depth (mm) 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850
Agg Blows (Dyn Cone
CBR (Dynamic Cone)
Farnell - CI Scale 2
Farnell - CI/20 = CBR
Remarks and Sketches Note upper layer CBN based on sample, inside CBN middlingher.

Job Name	Harvey Street - Pavement Investigation
Job No	HB13604
Ref Point	Lyell Highway
Link Number	, , ,
Pit No	TP9
Pit Ch	2670
from CL	2.5
side	LHS
Grade	8
Crossfall	3
Seal W	5.2
Pavement Type	flush seal
Shoulder LHS	0.3
Shoulder RHS	0.3
Cut/Fill LHS	1
cut / fill	cut
Cut/Fill RHS cut / fill	0
Pav Drainage	Fair
Table Drains	Fair
Pav Condition	NDI
Rut Depth	0
BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14

DCP Results										
depth	blows		cbr							
0	-									
50	-	0	0							
100	-	0	U							
150	-	0	0							
200	-	0	0							
250	-	0	U							
300	-	0	0							
350	-	0	0							
400	-	0	0							
450	-	0	0							
500	-	0	0							
550	-	0	0							
600	-	0	0							
650	-	0	U							
700	-	0	0							
750	-	0	0							
800	_	0	0							
850	_	0	0							
900	0	0	0							
900	0		0							

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141 41



	ob Name Macquarie Heads Road - Pavement Investigation Job No HB13604																			
Reference Point (Cl 0.0) Harvey Street / Ocean Beach R (+) Link Number Pit Number TP10 CH:- (+) 660 m 0 m from ¢ on centre line side																				
Pit Nur	mbeı_ <i>TF</i>	210	CH:	- (+)		660		m		0		m fr	om	<u>¢_</u> _	or	cen	tre li	ne	si 	ide
Grade	0	%	Cros	sfall	2	2	%	Se	eal W	/idth	į	5	m		5	Seal 7	Гуре		Grave	el
-	Grade0 % Crossfall _ 2 % Seal Width _ 5 m Seal Type <i>Gravel</i> _eft Shoulder _ <i>0.0</i> _m_ Right Shoulder _ <i>0.0</i> _m_ LH Side _0 _m_ RH Side _0 _m																			
	Pavement Drainage Poor Table Drains none																			
	ent Condi	_	•						t De			_				flect	ion			
						<u> </u>														
Graphic Log	Depth (mm)						/lateria		-						Co		Cond		Nu	mple mber
$\times \nabla \times$		GRA	/EL; m	nedium	sized,	limes	tone, a	angula	r, with	silty s	andy fi	ines, b	rown.		I	0	٨	Λ	A	127
$\wedge \times /$												Class Estima								
525	100			nedium		oble siz	zed, qu	uartz, i	rounde	ed, with				JIN 30	ν	'D	D-	М	F	128
$\times \circ \times$		sandy	/ fines	grey b	rown.															
$0\times$	200																			
\times \bigcirc \rangle																				
0×0	300																			
$\langle \circ \rangle$	300																			
0×0	_																			
хох) хо	400																			
$\langle O \times \rangle$																				
$\stackrel{\wedge}{\circ}$	500																			
×0;	_																			
0×0	600																			
$\times \circ \times$																				
0×0	_																			
$\tilde{\times}$	— 700																			
0×0	700										Soil	Class	ificatio	n GM						
\times O \times												Estima								
INSITU (800 CBR Depth		Going 8 0	300 50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
Agg Blov	vs (Dyn Co	ne	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	namic Cor CI Scale	ne) 1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Farnell -	CI Scale	2																		
	CI/20 = CE and Sketo					*Note	unner	laver	CBR F	hased	on san	nple, ir	neitu C	BR mi	ich hid	nher				
Nemarks	and Skett	1162				NOLE	ирреі	layei	ODICE	Jaseu	on san	пріс, ії	isitu C	ווו אום	ucii iiiç	grier.				
	-	other.	Alexander of the same																	
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Job Name	Macquarie Heads Road - Pavement Investigation
Job No	HB13604
Ref Point	Harvey Street / Ocean Beach Road
Link Number	
D'AN-	TDIO
Pit No	TP10
Pit Ch	660
from CL	0
side	on centre line
Grade	
Crossfall	2
Seal W	5
Pavement Type	Gravel
Shoulder LHS	
Shoulder RHS	0
Cut/Fill LHS	
cut / fill	
Cut/Fill RHS	
cut / fill	
Pav Drainage	Poor
Table Drains	none
Pav Condition	
Rut Depth	
BB Deflection	European Annua
Exc Method	Excavator and Auger NJ RG
Log By Date	24-Jan-14
Date	24°0011°14

DCP Results										
depth	blows		cbr							
0	-									
50	-	0	0							
100	-	0	U							
150	-	0	0							
200	-	0	0							
250	-	0	U							
300	-	0	0							
350	-	0	0							
400	-	0	0							
450	-	0	0							
500	-	0	0							
550	-	0	0							
600	-	0	0							
650	-	0	U							
700	-	0	0							
750	_	0	0							
800	_	0	0							
850	_	0	0							
900	0	0	0							

Look ups											
Excav & comp very loose -VL loose - L medium dense - MD dense - D very dense - VD very soft - VS soft - S firm - F stiff - St hard - H	Mosture dry - D moist - M wet - W	cut fill cut fill									

.



Job Na	ob Name Macquarie Heads Road - Pavement Investigation Job No _HB13604_																			
Reference Point (Cl 0.0) Harvey Street / Ocean Beach R (+) Link Number																				
Pit Number TP11 CH:- (+) 660 m 2.5										m from dt					IS		s	ide		
Grade	0	%	Cros	ssfall	2	>	%	Se	eal W	/idth		5	m		5	Seal 1	vpe		Grave	el
Grade 0 % Crossfall _ 2 % Seal Width _ 5 m Seal Type <i>Grave</i> Left Shoulder _ <u>0.0 _ m</u> Right Shoulder _ <u>0.0 _ m</u> LH Side _ 0 _ m _ RH Side _ <u>0 _ m</u> _																				
				_			-										Side		<u> </u>	
	Pavement Drainage Poor Table Drains none																			
Paveme	ent Conc	dition	ı				ı	Ru	it Dep	oth				B.E	3. De	flecti	ion			
Graphic Log	Depth (mm)		151 . see	15 . m.	(Materia		-			' · fin a			Co	av. &	Mois Cond	dition		imple imber
$\tilde{}$		GRAN grey.	/EL; m	nedium	to con)bie siz	zea, qu	ıartz, r	rounae	ed, Witr	ı sanc	ly fines	S,		IVI	1D	٨	1		
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$2 \cdots $	100	SANI)· fine	graine	d arev	,						Estima	ted CE	3R 60	 ,	L		7		429
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	200																			
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	500																			
	500																			
$\cdot \times \cdot \cdot$	_																			
	600																			
$\cdot \times \cdot \cdot$																				
	_																			
	700																			
											Soil	l Class	ificatio	n SM						
$\cdot \times \cdot \cdot$	_											Estim	ated C	BR 8						
INSITU C	800 CBR Dept		Going 8 0	500 50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
	vs (Dyn C		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CBR (Dyi	namic Co			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Farnell - 0		1																		
Farnell - (CI Scale CI/20 = C	2 PRR		igwdapprox	igwdot	igwdapprox	\longmapsto						\longmapsto							
	and Sket					*Note	upper	layer	CBR b	pased (on san	nple, ir	nsitu C	BR mı	uch hiç	aher.				
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	157 15			1		-														i

Job Name	Macquarie Heads Road - Pavement Investigation
Job No	HB13604
Ref Point	Harvey Street / Ocean Beach Road
Link Number	
Pit No	TP11
Pit Ch	660
from CL	2.5
side	LHS
Grade	0
Crossfall	2
Seal W	5
Pavement Type	Gravel
Shoulder LHS	0
Shoulder RHS	0
Cut/Fill LHS	0
cut / fill	
Cut/Fill RHS cut / fill	
Pav Drainage	Poor
Table Drains	none
Pav Condition	
Rut Depth	
BB Deflection	
Exc Method	Excavator and Auger
Log By Date	NJ RG 24-Jan-14
Date	24-Jaii-14

DCP Results													
depth	blows		cbr										
0	-												
50	-	0	0										
100	-	0	U										
150	-	0	0										
200	-	0	0										
250	-	0	U										
300	-	0	0										
350	-	0	0										
400	-	0	0										
450	_	0	0										
500	-	0	0										
550	-	0	0										
600	-	0	0										
650	-	0	U										
700	-	0	0										
750	-	0	0										
800	_	0	0										
850	_	0	0										
900	0	0	0										

L	ook ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		
naid - 11		



Job Name <u>M</u>	acquai	rie <u>H</u> e	eads	Roa	<u>d - P</u>	<u>'aver</u>	nent	Inve	stiga	ation_						Job	No	<u>HB</u> 1	<u> 3604</u>	
Reference Po	oint (C	0.0)	Har	vey S	3 <u>tre</u> e	t / O	cean	Bea	i <u>ch</u> R	(+)			Li	nk N	umb	er			
Pit Numbe _{l_}	ΓP12	CH:	- (+)		900		m		2		m fr	om	<u>¢</u> _		RI	IS_		si	ide	
Grade 0	%	Cros	sfall		3	%	Se	eal W	/idth	4.	.6	m		5	Seal 7	Гуре		Grave	el	
Left Shoulder	0.0	m	Riç	tht S	houl	der	0.0	m_		LH S	Side	0.3	m _					m		
Pavement Drai			Fair			•	. – – -				Drain		Fair							
Pavement Con	•	•					. – – . Ru	t Dep							flecti	on			1	
I avoinont Je.									J			i		J	11000					
Graphic Depth Log (mm)					N.	/lateria	ls Des	criptio	n						av. & mp	Mois Cond	sture dition		mple mber	
	GRAV	VEL; fir	ne, qua	artz, ar	ngular,	with h	nigh %	of san	dy fine	es sligl	htly pla	istic, b	rown.	I	-	I)	Α	129	
×											Classi									
	GRA	VEL; m	nedium	to cob	ble siz	zed, qı	uartz, s	sub roi	unded,		Estima	tea C	3K 3U)	Ĺ)	A	130	
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0×1 700													5							
$\tilde{\times}$											Classi Estima									
800		Going 8		120	:=0	220	250	220						220		=00	==0		350	
INSITU CBR Dep Agg Blows (Dyn (0 -	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850 -	
CBR (Dynamic C	one)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Farnell - CI Scale				$ar{ar{\Box}}$	$\overline{\longmapsto}$													\longrightarrow		
Farnell - CI Scale				\vdash	\longrightarrow	$\overline{}$														
Remarks and Ske					*Note	upper	layer	CBR b	ased	on san	nple, ir	nsitu C	BR mı	uch hiç	gher.					
-15 · A				\vdash	$\overline{}$															
distribution of		Way and																	-	
5.3		No.		$\vdash \vdash$	\vdash	\square														
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Job Name	Macquarie Heads Road - Pavement Investigation
Job No	HB13604
Ref Point	Harvey Street / Ocean Beach Road
Link Number	
Pit No	TP12
Pit Ch	900
from CL	2
side	RHS
Grade	0
Crossfall	3
Seal W	4.6
Pavement Type	Gravel
Shoulder LHS	0
Shoulder RHS	0
Cut/Fill LHS	0.3
cut / fill	cut
Cut/Fill RHS	0.3
cut / fill Pav Drainage	cut Fair
Table Drains	Fair
Pav Condition	
Rut Depth	
BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14

DCP Results												
depth	blows		cbr									
0	-											
50	-	0	0									
100	-	0	U									
150	-	0	0									
200	-	0	0									
250	-	0	U									
300	-	0	0									
350	-	0	0									
400	-	0	0									
450	-	0	0									
500	-	0	0									
550	-	0	0									
600	-	0	0									
650	-	0	U									
700	-	0	0									
750	_	0	0									
800	_	0	0									
850	_	0	0									
900	0	0	0									

	Look ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		



Job Name Mag	cquar	ie H	<u>eads</u>	Roa	<u>d - F</u>	<u>'aver</u>	<u>nent</u>	<u>Inv</u> e	stiga	ation_	. – – .					Job	No	HB1	<u> 3604</u>
Reference Poi	nt (Cl	0.0)	Han	vey S	Stree	t / O	cean	Bea	i <u>ch</u> R	(+)			Li	nk N	umb	er		
Pit Numbe _{l_} <u>T</u>	⊃13	CH:	- (+)		1200) <u> </u>	m		0		m fr	om	<u>¢</u> _		cer	ntre	<u></u>	si	ide
Grade 5	%	Cros	sfall	3	3	%	Se	eal W	idth	ć	3	m		5	Seal T	Гуре		Grave	əl
Left Shoulder	_		-																
Pavement Drain			Fair					- = -			Drair		 Fair		• • • •				
	•		Faii							anie	Dian	15			. .	·			
Pavement Cond	ition						Ku	ıt Dep	otn			•	В.	3. De	flecti	ion			
1	T																		
Graphic Depth Log (mm)	CDAL	Materials Description Excav. & Moisture Comp Condition Number AVEL; fine, quartzite, angular, with sandy fines, brown. L D																	
50	GKAV	'EL; III	ie, qua	intzite,	angui	ar, wıu	1 Sarıu	y tines	i, brow	⁄n. 		GI	P - 15				, _		
× () > 100		AVEL; coarse to cobble sized, quartz, sub rounded, with sandy fines D M A31 htly clayey grey brown.																	
0×(<u> </u>																			
× () >		Soil Classification GM Estimated CBR 25																	
$0 \times ($																			
$\times \circ \times$																			
○ X (300	1																		
		ND; fine grained, slightly clayey organic, low plasticity, with cobble L M A32 and quartz gravel, black brown.																	
. ĽÆ	31 <u>2</u> 2	yuu	gra.	, W	\ D. C.	11.								İ					
··· [400														İ					
·																			
·· [O]																			
· — (500																			
○ _																			
· — (S	oil Cla	ssificat	tion SC	C/GC						
										I	Estima	ted CE	3R 10						
650	COBE	3LES &	& BOU	LDER	s									V	'D	٨	И		
0		_																	
O (700																i			
\cap Γ																i			
0 600	Still G	oing 8	300																
INSITU CBR Depth	h (mm)		50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
Agg Blows (Dyn Co			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CBR (Dynamic Cor Farnell - CI Scale	ne) 1	$\vdash\vdash\vdash$	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Farnell - CI Scale	2	$\overline{}$	\Box	1	\square	\square	\vdash	$\vdash \vdash$				$\mid - \mid \mid$	\vdash			$\mid - \mid \mid$			
Farnell - CI/20 = CI	BR																		
Remarks and Sket	ches				*Note	upper	layer	CBR b	ased o	on san	nple, ir	nsitu C	BR mu	uch hig	jher.			- -	
					\vdash		\vdash	_											
Carrier Williams		200			\vdash	$\overline{\Box}$													

Job Name	Macquarie Heads Road - Pavement Investigation
	HB13604
Ref Point	Harvey Street / Ocean Beach Road
Link Number	
Pit No	TP13
Pit Ch	1200
from CL	0
side	
Grade	5
Crossfall	3
Seal W	6
Pavement Type	Gravel
Shoulder LHS	0
Shoulder RHS	0
Cut/Fill LHS	0
cut / fill	
Cut/Fill RHS	0
cut / fill	Fair
Pav Drainage Table Drains	Fair Fair
Pav Condition	ı dii
Rut Depth	
BB Deflection	
Exc Method	Excavator and Auger
3	NJ RG
Date	24-Jan-14

	DCP R	esults	
depth	blows		cbr
0	-		
50	-	0	0
100	-	0	U
150	-	0	0
200	-	0	0
250	-	0	U
300	-	0	0
350	-	0	0
400	-	0	0
450	-	0	0
500	-	0	0
550	-	0	0
600	-	0	0
650	-	0	U
700	-	0	0
750	-	0	0
800	-	0	0
850	-	0	0
900	0	0	0

L	ook ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		
naid - 11		

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	acquarie Heads Road - Pavement Investigation Job No _HB13604												3604						
Reference Point	t (C I ().O)	-	<u>Har</u> ı	<u>⁄ey</u>	3 <u>tre</u> e	t / O	<u>cean</u>	Bea	i <u>ch</u> R	(+)			Li	nk N	umb	er		
Pit Number_ TP1	14 C	:H:-	(+)		1200) <u> </u>	m		2.6		m fr	om	<u>¢</u> _		RI	IS_		s	ide
Grade 5	% C	ross	fall	3	3	%	S	eal W	/idth		5	m		5	Seal 7	Гуре		Grave	el
Left Shoulder			_									_							
-							. – – .								1111	Siuc		<u> </u>	
Pavement Draina	_	-	-aır							abie	Drair	าร	Fair						
Pavement Condit	ion						Ru	ıt Dep	pth		. – – .	•	B.I	3. De	flect	ion			
Graphic Depth Log (mm)		Materials Description												av. & mp	Mois Cond	sture dition	Nu	mple mber	
	SAND; i medium		_			-	-	/ plasti	city, w	ith					_		1 V	1	433
· ×× 9— /	II C ulai	edium quartz gravels grey to black.													•	,	l		
[] 100																			
$\cdot \cdot \times ($																		l	
0:																			
· ×× (— ²⁰⁰																		l	
63																			
300																			
0_																			
$\cdot \cdot \times ($									Ç,	- !! Clor	:fioof	' CA	4 /OM					l	
·· (c) 4 00									Su		ssificati Estima								
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	SAND; i sized qu						ganic,	low pl	asticity	y, with	cobble	Э		I	<u>L</u>		1 V		
·×·• 500	SIZEU YU	ai iz y	llavoi	, Diaon	(DI OW	11.										•	,		
																		l	
																		l	
600																			
· × · · ⁶⁵⁰											l Class								
										ı	Estima	itea Ci	BK 10						
700	COBBL	ES & I	BOUL	LDERS	s														
0 –																			
O (
\circ	, ,	<u> </u>	50	400	450	000	050	000	050	400	450			000	0.50	700	750	000	0.50
INSITU CBR Depth (Agg Blows (Dyn Con		0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
CBR (Dynamic Cone		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Farnell - CI Scale 1		士	\Box																
Farnell - CI Scale 2																			
Farnell - CI/20 = CBF Remarks and Sketch					*Note	unner	Lover	CBR b	beacc	on car	∽nla ir	ocitu C	DD mi	ich hic	shor				
Remarks and Skelon	ies				INOLE	upper	layei	CDN	Jaseu	OII Saii	пріе, іі	ISITU C	DK III	JUII IIIQ	Jilei.				
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			7																

Job Name	Macquarie Heads Road - Pavement Investigation
Job No	HB13604
Ref Point	Harvey Street / Ocean Beach Road
Link Number	
Pit No	TP14
Pit Ch	1200
from CL	0
side	
Grade	5
Crossfall	3
Seal W	6
Pavement Type	Gravel
Shoulder LHS	0
Shoulder RHS	0
Cut/Fill LHS	0
cut / fill Cut/Fill RHS	
cut/fill RHS	0
Pav Drainage	Fair
Table Drains	Fair
Pav Condition	
Rut Depth	
BB Deflection	
Exc Method	Excavator and Auger NJ RG
Log By Date	NJ RG 24-Jan-14
Date	27 Juli 17

DCP Results													
depth	blows		cbr										
0	-												
50	-	0	0										
100	-	0	U										
150	-	0	0										
200	-	0	0										
250	-	0	U										
300	-	0	0										
350	-	0	0										
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450	-	0	0										
500	-	0	0										
550	-	0	0										
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650	-	0	U										
700	-	0	0										
750	-	0	0										
800	_	0	0										
850	_	0	0										
900	0	0	0										
900	0		0										

Look ups	
Mosture	cut fill
dry - D	cut
moist - M	fill
wet - W	
	Mosture dry - D moist - M



Job Name Ma	b Name Macquarie Heads Road - Pavement Investigation													Job No HB13604						
Reference Poi	nt (Cl	0.0)	Han	vey §	Stree	t / O	cean	Bea	ich R	(+)			Li	nk N	umb	er			
Pit Number_ T			_									om	<u>¢_</u>		Rŀ	HS .		si	ide	
Grade 3	%	Cros	sfall	2	>	%	Se	eal W	/idth	4.	.9	m		5	Seal T	Гуре		Grave	əl	
Left Shoulder			-			•						•	m					5 m		
Pavement Drain			Fair				. <u>-</u> -				Drair		Fair		•		_~		1	
	_	•	I aii				. .	· Dar		abi c i	Dian	15				• = = ·				
Pavement Cond	lition		<u></u> :				Ku	ıt Dep)th				D.1	პ. ს	flecti	lon				
I	T													$\overline{}$				_		
Graphic Depth Log (mm)	CDAL	Materials Description GRAVEL; medium, quartz, angular, with sandy fines, brown													av. & emp	Mois	dition	Nu	mple mber	
× 🗸	GKAV	EL, III	eaiurri,	, quar.	z, any	ular, wi	th San	iay iire	∋S, DIU	wn				,	D		,	<i>H</i>	134	
^ × T		2 # 2 #												i		i				
100	0	Soil Classification GM Estimated CBR 30																		
×Ô	GRAV	RAVEL; medium to coarse, quartz, rounded,with sandy fines, brown VD														٨	Λ	Α	A35	
200 ×																				
× () > 300		Soil Classification GM Estimated CBR 30																		
) 		RAVEL; coarse to cobble sized, quartz, high in coarse sands, MD M A36 ightly clayey, low plasticity, brown.															136			
- O -	slightly	y claye	∍y, low	plastic	city, br	own.														
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500														İ		l				
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600														i		i				
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_O 1											l Class Estima			i		i				
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-0-														i		i				
O - (
INSITU CBR Dept	h (mm)	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	
Agg Blows (Dyn C	\ /		<u> </u>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
CBR (Dynamic Co	ne)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Farnell - Cl Scale	1		\longmapsto		igwdot		igwdot					igwdapprox		igwdapprox	\longmapsto	 		 		
Farnell - CI Scale Farnell - CI/20 = C			$\vdash \vdash \vdash$	\longrightarrow	$\vdash\vdash\vdash$	$\vdash\vdash\vdash$	$\vdash \vdash \vdash$	\vdash				\vdash		\vdash	\vdash	\vdash				
Remarks and Sket			_		*Note	upper	layer	CBR b	oased (on san	nple, ir	nsitu C	BR mı	uch hiç	gher.	<u> </u>				
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Job Name	Macquarie Heads Road - Pavement Investigation
Job No	HB13604
Ref Point	Harvey Street / Ocean Beach Road
Link Number	·
Pit No	TP15
Pit Ch	1380
from CL	1.2
side	RHS
Grade	3
Crossfall	2
Seal W	4.9
Pavement Type	Gravel
Shoulder LHS	0
Shoulder RHS	0
Cut/Fill LHS	0
cut / fill	
Cut/Fill RHS	0.5
cut / fill	cut
Pav Drainage Table Drains	Fair Fair
Pav Condition	i ali
Rut Depth	
BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14

	DCP R	lesults	
depth	blows		cbr
0	-		
50	-	0	0
100	-	0	U
150	-	0	0
200	-	0	0
250	-	0	U
300	-	0	0
350	-	0	0
400	-	0	0
450	-	0	0
500	-	0	0
550	-	0	0
600	-	0	0
650	-	0	U
700	-	0	0
750	-	0	0
800	_	0	0
850	_	0	0
900	0	0	0

Look ups	
Mosture	cut fill
dry - D	cut
moist - M	fill
wet - W	
	Mosture dry - D moist - M



Job Name Macquarie Heads Road - Pavement Investigation														Job No <u>HB13604</u>						
Reference	ce Poir	nt (Cl	0.0)	<u>Har</u> ı	vey S	Stree	t / O	cean	Bea	ch R	(+)			Li	nk N	umb	er		
Pit Numl													om	<u>¢_</u>		LF	IS_		si	ide
Grade	5	%	Cros	ssfall	2	2	%	Se	eal W	/idth	4.	.7	m		ξ	Seal 7	Гуре		Grave	əl
		•	% Crossfall _ 2 % Seal Width _ 4.7 _ m 0.0 _ m _ Right Shoulder _ 0.0 _ m _ LH Side _ 0 _ m																	
															IXI i	Siuc	1.0	<u>'''</u>	Cui	
		_		Fair				. – – .			abie	Drair	ıs	Fair						
Pavemen	t Condi	ition					ı	Ru	ıt Dep	oth			•	B.F	B. De	flect	ion]
Graphic Log	Depth (mm)				Λ	Materia		Exca Co	av. & mp		sture dition		mple mber							
		GRAV	GRAVEL; fine, quartz, angular, with sandy fines, pale yellow brown. D D A														Α	437		
X ▽	-		Soil Classification GM Estimated CBR 30																	
	_ 100 130	GRAV	VFI: n	 redium	- nuan	+z rou	nded.v	vith sa	ndv fin	<u> </u>	1%)				М	וח	Ĺ,	И	_ ,	438
$^{\circ}$	130			obbles		2, 104.	Idoa,		<i>,</i>			"	A36							
\circ	<u>-</u> !																			
0	200																			
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\circ	220																		l	
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_ 0 ,	400																		l	
\circ	400																			
0	- !																		l	
\circ	500																		l	
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)	600											_301110		JI \ 20						
		SANE); fine	grained	d, with	quartz	z cobbl	les,pal	le yello	w, (10)%)				L	<u>_</u>	٨	И		
⊢	_ !										Soi	il Class	rificatio	on SP					İ	
· · · · · <u>L</u>	- 700											Estima							İ	
	700																		l	
	- !																			
L	800																		l	
INSITU CB	Donth	(mm)	0	50	100	150	200	250	300	250	400	450	500	550	600	650	700	750	900	950
Agg Blows			-	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
CBR (Dyna				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Farnell - Cl	l Scale	1																		1
Farnell - Cl																				
Farnell - Cl Remarks a			<u> </u>	Ш		*Note	upper	rlaver	CBR F	hase	on san	nole ir	ceitu C	DD mi	uch hir	shor				
Keillaiks a	III Skell	TIES		$\overline{}$		NOIC	upper	layer		laseu (Jii San	libie, ii	ISITU C	DIX III	JUITING	Jilei.				
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Job Name	Macquarie Heads Road - Pavement Investigation
Job No	HB13604
Ref Point	Harvey Street / Ocean Beach Road
Link Number	
Pit No	TP16
Pit Ch	1560
from CL	1300
	1
side	LHS
Grade	5
Crossfall	2
Seal W	4.7
Pavement Type	Gravel
Shoulder LHS	0
Shoulder RHS	0
Cut/Fill LHS	0
cut / fill	
Cut/Fill RHS	1.5
cut / fill	cut
Pav Drainage	Fair
Table Drains	Fair
Pay Condition	
Rut Depth BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14

DCP Results												
depth	blows		cbr									
0	-											
50	-	0	0									
100	-	0	U									
150	-	0	0									
200	-	0	0									
250	-	0	U									
300	-	0	0									
350	-	0	0									
400	-	0	0									
450	-	0	0									
500	-	0	0									
550	-	0	0									
600	-	0	0									
650	-	0	U									
700	-	0	0									
750	-	0	0									
800	_	0	0									
850	_	0	0									
900	0	0	0									

L	ook ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		
naid - 11		



Job Name Macquarie Heads Road - Pavement Investigation														Job No <u>HB13604</u>						
Reference	Point ((CI ().O)		Harv	/ey 5	Stree	t / 0	cean	Bea	ch R	(+)			Li	nk N	umb	er		
Pit Numbe	TP17	7_ C	CH:- ((+)_		1560	!	m		2.4		m fr	om	<u>¢</u> _	Sh	ould	er Ll	1S	si	ide
Grade 5		_ % С	ross	fall_	2	·	%	Se	eal W	/idth	4.	.7	m		5	Seal T	Гуре		Grave	el
		<u>0.0 m</u> Right Shoulder <u>0.0 m</u> LH Side <u>0 m</u>																		
Pavement D				air				. <u>-</u> -				Drair		Fair		•				
	•		_′ _	ali	. – –				. D		abie	Dian	15				 ·			+
Pavement C	onaitio	n 			· ·			Ku	ıt Dep	oth				Ь.	3. ve	flecti	on			
	$\overline{}$																			
Graphic Dep Log (mr	m)	Materials Description													Co	av. & mp	Mois	dition	Nur	mple mber
× 🔿 >		RAVEL; fine, quartz, rounded, slightly clayey, high sand content D M - W A39 ith cobble sized stone dark brown.															.39			
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											Soil	Classi	ificatio	n GM			l	ļ	l	
XU.												Estima					l	ļ	l	
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· · · × 8	800																l		l	
INSITU CBR D		am)	0 5	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
Agg Blows (Dy				-	-	-	200	200	-	330	400	450	500	ეეე -	-	-	-	750	-	- 650
CBR (Dynamic	Cone)		工	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Farnell - CI Sc			\Box																	
Farnell - CI Sc Farnell - CI/20		+	+	+	\dashv		igwdapprox	igwdapprox			\vdash			\vdash			 			
Remarks and S						*Note	upper	·layer	CBR b	ased (on san	nple, ir	nsitu C	BR mı	uch hiç	gher.	<u> </u>			
				-																
		-	Carte o	+		\longrightarrow		\Box		\vdash										
No. of Lot, House, etc., in such such such such such such such such		7000		H		$\overline{}$														
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Job Name	Macquarie Heads Road - Pavement Investigation
Job No	HB13604
Ref Point	Harvey Street / Ocean Beach Road
Link Number	
Pit No	TP17
Pit Ch	1560
from CL	2.4
side	Shoulder LHS
Grade	5
Crossfall	2
Seal W	4.7
Pavement Type	Gravel
Shoulder LHS	0
Shoulder RHS	0
Cut/Fill LHS	0
cut / fill	
Cut/Fill RHS	1.5
cut / fill	cut
Pav Drainage	Fair
Table Drains	Fair
Pay Condition	
Rut Depth BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14

DCP Results													
depth	blows		cbr										
0	-												
50	-	0	0										
100	-	0	U										
150	-	0	0										
200	-	0	0										
250	-	0	U										
300	-	0	0										
350	-	0	0										
400	-	0	0										
450	-	0	0										
500	-	0	0										
550	-	0	0										
600	-	0	0										
650	-	0	U										
700	-	0	0										
750	-	0	0										
800	_	0	0										
850	_	0	0										
900	0	0	0										

	Look ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		



ob Name Macquarie Heads Road - Pavement Investigation Job No _HB13604_																				
Reference Poi	nt (C	1 0.0)	Han	vey S	Stree	t / O	cea <u>n</u>	Bea	ich F	(+)			Li	nk N	umb	er			
Pit Number_ T			_												С			si	ide	
Grade 2	%	Cros	ssfall	2	2	%	Se	eal W	/idth	5	.2	m		ξ	eal 7	Гуре		Grave	el	
Left Shoulder	_		-																	
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Pavement Drain	•	r	Fair				. .			3DIE	Drain	is	Fair			·				
Pavement Cond	lition						Ru	t Dep	oth 				B.E	B. De	flecti	ion				
	一												$\overline{}$	_	=	$\overline{}$	$\overline{}$	_		
Graphic Depth Log (mm)		Materials Description												Co	av. & emp	Conc	sture dition	Nur	mple mber	
	GRAVEL; fine, quartz, angular, sub rounded with silty sandy fines, grey. Soil Classification GM																			
80		Soil Classification GM Estimated CBR 50																		
100	CRAI	GRAVEL; medium to cobble sized, quartz, rounded, with sandy fines. VD D A41																		
×O×	GNAV	TAVEE, medium to copple sized, quartz, rounded, with sandy lines.																		
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INSITU CBR Dept	h (mm)	0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	
Agg Blows (Dyn C					<u> </u>						<u> </u>	<u> </u>			<u> </u>	<u> </u>		-		
CBR (Dynamic Co Farnell - CI Scale	ne) 1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Farnell - CI Scale		\vdash	$\vdash \vdash \vdash$	\longrightarrow	$\vdash \vdash \vdash$	\vdash	\longrightarrow	\longrightarrow	$\overline{}$	\vdash	\vdash	$\vdash \vdash \vdash$	\vdash	 	\vdash	\vdash	\vdash	$\overline{}$		
Farnell - CI/20 = C	BR																			
Remarks and Sket	ches				*Note	upper	layer	CBR b	ased	on san	nple, ir	ısitu C	BR mu	uch hiç	jher.					
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Job Name	Macquarie Heads Road - Pavement Investigation
Job No	HB13604
Ref Point	Harvey Street / Ocean Beach Road
Link Number	
Pit No	TP18
Pit Ch	1860
from CL	0
side	CL
Grade	2
Crossfall	2
Seal W	5.2
Pavement Type	Gravel
Shoulder LHS	0
Shoulder RHS	0
Cut/Fill LHS	0
cut / fill	
Cut/Fill RHS cut / fill	
Pav Drainage	Fair
Table Drains	Fair
Pav Condition	
Rut Depth	
BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG 24-Jan-14
Date	24-Jd11-14

DCP Results													
depth	blows		cbr										
0	-												
50	-	0	0										
100	-	0	U										
150	-	0	0										
200	-	0	0										
250	-	0	U										
300	-	0	0										
350	-	0	0										
400	-	0	0										
450	-	0	0										
500	-	0	0										
550	-	0	0										
600	-	0	0										
650	-	0	U										
700	-	0	0										
750	-	0	0										
800	_	0	0										
850	_	0	0										
900	0	0	0										

L	₋ook ups	
Excav & comp	Mosture	cut fill
very loose -VL	dry - D	cut
loose - L	moist - M	fill
medium dense - MD	wet - W	
dense - D		
very dense - VD		
very soft - VS		
soft - S		
firm - F		
stiff - St		
hard - H		



Job No HB13604 Reference Point (Cl 0.0)																		
Reference Point (C	I 0.0)	Har	vey S	3tree	t / O	cean	Bea	ch R	(+)			Li	nk N	umb	er		
Pit Numbe TP19	CH:	- (+)		1860	!	m	<u> </u>	2.6		m fr	om	<u>¢_</u>	sh	oulde	er LI	HS_	si	ide
Grade2 %	Cros	ssfall	2	2	%	S	eal W	/idth	5.	.2	m		5	- Seal ⊺	 Гуре	1	Grave	əl
Left Shoulder 0.0		-									=							
Pavement Drainage		-				. – – .												
•		Fair							anie	Dian	15							
Pavement Condition						Ru	ıt Dep	oth				B.t	3. De	flecti	ion			
																	=	
Graphic Depth Log (mm)			<u> </u>		Materia		Co	av. &	Cond			mple mber						
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· >× (301			on Sivi ated CE		<u> </u>		<u> </u>		l	
INSITU CBR Depth (mm)) 0	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
Agg Blows (Dyn Cone CBR (Dynamic Cone)	 -	- 0	- 0	- 0	- 0	<u> </u>	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	-	- 0	- 0
Farnell - CI Scale 1	+	- 0			0	0	U	U	U	U	U	U	U	U	U	0		U
Farnell - CI Scale 2																		
Farnell - CI/20 = CBR				**1.240			222 6			1 - 5	· · · · · ·		5 Ja 1					
Remarks and Sketches				*Note	upper	layer	CBK D)ased (on san	nple, ir	nsitu C	BR mu	uch nig	jher.				
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Logged By

Job Name	Macquarie Heads Road - Pavement Investigation
Job No	HB13604
Ref Point	Harvey Street / Ocean Beach Road
Link Number	
Pit No	TP19
Pit Ch	1860
from CL	2.6
side	shoulder LHS
Grade	2
Crossfall	2
Seal W	5.2
Pavement Type	Gravel
Shoulder LHS	0
Shoulder RHS	0
Cut/Fill LHS	0
cut / fill	
Cut/Fill RHS cut / fill	
Pav Drainage	Fair
Table Drains	Fair
Pav Condition	
Rut Depth	
BB Deflection	
Exc Method	Excavator and Auger
Log By	NJ RG
Date	24-Jan-14

DCP Results													
depth	blows		cbr										
0	-												
50	-	0	0										
100	-	0	U										
150	-	0	0										
200	-	0	0										
250	-	0	U										
300	-	0	0										
350	-	0	0										
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450	-	0	0										
500	-	0	0										
550	-	0	0										
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650	-	0	U										
700	-	0	0										
750	-	0	0										
800	_	0	0										
850	_	0	0										
900	0	0	0										

		Look ups	
	Excav & comp	Mosture	cut fill
	very loose -VL	dry - D	cut
	loose - L	moist - M	fill
	medium dense - MD	wet - W	
	dense - D		
	very dense - VD		
	very soft - VS		
	soft - S		
	firm - F		
	stiff - St		
	hard - H		
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Job Name <u>Macquarie Heads Road - Pavement Investigation</u> Job No <u>HB13604</u> Reference Point (Cl 0.0) <u>Harvey Street / Ocean Beach R</u> (+) Link Number																			
Reference Poi	nt (CI 0	0.0)	<u>Har</u>	vey S	Stree	t / O	<u>cean</u>	Bea	ch_R	(+)			Li	nk N	umb	er		
Pit Numbeı_ The																		si	ide
Grade2	% C	ros	sfall	2	2	%	Se	eal W	/idth	6	3	m		5	Seal 1	Гуре		Grave	e/
Left Shoulder	=											_							
Pavement Drain							. – – .	_ =				- <u>-</u> - าร				0.0.0			
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Pavement Cond	ition	-					Ru	t De	oth				В.	3. De	flecti	ion			
Graphic Depth Log (mm)		Materials Description												Excav. & Moisture Comp Condition					mple mber
	GRAVE	GRAVEL; fine, quartz, angular,with sandy fines, yellow. Soil Classification GM D																	
		Estimated CBR 50																	
△×4 100																			
× ▽ > 140																			
	GRAVE	RAVEL; medium, quartz, rounded, with sandy fines grey brown. D D-M																	
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800																			
INSITU CBR Depth	(100,100)	0	50	100	150	200	250	300	350	400	450	500	EEO	600	650	700	750	900	850
Agg Blows (Dyn Co		-	-	-	-	200	230	-	-	400	450	-	-	-	-	700	-	-	- 000
CBR (Dynamic Cor			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Farnell - CI Scale	1																		
Farnell - CI Scale Farnell - CI/20 = CE																			
Remarks and Sketo					*Note	upper	layer	CBR b	ased (on san	nple, ir	nsitu C	BR mı	uch hiç	gher.				
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Pit Details

Job Name	Macquarie Heads Road - Pavement Investigation		
Job No	HB13604		
Ref Point	Harvey Street / Ocean Beach Road		
Link Number			
Pit No	TP20		
Pit Ch	2040		
from CL	2		
side	RHS		
Grade	2		
Crossfall	2		
Seal W	6		
Pavement Type	Gravel		
Shoulder LHS	0		
Shoulder RHS	0		
Cut/Fill LHS	0		
cut / fill			
Cut/Fill RHS cut / fill			
Pav Drainage	Fair		
Table Drains	Fair		
Pav Condition			
Rut Depth			
BB Deflection			
Exc Method	Excavator and Auger		
Log By	NJ RG 24-Jan-14		
Date	24-Jan-14		

DCP Results					
depth	blows		cbr		
0	-				
50	-	0	0		
100	-	0	U		
150	-	0	0		
200	-	0	0		
250	-	0	U		
300	-	0	0		
350	-	0	0		
400	-	0	0		
450	-	0	0		
500	-	0	0		
550	-	0	0		
600	-	0	0		
650	-	0	U		
700	-	0	0		
750	_	0	0		
800	_	0	0		
850	_	0	0		
900	0	0	0		

Look ups					
Excav & comp	Mosture	cut fill			
very loose -VL	dry - D	cut			
loose - L	moist - M	fill			
medium dense - MD	wet - W				
dense - D					
very dense - VD					
very soft - VS					
soft - S					
firm - F					
stiff - St					
hard - H					
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Appendix D

Traffic Calculations

Appendix D – Methodology for Design Traffic

Traffic and Deflection Parameters

Considering the different traffic volumes as described on Section 2.2 the following sections have been created to analyse the Characteristic Deflection for the existing pavement:

- Harvey Street Lyell Highway to Andrew Street
- Harvey Street and Ocean Beach Road Andrew Street to Macquarie Heads Road
- Macquarie Heads Road

Harvey Street – Lyell Highway to Andrew Street

Traffic on this section of Harvey Street has been divided in two components for a 20 years design life:

• Existing traffic with 2% annual growth factor

$$N_{DT} = 365 \text{ x (AADT x DF) x %HV/100 x } N_{HVAG} \text{ x LDF x CGF}$$
 $N_{DT} = 365 \text{ x (766 x 0.5) x 0.14 x 2.6 x 1 x 24.3}$
 $N_{DT} = 1.24 \text{ x } 10^6$
 $DESA = N_{DT} \text{ x ESA/H}_{VAG} = 1.24 \text{ x } 10^6 \text{ x 0.9} = 1.1 \text{ x } 10^6$

• Aquaculture hub traffic with no annual growth factor (only heavy traffic considered)

```
N_{DT} = 365 \text{ x (AADT x DF) x %HV/100 x } N_{HVAG} \text{ x LDF x CGF}
N_{DT} = 365 \text{ x (30 x 0.5) x 1 x 2.6 x 1 x 20}
N_{DT} = 2.85 \text{ x } 10^5
DESA = N_{DT} \text{ x ESA/H}_{VAG} = 2.85 \text{ x } 10^5 \text{ x 0.9} = 2.6 \text{ x } 10^5
```

Total traffic: $1.1 \times 10^6 + 2.6 \times 10^5 = 1.4 \times 10^6$ ESA

Harvey Street and Ocean Beach Road - Andrew Street to Macquarie Heads Road

Traffic on this section of Harvey Street and Ocean Beach Road has been divided in two components for a 20 years design life:

• Existing traffic with 2% annual growth factor

$$\begin{split} N_{DT} &= 365 \text{ x (AADT x DF) x %HV/100 x N}_{HVAG} \text{ x LDF x CGF} \\ N_{DT} &= 365 \text{ x (460 x 0.5) x 0.15 x 2.6 x 1 x 24.3} \\ N_{DT} &= 7.96 \text{ x } 10^5 \\ DESA &= N_{DT} \text{ x ESA/H}_{VAG} = 7.96 \text{ x } 10^5 \text{ x 0.9} = 7.2 \text{ x } 10^5 \end{split}$$

• Aquaculture hub traffic with no annual growth factor (only heavy traffic considered)

$$N_{DT} = 365 \text{ x (AADT x DF) x %HV/100 x } N_{HVAG} \text{ x LDF x CGF}$$
 $N_{DT} = 365 \text{ x (49 x 0.5) x 1 x 2.6 x 1 x 20}$
 $N_{DT} = 4.65 \text{ x } 10^5$
 $DESA = N_{DT} \text{ x ESA/H}_{VAG} = 4.65 \text{ x } 10^5 \text{ x 0.9} = 4.2 \text{ x } 10^5$

Total traffic: $7.2 \times 10^5 + 4.2 \times 10^5 = 1.1 \times 10^6$ ESA

Macquarie Heads Road

Traffic on Macquarie Heads Roads has been divided in two components for a 20 years design life:

• Existing traffic with 2% annual growth factor

$$N_{DT} = 365 \text{ x (AADT x DF) x %HV/100 x } N_{HVAG} \text{ x LDF x CGF}$$
 $N_{DT} = 365 \text{ x (227 x 0.5) x 0.30 x 2.6 x 1 x 24.3}$
 $N_{DT} = 7.85 \text{ x } 10^5$
 $DESA = N_{DT} \text{ x ESA/H}_{VAG} = 7.85 \text{ x } 10^5 \text{ x 0.9} = 7.1 \text{ x } 10^5$

• Aquaculture hub traffic with no annual growth factor (only heavy traffic considered)

$$N_{DT} = 365 \text{ x (AADT x DF) x %HV/100 x } N_{HVAG} \text{ x LDF x CGF}$$
 $N_{DT} = 365 \text{ x (49 x 0.5) x 1 x 2.6 x 1 x 20}$
 $N_{DT} = 4.65 \text{ x } 10^5$
 $DESA = N_{DT} \text{ x ESA/H}_{VAG} = 4.65 \text{ x } 10^5 \text{ x 0.9} = 4.2 \text{ x } 10^5$

Total traffic: $7.1 \times 10^5 + 4.2 \times 10^5 = 1.1 \times 10^6$ ESA

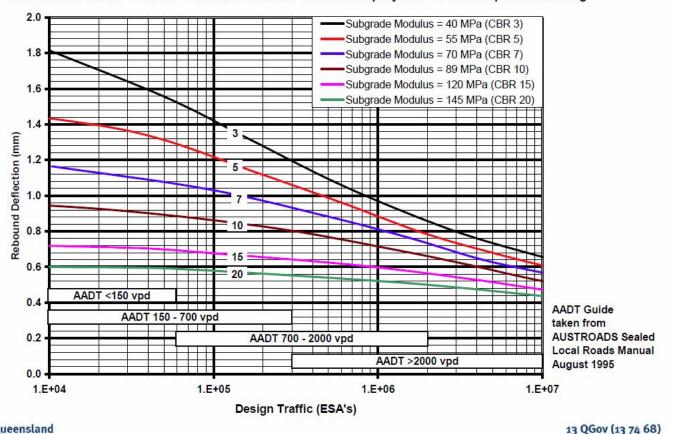
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Appendix E

TMR Chart

TMR Tolerable Deflection Charts for Low Volume Roads - Benkelman Beam

Tolerable Deflection - Benkelman Beam - Standard Axle Load with 550 kPa Tyre Pressure Low Volume Roads - Urban - Unbound Granular Base with Spray Seal or Thin Asphalt Surfacing



Connecting Queensland

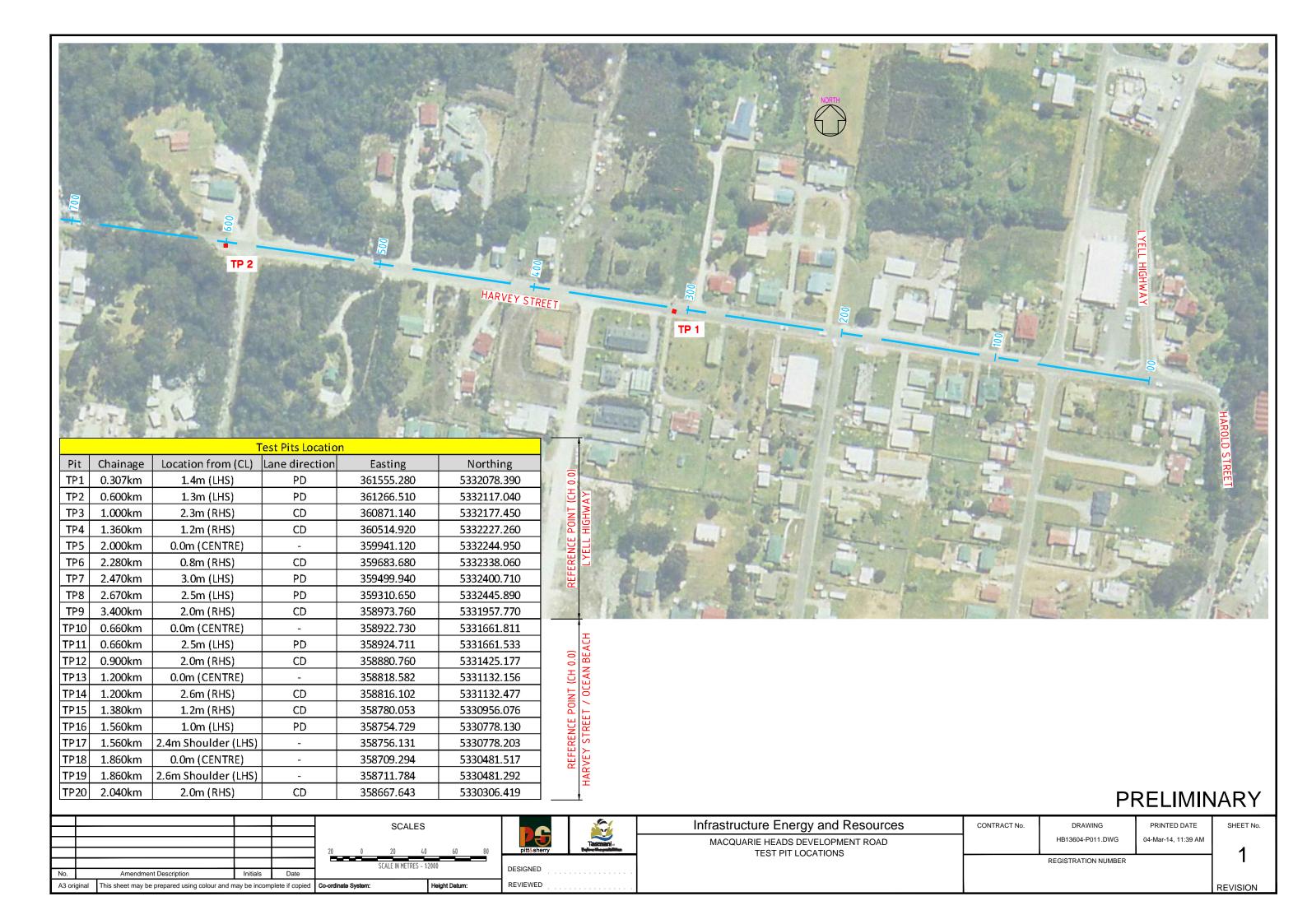
delivering transport for prosperity

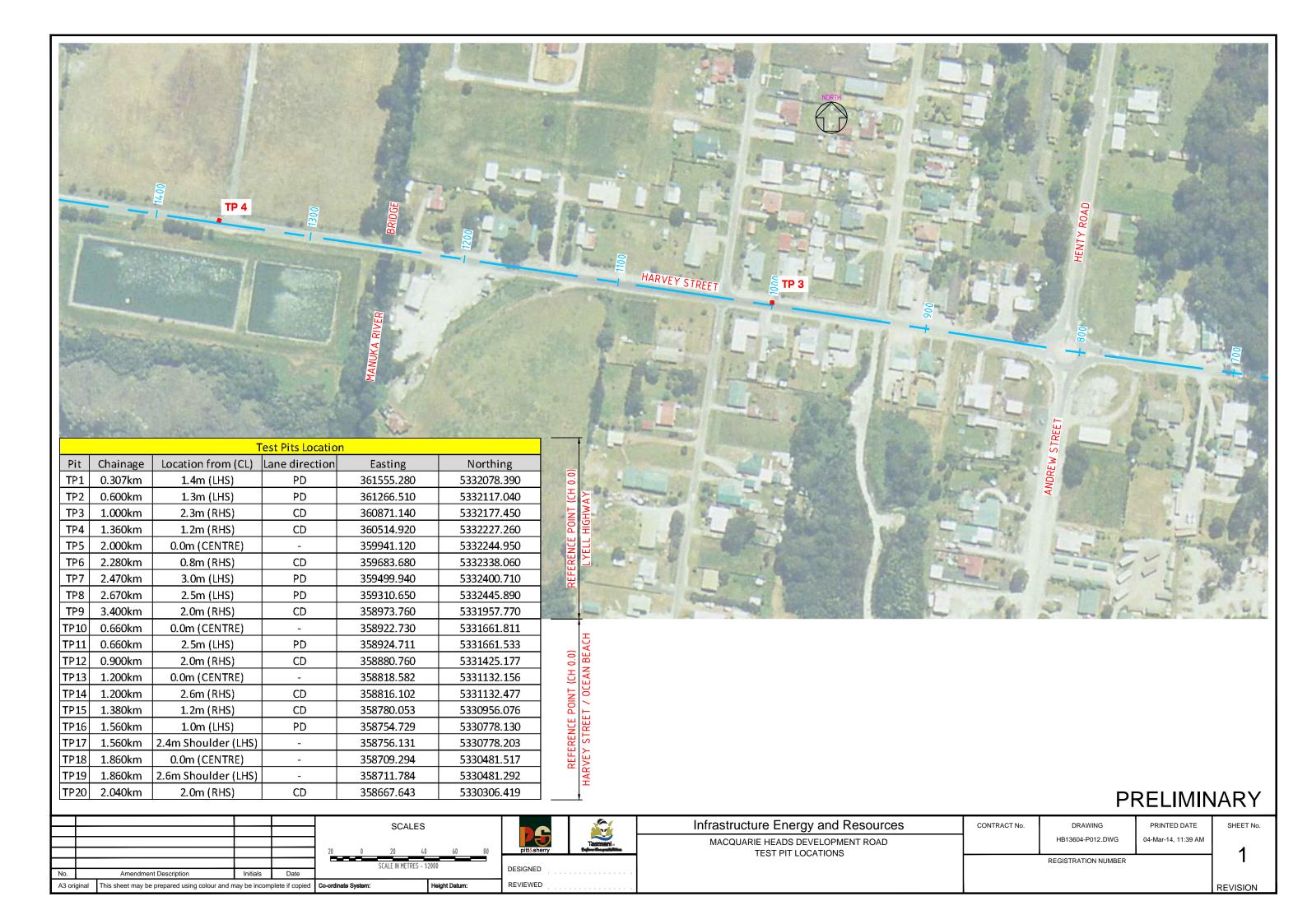
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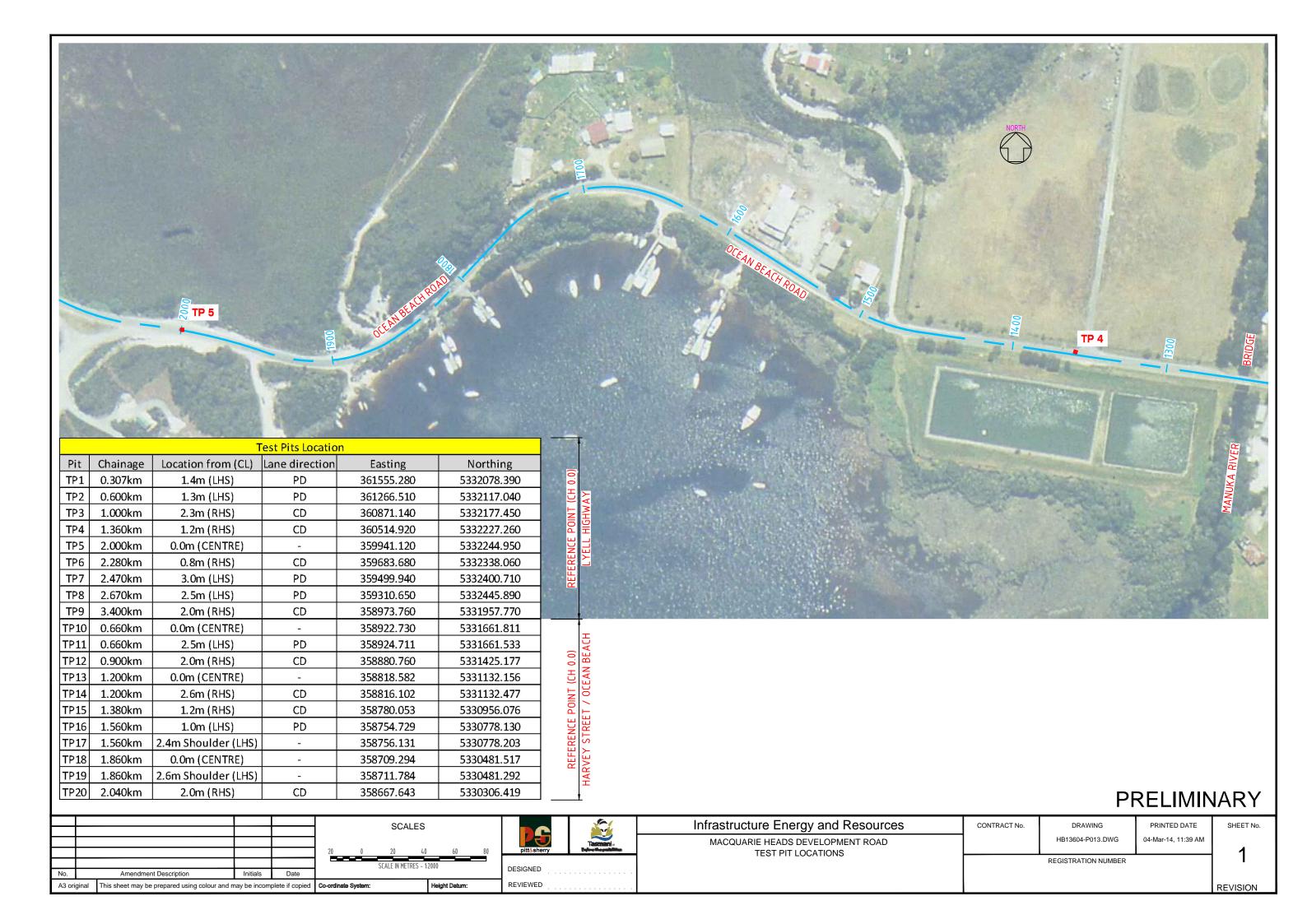
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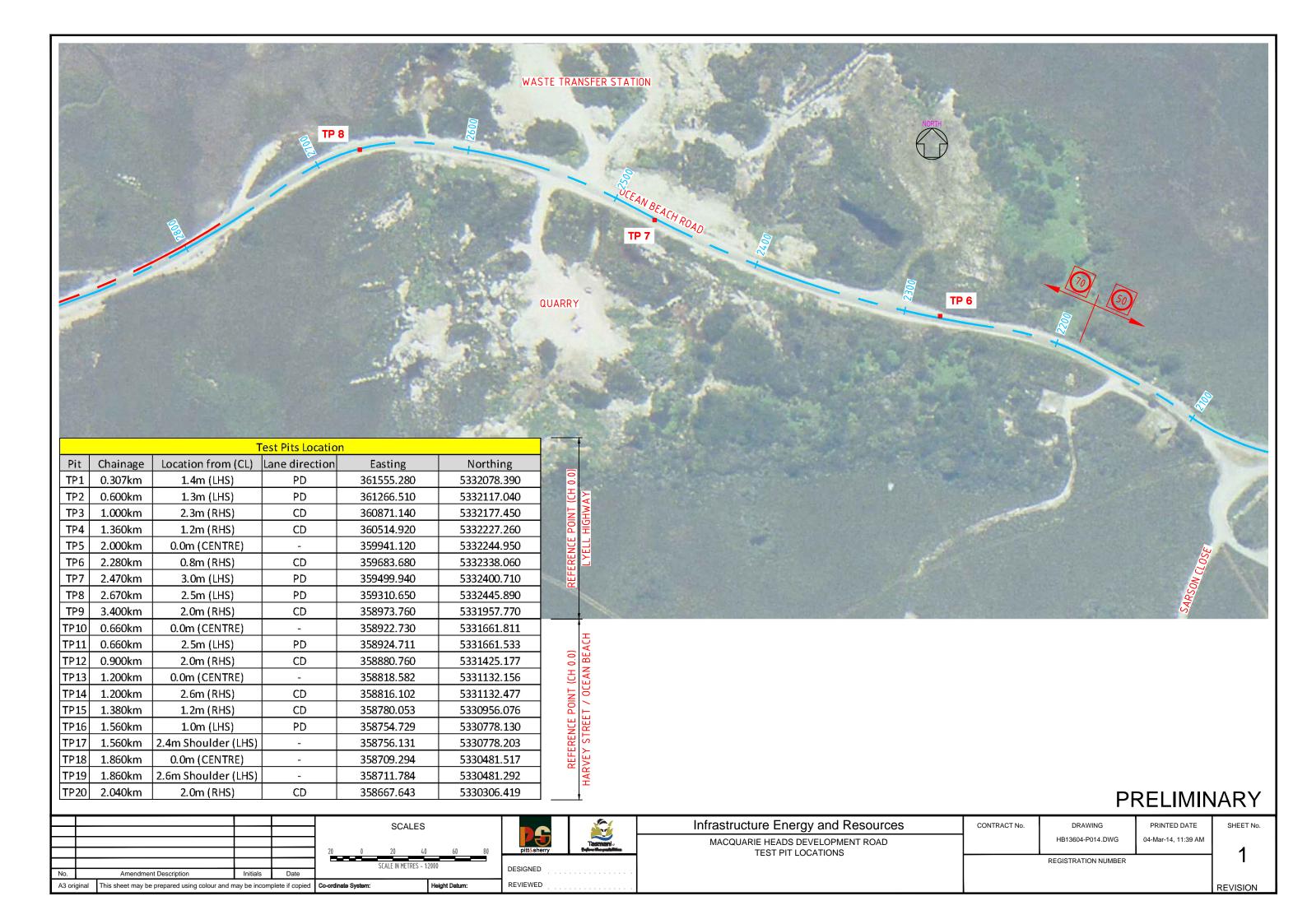
Appendix F

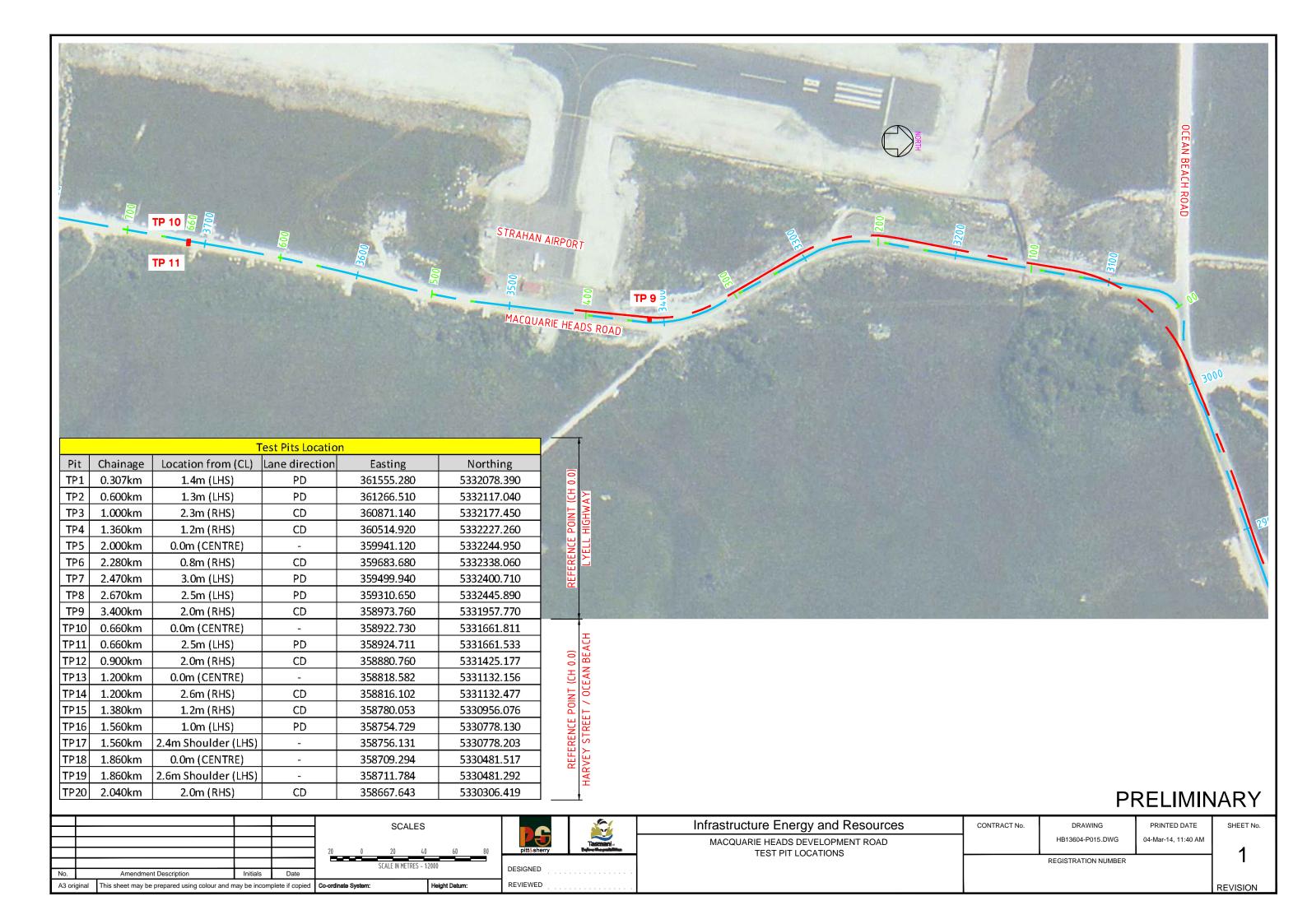
Set of Drawings

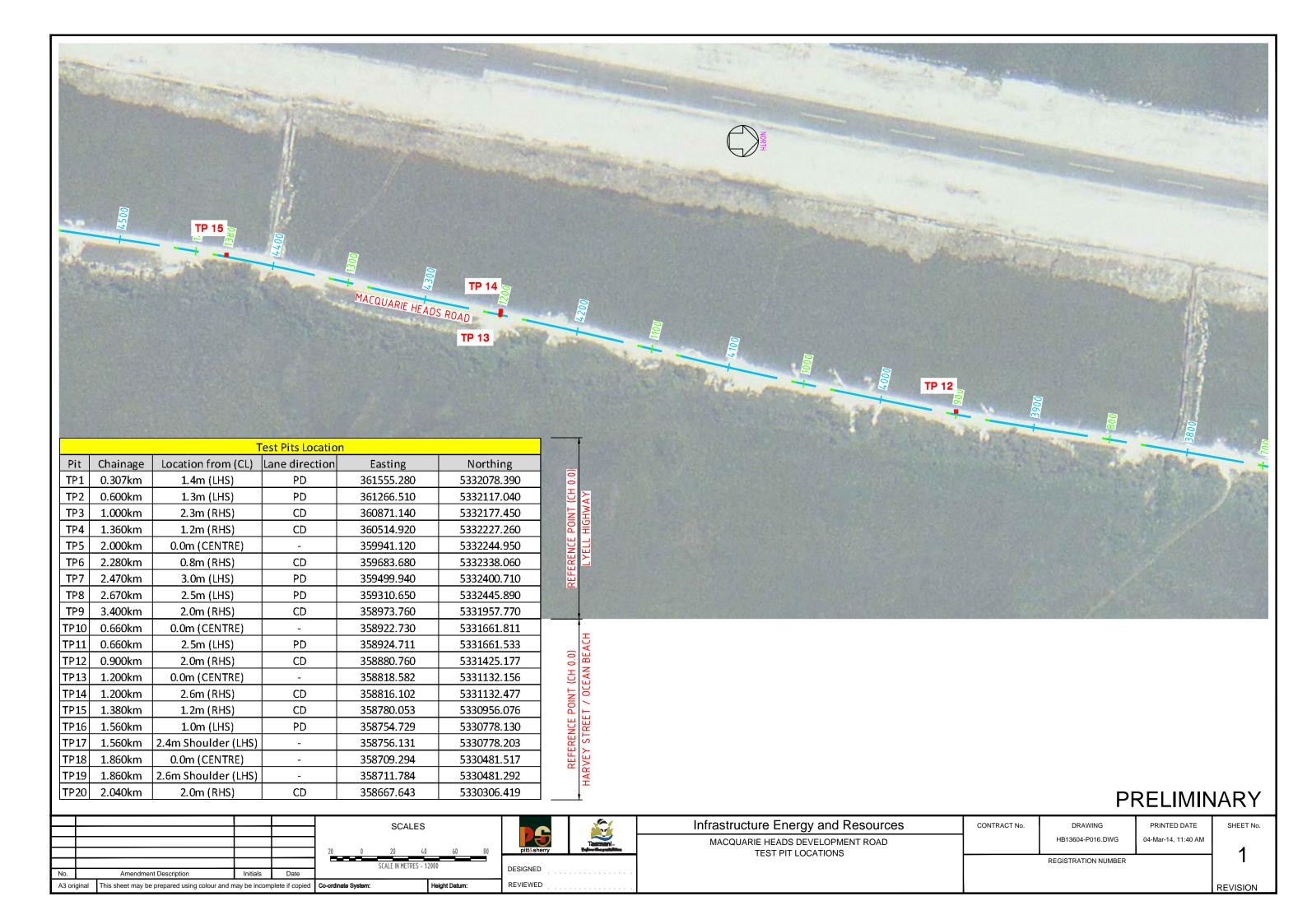


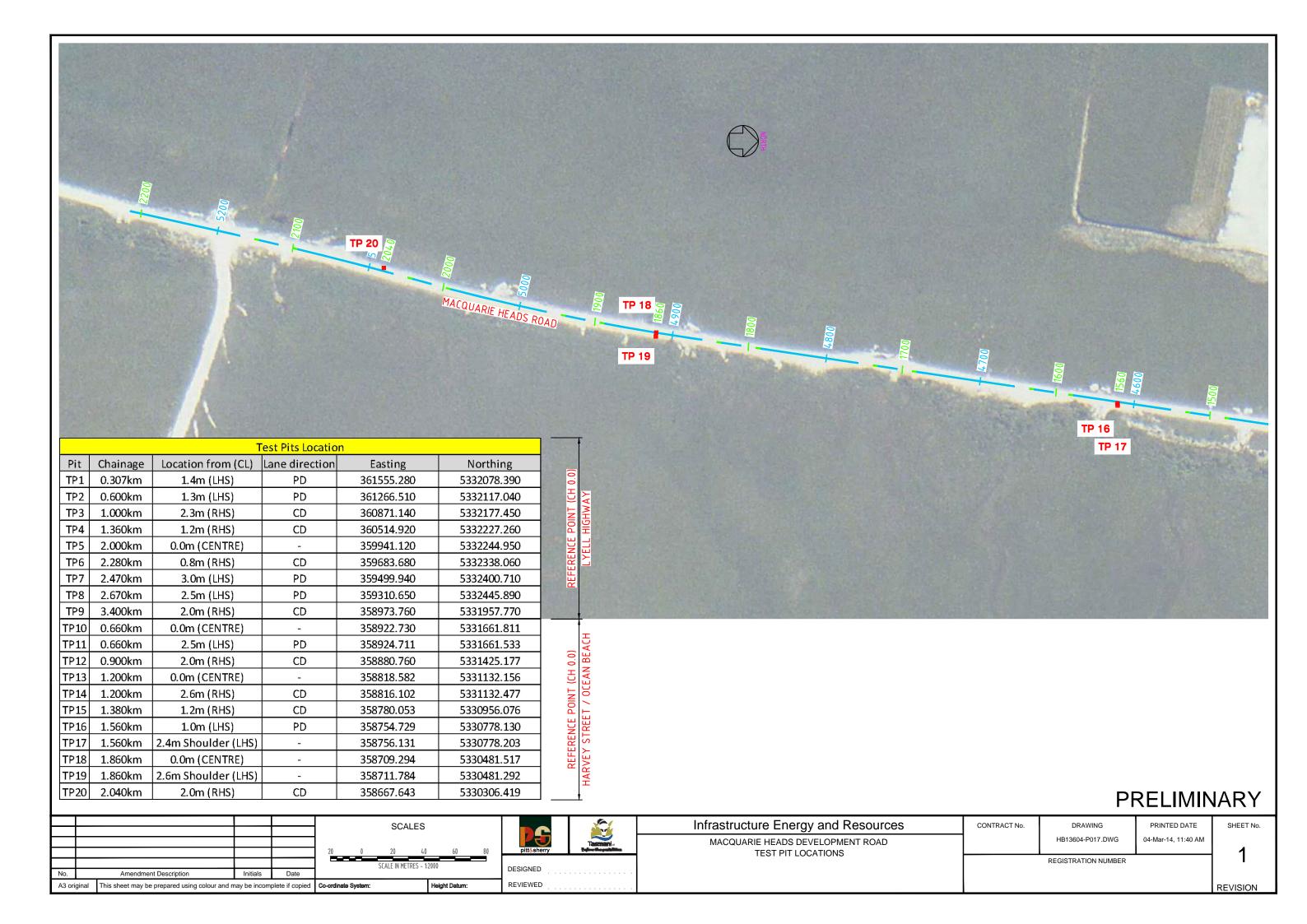












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transport | community | industrial & mining | carbon & energy









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