
Effect of Removing the Amelioration Period on Design and Construction of Lime Stabilised Subgrades in Local Government

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ABSTRACT

Lime stabilisation of subgrades to improve the California Bearing Ratio (CBR) in local government roads is not a new concept and has been widely used and accepted for many decades in Queensland. The process of spreading and mixing lime into non-compliant subgrade materials is simple and effective where permanent CBR improvements can be increased by a factor of well over 10.

The most common construction standard in Queensland is to mix the lime into the subgrade material over a two day period to facilitate amelioration and breakdown of heavy clay particles. The spreading and mixing requirement in TMR's construction specification, (MRTS07A Insitu Stabilised Subgrades using Quicklime or Hydrated Lime) is based on research that optimised the amelioration period. This research found maximum improvements to unconfined compressive strength (UCS) measurements of lime stabilised subgrade materials when the material was stabilised with a 14 hour amelioration period. Local government's adaptation of TMR's specification that requires lime to be mixed over a minimum two day period (to allow for the 14 hour amelioration period) is considered conservative in local government applications. This is due to the significant difference in the way subgrades are designed at state and local government levels.

Two of TMR's primary objectives in specifying a two day mixing process is to ensure adequate treatment of the material so that their strength requirement to achieve a target UCS of 1.5MPa is obtained, as well as ensuring sufficient particle breakdown, particularly in regions where highly reactive clays exist. In contrast to TMR's compressive strength requirement, most local government roads where low CBR subgrades exist, the designer regularly imposes a CBR improvement requirement for the subgrade material to exceed 5%.

The inconsistency that exists within the local government industry is the design and construction practices of stabilised subgrades (eg. a new housing subdivision or rehabilitation of an existing road). Whilst the design often has a requirement for the subgrade CBR to achieve a minimum CBR (say 5%), the corresponding construction specification which commonly follows TMR's MRTS07A stipulates that the lime must be mixed over a two day period (driven by the amelioration period and desire to achieve a target UCS of 1.5MPa). This construction practice is significantly conservative for local government to the point where it is unnecessary and costly.

This paper explores and compares single day and multiple day mixing processes with an emphasis on the effect of strength gain measured by UCS and CBR and how these correlate to the intended design outcomes. It will be shown that a single day mixing process with no amelioration period of the lime-soil mixture is sufficient in achieving the majority of local government design assumptions.

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1. BACKGROUND

Design and construction of lime stabilised subgrades is a well understood concept across Australia and particularly QLD where this treatment has been used significantly for many decades to provide economical benefits to asset owners in lieu of removing and replacing unsuitable materials. From a design perspective, the governing objective is to specify an increase in engineering properties from the existing material to support and allow the overlying pavement to absorb the traffic loadings. This is then achieved in the field through standard construction practices of mixing lime into the subgrade material as shown in Figure 1.



Figure 1. Lime Stabilisation of Subgrade Materials

The process of mixing lime into subgrade materials is well documented and Little (1995) references the use of Two-Stage Mixing whereby 100% of the required lime is mixed on the first day with a second pulverising mix carried out on the second, third or even fourth day. This ‘mellowing’ or amelioration period between mixes is designed to allow the clay particles to achieve effective breakdown through optimisation of the chemical reactions between the plastic particles and the lime. Little (1995) also notes that the mellowing period is best suited to heavy, plastic clays.

Austrroads (2006) suggests that amelioration periods from 4 to 72 hours are considered with the lime being added in two stages.

Queensland Department of Transport and Main Roads (TMR) follow the Austrroads guidance but have conducted research to optimise the amelioration period. Wilson (2011) found that a 14 hour amelioration period provided the maximum UCS results and in fact were equivalent to the results obtained at 24 hours. In either case, TMR stipulate in their mix design and construction specifications that lime is to be added in two stages to facilitate an amelioration period of at least one day and up to 3 days for heavy clays. The primary desire for this is to ensure there is adequate breakdown of the clay particles (100% passing 19mm sieve and > 60% passing 9.5mm sieve) to allow effective chemical reactions and hence strength gain, with the latter being a target UCS of 1.5MPa and range between 1.0 and 2.0 MPa (QLD Government 2012, TN74).

Many local government areas follow the above construction principle of specifying a two stage mixing process. Townsville City Council is one example who note, ‘*Lime stabilisation of subgrade material shall be carried out as a 2 day operation to a minimum depth of 250mm...*’ in their Lime Stabilisation sub section of Council’s City Plan.

2. PROBLEM STATEMENT

Whilst there is a synergy between state and local government with respect to following two stage mixing of lime in the field, there is a clear disparity in the way each sector carries out pavement designs. As highlighted above, TMR target compressive strengths of 1.5MPa whilst most local council’s

design their pavements based on the CBR of subgrade materials, usually with a maximum value of 10% and sometimes up to 15-20%. Some examples include:

Brisbane City Council:

3.5.4 Subgrade evaluation

3.5.4.1 General

- (1) The design parameter for the subgrade is the California Bearing Ratio (CBR). The pavement design must be based on the soaked CBR tests being representative of the subgrade over the various lengths of road at the box depth.

Mackay Regional Council:

1.5.2 Subgrade Evaluation

Except where a mechanistic design approach is employed using Aust Roads Pavement Design Manual, the measure of subgrade support shall be the California Bearing Ratio (CBR). Where a mechanistic design approach using linear elastic theory is employed for flexible pavements, the measure of subgrade support shall be in terms of the elastic parameters (modulus, Poisson's ratio).

Western Downs Regional Council:

1.13.2 Subgrade Evaluation

The Subgrade Evaluation shall adhere to the following requirements:

- A design CBR is to be determined for each identifiable unit defined on the basis of topography, geological and drainage condition of the site

Gladstone Regional Council:

9.4.1 PAVEMENT DESIGN BASIS

General - Pavements shall be designed for a 20 year life in service. The total pavement depth shall be based on the soaked California Bearing Ratios (CBR) of the subgrade material, the thickness and CBR of the various pavement layers (base, sub-base, etc), and the number of repetitions of Equivalent Standard Axles (ESA) for the life of the pavement.

Acknowledging that this disparity requires a different focus if ever there is to become a single approach to designing subgrades, the problem that exists is that local government in most cases is over specifying the construction requirements. Given local government only require their subgrades to achieve a CBR of say 5-10%, this is usually achieved easily with lime stabilisation when existing subgrade materials are less than 5%. The question is whether or not the two stage mixing process currently being specified by councils is necessary and what benefit is obtained from being specified.

Based on the current TMR laboratory testing requirements for lime stabilised materials, samples will be tested for UCS and CBR with no amelioration period and 24 hour amelioration period. The former is designed to replicate a process whereby 100% of the lime is mixed into the subgrade material at the same time. It is recognised that often due to higher spread rates, the lime may need to be spread and mixed twice, however this is usually done within a matter of hours and in effect facilitates some amelioration. Hence, the laboratory testing at zero hours is conservative. The 24 hour amelioration period is designed to replicate what is commonly

observed in the field with the second half of the lime mixed into the subgrade material on the second day. It is not considered practical to replicate the 14 hours as found from previously stated research (Wilson, 2011) since this time frame puts second stage mixing somewhere in the middle of the night.

The objective is to explore the effect on not only UCS and CBR strength gains, but other characteristics such as material breakdown with both amelioration periods. Comparison will then be made with the common local government design parameter to use CBR for subgrade modelling rather than UCS.

3. MATERIAL SAMPLES

Subgrade soil samples were collected from two locations in Queensland, one in north Queensland and one in south east Queensland. Each location can be described as:

NQ Soil: Exposed subgrade at Stockland Northshore development, Townsville.

SQ Soil: Exposed subgrade at Warrego Hwy on the Charlton Upgrade Stage 2, ~1.7km west of Kingsthorpe Haden Rd, E/B carriageway slow lane (~20km west of Toowoomba).

Diagrams of each location are shown below in Figures 2 and 3. Approximately 200kg were sampled from two test pits at each site. Whilst an effort has been made to collect subgrade material samples that represent 'typical' low quality reactive subgrades often encountered in construction projects, it is difficult to characterise all subgrade materials across QLD.

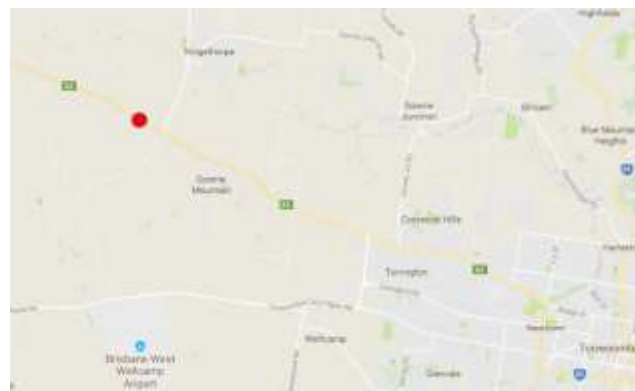


Figure 2. SQ Sample Location

5. LABORATORY TEST RESULTS

Untreated Material Characteristics

Table 2. Untreated Material Properties

Characteristic	Spec Requirement	NQ Soil	SQ Soil
PSD	> 25% passing 0.425mm	87%	78%
MDD		1.744 t/m ³	1.468 t/m ³
OMC		17.2%	29.9%
Atterberg Limits	PI > 10%	21.2%	27.2%
Organic Content	< 1.0%	0.8%	1.0%
Sulfate Content	< 0.3%	0.16%	0.43%
Ferrous Oxide (FeO)	< 2.0%	0.05%	2.28%
4 day soaked CBR		3.0%	3.5%
Lime Demand (LD)		3%	5%
Capillary Rise	Time to 100%	2.0 hrs	2.5 hrs

Where a specification requirement has been set, the NQ soil was compliant whilst the SQ soil exceeded the limits for sulfate content and ferrous oxide content, however these limits are guides only and the amounts exceeded are not considered significant enough to warrant terminating testing of this material.

The lime demand results of 3% and 5% for the NQ and SQ soils respectively are illustrated in Table 3 and graphically in Figures 4 and 5. Eades and Grim (1966) refer to lime demand as being the least amount of lime required when the pH is above 12.4 and three consecutive results are within 0.05 of each other.

Table 3. Lime Demand Results

Lime %	0	1	2	3	4	5	6	7
SQ Soil	7.75	10.2	11.39	12.3	12.68	12.79	12.79	12.81
NQ Soil	7.85	12.26	12.9	12.96	12.96	12.94	12.96	12.96

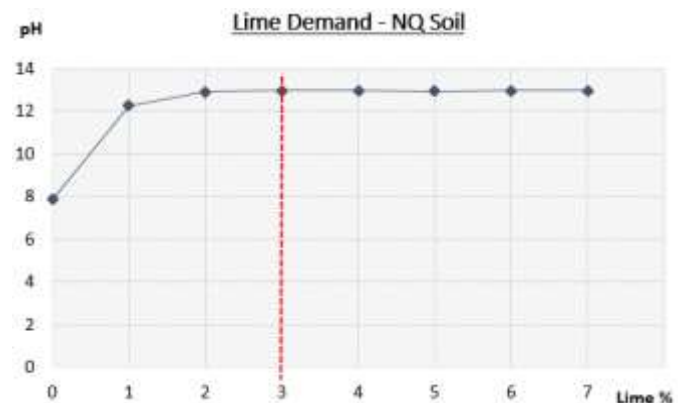


Figure 4. NQ Lime Demand



Figure 3. NQ Sample Location

4. MATERIAL TESTING PROGRAM

Material samples from both locations were subjected to a variety of tests that generally followed those set out in TMR's Technical Note 151: Testing of Materials for Lime Stabilisation. A summary of the tests performed is shown in Table 1.

Table 1. Testing Program

Untreated Material		Treated Material	
Test ID	Test Type	Test ID	Test Type
A	PSD	J	UCS - 28 day cure
B	MDD & OMC	K	4 day soaked CBR
C	Atterberg Limits	L	PSD
D	Organic Content	M	Capillary Rise
E	Sulfate Content		
F	Ferrous Oxide (FeO)	N	UCS - 28 day cure
G	4 day soaked CBR	O	4 day soaked CBR
H	Lime Demand (LD)	P	PSD
I	Capillary Rise	Q	Capillary Rise

Tests J through M did not have an amelioration period, while tests N through Q had the lime added in equal amounts across two stages with the samples allowed to mellow for 24 hrs prior to testing.

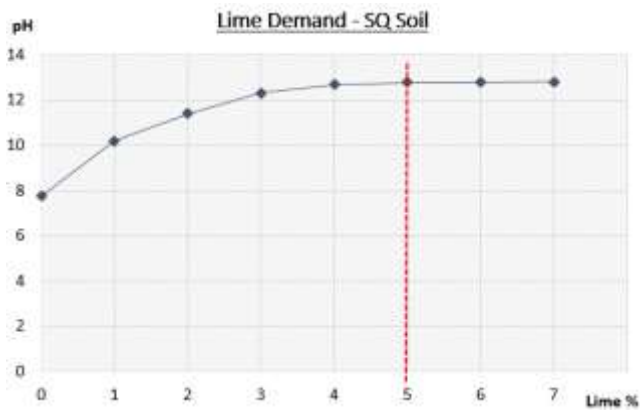


Figure 5. SQ Lime Demand

The Lime Demand for each soil was then used as the starting point for subsequent testing of UCS and CBR testing.

Laboratory reports can be found in Appendix A for all tests listed in Table 2.

Treated Material Characteristics

Graphical representations are shown below for 4 day soaked CBR, 28 day cured UCS, PSD, swell and capillary rise. Lime contents used for each of these tests is shown in Table 3.

Table 3. Laboratory Lime Contents

	SQ Soil	NQ Soil
CBR	0%, 3%, 5% , 7%	0%, 1%, 3% , 5%, 7%
UCS	3%, 5% , 7%	1%, 3% , 5%, 7%
Swell	0%, 3%, 5% , 7%	0%, 1%, 3% , 5%, 7%
PSD	0%, 5%	0%, 3%
Cap. Rise	0%, 5%	0%, 3%

The application rates above in bold indicate lime demand (LD) percentage. For the SQ soil there was not enough material available, so LD+4% was not tested for CBR and UCS.

Laboratory reports can be found in Appendix B for all tests listed in Table 3.

It is important to note that upon completion of any mix design process, the selection of a lime application rate whether it be based on CBR, UCS or other criteria, often has 0.5-1.0% added to the Lime Demand (LD) percentage to allow for construction tolerances and host material variances.

For the purpose of discussing the outcomes of the two materials tested, the following Application Rates (AR) have been selected:

SQ Soil: AR = LD + 1%
AR = 6%

NQ Soil: AR = LD + 1%
AR = 4%

CBR

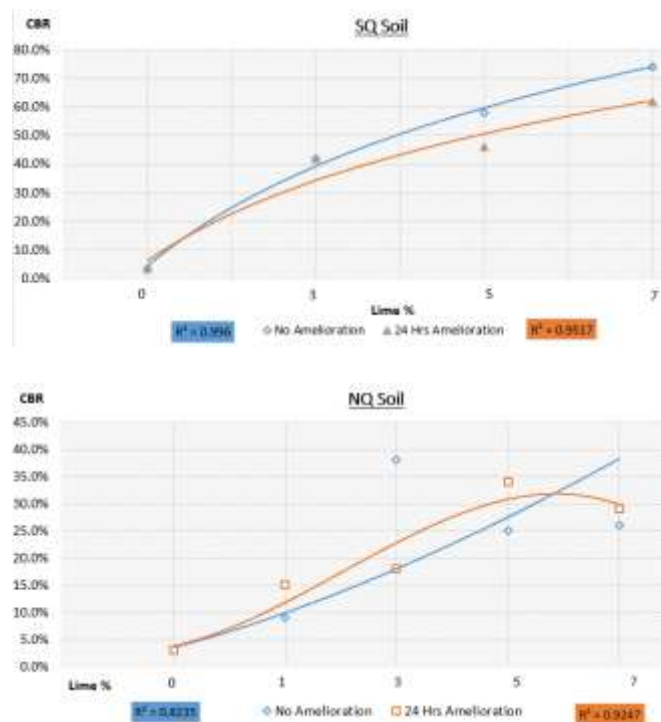


Figure 6. CBR Results

For both soils the samples with no amelioration returned higher results. At AR+6%, the SQ soil exhibited CBR's between 55% and 65%, whilst the NQ soil exhibited CBR's between 20% and 30%.

UCS

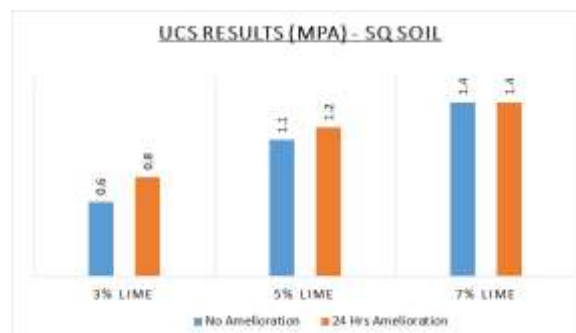




Figure 7a. SQ Soil UCS Results

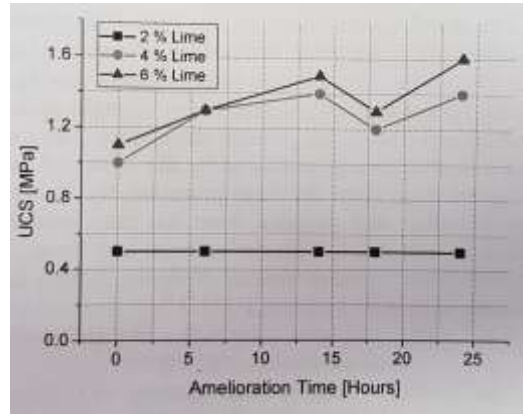


Figure 8. Increase in UCS (Gallage et. al)

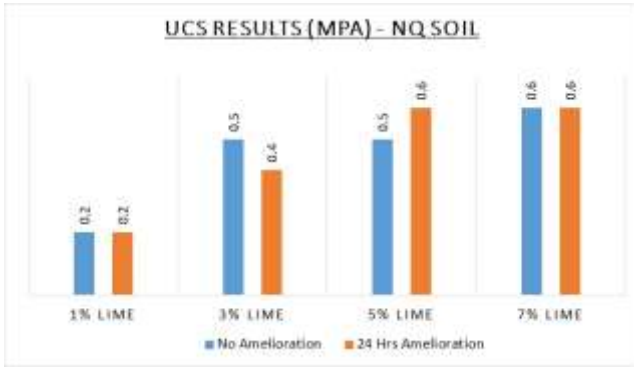


Figure 7b. NQ Soil UCS Results

For the SQ Soil, the ameliorated samples returned results ranging from approximately 10-30% higher than the non-ameliorated samples, apart from the 7% application rate which showed no difference.

For the NQ Soil, there was no distinct pattern showing an increase from no amelioration to 24 hours of amelioration.

These increases align with the two soils from Barcaldine and Emerald examined by Gallage et. al (2012) where the difference in UCS based on a 5% application rate (LD was 4%), was in the range 25% to 60% higher for the ameliorated samples (Fig 8).

PSD

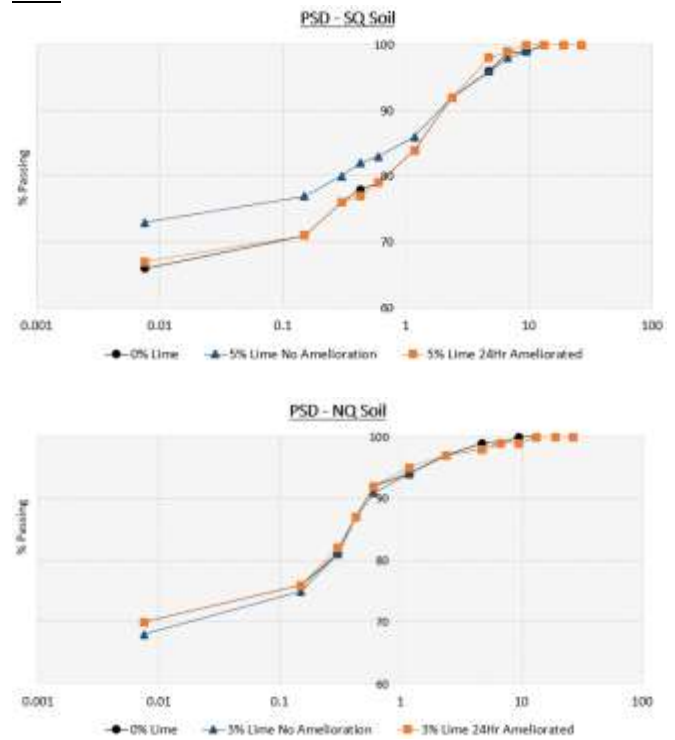
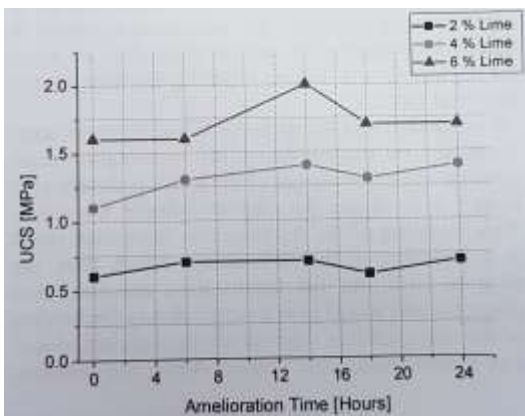


Figure 9. PSD Results

Table 4 compares the PSD of each treated sample against the specification requirements set out by TMR which are designed to indicate adequate particle breakdown and hence reactivity with the soil and lime.

Table 4. PSD Comparison Post Treatment

	No Amelioration		24 Hrs Amelioration	
	% Passing 19mm	% Passing 9.5mm	% Passing 19mm	% Passing 9.5mm
SQ Soil (@ 5% LD)	100	99	100	100
NQ Soil (@ 3% LD)	100	99	100	99
Spec Requirement	100	60-100	100	60-100



SWELL

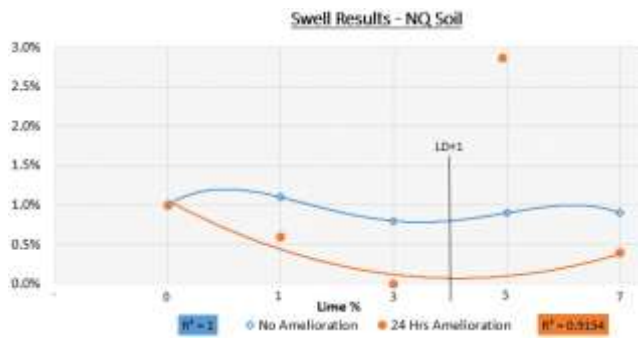
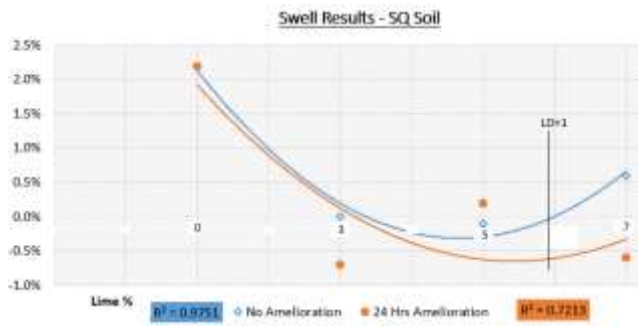


Figure 10. Swell Results

Swell was higher for the non-ameliorated samples at all application rates. Both samples indicated lowest swell characteristics at approximately Lime Demand percentage plus 1%. This provides confidence that upon selection of application rates at mix design stage of LD 1.0%, this characteristic is at its lowest point.

CAPILLARY RISE

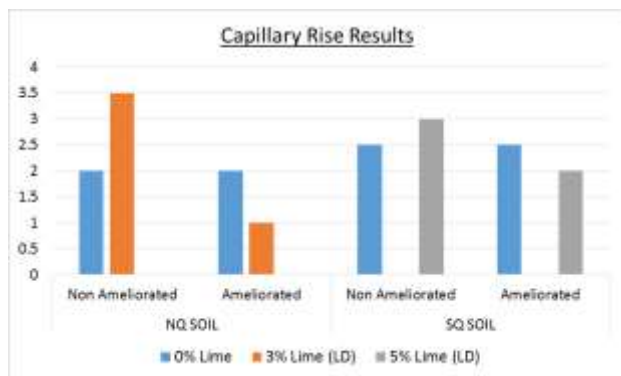


Figure 11. Capillary Rise Results



Non Ameliorated Ameliorated

Figure 12. SQ Soil, Capillary Rise



Non Ameliorated Ameliorated

Figure 13. NQ Soil, Capillary Rise

Capillary rise results are often difficult to conclude benefit, as incorporation of lime at certain application rates can actually increase the permeability of a given material. These results show that the samples with no amelioration decreased the permeability where the samples with 24 hours amelioration increased the permeability when compared to the untreated samples. The SQ soil reached 100% absorption in less time than the NQ soil even though the SQ soil exhibited UCS values around double that of the NQ soil.

6. CASE STUDY EXAMPLE

Scenario:

A local council designs a new pavement for a residential development that resembles the schematic shown in Figure 14, with a design subgrade of CBR 5.

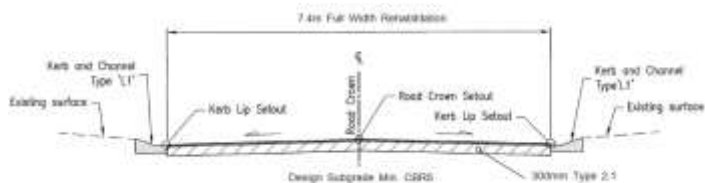


Figure 14. Example LG Pavement Design

Consider the materials described in this paper from SQ and NQ which have insitu CBRs of 3.5% and 3% respectively. Given these characteristics do not meet the design CBR of 5%, the local council has decided to stabilise the subgrade to a thickness of 300mm.

Austrroads 2013 have proposed the equation shown below with accompanying conditions for the selection of a design CBR on a stabilised subgrade. Once this new approach becomes part of Austrroads updated Part 2 for Structural Design, this approach will allow designers to model stabilised subgrades separately to insitu subgrade materials.

The design CBR of each selected subgrade and stabilised subgrade material is the minimum of (1) 15%, (2) the value determined from CBR tests or presumed CBR, and (3) the value determined from the support provided by the underlying material (i.e. in situ subgrade, selected subgrade or stabilised subgrade material) using (Equation 25).

$$CBR_{\text{selected or stab. subgrade}} = CBR_{\text{underlying material}} \times 2^{\frac{(\text{selected or stab. subgrade} / 150)}$$

Using the Austrroads equation to establish the design CBR of the stabilised subgrade, we get the following:

$$\text{SQ Soil: } CBR_{SS} = 3.5 \times 2^{(300/150)} = 14\%$$

$$\text{NQ Soil: } CBR_{SS} = 3.0 \times 2^{(300/150)} = 12\%$$

Since the above results are lower than all laboratory test results and are less than 15%, these values would therefore be deemed design CBRs for the stabilised subgrade from which the overlying pavement can then be designed from empirical or mechanistic means. In contrast, the use of design CBR values of 14% and 12% for the stabilised subgrades are still considered conservative given the laboratory test results far exceed these values.

7. CONCLUSIONS & RECOMMENDATIONS

Clarification of the outcomes provided from the laboratory testing program and the case study enables a firm conclusion to be drawn on the impact of incorporating lime into subgrade materials with or

without an amelioration period. Supporting outcomes from this research for local government applications are:

1. In most local government cases, lime stabilisation of subgrades is often implemented to improve CBR's up to values of at least 5% in order to meet design assumptions and provide suitable working platforms.
2. Regardless of the soil improvement characteristic, the minimum amount of lime to be used should always be at least the Lime Demand percentage, often with 0.5 - 1.0% added to ensure the engineering property improvements are permanent.
3. The use of TMR guidelines for design purposes in local government provides a conservative outcome (lime stabilised subgrades only).
4. The use of TMR specifications for construction of lime stabilised subgrades with a minimum 2 day mixing process in local government is unnecessary.
5. There was no conclusive evidence of any well correlated rise in UCS between 0 and 24 hours amelioration.
6. The difference in CBR obtained by using Lime Demand +1% application rates with or without an amelioration period has no effect on the ability of the stabilised subgrade to meet the CBR design requirements. Using the Austrroads design approach is conservative with a maximum permitted stabilised subgrade design CBR of 15%, where field results in heavy clays ranged from 22% to 55%.
7. Local government authorities should specify in their construction documents amendments to the current TMR specifications that incorporation of 100% of lime can be carried out without applying an amelioration period. The use of Annexure MRTS07A.1 can satisfy this change. Alternatively local government should specify this in their own documentation.

8. REFERENCES

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9. ACKNOWLEDGEMENTS

All laboratory testing was carried out by Douglas Partners Pty Ltd (or their nominated third party) from their Townsville and Brisbane Laboratories. Special thanks to Serge Jajcanin, Chris Bell and Dean Pollock for their support.

AustStab and their QLD Working Group must also be thanked for their commissioning and financial support of this project.

10. AUTHOR BIOGRAPHIES



Scott Young, Corporate Manager, SPA

Scott Young, a Registered Professional Civil Engineer with Honours from the University of Newcastle, NSW Australia is currently a Corporate Manager with Stabilised Pavements of Australia (SPA) and also holds the position of Managing Director for the group's Malaysian operations (Stabilised Pavements Malaysia – SPM). Scott is a member of Professionals Australia, REAM and REAAA.

Scott previously held positions of North QLD Regional Manager in Townsville for SPA and Regional Stabilising Manager for Downer EDI Limited based in Sydney, NSW Australia for 11 years, managing their stabilisation contracting business in NSW and SE Queensland. He has been heavily involved in the stabilisation industry for over 15 years and during that time held positions of Director, Vice President and President in Australia's national association AustStab, which provides research, development, education and advice to the pavement recycling industry.

His experience covers civil and geotechnical engineering, predominantly in pavements with areas of responsibility including asset management, structural design, performance specified maintenance contracts, asphalt production and laying, spray sealing, pavement rejuvenation and pavement recycling. Scott has delivered numerous presentations at conferences and industry seminars on a variety of pavement stabilisation topics, from design through to construction as well as delivering guest lectures at undergraduate and postgraduate level at the University of New South Wales and University of Technology Sydney.



Graham Hennessy, CEO, AustStab

Prior to taking up his current position with AustStab, Graham was the Senior Pavements Manager for the NSW Roads & Maritime Services (RMS). Graham was responsible for the RMS Pavements Unit for a period of two years. Graham has over 35 years of experience in the fields of geotechnical and pavement investigations, pavement design, road construction, pavement maintenance and pavement construction materials. This being the result of previous senior appointments as Associate Director (Pavements), AECOM, National Technical Manager, Boral Asphalt and previous employment as Pavements and Geotechnical Officer, RTA (now RMS).

Appendix A: Laboratory Test Reports, SQ Soil

Material Test Report

Douglas Partners
Infrastructure & Environment / Specialist
 Douglas Partners Pty Ltd
 Brisbane Laboratory
 439 Montague Road West End QLD 4101
 Phone: (07) 3237 8900
 Fax: (07) 3237 8999
 Email: serge.jajcarin@douglaspartners.com.au
 Accredited for compliance with ISO/IEC 17025 - Testing

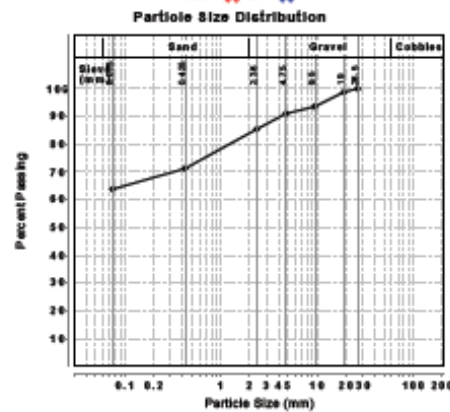
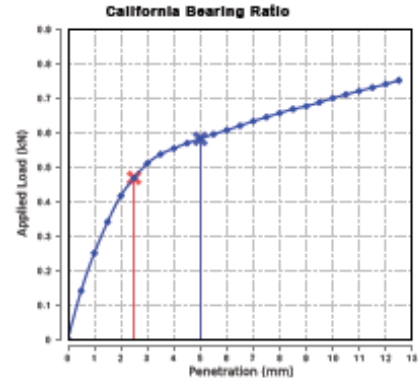
Report Number: 93082.00-1
Issue Number: 1
Date Issued: 18/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Project Number: 93082.00
Project Name: Kingshorpe - Laboratory Testing Program
Project Location: Warrego Highway, Kingshorpe
Work Request: 1422
Sample Number: 17-1422A
Date Sampled: 31/07/2017
Sampling Method: Sampled by Client
Lot No: Sample 1 S/P Subgrade

NATA
NATIONAL ASSOCIATION OF TESTING AUTHORITIES
 Approved Signatory: Serge Jajcarin
 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	3.5		
CBR % (at 5 mm)	3.0		
CBR %	3.6		
Method of Compactive Effort	Standard		
Method used to Determine MDD	Q142A & Q102A		
Maximum Dry Density (t/m ³)	1.468		
Optimum Moisture Content (%)	29.9		
Target Dry Density (t/m ³)	1.424		
Achieved Dry Density (t/m ³)	1.427		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.2		
Target Moisture Content (%)	29.9		
Achieved Moisture Content (%)	29.6		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	99.0		
Dry Density after Soaking (t/m ³)	1.395		
Field Moisture Content (%)	23.9		
Moisture Content at Placement (%)	29.6		
Moisture Content Top 30mm (%)	42.5		
Moisture Content Rest of Sample (%)	32.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	2.2		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

Particle Distribution (Q103A & Q102A)		
Sieve	Passed %	Passing Limits
25.5 mm	100	
19 mm	99	
9.5 mm	94	
4.75 mm	91	
2.36 mm	86	
0.425 mm	71	
0.075 mm	84	

Atterberg Limit (Q104A & Q105 & Q102A)		Min	Max
Preparation Method	Dry Sieve		
Sample History	Oven Dried		
Liquid Limit (%)	51.0		
Plastic Limit (%)	23.8		
Plasticity Index (%)	27.2		
Weighted Plasticity Index (%)	1931		



Linear Shrinkage (Q106)		Min	Max
Shrinkage Drying Type	Oven Dried		
Linear Shrinkage (%)	14.4		
Weighted Linear Shrinkage (%)	1017		

Material Test Report



Douglas Partners Pty Ltd
Brisbane Laboratory

439 Montague Road West End QLD 4101

Phone: (07) 3237 8900

Fax: (07) 3237 8999

Email: serge.jajcanin@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

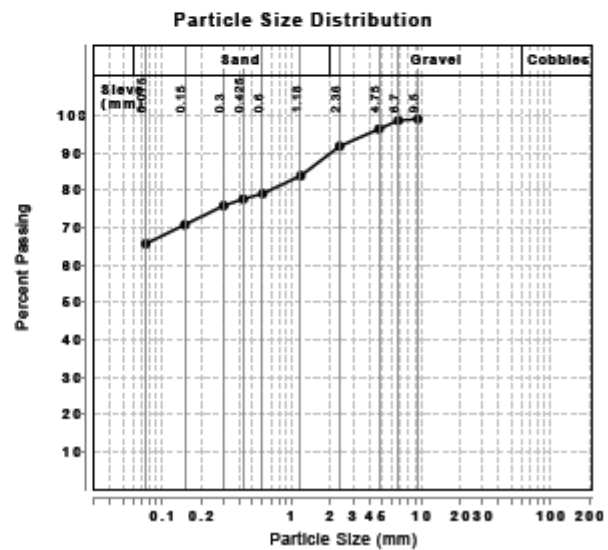


Approved Signatory: Serge Jajcanin

NATA Accredited Laboratory Number: 828

Report Number: 93082.00-2
Issue Number: 3 - *This version supercedes all previous issues*
Date Issued: 28/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Contact: Scott Young
Project Number: 93082.00
Project Name: Kingsthorpe - Laboratory Testing Program
Project Location: Warrego Highway, Kingsthorpe
Work Request: 1840
Sample Number: 17-1840O
Date Sampled: 14/09/2017
Sampling Method: Sampled by Client
Sample Location: (SG)
Lot No: Original sample

Particle Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
9.5 mm	99	
6.7 mm	99	
4.75 mm	96	
2.36 mm	92	
1.18 mm	84	
0.6 mm	79	
0.425 mm	78	
0.3 mm	76	
0.15 mm	71	
0.075 mm	66	



Material Test Report



Douglas Partners Pty Ltd
Brisbane Laboratory

439 Montague Road West End QLD 4101

Phone: (07) 3237 8900

Fax: (07) 3237 8999

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Accredited for compliance with ISO/IEC 17025 - Testing



Serge Jajcanin

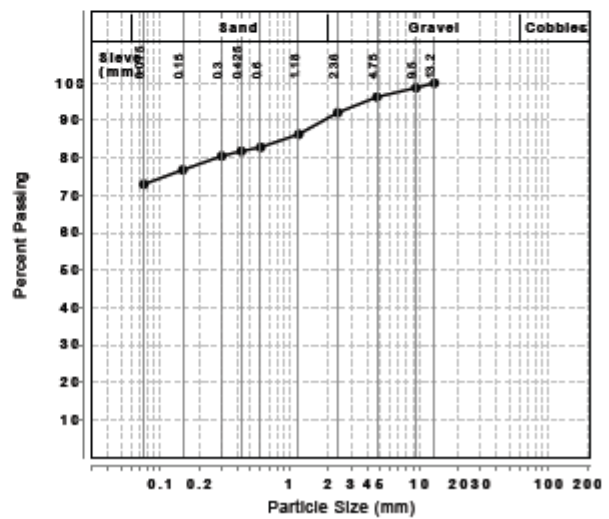
Approved Signatory: Serge Jajcanin

NATA Accredited Laboratory Number: 828

Report Number: 93082.00-2
Issue Number: 4 - *This version supercedes all previous issues*
Date Issued: 29/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Contact: Scott Young
Project Number: 93082.00
Project Name: Kingsthorpe - Laboratory Testing Program
Project Location: Warrego Highway, Kingsthorpe
Work Request: 1840
Sample Number: 17-1840P
Date Sampled: 14/08/2017
Sampling Method: Sampled by Client
Sample Location: (SG)
Lot No: 5% Lime Non-Ameliorated
Material: Slightly sandy clay with some gravel

Particle Distribution (AS1289 3.6.1)		
Sieve	Passed %	Passing Limits
13.2 mm	100	
9.5 mm	99	
6.7 mm		
4.75 mm	96	
2.36 mm	92	
1.18 mm	86	
0.6 mm	83	
0.425 mm	82	
0.3 mm	80	
0.15 mm	77	
0.075 mm	73	

Particle Size Distribution



Material Test Report

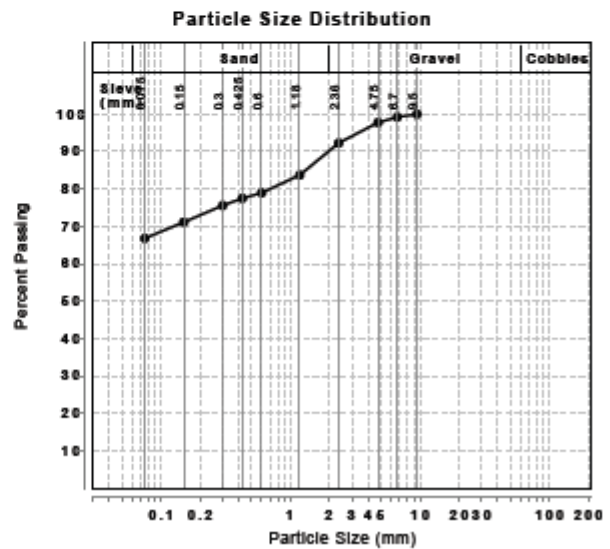
Report Number: 93082.00-2
Issue Number: 2 - *This version supercedes all previous issues*
Date Issued: 27/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Contact: Scott Young
Project Number: 93082.00
Project Name: Kingsthorpe - Laboratory Testing Program
Project Location: Warrego Highway, Kingsthorpe
Work Request: 1840
Sample Number: 17-1840N
Date Sampled: 28/09/2017
Sampling Method: Sampled by Client
Sample Location: (SG)
Lot No: **5% Lime Ameliorated**
Material: Sandy silty clay with some gravel


Douglas Partners
CONCRETE / FLOWMETER / GROUT/WATER
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 Brisbane Laboratory
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 Accredited for compliance with ISO/IEC 17025 - Testing




 Approved Signatory: Serge Jajcanin
 NATA Accredited Laboratory Number: 828

Particle Distribution (AS1289 3.8.1)		
Sieve	Passed %	Passing Limits
9.5 mm	100	
6.7 mm	99	
4.75 mm	98	
2.36 mm	92	
1.18 mm	84	
0.6 mm	79	
0.425 mm	77	
0.3 mm	76	
0.15 mm	71	
0.075 mm	67	



pH LIME DEMAND TEST REPORT																																																																																																																																																																																																																																																																																		
Test method : Department of Transport & Main Roads - D133 : Lime Demand of Soil																																																																																																																																																																																																																																																																																		
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NOTES/REMARKS: Tested with distilled water at 22°C at 5:1 Water/Soil Ratio using Hydrated Lime																																																																																																																																																																																																																																																																																		
Samples supplied by the client Page 1 of 1 REP16101																																																																																																																																																																																																																																																																																		

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory



C. Chanvot



Laboratory No. 9026

The results of calibrations and tests performed apply only to the specific instrument or sample at the time of test unless otherwise clearly stated.
Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details.
Trilab Pty Ltd ABN 25 085 800 506

Report No: MAT:S172-2176

Issue No: 1

Material Test Report

Client: Douglas Partners
 439 Montague Road
 West End Qld 4101

Project: Samples Submitted for Testing



Accredited for compliance with ISO/IEC 17025.

G D Kent
 Approved Signatory: Graham Kent

Accreditation No. 2911
 Date of Issue: 24/08/2017

THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL

Sample Details

General Location: Warrego Highway, Kingsthorpe - Project #93082.00
Sample ID: S172-2176
Sampled By: Client
Sampling Method: Sampled by Client- tested as recieved.
Date Sampled: 1/07/2017
Source: Insitu Material
Material: Subgrade
Material Description: Silty Clay
Location: Warrego Highway, Kingsthorpe , Client Sample No: 17-1422A, Subgrade

Test Results

Description	Method	Result	Limits
Date Test Started	Q125D	24/08/2017	
Additive Type		NA	
Additive Proportion (%)		0.0	
Maximum Dry Density (t/m3)		1.468	
Optimum Moisture Content (%)		29.9	
Specified Dry Density (t/m3)		1.470	
Specified Moisture Content (%)		29.6	
Initial Height of Specimen (mm)		112	
Rise Time (Hours)		2.5	
CAPILLARY RISE (%)		100%	
Date Tested		24/08/2017	

CERTIFICATE OF ANALYSIS

Work Order : EB1716073
Client : DOUGLAS PARTNERS PTY LTD
Contact : MR CHRIS BELL
Address : 439 MONTAGUE ROAD
 WEST END QLD, AUSTRALIA 4101
Telephone : +61 32378900
Project : LABORATORY TESTING PROGRAM
Order number : 124093
C-O-C number : ---
Sampler : ---
Site : ---
Quote number : EN/020/16
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 2
Laboratory : Environmental Division Brisbane
Contact : John Pickering
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : +61-7-3243 7222
Date Samples Received : 04-Aug-2017 15:45
Date Analysis Commenced : 08-Aug-2017
Issue Date : 15-Aug-2017 14:17



Accreditation No. 625
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ben Felgendrejeris	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

RIGHT SOLUTIONS | RIGHT PARTNER

Page : 2 of 2
Work Order : EB1716073
Client : DOUGLAS PARTNERS PTY LTD
Project : LABORATORY TESTING PROGRAM


General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

* = This result is computed from individual analyte detections at or above the level of reporting

⊖ = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID		17-1422A	---	---	---	---
Client sampling date / time		04-Aug-2017 13:00		---	---	---	---	---
Compound	CAS Number	LOR	Unit	EB1716073-001	---	---	---	---
Result				---	---	---	---	---
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	---	1.0	%	19.2	---	---	---	---
ED040: Sulfur as SO4 2-								
Sulfate as SO4 2-	14808-79-8	100	mg/kg	430	---	---	---	---
EP003: Total Organic Carbon (TOC) In Soil								
Total Organic Carbon	---	0.02	%	1.00	---	---	---	---



Australian Laboratory Services Pty. Ltd.
 32 Shand Street
 Stafford
 Brisbane QLD 4053
 Phone: +61 (7) 3243 7222 Fax: +61 (7) 3243 7218
 www.alsglobal.com

Page: 1
 Total # Pages: 2 (A)
 Plus Appendix Pages
 Finalized Date: 15- AUG- 2017
 Account: ALSENV

CERTIFICATE BR17169472

Project: EB1716073
 P.O. No.: Fe analysis
 This report is for 1 Pulp sample submitted to our lab in Brisbane, QLD, Australia on 14- AUG- 2017.

The following have access to data associated with this certificate:

SUB RESULTS - BRIS

SAMPLE PREPARATION	
ALS CODE	DESCRIPTION
LOC-22	Sample login - Rcd w/o BarCode

ANALYTICAL PROCEDURES	
ALS CODE	DESCRIPTION
Fe-VOL05	FeO (Ferrous Iron)

To: ALS ENVIRONMENTAL
 ATTN: SUB RESULTS - BRIS
 32 SHAND STREET
 STAFFORD QLD 4053

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:

Shaun Kenny, Brisbane Laboratory Manager



Australian Laboratory Services Pty. Ltd.
 32 Shand Street
 Stafford
 Brisbane QLD 4053
 Phone: +61 (7) 3243 7222 Fax: +61 (7) 3243 7218
 www.alsglobal.com

Page: 2 - A
 Total # Pages: 2 (A)
 Plus Appendix Pages
 Finalized Date: 15- AUG- 2017
 Account: ALSENV

Project: EB1716073

CERTIFICATE OF ANALYSIS BR17169472

Sample Description	Method Analyte Units LOR	Fe-VOL05 FeO % 0.01
17-1422A		2.28

Material Test Report

Report Number: 93082.00-2
Issue Number: 1
Date Issued: 15/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Contact: Scott Young
Project Number: 93082.00
Project Name: Kingsthorpe - Laboratory Testing Program
Project Location: Warrego Highway, Kingsthorpe
Work Request: 1840
Sample Number: 17-1840A
Date Sampled: 26/08/2017
Sampling Method: Sampled by Client
Sample Location: (SG)
Lot No: 3% Lime, 97% Ameliorated

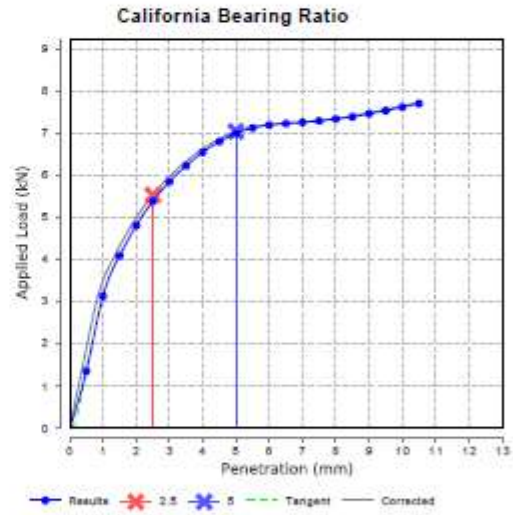


Douglas Partners
GRAVELL | EXCAVATION | ROADWORK
 Douglas Partners Pty Ltd
 Brisbane Laboratory
 439 Montague Road West End QLD 4101
 Phone: (07) 3237 8900
 Fax: (07) 3237 8999
 Email: serge.jajcanin@douglaspartners.com.au
 Accredited for compliance with ISO/IEC 17025 - Testing



Approved Signatory: Serge Jajcanin
 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	42		
CBR % (at 5 mm)	36		
CBR %	42		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Additive Type	Lime		
Additive Percent (%)	3		
Maximum Dry Density (t/m ³)	1.472		
Optimum Moisture Content (%)	29.6		
Target Dry Density (t/m ³)	1.428		
Achieved Dry Density (t/m ³)	1.427		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.0		
Target Moisture Content (%)	29.6		
Achieved Moisture Content (%)	29.7		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	100.3		
Dry Density after Soaking (t/m ³)	1.438		
Field Moisture Content (%)	23.1		
Moisture Content at Placement (%)	29.7		
Moisture Content Top 30mm (%)	33.4		
Moisture Content Rest of Sample (%)	31.0		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	-0.7		
Oversize Material (mm)	19		
Oversize Material Included	0		
Oversize Material (%)	0		



Material Test Report

Report Number: 93082.00-2
Issue Number: 1
Date Issued: 15/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Contact: Scott Young
Project Number: 93082.00
Project Name: Kingsthorpe - Laboratory Testing Program
Project Location: Warrego Highway, Kingsthorpe
Work Request: 1840
Sample Number: 17-1840B
Date Sampled: 26/08/2017
Sampling Method: Sampled by Client
Sample Location: (SG)
Lot No: 3% Lime, 97% Non-Ameliorated

Douglas Partners

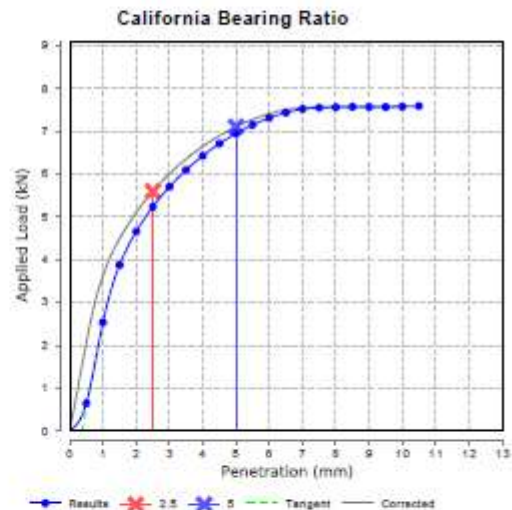
LABORATORY | CONSULTANT | CONSULTANT
Douglas Partners Pty Ltd
 Brisbane Laboratory
 439 Montague Road West End QLD 4101
 Phone: (07) 3237 8900
 Fax: (07) 3237 8999
 Email: serge.jajcanin@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing



Approved Signatory: Serge Jajcanin
 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	42		
CBR % (at 5 mm)	36		
CBR %	42		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Additive Type	Lime		
Additive Percent (%)	3		
Maximum Dry Density (t/m ³)	1.472		
Optimum Moisture Content (%)	29.6		
Target Dry Density (t/m ³)	1.428		
Achieved Dry Density (t/m ³)	1.430		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.2		
Target Moisture Content (%)	29.6		
Achieved Moisture Content (%)	29.2		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	98.6		
Dry Density after Soaking (t/m ³)	1.429		
Field Moisture Content (%)	23.1		
Moisture Content at Placement (%)	29.2		
Moisture Content Top 30mm (%)	32.3		
Moisture Content Rest of Sample (%)	32.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	0		
Oversize Material (%)	0		



Material Test Report

Report Number: 93082.00-2
Issue Number: 1
Date Issued: 15/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Contact: Scott Young
Project Number: 93082.00
Project Name: Kingsthorpe - Laboratory Testing Program
Project Location: Warrego Highway, Kingsthorpe
Work Request: 1840
Sample Number: 17-1840E
Date Sampled: 26/08/2017
Sampling Method: Sampled by Client
Sample Location: (SG)
Lot No: 5% Lime, 97% Ameliorated



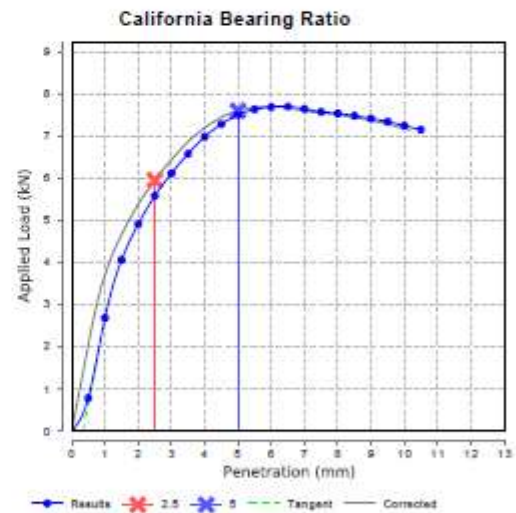
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Approved Signatory: Serge Jajcanin
 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	46		
CBR % (at 5 mm)	38		
CBR %	46		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Additive Type	Lime		
Additive Percent (%)	5		
Maximum Dry Density (t/m ³)	1.452		
Optimum Moisture Content (%)	29.7		
Target Dry Density (t/m ³)	1.452		
Achieved Dry Density (t/m ³)	1.418		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	97.7		
Target Moisture Content (%)	29.7		
Achieved Moisture Content (%)	28.6		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	96.3		
Dry Density after Soaking (t/m ³)	1.415		
Field Moisture Content (%)	23.1		
Moisture Content at Placement (%)	28.6		
Moisture Content Top 30mm (%)	36.0		
Moisture Content Rest of Sample (%)	30.8		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	0.2		
Oversize Material (mm)	19		
Oversize Material Included	0		
Oversize Material (%)	0		



Material Test Report

Report Number: 93082.00-2
Issue Number: 1
Date Issued: 15/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2260
Contact: Scott Young
Project Number: 93082.00
Project Name: Kingsthorpe - Laboratory Testing Program
Project Location: Warrego Highway, Kingsthorpe
Work Request: 1840
Sample Number: 17-1840F
Date Sampled: 26/08/2017
Sampling Method: Sampled by Client
Sample Location: (SG)
Lot No: 5% Lime, 97% Non-Ameliorated


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WORLD RECOGNISED
AGGREGATION



Approved Signatory: Serge Jajcanin

NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	58		
CBR % (at 5 mm)	52		
CBR %	58		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Additive Type	Lime		
Additive Percent (%)	5		
Maximum Dry Density (t/m ³)	1.452		
Optimum Moisture Content (%)	29.7		
Target Dry Density (t/m ³)	1.408		
Achieved Dry Density (t/m ³)	1.413		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.3		
Target Moisture Content (%)	29.7		
Achieved Moisture Content (%)	29.3		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	98.7		
Dry Density after Soaking (t/m ³)	1.414		
Field Moisture Content (%)	23.1		
Moisture Content at Placement (%)	29.3		
Moisture Content Top 30mm (%)	27.7		
Moisture Content Rest of Sample (%)	30.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	-0.1		
Oversize Material (mm)	19		
Oversize Material Included	0		
Oversize Material (%)	0		



Material Test Report

Report Number: 93082.00-2
Issue Number: 1
Date Issued: 15/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Contact: Scott Young
Project Number: 93082.00
Project Name: Kingsthorpe - Laboratory Testing Program
Project Location: Warrego Highway, Kingsthorpe
Work Request: 1840
Sample Number: 17-1840I
Date Sampled: 26/08/2017
Sampling Method: Sampled by Client
Sample Location: (SG)
Lot No: 7% Lime, 97% Ameliorated

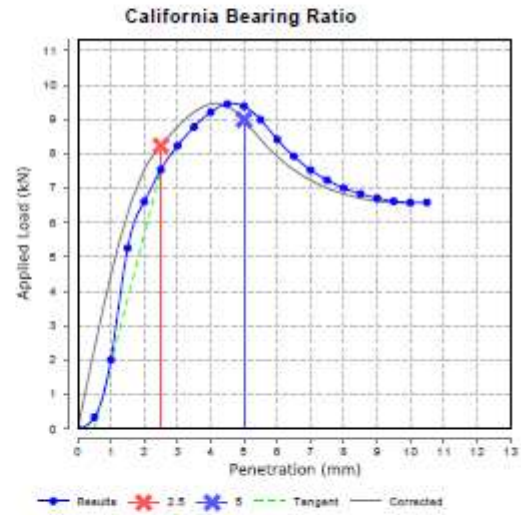


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 Accredited for compliance with ISO/IEC 17025 - Testing



Approved Signatory: Serge Jajcanin
 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	62		
CBR % (at 5 mm)	46		
CBR %	62		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Additive Type	Lime		
Additive Percent (%)	7		
Maximum Dry Density (t/m ³)	1.451		
Optimum Moisture Content (%)	29.2		
Target Dry Density (t/m ³)	1.407		
Achieved Dry Density (t/m ³)	1.400		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	96.5		
Target Moisture Content (%)	29.2		
Achieved Moisture Content (%)	29.5		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	101.0		
Dry Density after Soaking (t/m ³)	1.408		
Field Moisture Content (%)	23.1		
Moisture Content at Placement (%)	29.5		
Moisture Content Top 30mm (%)	34.1		
Moisture Content Rest of Sample (%)	31.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	-0.6		
Oversize Material (mm)	19		
Oversize Material Included	0		
Oversize Material (%)	0		



Material Test Report

Report Number: 93082.00-2
Issue Number: 1
Date Issued: 15/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Contact: Scott Young
Project Number: 93082.00
Project Name: Kingsthorpe - Laboratory Testing Program
Project Location: Warrego Highway, Kingsthorpe
Work Request: 1840
Sample Number: 17-1840J
Date Sampled: 26/08/2017
Sampling Method: Sampled by Client
Sample Location: (SG)
Lot No: 7% Lime, 97% Non-Ameliorated



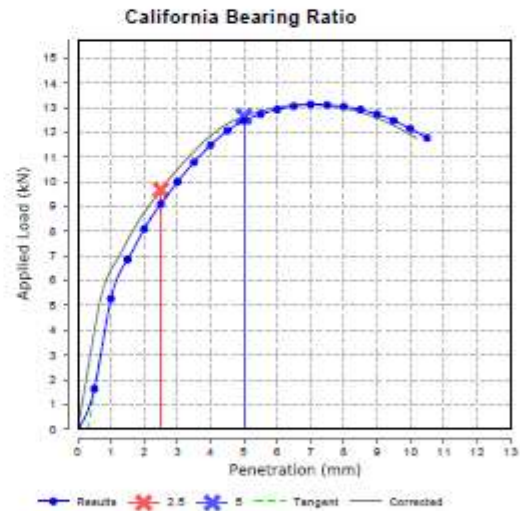
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Approved Signatory: Serge Jajcanin
 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	74		
CBR % (at 5 mm)	64		
CBR %	74		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Additive Type	Lime		
Additive Percent (%)	7		
Maximum Dry Density (t/m ³)	1.451		
Optimum Moisture Content (%)	29.2		
Target Dry Density (t/m ³)	1.407		
Achieved Dry Density (t/m ³)	1.407		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.0		
Target Moisture Content (%)	29.2		
Achieved Moisture Content (%)	29.1		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	99.7		
Dry Density after Soaking (t/m ³)	1.399		
Field Moisture Content (%)	23.1		
Moisture Content at Placement (%)	29.1		
Moisture Content Top 30mm (%)	33.6		
Moisture Content Rest of Sample (%)	31.8		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	0.6		
Oversize Material (mm)	19		
Oversize Material Included	0		
Oversize Material (%)	0		



Determination of Unconfined Compressive Strength of Compacted Materials

Client:	Stabilised Pavement Australia	Project No:	93082.00
Project:	Kingsthorpe – Laboratory Testing Program	Report No:	BO17-0765
Location:	Warrego Highway, Kingsthorpe	Report Date:	05.10.2017
		Date Sampled:	14.08.2017
		Date of Test:	04.10.2017
		Page:	1 of 6

Material Description:	Sub Grade. Slightly sandy clay with some gravel		
Sample type:	Laboratory mixed		
Elapsed time between addition of binder and compaction:	Ameliorated 24h		
Method of Compaction:	Standard		
Stabilising Agent:	3% Lime - Cement Australia. Lime index above 80%		
Capped Yes/No	No		
Curing Details:	28 days; 23°C +- 2°C at 95% Relative humidity		
	Specimen A	Specimen B	
Target Moisture Content:		29.5 %	
Moisture Content at Compaction:	29.1%	29.2%	
Moisture Content after Testing:	28.5%	28.4%	
Target Dry Density:		1.43 t/m ³	
Dry Density of Test Specimens:	1.42t/m ³	1.42t/m ³	
Target Density Ratio:		97 %	
Achieved Density Ratio:	96.5%	96.5%	
Achieved Moisture Ratio:	98%	99%	
Unconfined Compressive Strength:	0.7 MPa	0.9 MPa	
AVERAGE UNCONFINED COMPRESSIVE STENGTH:	0.8 MPa		

Test Method(s): Q115; Q135A; Q135B; Q102A

Sampling Method(s): Sampled by client.

Remarks:

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NATA Accredited Laboratory Number: 828

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Tested:	DG
Checked:	SJ

[Signature]
Srdjan Jajcanin
Laboratory Manager

**Determination of Unconfined Compressive Strength
of Compacted Materials**

Client:	Stabilised Pavement Australia	Project No:	93082.00
Project:	Kingsthorpe – Laboratory Testing Program	Report No:	BO17-0766
Location:	Warrego Highway, Kingsthorpe	Report Date:	05.10.2017
		Date Sampled:	14.08.2017
		Date of Test:	04.10.2017
		Page:	2 of 6

Material Description:	Sub Grade. Slightly sandy clay with some gravel		
Sample type:	Laboratory mixed		
Elapsed time between addition of binder and compaction:	Non Ameliorated		
Method of Compaction:	Standard		
Stabilising Agent:	3% Lime - Cement Australia. Lime index above 80%		
Capped Yes/No	No		
Curing Details:	28 days; 23°C +- 2°C at 95% Relative humidity		
	Specimen A	Specimen B	
Target Moisture Content:	29.5 %		
Moisture Content at Compaction:	29.2%	29.0%	
Moisture Content after Testing:	28.3%	28.5%	
Target Dry Density:	1.43 t/m ³		
Dry Density of Test Specimens:	1.42t/m ³	1.44t/m ³	
Target Density Ratio:	97 %		
Achieved Density Ratio:	96.5%	98%	
Achieved Moisture Ratio:	99%	98%	
Unconfined Compressive Strength:	0.5 MPa	0.7 MPa	
AVERAGE UNCONFINED COMPRESSIVE STENGTH:	0.6 MPa		

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Test Method(s): Q115; Q135A; Q135B; Q102A
Sampling Method(s): Sampled by client.
Remarks:



NATA Accredited Laboratory Number: 828
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Tested:	DG
Checked:	SJ

Srdjan Jajcanin
Srdjan Jajcanin
Laboratory Manager

Determination of Unconfined Compressive Strength of Compacted Materials

Client:	Stabilised Pavement Australia	Project No:	93082.00
Project:	Kingsthorpe – Laboratory Testing Program	Report No:	BO17-0767
Location:	Warrego Highway, Kingsthorpe	Report Date:	05.10.2017
		Date Sampled:	14.08.2017
		Date of Test:	04.10.2017
		Page:	3 of 6
Material Description:		Sub Grade. Slightly sandy clay with some gravel	
Sample type:		Laboratory mixed	
Elapsed time between addition of binder and compaction:		Ameliorated 24h	
Method of Compaction:		Standard	
Stabilising Agent:		5% Lime - Cement Australia. Lime index above 80%	
Capped Yes/No		No	
Curing Details:		28 days; 23 ⁰ C +/- 2 ⁰ C at 95% Relative humidity	
		Specimen A	Specimen B
Target Moisture Content:		29.5 %	
Moisture Content at Compaction:	29.3%	29.4%	
Moisture Content after Testing:	28.4%	28.2%	
Target Dry Density:		1.41 t/m ³	
Dry Density of Test Specimens:	1.40t/m ³	1.39t/m ³	
Target Density Ratio:		97 %	
Achieved Density Ratio:	96.5%	96%	
Achieved Moisture Ratio:	99%	99%	
Unconfined Compressive Strength:	1.2 MPa	1.2 MPa	
AVERAGE UNCONFINED COMPRESSIVE STENGTH:		1.2 MPa	

Test Method(s): Q115; Q135A; Q135B; Q102A

Sampling Method(s): Sampled by client.

Remarks:



NATA Accredited Laboratory Number: 828

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Tested:	DG
Checked:	SJ



Srdjan Jajcanin
Laboratory Manager

Determination of Unconfined Compressive Strength of Compacted Materials

Client:	Stabilised Pavement Australia	Project No:	93082.00
Project:	Kingsthorpe – Laboratory Testing Program	Report No:	BO17-0768
		Report Date:	05.10.2017
Location:	Warrego Highway, Kingsthorpe	Date Sampled:	14.08.2017
		Date of Test:	04.10.2017
		Page:	4 of 6
Material Description:		Sub Grade. Slightly sandy clay with some gravel	
Sample type:		Laboratory mixed	
Elapsed time between addition of binder and compaction:		Non Ameliorated	
Method of Compaction:		Standard	
Stabilising Agent:		5% Lime - Cement Australia. Lime index above 80%	
Capped Yes/No		No	
Curing Details:		28 days; 23 ⁰ C + 2 ⁰ C at 95% Relative humidity	
		Specimen A	Specimen B
Target Moisture Content:		29.6 %	
Moisture Content at Compaction:	29.5%	29.6%	
Moisture Content after Testing:	27.9%	28.0%	
Target Dry Density:		1.41 t/m ³	
Dry Density of Test Specimens:	1.40t/m ³	1.40t/m ³	
Target Density Ratio:		97 %	
Achieved Density Ratio:	96.5%	96.5%	
Achieved Moisture Ratio:	100%	100%	
Unconfined Compressive Strength:	1.0 MPa	1.2 MPa	
AVERAGE UNCONFINED COMPRESSIVE STRENGTH:		1.1 MPa	

Test Method(s): Q115; Q135A; Q135B; Q102A

Sampling Method(s): Sampled by client.


Remarks:



NATA Accredited Laboratory Number: 828

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Tested:	DG
Checked:	SJ


Srđjan Jajcanin
Laboratory Manager

Determination of Unconfined Compressive Strength of Compacted Materials

Client:	Stabilised Pavement Australia	Project No:	93082.00
Project:	Kingsthorpe – Laboratory Testing Program	Report No:	BO17-0769
Location:	Warrego Highway, Kingsthorpe	Report Date:	05.10.2017
		Date Sampled:	14.08.2017
		Date of Test:	04.10.2017
		Page:	5 of 6
Material Description:		Sub Grade. Slightly sandy clay with some gravel	
Sample type:		Laboratory mixed	
Elapsed time between addition of binder and compaction:		Ameliorated 24h	
Method of Compaction:		Standard	
Stabilising Agent:		7% Lime - Cement Australia. Lime index above 80%	
Capped Yes/No		No	
Curing Details:		28 days; 23°C +- 2°C at 95% Relative humidity	
		Specimen A	Specimen B
Target Moisture Content:		29.1 %	
Moisture Content at Compaction:		29.3%	29.2%
Moisture Content after Testing:		26.3%	27.1%
Target Dry Density:		1.41 t/m ³	
Dry Density of Test Specimens:		1.41t/m ³	1.42t/m ³
Target Density Ratio:		97 %	
Achieved Density Ratio:		97%	98%
Achieved Moisture Ratio:		101%	100%
Unconfined Compressive Strength:		1.3 MPa	1.6 MPa
AVERAGE UNCONFINED COMPRESSIVE STENGTH:		1.4 MPa	

Test Method(s): Q115; Q135A; Q135B; Q102A

Sampling Method(s): Sampled by client.

Remarks:



NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian national standards. Accredited for compliance with ISO IEC 17025

Tested:	DG
Checked:	SJ

Srdjan Jajcanin
Srdjan Jajcanin
Laboratory Manager

Determination of Unconfined Compressive Strength of Compacted Materials

Client:	Stabilised Pavement Australia	Project No:	93082.00
Project:	Kingsthorpe – Laboratory Testing Program	Report No:	BO17-0770
Location:	Warrego Highway, Kingsthorpe	Report Date:	05.10.2017
		Date Sampled:	14.08.2017
		Date of Test:	04.10.2017
		Page:	6 of 6
Material Description:		Sub Grade, Slightly sandy clay with some gravel	
Sample type:		Laboratory mixed	
Elapsed time between addition of binder and compaction:		Non Ameliorated	
Method of Compaction:		Standard	
Stabilising Agent:		7% Lime - Cement Australia. Lime index above 80%	
Capped Yes/No		No	
Curing Details:		28 days; 23°C +/- 2°C at 95% Relative humidity	
		Specimen A	Specimen B
Target Moisture Content:		29.1 %	
Moisture Content at Compaction:		29.0%	29.2%
Moisture Content after Testing:		26.7%	26.8%
Target Dry Density:		1.41 t/m ³	
Dry Density of Test Specimens:		1.41t/m ³	1.41t/m ³
Target Density Ratio:		97 %	
Achieved Density Ratio:		97%	97%
Achieved Moisture Ratio:		100%	100%
Unconfined Compressive Strength:		1.3 MPa	1.5 MPa
AVERAGE UNCONFINED COMPRESSIVE STENGTH:		1.4 MPa	

Test Method(s): Q115; Q135A; Q135B; Q102A

Sampling Method(s): Sampled by client.

Remarks:




NATA Accredited Laboratory Number: 828

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**TECHNICAL
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Tested:	DG
Checked:	SJ


Srdjan Jajcanin
Laboratory Manager

Material Test Report

Report No: MAT-S172-2176
 Issue No: 1

<p>Client: Douglas Partners 439 Montague Road West End Qld 4101</p> <p>Project: Samples Submitted for Testing</p>	 <p>Accredited for compliance with ISO/IEC 17025</p> <p><i>J. D. Kent</i> Approved Signatory: Graham Kent</p> <p>Accreditation No: 2011 Date of Issue: 24/08/2017 THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL</p>
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Sample Details			
General Location:	Warrego Highway, Kingsthorpe - Project #93082.00		
Sample ID:	S172-2176		
Sampled By:	Client		
Sampling Method:	Sampled by Client- tested as received.		
Date Sampled:	1/07/2017		
Source:	In situ Material		
Material:	Subgrade		
Material Description:	Silty Clay		
Location:	Warrego Highway, Kingsthorpe, Client Sample No: 171422A, Subgrade		


Test Results			
Description	Method	Result	Limits
Date Test Started	Q1250	24/08/2017	
Additive Type		NA	
Additive Proportion (%)		0.0	
Maximum Dry Density (t/m3)		1.458	
Optimum Moisture Content (%)		29.9	
Specified Dry Density (t/m3)		1.470	
Specified Moisture Content (%)		29.6	
Initial Height of Specimen (mm)		112	
Rise Time (Hours)		2.5	
CAPILLARY RISE (%)		100%	
Date Tested		24/08/2017	

Comments
NATA Endorsement does cover Maximum Dry density & Optimum Moisture Content.
Sampled by Client- tested as received.

Report No: MAT:S172-2404

Issue No: 1

Material Test Report

<p>Client: Douglas Partners Pty Ltd 439 Montague Road West End Qld 4101</p> <p>Project: Samples Submitted for Testing</p>	 <p>Accredited for compliance with ISO/IEC 17025</p> <p>Accreditation No: 2911 Approved Signatory: Mark Madden</p> <p>Date of Issue: 9/10/2017 THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL</p>
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Sample Details

General Location: Warrego Highway, Kingsthorpe (93082.00)
Sample ID: S172-2404
Sampled By: Client
Sampling Method: Sampled by Client.
Date Sampled:
Source: As Per Location
Material: Subgrade
Material Description: Silty Clay
Location: SIG A, Subgrade Level

Test Results

Description	Method	Result	Limits
Date Test Started	Q125D		
Additive Type		Hydrated Lime (Client Supplied)	
Additive Proportion (%)		5.0	
Maximum Dry Density (t/m ³)		1.452	
Optimum Moisture Content (%)		29.6	
Specified Dry Density (t/m ³)		1.452	
Specified Moisture Content (%)		29.6	
Initial Height of Specimen (mm)		113	
Rise Time (Hours)		3.0	
CAPILLARY RISE (%)		100	
Date Tested		9/10/2017	

Comments

Variation: 21 Day cure of specimen as requested by client.
 Short term conditioning Q135A Clause 6.2.3 (A)
 M.D.D, O.M.C and hygroscopic moisture supplied by client.
 Achieved dry density: 1.445 t/m³, achieved moisture content: 30.1 %

Report No: MAT:5172-2405

Issue No: 1

Material Test Report

Client:
 Douglas Partners Pty Ltd
 439 Montague Road
 West End Qld 4101

Project: Samples Submitted for Testing



Accredited for compliance with ISO/IEC 17025

Accreditation No: 2911 Approved Signatory: Mark Medden

Date of Issue: 9/10/2017

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Sample Details

General Location: Warrego Highway, Kingsthorpe (93082.00)
Sample ID: S172-2405
Sampled By: Client
Sampling Method: Sampled by Client
Date Sampled:
Source: As Per Location
Material: Subgrade
Material Description: Silty Clay
Location: S10G B, Subgrade Level

Test Results

Description	Method	Result	Limits
Date Test Started	Q1250		
Additive Type		Hydrated Lime (Client Supplied)	
Additive Proportion (%)		5.0	
Maximum Dry Density (t/m ³)		1.452	
Optimum Moisture Content (%)		29.6	
Specified Dry Density (t/m ³)		1.452	
Specified Moisture Content (%)		29.6	
Initial Height of Specimen (mm)		112	
Rise Time (Hours)		2.0	
CAPILLARY RISE (%)		100	
Date Tested		9/10/2017	

Comments

Variation: 21 Day cure of specimen as requested by client.
 Long term conditioning Q135A, Clause 6.2.3 (B)
 M.D.D, O.M.C and hygroscopic moisture supplied by client.
 Achieved dry density: 1.444 t/m³, achieved moisture content: 30.3 %

Appendix B: Laboratory Test Reports, NQ Soil

Material Test Report

Report Number: 883444.00-1
Issue Number: 1
Date Issued: 23/08/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250

Project Number: 663444.00
Project Name: Proposed Material Testing
Project Location: Northshore, Northshore
Work Request: 131
Sample Number: 17-131A
Date Sampled: 31/07/2017
Sampling Method: Sampled by Client
Sample Location: Northshore
Material: Sandy silty clay


Douglas Partners
 Distributor / Accredited / Signatory
 Douglas Partners Pty Ltd
 Townsville Laboratory
 29 Civil Road GARBUTT QLD 4814
 Phone: (07) 4779 9888
 Fax: (07) 4725 1224
 Email: dean.pollock@douglaspartners.com.au
 Accredited for compliance with ISO/IEC 17025 - Testing



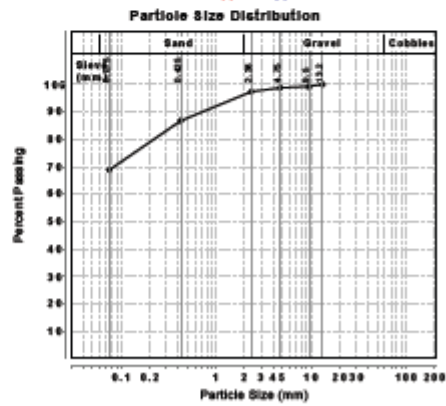
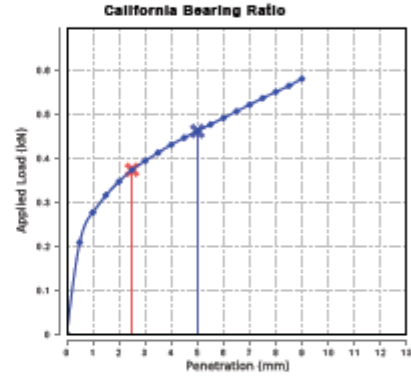
 Approved Signatory: Dean Pollock
 NATA Accredited Laboratory Number: 626

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	3.0		
CBR % (at 5 mm)	2.5		
CBR %	3.0		
Method of Compactive Effort	Standard		
Method used to Determine MDD	Q142A & Q102A		
Maximum Dry Density (t/m ³)	1.744		
Optimum Moisture Content (%)	17.2		
Target Dry Density (t/m ³)	1.692		
Achieved Dry Density (t/m ³)	1.692		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.0		
Target Moisture Content (%)	17.1		
Achieved Moisture Content (%)	17.1		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	99.4		
Dry Density after Soaking (t/m ³)	1.676		
Field Moisture Content (%)	14.5		
Moisture Content at Placement (%)	17.1		
Moisture Content Top 30mm (%)	22.3		
Moisture Content Rest of Sample (%)	18.0		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			

Particle Distribution (Q103A & Q102A)		
Sieve	Passed %	Passing Limits
13.2 mm	100	
9.5 mm	99	
4.75 mm	99	
2.36 mm	97	
0.425 mm	87	
0.075 mm	88	

Atterberg Limit (Q104D & Q105 & Q102A)			Min	Max
Liquid Limit (%)	37.2			
Plastic Limit (%)	16.0			
Plasticity Index (%)	21.2			

Linear Shrinkage (Q106)			Min	Max
Shrinkage Drying Type	Oven Dried			
Linear Shrinkage (%)	13.0			



pH LIME DEMAND TEST REPORT																																																																																																																																																																																																																																																									
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<small>NOTES/REMARKS:</small> Tested with distilled water at 22°C at 5:1 Water/Soil Ratio using Hydrated Lime																																																																																																																																																																																																																																																									
<small>Samples supplied by the client</small> <small>Page 1 of 1 REP-0101</small>																																																																																																																																																																																																																																																									

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Authorized Signatory

C. Channon



Tested at Trilab Brisbane Laboratory.

Laboratory No. 9525

The results of calibrations and tests performed apply only to the specific instrument or sample at the time of test unless otherwise clearly stated.
Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details.
Trilab Pty Ltd - ABN 25 062 030 508

Report No: MAT:S172-2181

Issue No: 1

Material Test Report

Client:

Douglas Partners
 439 Montague Road
 West End Qld 4101

Project:

Samples Submitted for Testing



Accredited for compliance with ISO/IEC 17025.

Accreditation No. 2911 Approved Signatory: *Graham Kent*

Date of Issue: 25/08/2017

THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL

Sample Details

General Location: Northshore.
Sample ID: S172-2181
Test Request No: 131
Sampled By: Client
Sampling Method: Sampled by Client- tested as recieved.
Date Sampled: 31/07/2017
Source: Insitu Material
Material: Proposed Material Testing
Material Description: Sandy Silty Clay
Location: Northshore, Client Sample No: 17-131A

Test Results

Description	Method	Result	Limits
Date Test Started	Q125D	24/05/2017	
Additive Type		NA	
Additive Proportion (%)		0.0	
Maximum Dry Density (t/m3)		1.744	
Optimum Moisture Content (%)		17.2	
Specified Dry Density (t/m3)		1.738	
Specified Moisture Content (%)		17.6	
Initial Height of Specimen (mm)		112	
Rise Time (Hours)		2.0	
CAPILLARY RISE (%)		100	
Date Tested		24/08/2017	

CERTIFICATE OF ANALYSIS

Work Order	: EB1715709	Page	: 1 of 2
Client	: DOUGLAS PARTNERS PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR DEAN POLLOCK	Contact	: John Pickering
Address	: 29 Civil Road GARBUTT TOWNSVILLE QLD, AUSTRALIA 4814	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 4779 8868	Telephone	: +61-7-3243 7222
Project	: Proposed Material Testing	Date Samples Received	: 02-Aug-2017 08:15
Order number	: 663444	Date Analysis Commenced	: 02-Aug-2017
C-O-C number	: ---	Issue Date	: 21-Aug-2017 17:00
Sampler	: Client		
Site	: ---		
Quote number	: EN/020/16		
No. of samples received	: 1		
No. of samples analysed	: 1		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

RIGHT SOLUTIONS | RIGHT PARTNER

Page : 2 of 2
Work Order : EB1715709
Client : DOUGLAS PARTNERS PTY LTD
Project : Proposed Material Testing



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
▲ = This result is computed from individual analyte detections at or above the level of reporting
■ = ALS is not NATA accredited for these tests.
- = Indicates an estimated value.

Analytical Results

Sub-Matrix: SOIL		Client sample ID		17-131A			
(Matrix: SOIL)		Client sampling date / time		31-Jul-2017 00:00			
Compound	CAS Number	LOR	Unit	EB1716708-001			
				Result			
EA055: Moisture Content (Dried @ 105-110°C)							
Moisture Content	---	1.0	%	4.7	---	---	---
ED040: Sulfur as SO4 2-							
Sulfate as SO4 2-	14808-79-8	100	mg/kg	180	---	---	---
EP004: Organic Matter							
Organic Matter	---	0.5	%	0.8	---	---	---



Australian Laboratory Services Pty. Ltd.
 32 Shand Street
 Stafford
 Brisbane QLD 4053
 Phone: +61 (7) 3243 7222 Fax: +61 (7) 3243 7218
 www.alsglobal.com/geochemistry

Page: 1
 Total # Pages: 2 (A)
 Plus Appendix Pages
 Finalized Date: 21- AUG- 2017
 Account: ALSENV

CERTIFICATE BR17173445

Project: EB1715709

This report is for 1 Pulp sample submitted to our lab in Brisbane, QLD, Australia on 18- AUG- 2017.

The following have access to data associated with this certificate:
 SUB RESULTS - BRIS

SAMPLE PREPARATION	
ALS CODE	DESCRIPTION
LOC-22	Sample login - Rcd w/o BarCode

ANALYTICAL PROCEDURES	
ALS CODE	DESCRIPTION
Fe- VOL05	FeO (Ferrous Iron)

To: **ALS ENVIRONMENTAL**
ATTN: SUB RESULTS - BRIS
32 SHAND STREET
STAFFORD QLD 4053

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.
 ***** See Appendix Page for comments regarding this certificate *****

Signature: 
 Shaun Kenny, Brisbane Laboratory Manager



Australian Laboratory Services Pty. Ltd.
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 Stafford
 Brisbane QLD 4053
 Phone: +61 (7) 3243 7222 Fax: +61 (7) 3243 7218
 www.alsglobal.com/geochemistry

Page: 2 - A
 Total # Pages: 2 (A)
 Plus Appendix Pages
 Finalized Date: 21- AUG- 2017
 Account: ALSENV

Project: EB1715709

CERTIFICATE OF ANALYSIS BR17173445

Sample Description	Method Analyte Units LOR	Fe- VOL05 FeO % 0.01
17-131A		0.05

Material Test Report

Report Number: 663444.00-2
Issue Number: 1
Date Issued: 26/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Project Number: 663444.00
Project Name: Proposed Material Testing
Project Location: Northshore, Northshore
Work Request: 156
Sample Number: 17-156E
Date Sampled: 31/07/2017
Sampling Method: Sampled by Client
Lot No: 50/50 Lime - 24 Hour Curing period
Material: Silty clay(1% Lime)

Douglas Partners

Townsville Laboratory
 29 Civil Road GARBUTT QLD 4814
 Phone: (07) 4779 9886
 Fax: (07) 4725 1224

Email: dean.pollock@douglaspartners.com.au

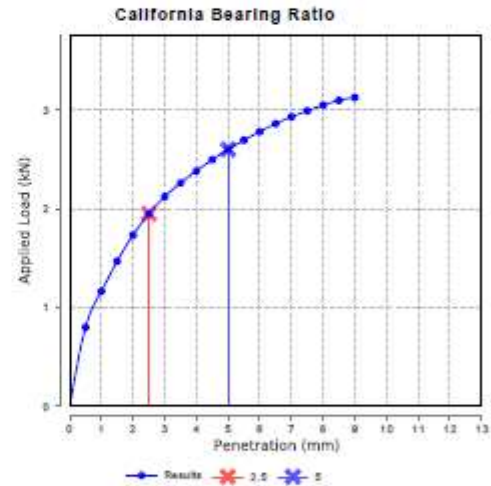
Accredited for compliance with ISO/IEC 17025 - Testing



Dean Pollock

Approved Signatory: Dean Pollock
 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	15		
CBR % (at 5 mm)	13		
CBR %	15		
Method of Compactive Effort	Standard		
Method used to Determine MDD			
Additive Type	Lime		
Additive Percent (%)	1		
Maximum Dry Density (t/m^3)	1.624		
Optimum Moisture Content (%)	20.4		
Target Dry Density (t/m^3)	1.576		
Achieved Dry Density (t/m^3)	1.575		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.0		
Target Moisture Content (%)	100.0		
Achieved Moisture Content (%)	20.4		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.565		
Field Moisture Content (%)	5.6		
Moisture Content at Placement (%)	20.4		
Moisture Content Top 30mm (%)	23.8		
Moisture Content Rest of Sample (%)	23.0		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	0.6		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			



Material Test Report

Report Number: 663444.00-2
Issue Number: 1
Date Issued: 26/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Project Number: 663444.00
Project Name: Proposed Material Testing
Project Location: Northshore, Northshore
Work Request: 156
Sample Number: 17-156A
Date Sampled: 31/07/2017
Sampling Method: Sampled by Client
Lot No: No Curing Period
Material: Silty clay(1.0% Lime)

Douglas Partners

Douglas Partners Pty Ltd
 Townsville Laboratory
 29 Civil Road GARBUTT QLD 4814
 Phone: (07) 4779 9866
 Fax: (07) 4725 1224

Email: dean.pollock@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

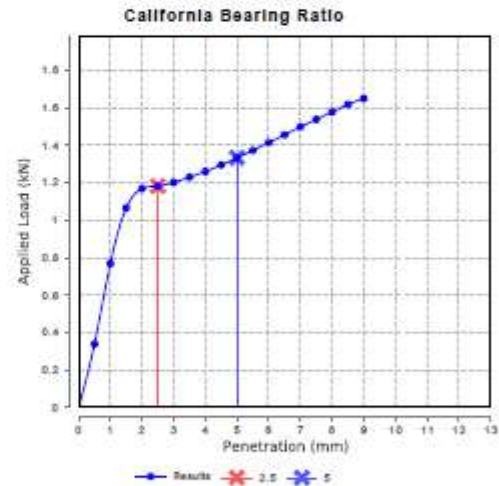


Dean Pollock

Approved Signatory: Dean Pollock

NATA Accredited Laboratory Number: 928

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	9.0		
CBR % (at 5 mm)	6.5		
CBR %	9.0		
Method of Compactive Effort	Standard		
Method used to Determine MDD	Q142A & Q102A		
Additive Type	Lime		
Additive Percent (%)	1		
Maximum Dry Density (t/m ³)	1.624		
Optimum Moisture Content (%)	20.4		
Target Dry Density (t/m ³)	1.576		
Achieved Dry Density (t/m ³)	1.575		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.0		
Target Moisture Content (%)	20.4		
Achieved Moisture Content (%)	20.4		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m ³)	1.557		
Field Moisture Content (%)	5.6		
Moisture Content at Placement (%)	20.4		
Moisture Content Top 30mm (%)	23.8		
Moisture Content Rest of Sample (%)	23.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	1.1		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			



Material Test Report

Report Number: 663444.00-2
Issue Number: 1
Date Issued: 26/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Project Number: 663444.00
Project Name: Proposed Material Testing
Project Location: Northshore, Northshore
Work Request: 156
Sample Number: 17-156F
Date Sampled: 31/07/2017
Sampling Method: Sampled by Client
Lot No: 60/60 Lime - 24 Hour Curing period
Material: Silty clay(Lime 3%)



Douglas Partners Pty Ltd
 Townsville Laboratory
 29 Civil Road GARBUTT QLD 4814
 Phone: (07) 4779 9866
 Fax: (07) 4725 1224
 Email: dean.pollock@douglaspartners.com.au
 Accredited for compliance with ISO/IEC 17025 - Testing

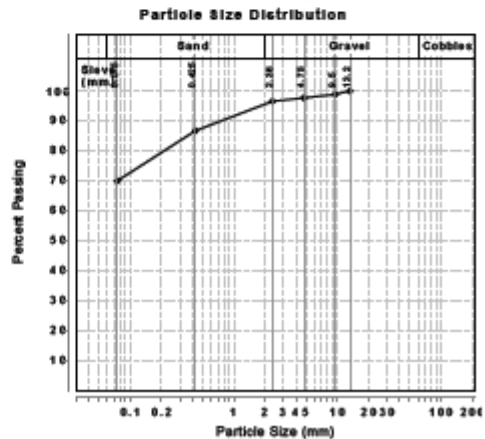
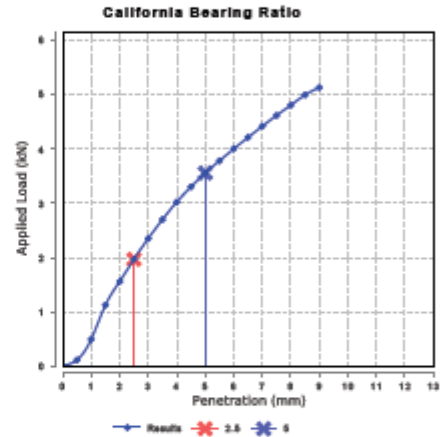


D. Pollock

Approved Signatory: Dean Pollock
 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	15		
CBR % (at 5 mm)	18		
CBR %	18		
Method of Compactive Effort	Standard		
Method used to Determine MDD			
Additive Type	Lime		
Additive Percent (%)	3		
Maximum Dry Density (t/m ³)	1.624		
Optimum Moisture Content (%)	20.4		
Target Dry Density (t/m ³)	1.576		
Achieved Dry Density (t/m ³)	1.567		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	96.5		
Target Moisture Content (%)	20.4		
Achieved Moisture Content (%)	20.3		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	99.5		
Dry Density after Soaking (t/m ³)	1.567		
Field Moisture Content (%)	5.6		
Moisture Content at Placement (%)	20.3		
Moisture Content Top 30mm (%)	24.2		
Moisture Content Rest of Sample (%)	23.5		
Mass Burcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Bwell (%)	0.0		
Override Material (mm)	19		
Override Material Included	Excluded		
Override Material (%)			

Particle Distribution (Q103A & Q102A)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
13.2 mm	100		0	
9.5 mm	98		1	
4.75 mm	98		1	
2.36 mm	97		1	
0.425 mm	87		10	
0.075 mm	70		17	



Material Test Report

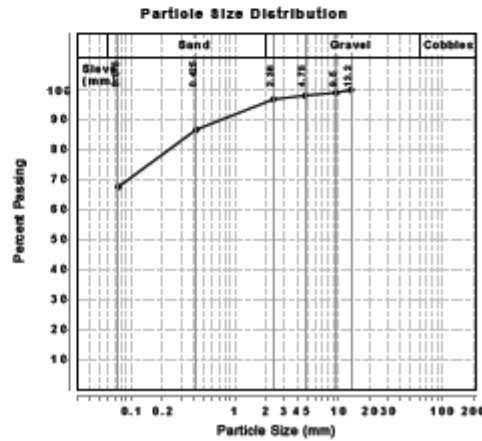
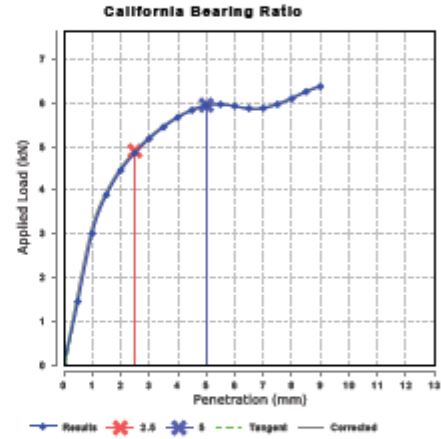
Report Number: 863444.00-2
Issue Number: 1
Date Issued: 26/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Project Number: 663444.00
Project Name: Proposed Material Testing
Project Location: Northshore, Northshore
Work Request: 156
Sample Number: 17-156B
Date Sampled: 31/07/2017
Sampling Method: Sampled by Client
Lot No: No Curing Period
Material: Silty clay (3% Lime) no curing

 **Douglas Partners**
SCIENCE / ENGINEERING / SOLUTIONS
 Douglas Partners Pty Ltd
 Townsville Laboratory
 29 Civil Road GARbutt QLD 4814
 Phone: (07) 4779 9868
 Fax: (07) 4725 1224
 Email: dean.pollock@douglaspartners.com.au
 Accredited for compliance with ISO/IEC 17025 - Testing

 **DPollock**
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 Approved Signatory: Dean Pollock
 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	38		
CBR % (at 5 mm)	30		
CBR %	38		
Method of Compactive Effort	Standard		
Method used to Determine MDD			
Additive Type	Lime		
Additive Percent (%)	3		
Maximum Dry Density (t/m ³)	1.624		
Optimum Moisture Content (%)	20.4		
Target Dry Density (t/m ³)	1.576		
Achieved Dry Density (t/m ³)	1.574		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	96.9		
Target Moisture Content (%)	20.4		
Achieved Moisture Content (%)	20.5		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	100.5		
Dry Density after Soaking (t/m ³)	1.561		
Field Moisture Content (%)	5.6		
Moisture Content at Placement (%)	20.5		
Moisture Content Top 30mm (%)	23.1		
Moisture Content Rest of Sample (%)	21.8		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	0.8		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			

Particle Distribution (Q103A & Q102A)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
13.2 mm	100		0	
9.5 mm	99		1	
4.75 mm	98		1	
2.36 mm	97		1	
0.425 mm	87		10	
0.075 mm	88		19	



Material Test Report

Report Number: 663444.00-2
Issue Number: 1
Date Issued: 26/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Project Number: 663444.00
Project Name: Proposed Material Testing
Project Location: Northshore, Northshore
Work Request: 156
Sample Number: 17-156G
Date Sampled: 31/07/2017
Sampling Method: Sampled by Client
Lot No: 50/50 Lime - 24 Hour Curing period
Material: Silty clay(5% Lime)



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 Townsville Laboratory
 29 Civil Road GARBUPT QLD 4814
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Email: dean.pollock@douglaspartners.com.au

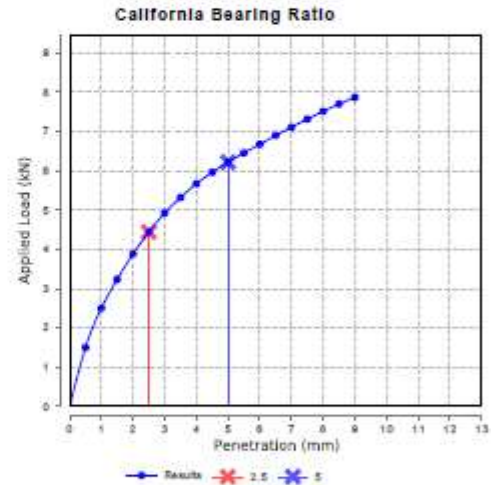
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 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	34		
CBR % (at 5 mm)	32		
CBR %	34		
Method of Compactive Effort	Standard		
Method used to Determine MDD			
Additive Type	Lime		
Additive Percent (%)	5		
Maximum Dry Density (t/m ³)	1.624		
Optimum Moisture Content (%)	20.4		
Target Dry Density (t/m ³)	1.576		
Achieved Dry Density (t/m ³)	1.576		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.0		
Target Moisture Content (%)	20.4		
Achieved Moisture Content (%)	20.4		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m ³)	1.533		
Field Moisture Content (%)	5.6		
Moisture Content at Placement (%)	20.4		
Moisture Content Top 30mm (%)	23.9		
Moisture Content Rest of Sample (%)	21.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	2.8		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			



Material Test Report



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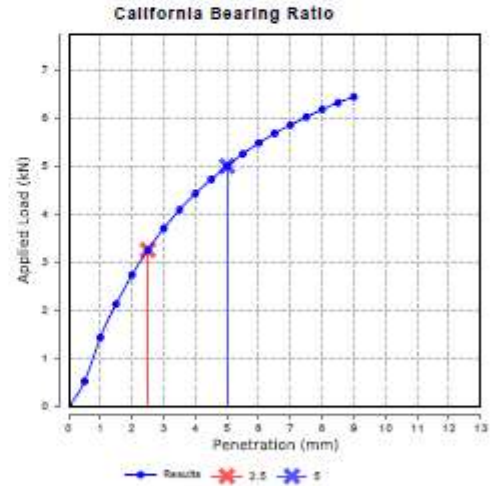


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Approved Signatory: Dean Pollock
 NATA Accredited Laboratory Number: 828

Report Number: 663444.00-2
 Issue Number: 1
 Date Issued: 26/09/2017
 Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
 Project Number: 663444.00
 Project Name: Proposed Material Testing
 Project Location: Northshore, Northshore
 Work Request: 156
 Sample Number: 17-156C
 Date Sampled: 31/07/2017
 Sampling Method: Sampled by Client
 Remarks: No Curing Period
 Lot No: No Curing Period
 Material: Silty clay (5% Lime)

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	25		
CBR % (at 5 mm)	25		
CBR %	25		
Method of Compactive Effort	Standard		
Method used to Determine MDD			
Additive Type	Lime		
Additive Percent (%)	5		
Maximum Dry Density (t/m ³)	1.624		
Optimum Moisture Content (%)	20.4		
Target Dry Density (t/m ³)	1.576		
Achieved Dry Density (t/m ³)	1.575		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.0		
Target Moisture Content (%)	20.4		
Achieved Moisture Content (%)	20.4		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m ³)	1.561		
Field Moisture Content (%)	5.6		
Moisture Content at Placement (%)	20.4		
Moisture Content Top 30mm (%)	27.0		
Moisture Content Rest of Sample (%)	22.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	0.9		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			



Material Test Report

Report Number: 663444.00-2
Issue Number: 1
Date Issued: 26/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Project Number: 663444.00
Project Name: Proposed Material Testing
Project Location: Northshore, Northshore
Work Request: 156
Sample Number: 17-156H
Date Sampled: 31/07/2017
Sampling Method: Sampled by Client
Lot No: 50/50 Lime - 24 Hour Curing period
Material: Silty clay(7% Lime)


Douglas Partners
Geotechnics | Environment | Geosynthetic

Douglas Partners Pty Ltd

Townsville Laboratory

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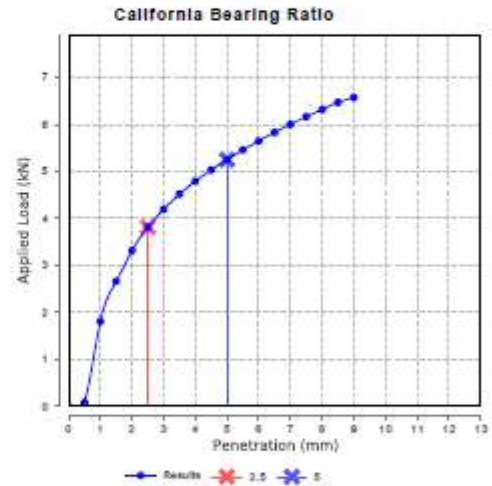


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NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)	Min	Max
CBR % (at 2.5 mm)	29	
CBR % (at 5 mm)	27	
CBR %	29	
Method of Compactive Effort	Standard	
Method used to Determine MDD		
Additive Type	Lime	
Additive Percent (%)	7	
Maximum Dry Density (t/m ³)	1.624	
Optimum Moisture Content (%)	20.4	
Target Dry Density (t/m ³)	1.576	
Achieved Dry Density (t/m ³)	1.577	
Target Laboratory Density Ratio (%)	97	
Laboratory Density Ratio (%)	97.1	
Target Moisture Content (%)	20.4	
Achieved Moisture Content (%)	20.4	
Target Laboratory Moisture Ratio (%)	100	
Laboratory Moisture Ratio (%)	100.0	
Dry Density after Soaking (t/m ³)	1.571	
Field Moisture Content (%)	5.6	
Moisture Content at Placement (%)	20.4	
Moisture Content Top 30mm (%)	25.6	
Moisture Content Rest of Sample (%)	25.1	
Mass Surcharge (kg)	4.5	
Soaking Period (days)	4	
Test Condition	Soaked	
Swell (%)	0.4	
Oversize Material (mm)	19	
Oversize Material Included	Excluded	
Oversize Material (%)		



Material Test Report

Report Number: 663444.00-2
Issue Number: 1
Date Issued: 26/09/2017
Client: Stabilised Pavements of Australia
 234 Wisemans Ferry Road, Somersby NSW 2250
Project Number: 663444.00
Project Name: Proposed Material Testing
Project Location: Northshore, Northshore
Work Request: 156
Sample Number: 17-156D
Date Sampled: 31/07/2017
Sampling Method: Sampled by Client
Remarks: No Curing Required
Lot No: No Curing Period
Material: Silty clay (7% Lime)



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Email: dean.pollock@douglaspartners.com.au

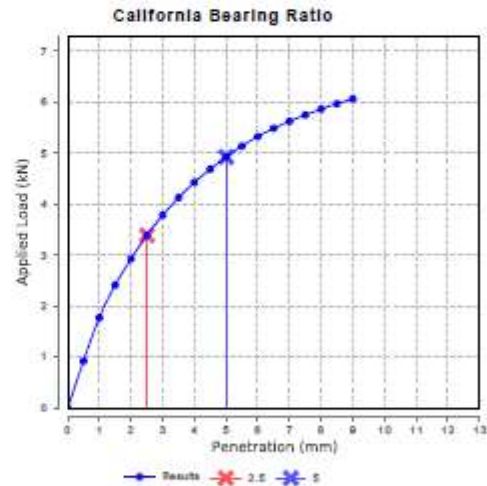
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 NATA Accredited Laboratory Number: 828

California Bearing Ratio (Q113C & Q102A)		Min	Max
CBR % (at 2.5 mm)	26		
CBR % (at 5 mm)	25		
CBR %	26		
Method of Compactive Effort	Standard		
Method used to Determine MDD			
Additive Type	Lime		
Additive Percent (%)	7		
Maximum Dry Density (t/m ³)	1.624		
Optimum Moisture Content (%)	20.4		
Target Dry Density (t/m ³)	1.576		
Achieved Dry Density (t/m ³)	1.577		
Target Laboratory Density Ratio (%)	97		
Laboratory Density Ratio (%)	97.1		
Target Moisture Content (%)	20.4		
Achieved Moisture Content (%)	20.3		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	99.5		
Dry Density after Soaking (t/m ³)	1.564		
Field Moisture Content (%)	5.6		
Moisture Content at Placement (%)	20.3		
Moisture Content Top 30mm (%)	26.1		
Moisture Content Rest of Sample (%)	22.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Test Condition	Soaked		
Swell (%)	0.9		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)			

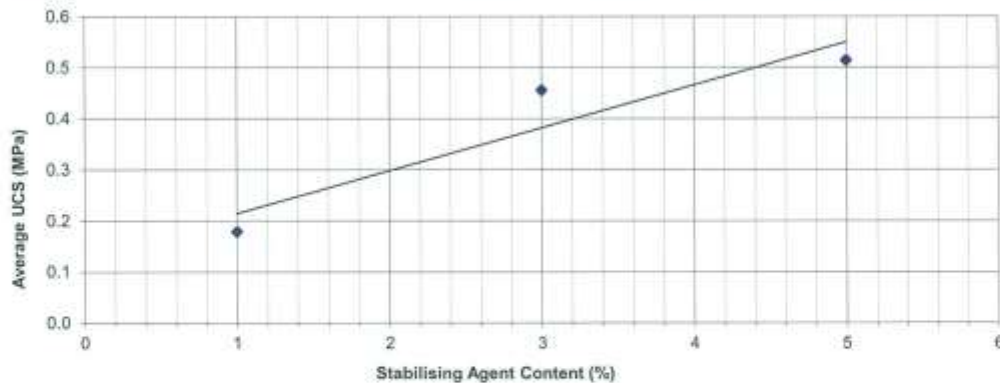


Determination of Unconfined Compressive Strength Of Stabilised Materials

Client :	Stabilised Pavements of Australia	DP Project No. :	663444
Project Title :	Proposed Material Testing	Report No. :	T17-197
Project Location:	Northshore	Report Date :	3/10/2017
Sample Location:		Date Sampled :	31/07/2017
Request / Order No:		Sample No.:	17-156A
Lot Number:	Chainage:	Offset:	
Material Description:	Silty clay (No cure)	Comp Standard:	STD
Design / Field Check:		Sample Method:	DP Eng
Stabilising Agent(s):	Hydrated Lime	Agent Source:	Bag
Test Methods:	Q115, Q135A, Q135B, Q102A	Page:	1 of 1

Target Relative Compaction 100 %
 Target Compaction Moisture Content 100 %

Total Stabilising Agent Content (%)	1			3			5		
Curing Period (days)	28			28			28		
Maximum Dry Density (t/m ³)	1.624			1.624			1.624		
Optimum Moisture Content (%)	20.4			20.4			20.4		
Achieved Compacted Dry Density (t/m ³)	1.623	1.623	1.621	1.623	1.621	1.622	1.625	1.625	1.625
Achieved Relative Compaction (%)	99.9	99.9	99.8	99.9	99.8	99.9	100.1	100.1	100.1
Achieved Compaction Moisture Content (%)	20.6	20.6	20.6	20.6	20.6	20.6	20.4	20.4	20.4
Achieved Percentage of OMC (%)	101	101	101	101	101	101	100	100	100
Capping of Upper Loaded Face (Y/N)	y	y	y	y	y	y	y	y	y
Unconfined Compressive Strength (MPa)	0.2	0.2	0.2	0.5	0.5	0.4	0.5	0.5	0.5
Average UCS (MPa)	0.2			0.5			0.5		



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 Remarks Second Content: -
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FORM R010A REV 0 MAY 2014



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Tested: SG
 Checked: DCP

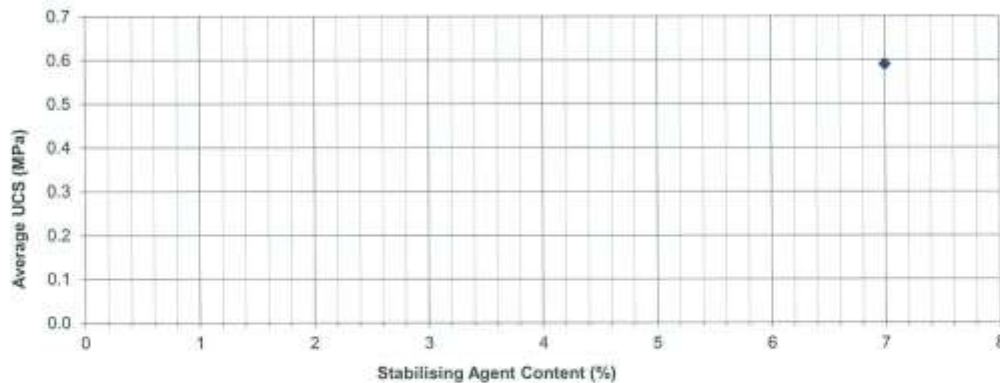
DPollock
 Dean Pollock
 Laboratory Manager

Determination of Unconfined Compressive Strength Of Stabilised Materials

Client :	Stabilised Pavements of Australia	DP Project No. :	663444
Project Title :	Proposed Material Testing	Report No. :	T17-198
Project Location:	Northshore	Report Date :	4/10/2017
Sample Location:		Date Sampled :	31/07/2017
Request / Order No:		Sample No.:	17-156A
Lot Number:	Chainage:	Offset:	
Material Description:	Silty clay (No cure)	Comp Standard:	STD
Design / Field Check:		Sample Method:	DP Eng
Stabilising Agent(s):	Hydrated Lime	Agent Source:	Bag
Test Methods:	Q115, Q135A, Q135B, Q102A	Page:	1 of 1

Target Relative Compaction 100 %
 Target Compaction Moisture Content 100 %

Total Stabilising Agent Content	(%)	7			#N/A			#N/A		
Curing Period	(days)	28			-			-		
Maximum Dry Density	(t/m ³)	1.624			-			-		
Optimum Moisture Content	(%)	20.4			-			-		
Achieved Compacted Dry Density	(t/m ³)	1.625	1.627	1.625	-	-	-	-	-	
Achieved Relative Compaction	(%)	100.0	100.2	100.0	-	-	-	-	-	
Achieved Compaction Moisture Content	(%)	20.2	20.2	20.2	-	-	-	-	-	
Achieved Percentage of OMC	(%)	99	99	99	-	-	-	-	-	
Capping of Upper Loaded Face	(Y/N)	y	y	y	-	-	-	-	-	
Unconfined Compressive Strength	(MPa)	0.6	0.6	0.6	-	-	-	-	-	
Average UCS	(MPa)	0.6			-			-		



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FORM R0118A REV 01 MAY 2014



NATA Accredited Laboratory Number: 828

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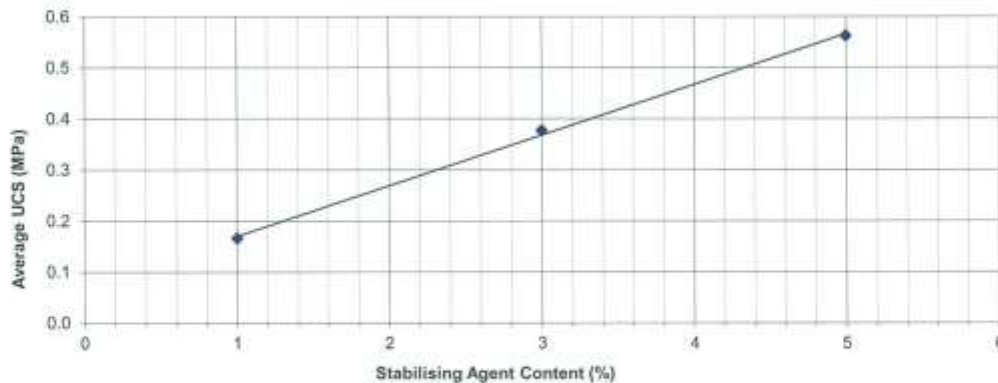
DPollock
 Dean Pollock
 Laboratory Manager

Determination of Unconfined Compressive Strength Of Stabilised Materials

Client :	Stabilised Pavements of Australia	DP Project No. :	663444
Project Title :	Proposed Material Testing	Report No. :	T17-199
Project Location:	Northshore	Report Date :	4/10/2017
Sample Location:		Date Sampled :	31/07/2017
Request / Order No:		Sample No.:	17-156E
Lot Number:	Chainage:	Offset:	
Material Description:	Silty clay (24 hour cure)	Comp Standard:	STD
Design / Field Check:		Sample Method:	DP Eng
Stabilising Agent(s):	Hydrated Lime	Agent Source:	Bag
Test Methods:	Q115, Q135A, Q135B, Q102A	Page:	1 of 1

Target Relative Compaction 100 %
 Target Compaction Moisture Content 100 %

Total Stabilising Agent Content (%)	1			3			5		
Curing Period (days)	28			28			28		
Maximum Dry Density (t/m ³)	1.624			1.624			1.624		
Optimum Moisture Content (%)	20.4			20.4			20.4		
Achieved Compacted Dry Density (t/m ³)	1.622	1.628	1.626	1.627	1.632	1.634	1.630	1.630	1.629
Achieved Relative Compaction (%)	99.9	100.2	100.1	100.2	100.5	100.6	100.4	100.4	100.3
Achieved Compaction Moisture Content (%)	20.5	20.5	20.5	20.3	20.3	20.3	20.4	20.4	20.4
Achieved Percentage of OMC (%)	100	100	100	99	99	99	100	100	100
Capping of Upper Loaded Face (Y/N)	y	y	y	y	y	y	y	y	y
Unconfined Compressive Strength (MPa)	0.2	0.2	0.2	0.4	0.4	0.3	0.6	0.6	0.5
Average UCS (MPa)	0.2			0.4			0.6		



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Tested:	SG
Checked:	DCP

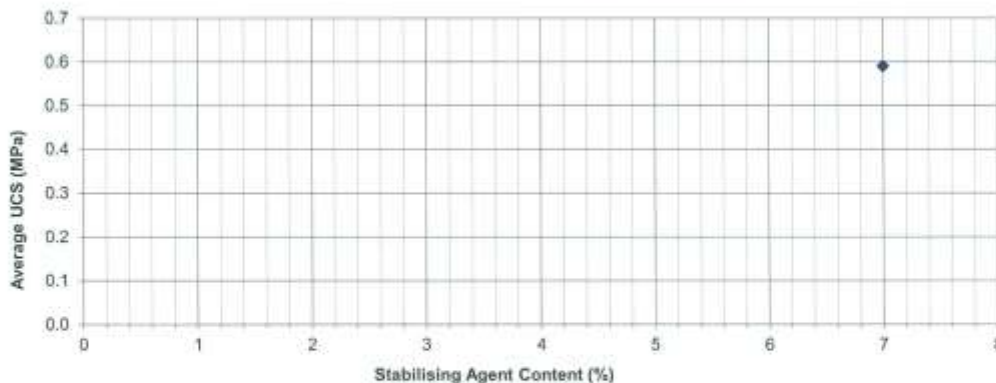
DPollock
 Dean Pollock
 Laboratory Manager

Determination of Unconfined Compressive Strength Of Stabilised Materials

Client :	Stabilised Pavements of Australia	DP Project No. :	663444
Project Title :	Proposed Material Testing	Report No. :	T17-200
Project Location:	Northshore	Report Date :	
Sample Location:		Date Sampled :	31/07/2017
Request / Order No:		Sample No.:	17-156E
Lot Number:	Chainage:	Offset:	
Material Description:	Silty clay (24 hour cure)	Comp Standard:	STD
Design / Field Check:		Sample Method:	DP Eng
Stabilising Agent(s):	Hydrated Lime	Agent Source:	Bag
Test Methods:	Q115, Q135A, Q135B, Q102A	Page:	1 of 1

Target Relative Compaction 100 %
 Target Compaction Moisture Content 100 %

Total Stabilising Agent Content	(%)	7			#N/A			#N/A		
Curing Period	(days)	28			-			-		
Maximum Dry Density	(t/m ³)	1.624			-			-		
Optimum Moisture Content	(%)	20.4			-			-		
Achieved Compacted Dry Density	(t/m ³)	1.623	1.624	1.624	-	-	-	-	-	-
Achieved Relative Compaction	(%)	99.9	100.0	100.0	-	-	-	-	-	-
Achieved Compaction Moisture Content	(%)	20.6	20.6	20.6	-	-	-	-	-	-
Achieved Percentage of OMC	(%)	101	101	101	-	-	-	-	-	-
Capping of Upper Loaded Face	(Y/N)	y	y	y	-	-	-	-	-	-
Unconfined Compressive Strength	(MPa)	0.6	0.6	0.6	-	-	-	-	-	-
Average UCS	(MPa)	0.6			-			-		



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Tested:	SG
Checked:	DCP

DPollock
 Dean Pollock
 Laboratory Manager

Report No: MAT-S172-2181

Issue No: 1

Material Test Report

Client:
Douglas Partners
439 Montague Road
West End Qld 4101

Project: Samples Submitted for Testing



Accredited for compliance with ISO/IEC 17025

Accreditation No: 2911 Approved Signatory: Graham Kent

Date of Issue: 25/09/2017

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Sample Details

General Location: Northshore.
Sample ID: S172-2181
Test Request No: 131
Sampled By: Client
Sampling Method: Sampled by Client- tested as received.
Date Sampled: 31/07/2017
Source: In situ Material
Material: Proposed Material Testing
Material Description: Sandy Silty Clay
Location: Northshore, Client Sample No: 17-131A

Test Results

Description	Method	Result	Limits
Date Test Started	Q1250	24/05/2017	
Additive Type		NA	
Additive Proportion (%)		0.0	
Maximum Dry Density (t/m ³)		1.744	
Optimum Moisture Content (%)		17.2	
Specified Dry Density (t/m ³)		1.735	
Specified Moisture Content (%)		17.6	
Initial Height of Specimen (mm)		112	
Rise Time (Hours)		2.0	
CAPILLARY RISE (%)		100	
Date Tested		24/08/2017	

Comments

NATA Endorsement does not cover Maximum Dry Density & Optimum Moisture Content.

Sampled by Client. Tested as received.

Report No: MAT:5172-2364
 Issue No: 1

Material Test Report

Client:
 Douglas Partners Pty Ltd
 29 Civil Road
 Garbutt Qld 4814

Project: Submitted sample for testing.

Accredited for compliance with ISO/IEC 17025



Accreditation No. 2911
 Approved Signatory: Mark Medden

Date of Issue: 15/09/2017
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Sample Details

Sample ID: S172-2364
Sampled By: Client
Sampling Method: Sampled by Client
Date Sampled: 31/07/2017
Source: As Per Location
Material: Proposed Material Testing
Material Description: Silty Clay
Location: Northshore, Sample 1

Test Results

Description	Method	Result	Limits
Date Test Started	Q1250	6/09/2017	
Additive Type		Hydrated Lime (Client Supplied)	
Additive Proportion (%)		3.0	
Maximum Dry Density (t/m ³)		1.624	
Optimum Moisture Content (%)		20.4	
Specified Dry Density (t/m ³)		1.624	
Specified Moisture Content (%)		20.4	
Initial Height of Specimen (mm)		114	
Rise Time (Hours)		3.5	
CAPILLARY RISE (%)		100	
Date Tested		14/09/2017	

Comments

Variation to test method.
 Specimen not cured for 28 days, as requested by client.
 M.C.D and O.M.C supplied by client - Client Reference No. 17-156A
 Achieved Compacted Dry Density: 1.643 t/m³ and Compacted Moisture Content: 20.0%

Report No: MAT:5172-2365

Issue No: 1

Material Test Report

Client:
 Douglas Partners Pty Ltd
 29 Civil Road
 Garbutt Qld 4814

Project: Submitted sample for testing.

Accredited for compliance with ISO/IEC 17025.



Accreditation No. 2911
 Approved Signatory: Mark Medden
 Date of Issue: 15/08/2017
 THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL.

Sample Details

Sample ID: S172-2365
Sampled By: Client
Sampling Method: Sampled by Client.
Date Sampled: 31/07/2017
Source: As Per Location
Material: Proposed Material Testing
Material Description: Silty Clay
Location: Northshore, Sample 2

Test Results

Description	Method	Result	Limits
Date Test Started	Q125D	6/05/2017	
Additive Type		Hydrated Lime (Client Supplied)	
Additive Proportion (%)		3.0	
Maximum Dry Density (t/m ³)		1.624	
Optimum Moisture Content (%)		20.4	
Specified Dry Density (t/m ³)		1.624	
Specified Moisture Content (%)		20.4	
Initial Height of Specimen (mm)		114	
Rise Time (Hours)		1.0	
CAPILLARY RISE (%)		100	
Date Tested		15/09/2017	

Comments

Variation to test method: Specimen not cured for 28 days. 1st Mix 50% Additive and 50% Water, 2nd Mix 50% Additive and 50% Water over 24 Hour Period, as requested by client.
 M.D.D and O.M.C supplied by client - Client Reference No: 17-156A
 Achieved Compacted Dry Density: 1.631 t/m³ and Compacted Moisture Content: 19.9%

Form No: 1806, Report No: MAT:5172-2365

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