

# OUTENIQUA LAB

EXTENTION TO WALVIS ROAD

MOSSEL BAY

SOIL INVESTIGATION



MAY 2018

Authors:  
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# Contents

Introduction .....	2
General Appreciation .....	2
Available Information .....	2
Geology.....	2
Site Investigation.....	2
Outcome of the Site Investigation .....	3
Field Testing .....	3

## **Introduction**

Outeniqua Lab (Pty) Ltd was requested by Aurecon of George to conduct a soil investigation on an green field area proposed for the extension of Walvis road. The investigation was done by.

- Machine (TLB) excavating five trial pits until machine refusal,
- Profiling of the five trial pits using the “MCCSSO” format,
- Taking disturbed samples of the various materials encountered for materials testing,
- Handheld Dynamic Cone Penetrometers (DCP) to a maximum depth of 2m or refusal.

## **General Appreciation**

The site lays to the west of the existing Walvis road section and is bordered between Louis Fourie Weg on the Northern side and a School fence line on the Southern side.

The site has two distinct storm water valleys which would flood/flow during rainy periods and the grade of the rest of the site falls towards the North.

Isolated rock outcrops are scattered across the site.

## **Available Information**

The following maps, plans and analysing software was used for the desk study of the road section:

- The 1:250 000 Geological map of the area (Sheet 3322 Oudtshoorn) obtained from the Council for Geoscience.
- Arial images obtained from Google Earth.
- A layout plan obtained from Aurecon.

## **Geology**

The geological mapping indicates that the site is underlain by Shales of the Bokkeveld Series and Feldspathic Sandstones of the Table Mountain Series.

## **Site Investigation**

In order to investigate the road section, the following was undertaken:

- Six trial pits were machine excavated to a maximum depth of 2.7m of refusal, profiled according to MCCSSO and disturbed samples taken for moisture content as well as California Bearing Ratio (CBR) testing.
- Seven number of hand held Dynamic Cone Penetrometer (DCP) tests were performed from the natural ground level.

## Outcome of the Site Investigation

### Field Testing

The detailed information and test results of the materials, trial pits and DCP's performed on the road section are attached.

Find a summary of the trial pits below:

Position	Depth (mm)	Thickness (mm)	Description
TP 1	0-180	180	Dry, dark grey, dense, intact, SILTY SANDY GRAVEL, transported.
	180-700	520	Dry, light reddish orange, dense, intact, SANDSTONE ROCK, residual.
TP 2	0-500	500	Slightly moist, dark grey, dense, intact, SILTY SANDY GRAVEL WITH ROOTS, transported.
	500-1200	700	Slightly moist, light brown, dense, intact, SANDSTONE ROCK, residual.
TP 3	0-600	600	Slightly moist to moist, dark reddish orange, dense, intact, SILTY SANDY GRAVEL WITH ROOTS, transported.
	600-620	20	Dry, light reddish orange, dense, intact, SANDSTONE ROCK, residual.
TP 4	0		Dry, light reddish orange, dense, intact, SANDSTONE ROCK, residual.
TP 5	0-250	250	Dry, light brown, dense, intact, SILTY SANDY GRAVEL WITH ROOTS, transported.
	250-1010	760	Dry, light reddish orange, very dense, intact, SILTY SANDY GRAVEL WITH BOULDERS, transported.
	1010-1700	690	Dry, light reddish orange, dense, intact, SANDSTONE ROCK, residual.
TP 6	0-170	170	Slightly moist to moist, dark brown, medium dense, intact, SILTY SANDY CLAY WITH GRASS, transported.
	170-2700	2530	Moist, dark brown, dense, intact, SILTY SANDY CLAY WITH COBBLES, transported.
TP 7	0-1300	1300	Slightly moist to moist, dark reddish orange, dense, intact, SILTY SAND WITH BRICKS AND RUBBLE, fill.
	1300-2200	900	Moist, dark reddish orange, dense, intact, SILTY SAND, transported.
	200-1400	1200	Dry, light reddish orange, dense, intact, SANDSTONE ROCK, residual.

Llewelyn Heathcote - B-Tech. (Civil Eng.) & BSc Hons (Transportation)

For Outeniqua Lab (Pty) Ltd.



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R-PROF-1-5

Dec-14

Customer :

Aurecon  
65 York Street  
George  
6530

Project :

Extension to Walvis Road - Soil Investigation - Mossel Bay

Date Reported :

10/05/18

## TP1

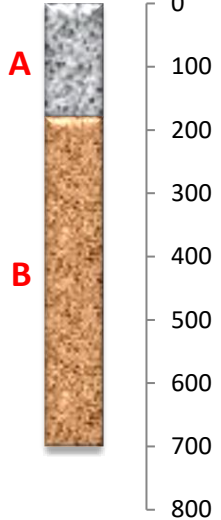
Datum: @ Natural Ground Level

Co-ordinates:

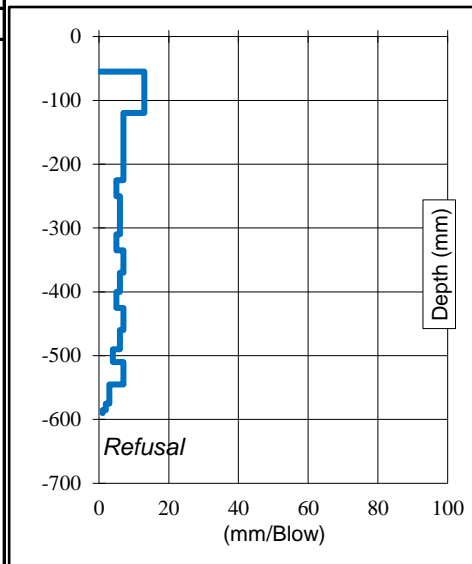
Key to symbols: ● Sample taken    ▽ Water seepage

(0 to 180) Dry, dark grey, dense, intact, **SILTY SANDY GRAVEL WITH RUBBLES**, transported.

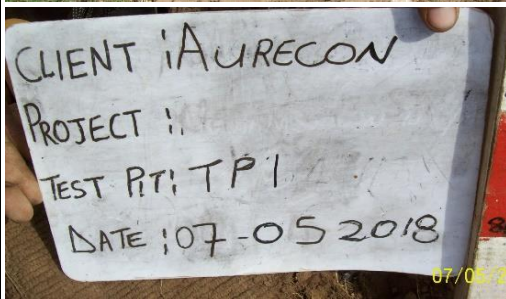
(180 to 700) Dry, light reddish orange, hard, intact, **SANDSTONE ROCK**, residual.



### Dynamic Cone Penetrometer (DCP)



### Photo of Test Pit







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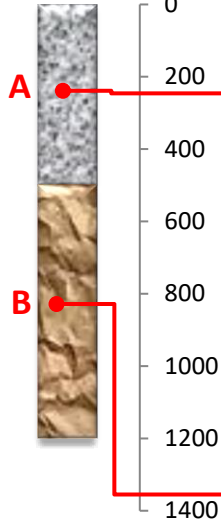
10/05/18

## TP2

Datum: @ Natural Ground Level

Co-ordinates:

Key to symbols: ● Sample taken    ▽ Water seepage



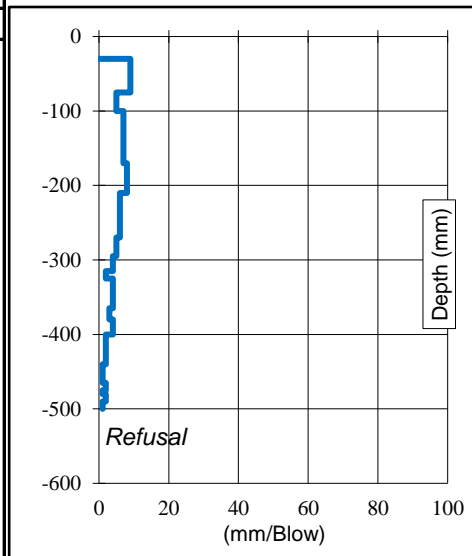
(0 to 500) Slightly moist, dark grey, dense, intact, **SILTY SANDY GRAVEL WITH ROOTS**, transported.

**MOD / CBR / Indicator / Moisture**

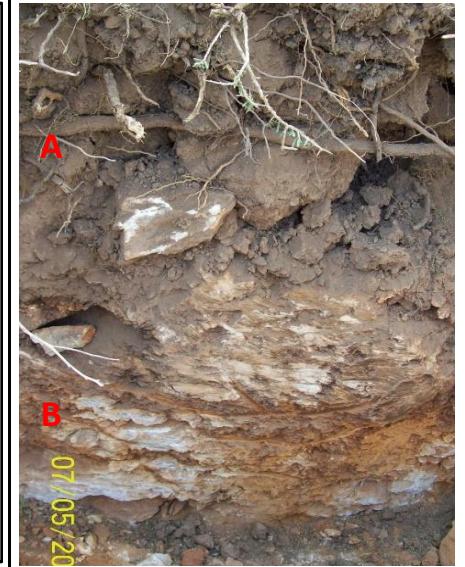
(500 to 1200) Slightly moist, light brown, hard, intact, **SANDSTONE GRAVEL WITH COBBLES**, transported.

**MOD / CBR / Indicator / Moisture**

### Dynamic Cone Penetrometer (DCP)



### Photo of Test Pit







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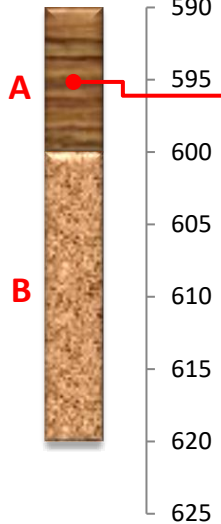
10/05/18

## TP3

Datum: @ Natural Ground Level

Co-ordinates:

Key to symbols: ● Sample taken    ▽ Water seepage

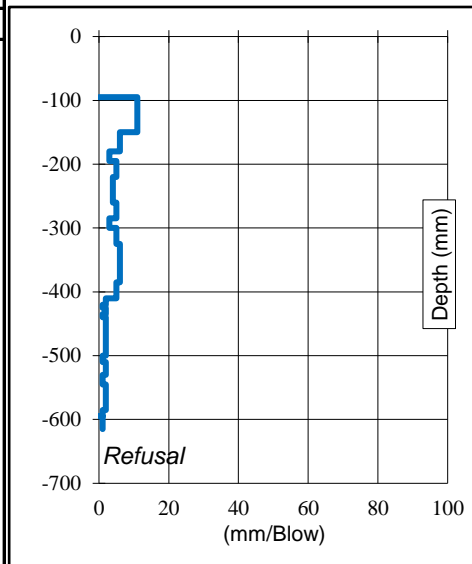


(0 to 600) Slightly moist to moist, dark reddish orange, dense, intact, **SILTY CLAYEY GRAVEL WITH ROOTS**, transported.

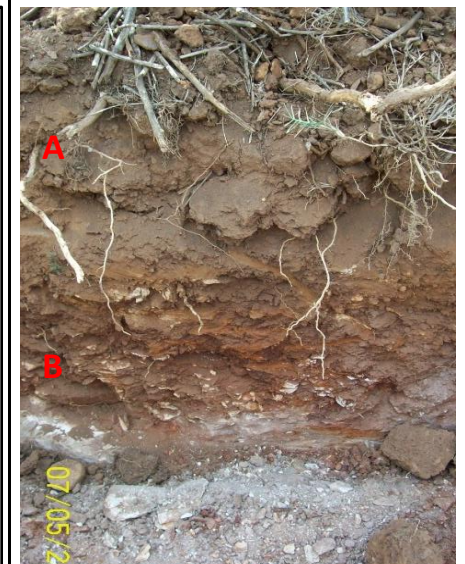
**MOD / CBR / Indicator / Moisture**

(600 to 620) Dry, light reddish orange, hard, intact, **SANDSTONE ROCK**, residual.

### Dynamic Cone Penetrometer (DCP)



### Photo of Test Pit







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## TP4

Datum: @ Natural Ground Level

Co-ordinates:

Key to symbols: ●

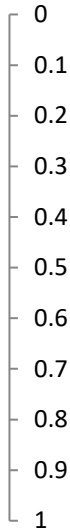
Sample taken



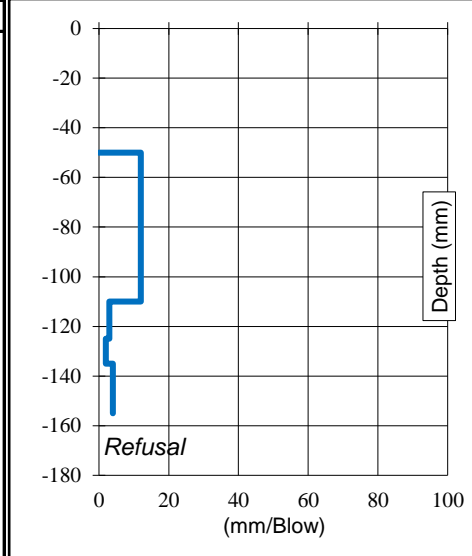
Water seepage

### Dynamic Cone Penetrometer (DCP)

### Photo of Test Pit



Refusal no test pit



Refusal no test pit



Refusal no test pit





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## TP5

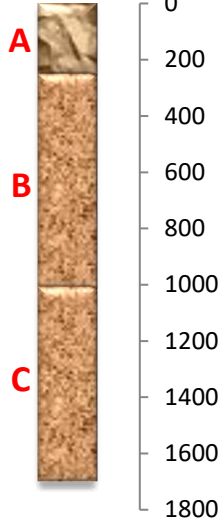
Datum: @ Natural Ground Level

Co-ordinates:

Key to symbols: ● Sample taken    ▽ Water seepage

### Dynamic Cone Penetrometer (DCP)

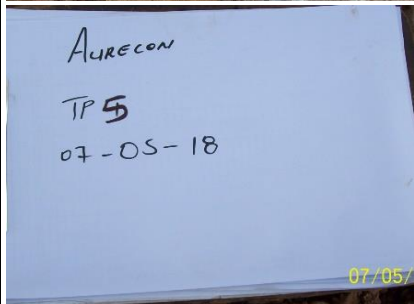
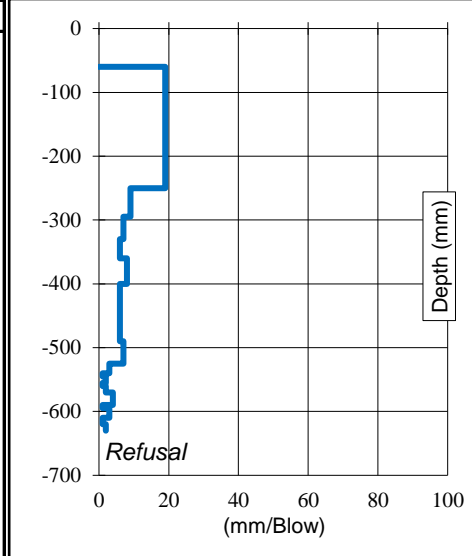
### Photo of Test Pit



(0 to 250) Dry, light brown, medium dense, intact, **SILTY SAND WITH ROOTS**, transported.

(250 to 1010) Dry, light reddish orange, very dense, intact, **SILTY SAND GRAVEL with BOULDERS**, transported.

(1010 to 1700) Dry, light reddish orange, hard, intact, **SANDSTONE ROCK**, residual.







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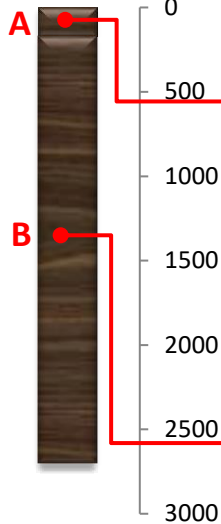
10/05/18

## TP6

Datum: @ Natural Ground Level

Co-ordinates:

Key to symbols: ● Sample taken    ▽ Water seepage



(0 to 170) Slightly moist to moist, dark brown, medium dense, intact, **SILTY SANDY CLAY WITH GRASS**, transported.

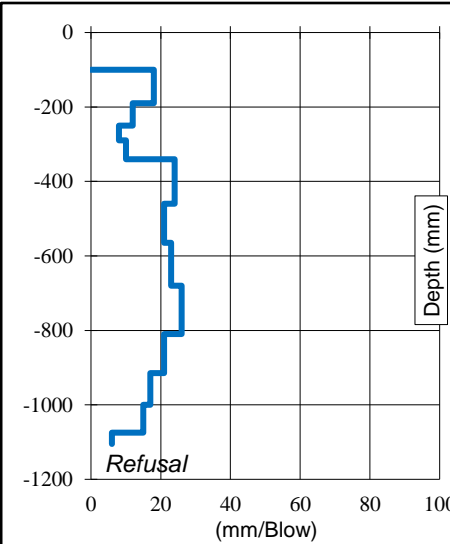
**MOD / CBR / Indicator / Moisture**

(170 to 2700) Moist, dark brown, dense, intact, **SILTY SANDY CLAY WITH COBBLES**, transported.

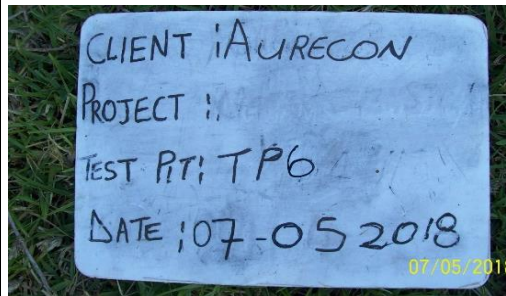
**MOD / CBR / Indicator / Moisture**

▽ Water tabel seepage.

### Dynamic Cone Penetrometer (DCP)



### Photo of Test Pit







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Date Reported :

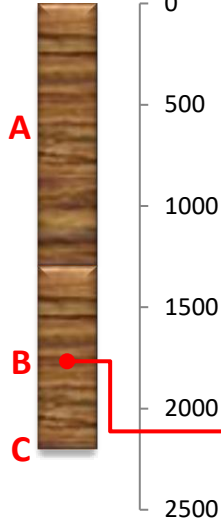
10/05/18

## TP7

Datum: @ Natural Ground Level

Co-ordinates:

Key to symbols: ● Sample taken    ▽ Water seepage

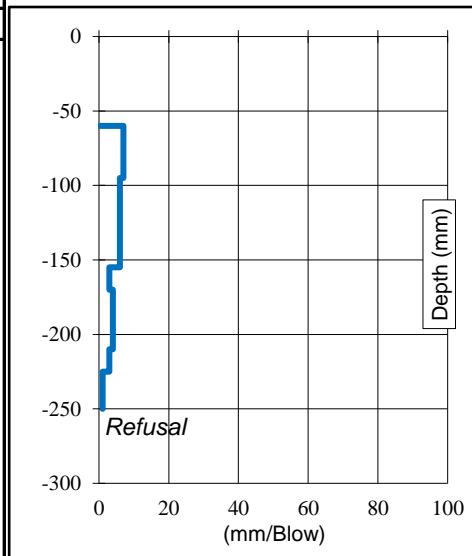


(0 to 1300) Slightly moist to moist, dark reddish orange, dense, intact, **SILTY SAND WITH BRICK and RUBBLES**, imported.

(1300 to 2200) Moist, dark reddish orange, dense, intact, **SILTY SAND**, transported.  
**MOD / CBR / Indicator / Moisture**

(2200 to 2200) Dry, light reddish orange, hard, intact, **SANDSTONE ROCK**, residual.

### Dynamic Cone Penetrometer (DCP)



### Photo of Test Pit





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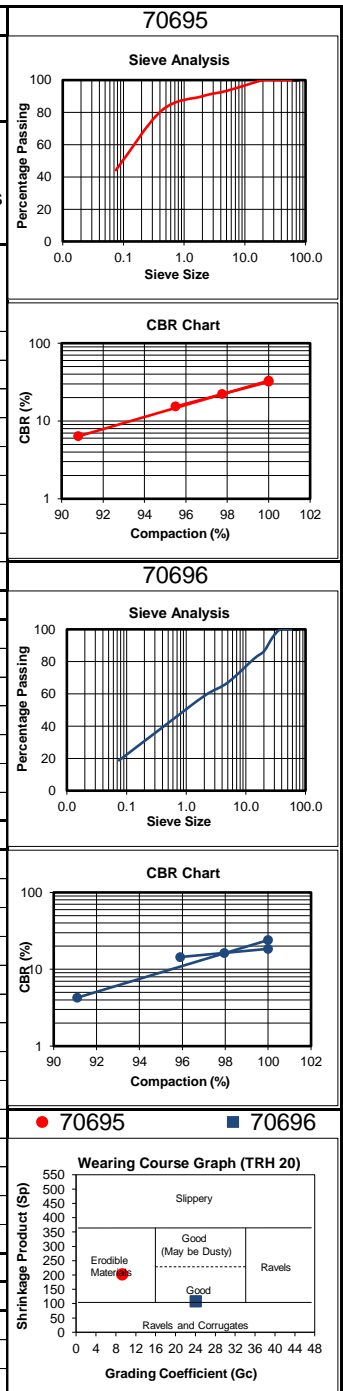
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za

Customer :	Aurecon	Project :	Extention to Walvis Road Soil Investigation - Mossel Bay
	65 York Street	Date Received :	07/05/18
	George	Date Reported :	22/05/18
Attention :	6530	Req. Number :	1348/18
	Ryno Schraader	No. of Pages :	1/4

## TEST REPORT

### CALIFORNIA BEARING RATIO - (SANS 3001 Method GR1,GR5,GR10,GR20,GR30,GR40)

		Material Indicators					
Sample Position (SV)		TP 2 - Layer 1	COLTO:	TP 2 - Layer 2	COLTO:		
Depth (mm)		0-500	G9	500-1200	Not		
Sample No		70695	Subgrade	70696	Classified		
Materials Description	Source	In-Situ		In-Situ			
	Colour	Dark Grey		Light Brown			
	Soil Type	Silty Sandy Gravel with Roots		Sandstone with Gravel & Cobbels			
	Classification	Existing		Existing			
Max. Stone size in hole (mm)							
Percentage Passing	75.0mm	100		100			
	63.0mm	100	Opinion	100			
	50.0mm	100		100			
	37.5mm	100		100			
	28.0mm	100		95			
	20.0mm	100		86			
	14.0mm	98		82			
	5.00mm	93		67			
	2.00mm	90		59			
	0.425mm	81		40			
0.075mm	44.2		18.8				
Soil Mortar & Constants							
Grading Modulus		0.85	0.75 - 2.70	✓	1.83		
Coarse Sand (%)		10			32		
Fine Sand (%)		41			36		
Silt & Clay (%)		49			32		
Liquid Limit (%)		17			25		
Plasticity Index (%)		5	≤ 12	✓	6		
Linear Shrinkage (%)		2.5			3.0		
CBR / Density Relationship							
MOD	Max Dry Density (kg/m <sup>3</sup> )	2120			1938		
	Opt Moisture Content (%)	7.1			10.2		
	Mould Moisture Con. (%)	7.1			10.1		
	@100% Mod AASHTO	100.0			100.0		
	Swell (%)	0.43	≤ 1.5	✓	0.98		
NRB	100% NRB	95.5			95.9		
	Swell (%)	0.56			1.39		
Proc	100% Proctor	90.8			91.1		
	Swell (%)	0.79			1.57		
CBR	@ 100% Mod AASHTO	33			24		
	@ 98% Mod AASHTO	23			16		
	@ 95% Mod AASHTO	13			9		
	@ 93% Mod AASHTO	9	≥ 7	*	6		
	@ 90% Mod AASHTO	5			3		
Insitu Moisture Content (%)		3.1			9.1		
Soil Classification Achieved By The Material							
COLTO:		G9 Subgrade			Not Classified		
AASHTO System		A-4			A-1-b / A-2-4		
Unified System		SM-SC			GM-GC		



- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 or MC1.
- Specimens sampled by Mawanda Rwatshube
- The weather conditions were such that there was no detrimental effect on the sample/s taken.

Llewelyn Heathcote  
 Technical Signatory  
 For Outeniqua Lab (Pty) Ltd.

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1. The opinion column is an interpretation of the direct comparison between the quoted specification and the single test sample results obtained. The compliant (P), non compliant (I) and uncertain (U) opinion indicators are based on an approximate 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.

2. The uncertain (U) indicates that the test result is either equal to or is above / below the specified limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliant (P) or non compliant (I) based on a 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.

3. This report (with attachments) is the correct record of all measurements made, and may not be reproduced other than with full written approval from the Director of Outeniqua Lab (Pty) Ltd.

4. Measuring Equipment, traceable to National Standards is used where applicable. Results reported in this Test Report relate only to the items tested and are an indication only of the sample provided and/or taken.

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	65 York Street	Date Received :	07/05/18
	George 6530	Date Reported :	22/05/18
Attention :	Ryno Schraader	Req. Number :	1348/18
		No. of Pages :	2/4

## TEST REPORT

### CALIFORNIA BEARING RATIO - (SANS 3001 Method GR1,GR5,GR10,GR20,GR30,GR40)

		Material Indicators				70697	
Sample Position (SV)		TP 3 - Layer 1	COLTO:				
Depth (mm)		0-600	Not				
Sample No		70697	Classified				
Materials Description	Source	In-Situ					
	Colour	Dark Reddish Orange					
	Soil Type	Silty Clayey Gravel with Roots					
	Classification	Existing					
Max. Stone size in hole (mm)							
Percentage Passing	75.0mm	100					
	63.0mm	100					
	50.0mm	100					
	37.5mm	100					
	28.0mm	100					
	20.0mm	99					
	14.0mm	99					
	5.00mm	98					
	2.00mm	96					
	0.425mm	86					
0.075mm	37.0						
<b>Soil Mortar &amp; Constants</b>							
Grading Modulus		0.81					
Coarse Sand (%)		11					
Fine Sand (%)		51					
Silt & Clay (%)		39					
Liquid Limit (%)		22					
Plasticity Index (%)		8					
Linear Shrinkage (%)		4.0					
<b>CBR / Density Relationship</b>							
MOD	Max Dry Density (kg/m <sup>3</sup> )	2020					
	Opt Moisture Content (%)	7.7					
	Mould Moisture Con. (%)	7.9					
	@100% Mod AASHTO	100.0					
	Swell (%)	0.79					
NRB	100% NRB	95.8					
	Swell (%)	0.91					
Proc	100% Proctor	91.3					
	Swell (%)	0.95					
CBR	@ 100% Mod AASHTO	22					
	@ 98% Mod AASHTO	15					
	@ 95% Mod AASHTO	8					
	@ 93% Mod AASHTO	5					
	@ 90% Mod AASHTO	3					
Insitu Moisture Content (%)		5.9					
<b>Soil Classification Achieved By The Material</b>							
COLTO:		Not Classified					
AASHTO System		A-4					
Unified System		SC					

- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 or MC1.
- Specimens sampled by Mawanda Rwatshube
- The weather conditions were such that there was no detrimental effect on the sample/s taken.

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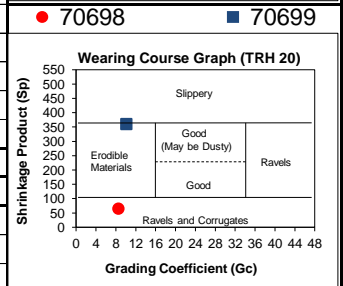
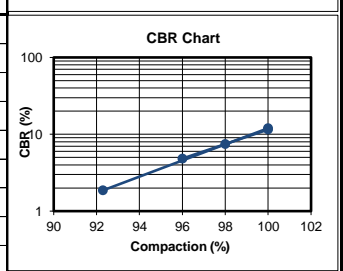
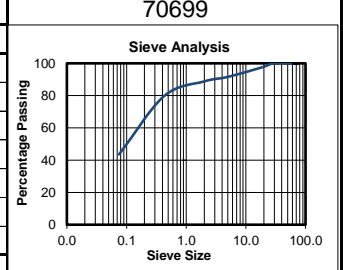
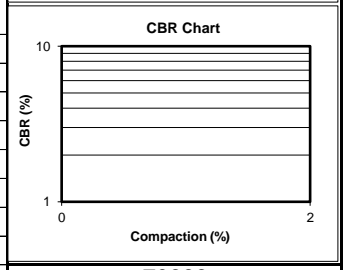
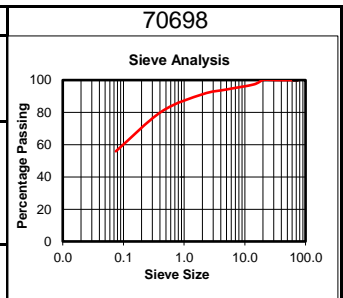
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	65 York Street	Date Received :	07/05/18
	George	Date Reported :	29/05/18
Attention :	6530	Req. Number :	1348/18
	Ryno Schraader	No. of Pages :	3/4

## TEST REPORT

### CALIFORNIA BEARING RATIO - (SANS 3001 Method GR1,GR5,GR10,GR20,GR30,GR40)

		Material Indicators					
Sample Position (SV)		TP 6 - Layer 1	COLTO:	TP 6 - Layer 2	COLTO:	70698	
Depth (mm)		0-170	Not	170-2700	Not		
Sample No		70698	Classified	70699	Classified		
Materials Description	Source	In-Situ		In-Situ			
	Colour	Dark Brown		Dark Brown			
	Soil Type	Silty Sandy Clay with Grass		Silty Sandy Clay with Cobbels			
	Classification	Existing		Existing			
Max. Stone size in hole (mm)			Opinion		Opinion		
Percentage Passing	75.0mm	100		100			
	63.0mm	100		100			
	50.0mm	100		100			
	37.5mm	100		100			
	28.0mm	100		100			
	20.0mm	100		98			
	14.0mm	97		96			
	5.00mm	94		92			
	2.00mm	91		89			
	0.425mm	81		80			
0.075mm	55.9		43.6				
<b>Soil Mortar &amp; Constants</b>							
Grading Modulus		0.72		0.88			
Coarse Sand (%)		12		10			
Fine Sand (%)		27		41			
Silt & Clay (%)		61		49			
Liquid Limit (%)		21		20			
Plasticity Index (%)		2		9			
Linear Shrinkage (%)		1.0		4.5			
<b>CBR / Density Relationship</b>							
MOD	Max Dry Density (kg/m <sup>3</sup> )			2118			
	Opt Moisture Content (%)			7.4			
	Mould Moisture Con. (%)			7.1			
	@100% Mod AASHTO			100.0			
	Swell (%)			0.91			
NRB	100% NRB			96.0			
	Swell (%)			1.28			
Proc	100% Proctor			92.3			
	Swell (%)			1.49			
CBR	@ 100% Mod AASHTO			12			
	@ 98% Mod AASHTO			7			
	@ 95% Mod AASHTO			4			
	@ 93% Mod AASHTO			2			
	@ 90% Mod AASHTO			1			
Insitu Moisture Content (%)		8.0		10.2			
<b>Soil Classification Achieved By The Material</b>							
COLTO:		Not Classified		Not Classified			
AASHTO System		A-4		A-4			
Unified System		ML		SC			



- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 or MC1.
- Specimens sampled by Mawanda Rwatshube
- The weather conditions were such that there was no detrimental effect on the sample/s taken.

Llewelyn Heathcote  
 Technical Signatory  
 For Outeniqua Lab (Pty) Ltd.

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1. The opinion column is an interpretation of the direct comparison between the quoted specification and the single test sample results obtained. The compliant (P), non compliant (I) and uncertain (U) opinion indicators are based on an approximate 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.  
 2. The uncertain (U) indicates that the test result is either equal to or is above / below the specified limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliant (P) or non compliant (I) based on a 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.  
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Registration No. 95/07742/07

**Materials Testing Laboratory**

6 Mirrorball Street, George : PO Box 3186, George Industria, 6536

Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za

Customer :	Aurecon	Project :	Extention to Walvis Road Soil Investigation - Mossel Bay
	65 York Street	Date Received :	07/05/18
	George 6530	Date Reported :	22/05/18
Attention :	Ryno Schraader	Req. Number :	1348/18
		No. of Pages :	4/4

## TEST REPORT

### CALIFORNIA BEARING RATIO - (SANS 3001 Method GR1,GR5,GR10,GR20,GR30,GR40)

Material Indicators		70700		
Sample Position (SV)	TP 7 -Layer 2	COLTO:		
Depth (mm)	1300-2200	G8 SSG		
Sample No	70700			
Materials Description	Source Colour Soil Type Classification	In-Situ Dark Reddish Orange Silty Sand Existing		
Max. Stone size in hole (mm)		Opinion		
Percentage Passing	75.0mm	100		
	63.0mm	100		
	50.0mm	100		
	37.5mm	100		
	28.0mm	100		
	20.0mm	100		
	14.0mm	99		
	5.00mm	96		
	2.00mm	94		
	0.425mm	84		
0.075mm	33.6			
Soil Mortar & Constants				
Grading Modulus	0.89	0.75 - 2.70	✓	
Coarse Sand (%)	10			
Fine Sand (%)	54			
Silt & Clay (%)	36			
Liquid Limit (%)	15			
Plasticity Index (%)	4	≤ 12	✓	
Linear Shrinkage (%)	2.0			
CBR / Density Relationship				
MOD	Max Dry Density (kg/m <sup>3</sup> )	2150		
	Opt Moisture Content (%)	7.4		
	Mould Moisture Con. (%)	7.7		
	@100% Mod AASHTO	100.0		
	Swell (%)	0.06	≤ 1.5	✓
Proc NRB	100% NRB	95.2		
	Swell (%)	0.12		
	100% Proctor	91.7		
CBR	@ 100% Mod AASHTO	43		
	@ 98% Mod AASHTO	31		
	@ 95% Mod AASHTO	19		
	@ 93% Mod AASHTO	14	≥ 10	✓
	@ 90% Mod AASHTO	9		
	Insitu Moisture Content (%)	7.0		
Soil Classification Achieved By The Material				
COLTO:	G8 SSG			
AASHTO System	A-2-4			
Unified System	SM-SC			

- Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 or MC1.
- Specimens sampled by Mawanda Rwatshube
- The weather conditions were such that there was no detrimental effect on the sample/s taken.

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For Outeniqua Lab (Pty) Ltd.

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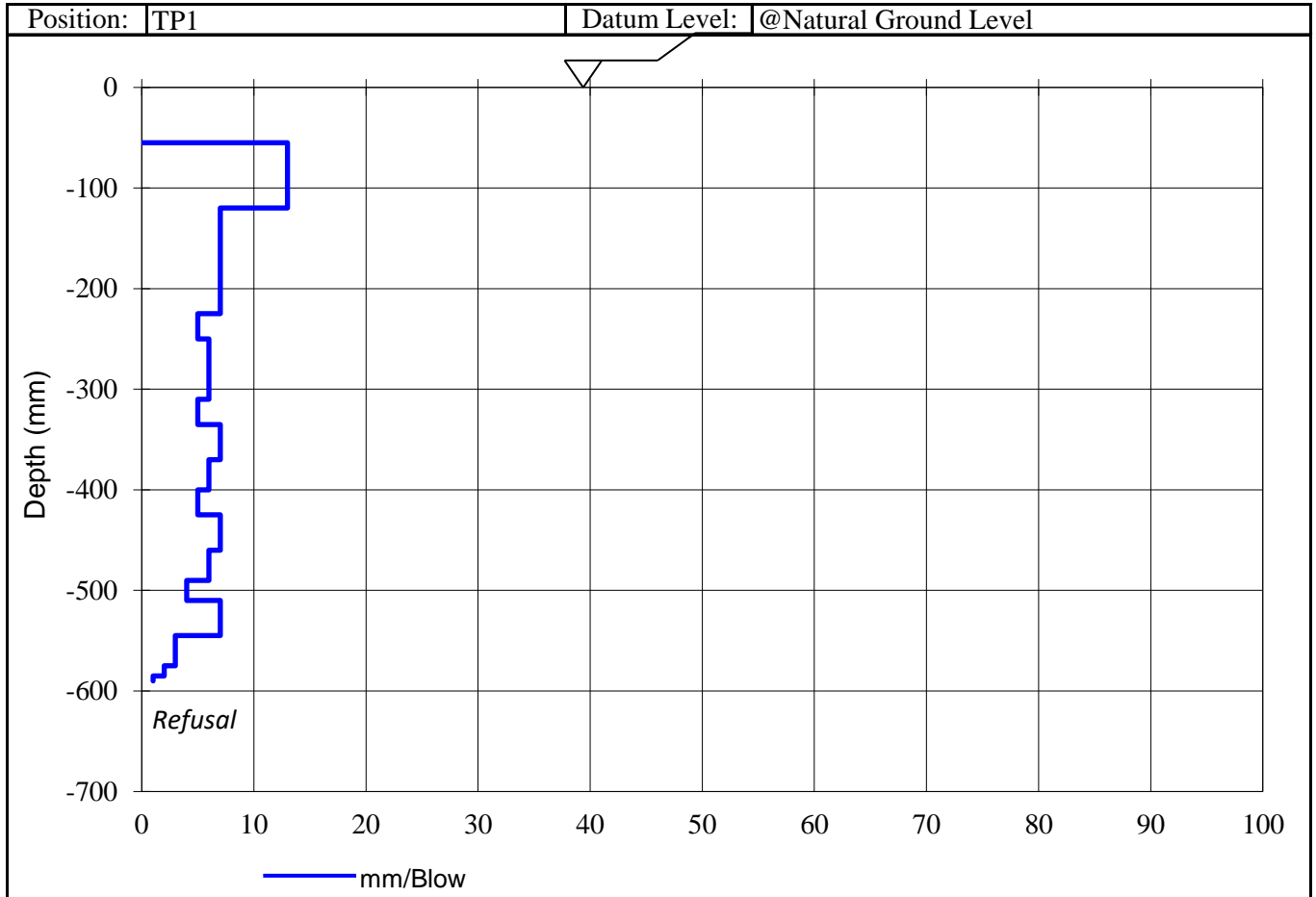
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	George	Date Reported :	10/05/18
	6530	Req. Number :	1348/18
Attention :	Ryno Schraader	No. of Pages :	1 of 7

### TEST REPORT

### Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)



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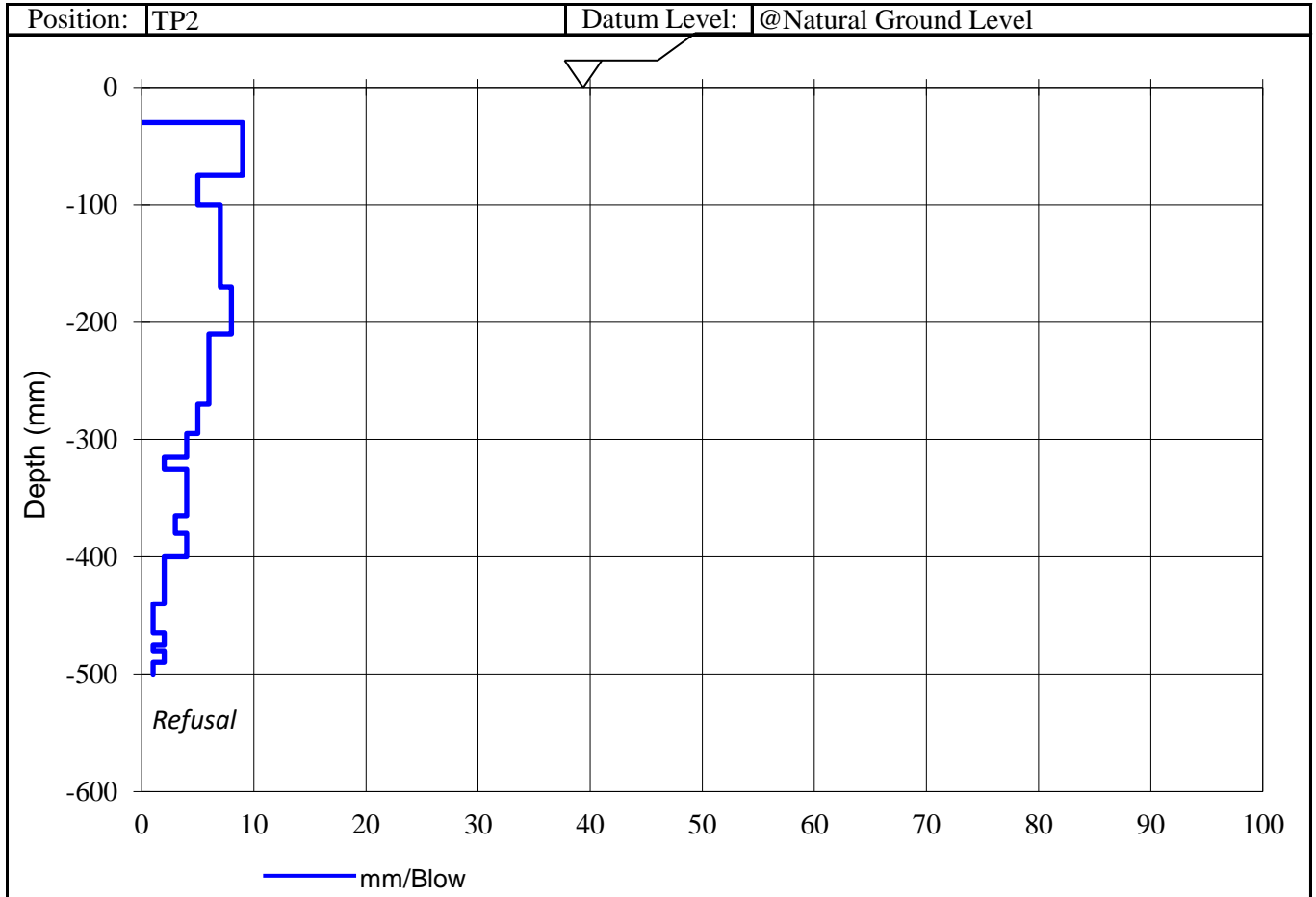
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			Date Reported :	10/05/18
			Req. Number :	1348/18
		No. of Pages :	2 of 7	

### TEST REPORT

#### Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)



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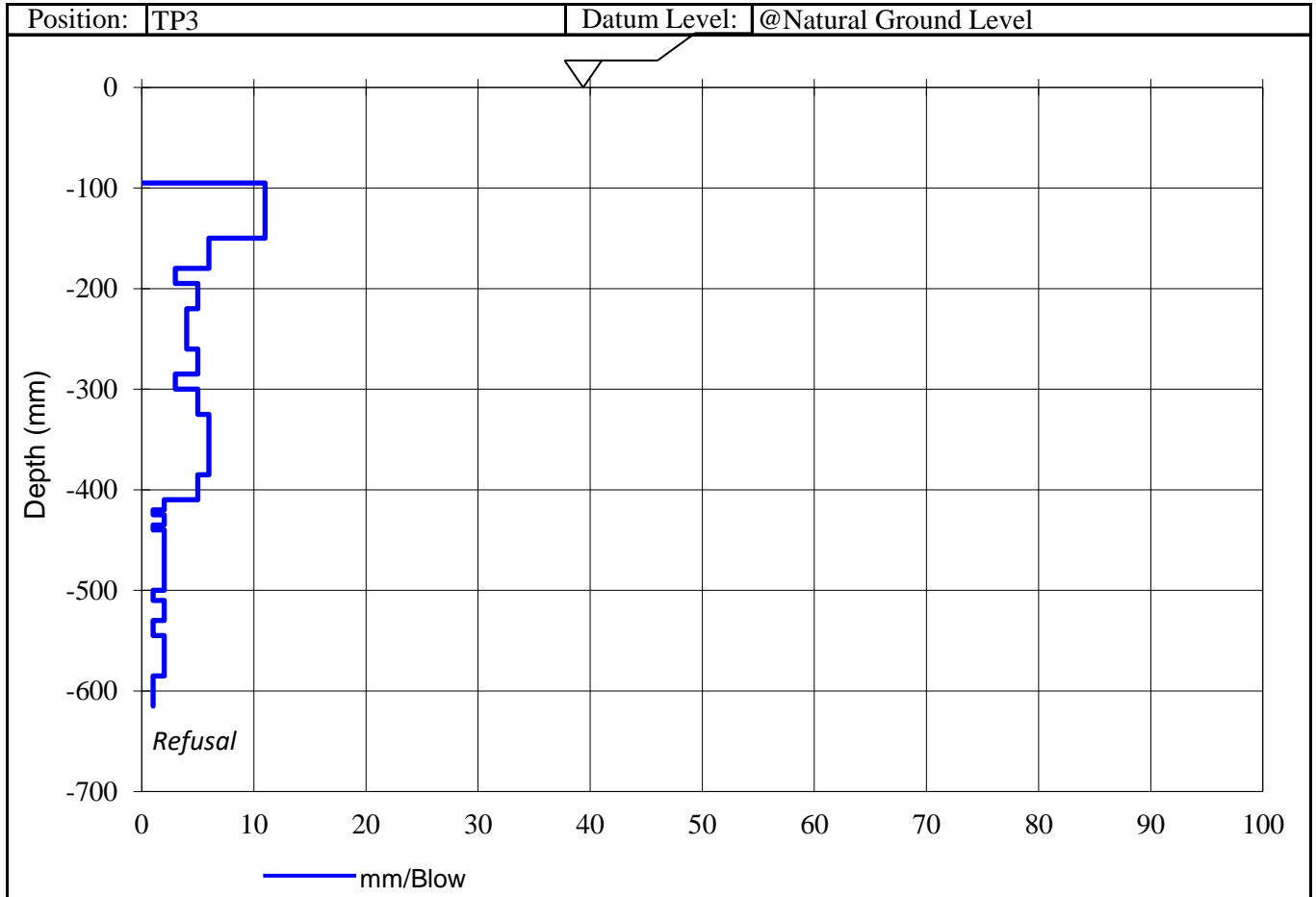
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	George	Date Reported :	10/05/18
	6530	Req. Number :	1348/18
Attention :	Ryno Schraader	No. of Pages :	3 of 7

### TEST REPORT

### Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)



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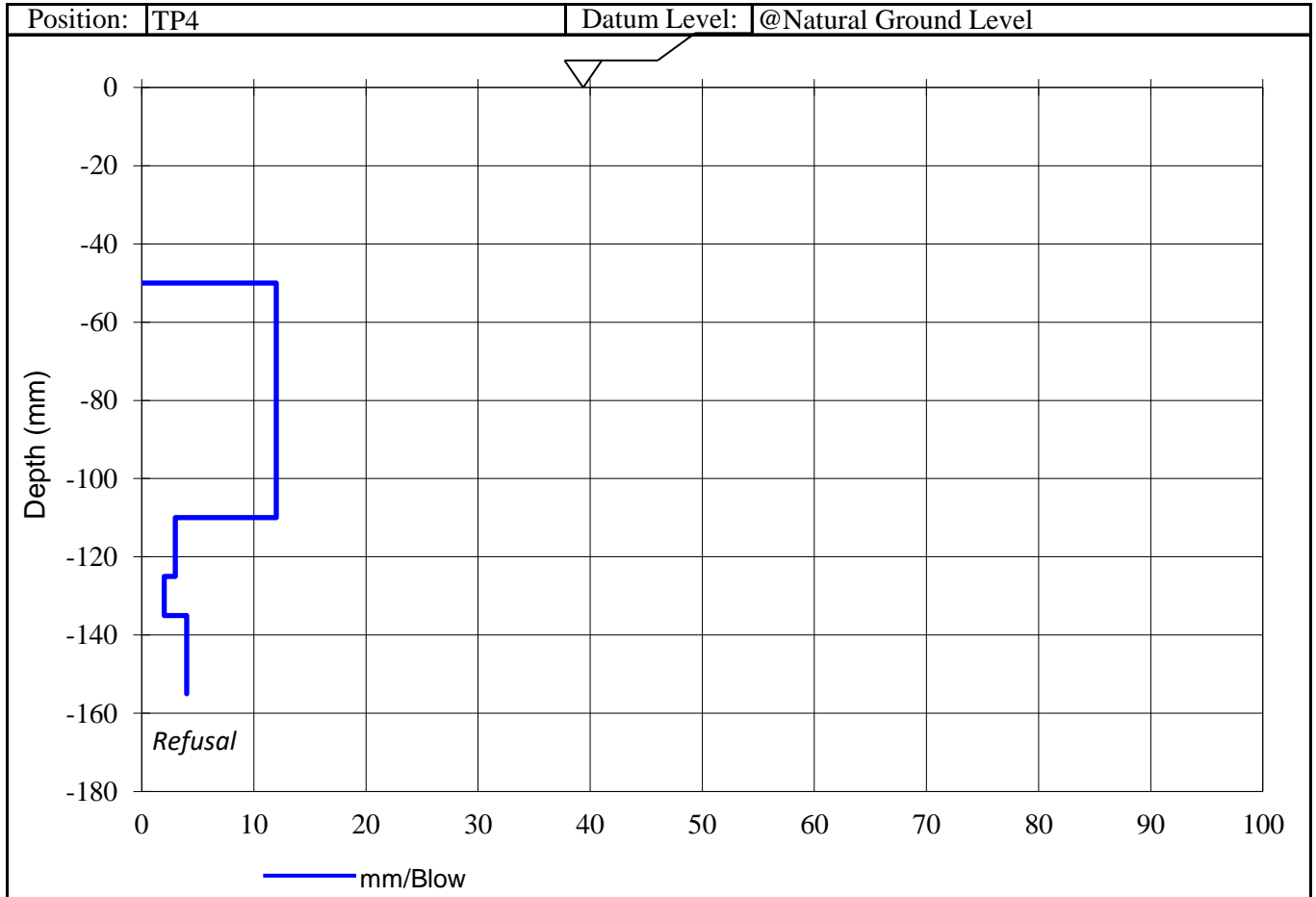




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	65 York Street	Date Received :	07/05/18
	George	Date Reported :	10/05/18
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### TEST REPORT

### Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)



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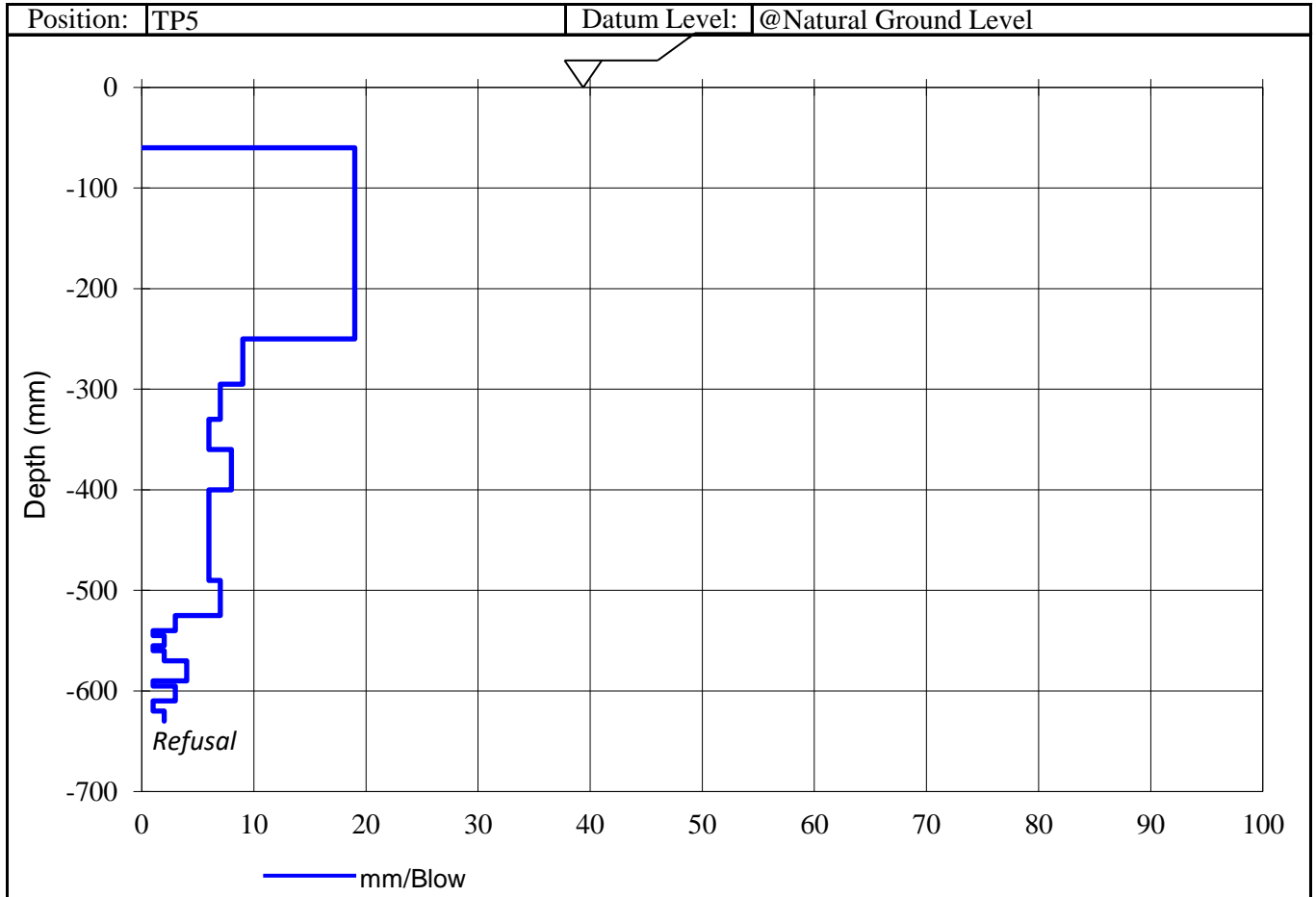
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Attention :	Ryno Schraader	No. of Pages :	5 of 7

### TEST REPORT

### Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)



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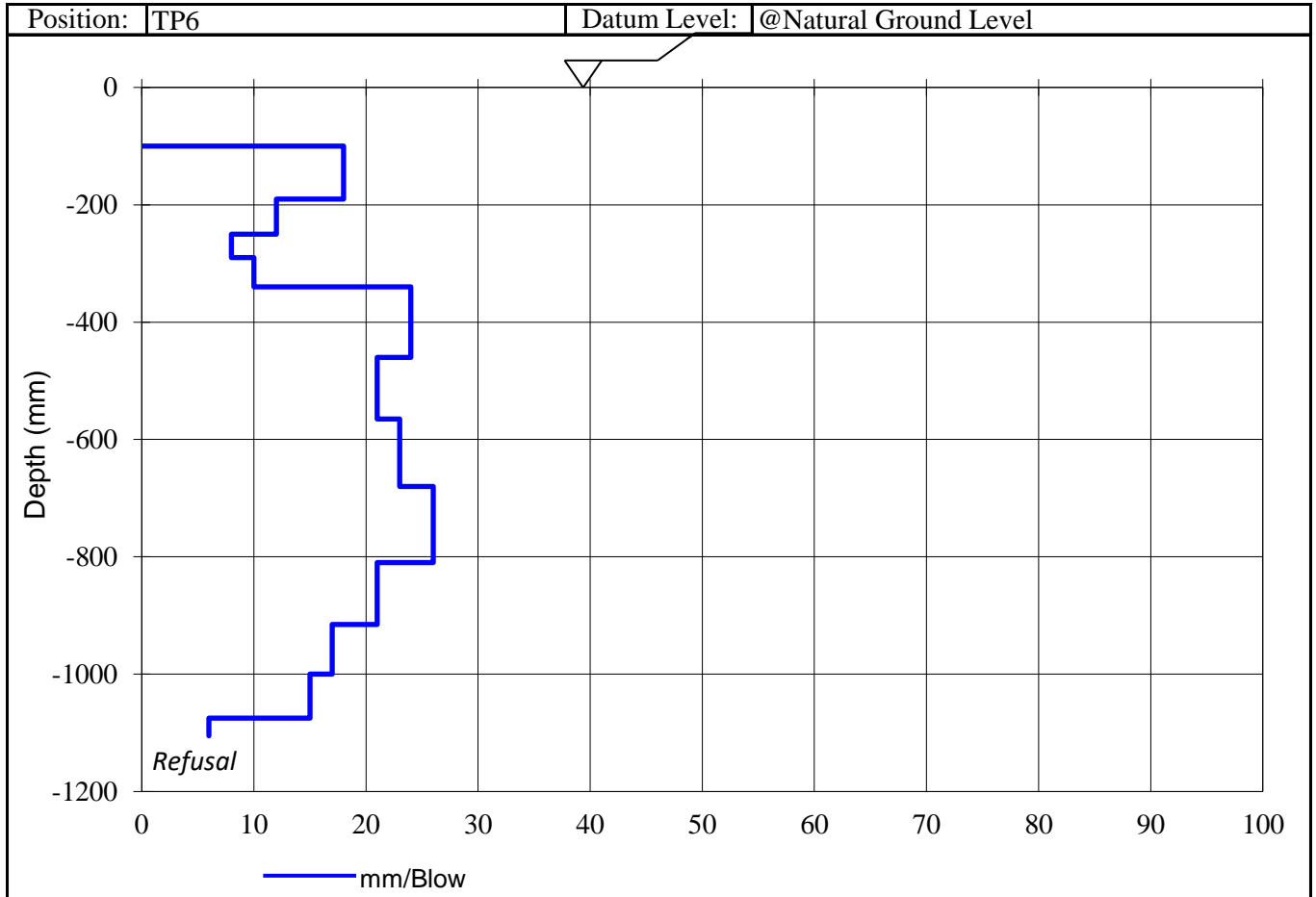
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Attention :	Ryno Schraader	No. of Pages :	6 of 7

### TEST REPORT

#### Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)



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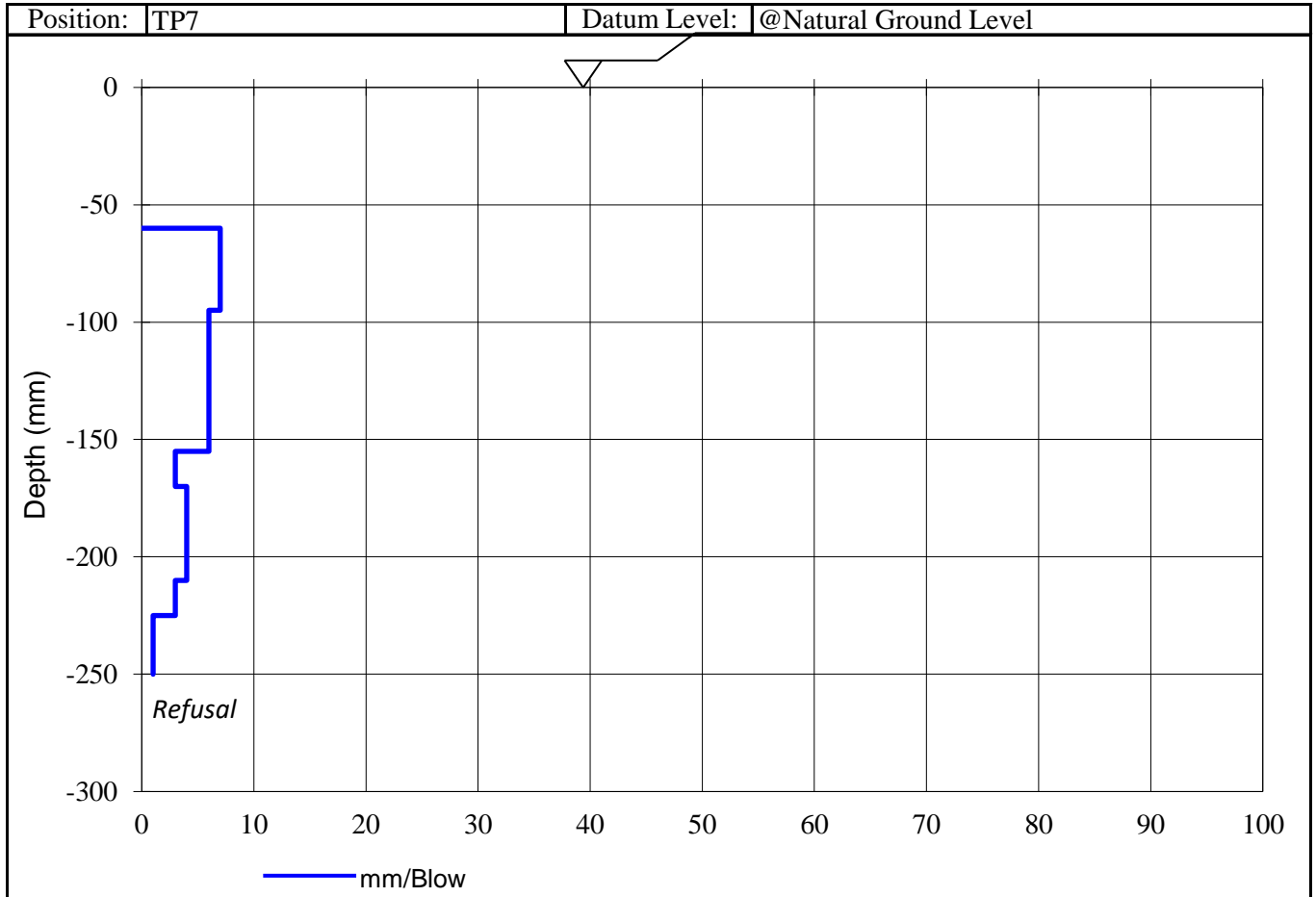
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	6530	Req. Number :	1348/18
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### TEST REPORT

### Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)



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