

ACSA - AA2073 -INSTALLATION OF BULK SERVICES AND ACCESS ROAD AT CAPE TOWN INTERNATIONAL AIRPORT'S PRECINCT 3

February 13 2023

Quality information

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1. Introduction

AECOM SA (Pty) Ltd was appointed by INGEROP SA (Pty) Ltd on behalf of ACSA to undertake a geotechnical investigation for access roads and bulk services at Precinct 3 of the Cape Town International Airport. The project is currently in the preliminary design stage with geotechnical investigation required to allow further design considerations.

The site is located west of the security check point on Erica Drive at 33°57'38.81"S latitude and 18°37'11.82"E Longitude. The site is bordered by Cape Town international airport in the west and semi-arid undulating land in the south and east with a nature reserve in the north.



Figure 1: Aerial image of the proposed site(From City of Cape Town Map viewer)

2. Scope of the Geotechnical investigation

The scope of works conducted as part of the investigation is presented below.

2.1 Available information

The following information was available to AECOM when compiling this report:

- 1:50,000 Geological Survey Series (Map Number 3318 DC, Bellville)

- A General Plan produced by Ingerop indicating the erf layout of the area as well as the coordinates of the exploratory test pits.
- Civil engineering drawings developed by Ingerop (emailed 20th February 2023) indicating the proposed road layout and layerworks, location and depth of bulk services to be installed in the ground as well as preliminary fill platform levels.

2.2 Fieldwork

Following a walkover inspection of the site, six (6) machine excavated test pits were put down to 2,30 to 3,50 m depth at pre-selected positions over the proposed development area.

Subsoil conditions were assessed by detailed visual examination of the in-situ materials exposed in the test pits.

In addition, Dropweight Cone Penetrometer (DCP) tests were conducted adjacent to and partway down some of the test pits for correlation of the visual soil consistency assessments and to obtain some indication of the density of the soils underlying the site at depth.

Soil samples were taken from various soil horizons and taken to the geotechnical laboratory to determine the subsoil characteristics as well as the utilisation potential of the excavated materials.

The test pit and DCP positions, the test pit profiles, DCP results and laboratory test results are presented in the Appendices.

2.2.1 Test Pits

The test pit investigations were conducted on the 9th of February 2023, by AECOM using a Tractor Loader Backhoe (TLB) machine. Six test pits were completed to a maximum depth ranging from 2.3 to 3.5 metres below existing ground level. The location of the six test pits can be found in **Table 1**. One test pit denoted "TP 1", could not be undertaken as it fell out of the ACSA's cadastral boundary and we were not granted access onto the land.

Dropweight Cone Penetrometer (DCP) Tests were conducted by Steyn-Wilson laboratories at surface level for all trail holes. This was done in order to develop a comparative model of near surface soils at each hole.

The test pit profiles and DCP results can be found in **Appendix 1**

Table 1: Test Pit locations, depth and groundwater interaction

Test pit No	Latitude	Longitude	Elevation (masl)	Depth (m)	Ground water level (mbegl)
TP 2	33°57'29.10"S	18°37'9.53"E	50.285	2.9	2.15
TP 3	33°57'36.50"S	18°37'7.38"E	51.463	3.5	Not Encountered
TP 4	33°57'37.42"S	18°37'16.16"E	50.771	2.3	Not Encountered

TP 5	33°57'45.73"S	18°37'13.62"E	51.732	3.5	Not Encountered
TP 6	33°57'42.72"S	18°37'17.70"E	51.257	3.2	2.80
TP 7	33°57'33.81"S	18°37'25.12"E	55.406	2.5	Not Encountered

2.2.2 Geotechnical Testing

Thirteen disturbed samples were retrieved from the test pit investigations for geotechnical laboratory testing. These samples were subjected to foundation indicator (FI) and/or MOD CBR testing to determine the subsoil engineering characteristics and utilisation potential of the site soils. Table 2 below presents the geotechnical testing undertaken during this investigation stage.

Table 2: Geotechnical Tests Conducted During The Investigation

Test Location	Sample Type	Depth(mbegl)	Testing Type
TP 2	Penetrated transports soils	NGL	DCP
TP 2	Transported Material	0.0 – 0.5	MOD +CBR + FI
TP 2	Penetrated transports soils	1.7 – 3.0	FI
TP 3	Penetrated transports soils	NGL	DCP
TP 3	Penetrated transports soils	0.0 – 0.65	FI
TP 3	Transported Material	1.1 – 3.5	MOD +CBR + FI
TP 4	Penetrated transports soils	NGL	DCP
TP 4	Transported Material	2.3 – 2.57	FI + CBR+ MOD
TP 5	Penetrated transports soils	NGL	DCP
TP5	Penetrated transports soils	1.40	DCP
TP 5	Transported Material	1.7 – 3.5	FI
TP 6	Penetrated transports soils	NGL	DCP
TP 6	Transported Material	1.4 – 2.7	MOD +CBR + FI
TP 7	Penetrated transports soils	NGL	DCP
TP 7	Transported Material	0.0 – 1.5	MOD + CBR + FI

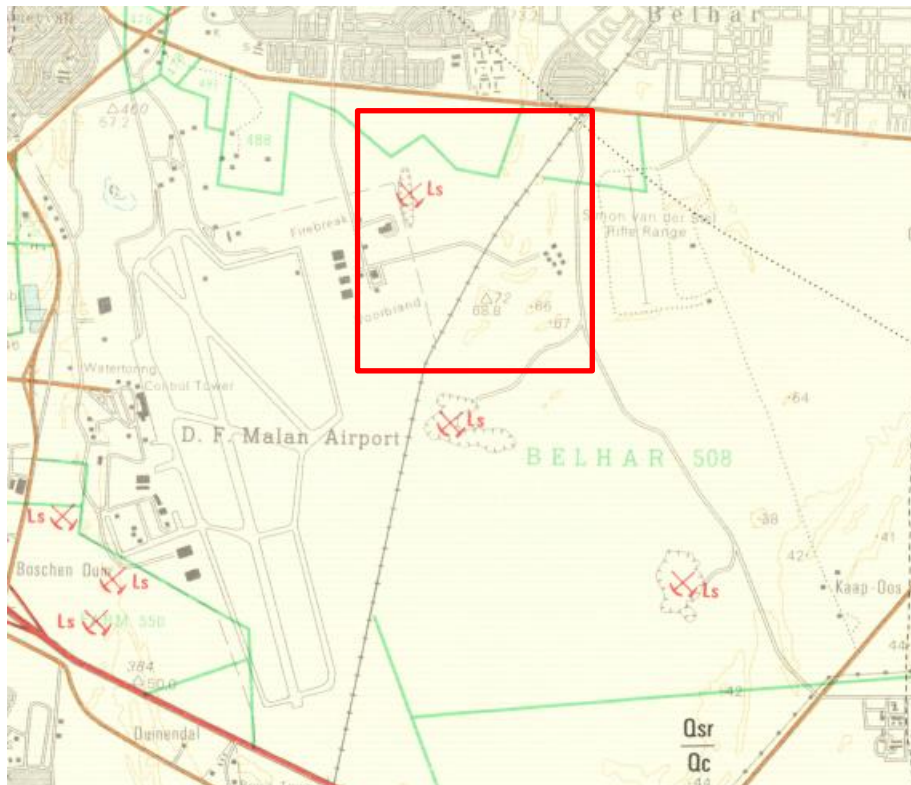
3. Regional Geology and Geohydrology

3.1 Geology

From data published by the South African Council for Geosciences, it is anticipated that Quaternary sub-surface soil profiles on site would consist of transported soils such as alluvial, aeolian and marine sands of the Witzand formation under the Sandveld group with paedogenic concretions. The Tygerberg formations of the Malmesbury Group underlies the calcareous coastal dunes. Calcrete concretions may occasionally be more developed/cemented as irregular hardpan calcrete lenses which can become up to 0.2-0.6m thick. Sands in the area may be whitish grey to reddish and have fine to medium sized grains with occasional coarse grained areas. These calcareous sands are partly vegetated and unconsolidated and is a deflation product of modern beaches. An extract from the 1:50 000 scale geological map 3318 DC Bellville is included Figure 1.

It is envisaged that Ingerop plans to utilise a cut/fill system on site. It should be noted that coarse granitic gravel was encountered in inconsistent lenses at Test Pit 6. This could be due to an old railway line from the 1930's. In The upper 0.6m of soil one is likely to encounter a lot of organic material. This can be seen from the mole activity and root systems within this layer, with tree trunks being encountered as deep as 1.10m.

Figure 2: An extract from the 1:50 000 scale Geological map 3318 DC Bellville



Note: **Qsr/Qc** - Witzand Formation / Springfontyn – Un consolidated, fine-grained to medium -grained white calcareous sand with shell fragments; underlain by light grey to pale-red sandy soil ; **Qg** - Loam and sandy loam ; **Nt** - Tygerberg Formation - Greywacke, phyllite and quartzitic sandstone; interbedded lava and tuff

3.2 Geohydrology

According to Engineering Geology of Bellville and Environs by Frederik D.J. Stapelberg, sands of the Sandveld Group function as intergranular aquifers due to their largely unconsolidated and porous character. From the Bellville 3318DC geohazards map the study area has a map code depicted as "H2". This correlates to having a medium to high permeability rate due to the free draining nature of the granular material in the area.

Ground water within the area was encountered in two test pits only, namely (TP2) and (TP6). Groundwater in the respective test pits were found at a depth of 2.15m and 2.80m below existing ground level. Due to the free draining nature of the Sandveld Group sands, it is envisaged that the groundwater levels are subject to seasonal fluctuations and will rise in the winter months to within 1.5m of the existing ground surface level after heavy rainfall.

It is important to note that earthwork activities planned for the installation of deep bulk/pipe network should be undertaken during summer months when groundwater conditions would be most favourable, however there are deep excavations greater than 2.5m, which will warrant consideration of suitable dewatering measures (in conjunction with trench battering and/or temporary support measures), especially when undertaken during winter conditions.

AECOM has done ground water monitoring on a site in close proximity to this one in recent years. From this groundwater monitoring, it was evident that the ground water levels are their lowest in March, (just before the start of the rainy season) and are their highest in September. It is anticipated this area would therefore exhibit seasonal fluctuations in the groundwater levels by about 0.5-1.0m.

4. General subsoil profile

The test pit logs along with the test pit photographs are attached in **Appendix A**. Five (5) test pits were excavated for the proposed road and bulk services to access subsoil characteristics. These characteristics can further be explored in Table 3 for more detail. A summary of the general soil horizons can be discussed below.

Topsoil/Fill/Reworked: Comprising the upper 0.2 - 0.6m from natural ground level, this reworked transported (fill) layer is comprised of dry becoming slightly moist, light brown, loose to medium dense, fine to very fine sand with no distinguishable structure. The soil horizon includes roots and mole activity. It is highlighted that there may be localised areas containing buried organic concentrations such as buried tree trunks observed at TP3, which could be problematic for subgrade and/or founding conditions. Granitic gravel lenses were also encountered in TP6 which is related to the old rail track.

According to the Unified Soils Classification System these soil layers would classify as poorly graded sand and should therefore be carefully considered for reuse during construction once unsuitable material is removed and controlling the soil moisture content. Parts of the site contain localised buried section comprising of sub angular to angular coarse granitic gravel along with a 100mm thick asphalt segment was also encountered in some test pits (old layerworks).

Transported: This soil horizon occurs beneath the topsoil/fill/Reworked layers and has a thickness of at least 3.5m extending to an unproven depth. This layer is characterised by soils becoming moist to wet with depth (groundwater). These soils are medium dense becoming dense with depth and consist of fine to medium sand.

Table 3: Soil horizons encountered

Test Position	Final Depth(m)	Topsoil/Fill	Transported Material	Groundwater Level (mbegl)	Depth to bedrock
TP2	2.90	0.50	2.90+	2.15	Not Proven
TP3	3.50	0.65	3.50+	Not encountered	Not Proven
TP4	2.30	0.11	2.30	Not encountered	Not Proven
TP5	3.50	0.30	3.50+	Not encountered	Not Proven
TP6	3.20	0.60	3.20+	2.80	Not Proven
TP7	2.50	0.20	2.50+	Not encountered	Not Proven

Table 4: Laboratory results obtained from samples

Sample Location	Depth (m)	Origin	LL	PI (425)	LS	NMC (%)	GM	4.75	2.36	425	075	002	USC	CBR (Modified AASHTO)					COTO Classification	MDD	OMC
			—	—				(%)	(%)	(%)	(%)	(%)		100	98	95	93	90		(kg/m) ³	(%)
TP2	0-0.5	Transported	NP	NP	0	0	1.21	100	100	74	5.4	3	SP	22	19	14	12	9	G8	1844	12.2
TP2	1.7-3.0	Transported	NP	NP	0		1.32	100	100	64	3.7	1	SP								
TP3	0-0.65	Transported	NP	NP	0		0.96	100	100	99	4.6	1	SP								
TP3	1.1-3.5	Transported					1.33	100	100	62	5	1	SP	18	16	13	11	9	G8	1712	10.2
TP4	2.3-3.0	Transported	NP	NP	0	0	1.16	100	100	80	3.7	2	SP	20	16	11	9	6	G9	1760	10.3
TP5	1.7-3.5	Transported					1.02	100	100	91	7.2	3	SP								
TP6	1.4-2.7	Transported	NP	NP	0		1.08	98	98	87	7.3	3	SP								
TP6	2.8-3.2	Transported												25	21	16	14	11	G8	1765	10.2
TP7	0-1.5	Transported	NP	NP	0	0	0.97	100	100	99	4.1	2	SP	24	20	16	13	10	G8	1669	10.3

Key:

LL - Liquid limit

PI (425) - Plastic index – Non-Plastic

LS - Linear shrinkage

GM - Grading modulus

4.75% - Percentage passing 4.75mm sieve

MDD - Maximum Dry Density

OMC - Optimum Moisture Content

5. Excavation Conditions

The existing fill material, reworked and transported soils are considered as 'soft' in terms of the excavation classification given in South African specification SANS 1200 DA.

Although not encountered during this investigation, discontinuous horizons of strongly cemented pedogenic material could be encountered in localised areas across the site. This pedogenic material would classify as 'intermediate' in terms SANS 1200DA.

South African specification SANS 1200 DA describes the various classes of excavation as follows:

a) Soft Excavation

Soft excavation shall be excavation in material that can be efficiently removed by a back-acting excavator of flywheel power approximately 0,10 kW per millimetre of tined-bucket width without the assistance of pneumatic or hydraulic tools such as paving breakers, or that can be efficiently loaded without prior ripping or stockpiling by a rubber tyre type front-end loader of approximately 15t mass and a flywheel power of approximately 100 kW.

b) Intermediate Excavation

Intermediate excavation shall be excavation in material that requires a back-acting excavator of flywheel power exceeding 0,10 kW per millimetre of tined-bucket width and the assistance of pneumatic tools prior to removal by equipment equivalent to that specified in (a) above.

From test pits conducted on site it is evident that, with the presence of windblown fine sands to depths exceeding 3.0m, soft excavations will occur throughout the site with limited to no instances of intermediate or hard excavations. The depth of the test pits was hampered by the loose and unstable near surface soils.

The installation of services at the site comprises of excavations varying from approximately 1.0m depth up to 5.76m depth. We would recommend that for excavations up to 2.5m depth (or where groundwater is encountered), excavations should be battered to 1v:2h (27 degrees) in order to prevent the sidewalls from collapsing. Furthermore, where groundwater is encountered along the toe of trench excavations, sandbags could be packed along these toe sections to provide short term stability integrity to the cut slopes.

For excavations deeper than 2.5m depth (below groundwater levels), open trench excavation incorporating benching as well as dewatering (well points) would be possible (depending on the lateral constraints available). It may prove cost effective to consider the installation of a temporary sheet pile wall in deeper excavation zones. Sheet pile walls have been successfully implemented in subsoil profiles of this nature. Please note that hardpan calcrete lenses may be encountered at depth and would require pre-drilling to install sheet piled wall through them. The detailed temporary shoring system design should be undertaken in consultation with a specialist geotechnical contractor.

6. Material Utilisation

The materials utilisation potential was based on previous geotechnical investigations undertaken on similar soils as well as assessment of the laboratory test results.

Fill/Reworked Material :	the utilisation potential is related to the variability and composition of the fill. Due to the predominantly sandy nature of the fill/reworked material on the site and provided oversize/unsuitable material is removed; these soils would be suitable for G8/G9 material when compacted to at least 95% of the Modified AASHTO density. It is noted that the upper 0.60m of this profile contains variable concentrations of organic material and fill debris, which requires removal prior to use.
Transported Material :	Due to the predominantly sandy nature of the transported material on the site; these soils would be suitable as G8 quality material when compacted to at least 95% of the Modified AASHTO density. These soils are fine grained and careful control of soil moisture content will be required to achieve suitable compaction.

Pipe Bedding

According to SANS 1200LB – Bedding (pipes), two specific material types are required for the bedding of new buried piped services, namely Selected Granular Material and Selected Fill Material. The following properties are required, per material type:

Selected Granular:	A granular non-cohesive material that is singularly graded from 0.6-19mm and has a compatibility factor (as per SANS 0120) not exceeding 0.4.
Selected Fill:	A material that has a Plasticity Index not exceeding 6 and that is free from all organic material and/or other lumps and stones exceeding 30mm diameter.

Based on the laboratory test results, the sandy fill/reworked/transported soils are too fine grained (i.e. 66-92% passing the 0.6mm sieve) to meet the criteria for Selected Granular material. This bedding material will need to be imported to site.

However, the sandy material below approximately 0.6m depth is classified as non-plastic and free of organics and will meet the requirement for Selected Fill material as noted above.

Cut/Fill Platforms

It is envisaged that earthworks will be undertaken to level the site. Based on Ingerop civil drawings, it is envisaged that up to 1.0 m will be excavated along the southern and northern portions of the site in order to fill the central portions of the site by up to 1.0-1.9m. It is noted that there may be localised spots containing organic concentrations (such as tree trunks in area of TP3), especially in the upper 0.60m which may require selective sorting on site by the contractor.

In terms of cut areas, we would recommend that these exposed in-situ soils are compacted to a minimum of 95% Modified AASHTO density, and following checking/confirmation of the compaction, would classify as G7/G8 quality

material. It is noted that the improved soils would typically have an allowable bearing capacity of 100kPa. The 100kPa bearing capacity should be checked following completion of the compaction works and verified by appropriate density and DCP testing.

For filling areas, we recommend the upper 0.60m be stripped (organic debris removed) and suitable sandy in-situ soils reinstated in well-watered, compacted layers of between 150-200mm thick by means of heavy vibratory compaction. It is noted that such engineered platform soils would typically have an allowable bearing capacity of 125kPa. The 125kPa bearing capacity should be checked following completion of the compaction works and verified by appropriate density and DCP testing.

7. Founding Conditions

The nature of potential structures to be constructed on site is unknown, but it is expected that light infrastructure would be constructed at the site. Given the indicated variable nature of the fill/reworked soils and poor consistency of these subsoils, founding conditions are not considered to be favourable for construction of building foundations at shallow depth at present without consideration of removing the top 0.60m and undertaking soil improvement..

In contrast, the underlying medium dense to dense transported soils can be regarded as competent founding material suitable for support of conventional spread footings dimensioned not to exceed a maximum permissible bearing pressure of 125 kPa.

In view of the above, foundation options that could be considered include:

- founding as close as possible to existing ground level within the loose fill and reworked material would result in significant differential settlement (exceeding of 30 to 40 mm) due to the prolonged consolidation of the fill/reworked; clearly the option of shallow founding can only be considered where allowance is made for improvement of the upper ground conditions by means of conventional compaction and by way of redesign of structure and articulation using strategically placed movement / control joints and reinforcement of the brickwork. Panels between foundations should be dimensioned not to exceed a maximum permissible bearing pressure of 100 kPa in this instance.
- founding at depth on or in naturally transported soils; should construction be programmed for the wet winter months; the shallow presence of groundwater and the attendant risk of excavation sidewall collapse is likely to preclude this option; during the summer months however the groundwater would be manageable and collapse of sidewalls less of an issue. For concept design purposes, the typical founding depth would be around 1,50m below existing ground level. Foundations should be dimensioned not to exceed a maximum permissible bearing pressure of 25 kPa in this instance.
- should heavy building be proposed and movement of the structure be unacceptable, piled and/or micropiles foundations are likely to provide the most cost effective means of support for the heavy industrial structures. Further deeper forms of geotechnical investigation would be required to confirm the pile suitability, type and length.

8. Subsoil Conditions for Roadbeds

Across the majority of the site, subgrade conditions are not considered entirely favourable due to the highly variable nature and variable consistency of the fill/reworked material.

Should stable pavements be a requirement, subgrade conditions will need to be improved by means of additional layer works for support of roads (as indicated in Ingerop civil drawings), but the in-situ subgrade will also require improvement/densification to reduce the risk of differential settlement (as well as meeting the requirement for lower selected subgrade material).

Following removal of the near surface soils to create the road box cut, the expose loose fill/reworked soils should be subjected to heavy vibratory compaction so that the degree of movement in the surface beds / pavement layerworks limited to an acceptable degree.

It should be noted that the sandy fill/reworked subsoils, once compacted to a minimum of 95% Modified AASHTO density, would be suitable for the lower selected subgrade conditions (roadbed) and that any base and subbase material would have to be imported.

9. Conclusions



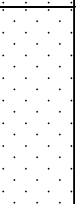

1. From the geotechnical investigation findings the site is underlain by a mantle of uncontrolled fill, reworked transported and transported soils. The upper 0.6m of the subsoil profile consists of variable fill/reworked material containing organics. The fill/reworked layer comprises of low strength and varies in thickness and composition, while the transported soils are medium dense becoming dense with depth.
2. Groundwater seepage was encountered in two test pits at 2.80m and 2.15m depths. From groundwater monitoring of sites in close proximity to this site, it is envisaged that groundwater levels within the area could rise 0.5 -1.0m during winter conditions.

Suitable groundwater dewatering systems along with surface runoff control measures would need to be implemented. This is dependent on the planned excavation dates for deep and shallow excavations. It is recommended that excavations should be undertaken during summer months when groundwater levels are most favourable

3. It is foreseen that most site soils would categorise as soft excavation, thus light earthmoving plant along with hand labour can be utilised. Although not encountered during this investigation, it is noted that discontinuous strongly cemented calcrete concretions/lenses (hardpan) could be encountered.
4. Battering of service trenches of up to 2.5m deep should be 1v:2h(27 degrees). Sandbags should be packed at the toe of the slope to ensure short term stability of the trench and thus prevent sidewall collapse where groundwater seepage occurs along toe sections of excavations. Trenches deeper than 2.5m should incorporate battering/benching of subsoils but would likely require well point dewatering. It may prove cost effective to install temporary sheet pile walls in deeper excavations.

5. The sandy fill/reworked material would be suitable as a G8/G9 material when compacted to 95% of the Modified AASHTO density once the unsuitable material is moved. The transported layer beneath the fill/reworked material would classify as a G8 material when compacted to minimum 95% of the Modified AASHTO density. Soil moisture content should be controlled carefully during compaction due to the fine grained nature of the soils.
6. Founding conditions are not favourable on site for light infrastructure at shallow depth unless the top 0.6m soil layer is removed and soil improvement measures are introduced. Section 7 details founding conditions for different structures at various depths.
7. The soil layers below 0.6m would not classify as selected granular material for pipe bedding as they are generally fine grained, thus suitable bedding material will need to be imported. The site soils can however be used selected fill material.
8. Subgrade conditions for roadways/pavements are not entirely favourable across the entire site due to the variable nature of the fill/reworked material. The insitu subgrade would need to be improved to prevent differential settlement of the road layerworks. These weak soils would need to be compacted to at least 95% of the Modified AASHTO density. The improved material would then be suitable for use in lower selected subgrade conditions. Material for base and subbase would need to be imported to site.
9. Although every effort has been made to ensure the accuracy of the information contained in this report, the results of the investigation are based upon fieldwork, which provides a limited view of the subsoil conditions. The recommendations and discussions presented in this report are based on the subsurface conditions encountered during the site work at the time of investigation and on the results of the field and laboratory testing. There may however be localised conditions pertaining to the site, particularly between exploratory holes (such as uncontrolled fill), which have not been encountered during this investigation. It is therefore important that excavation and founding conditions are inspected and approved by a suitably qualified geotechnical engineer.

10. Appendix A - Test Pits

Sample Name and Type	Depth (m)	Graphic Log	Material Description
DCP, MOD, CBR, FI	0.2		Dry becoming slightly moist, brown, loose becoming dense, slightly silty fine SAND with roots. TRANSPORTED(Aeolian)
	0.4		
	0.6		
	0.8		
	0.85		
	1.0		Slightly moist, light brown, medium dense becoming dense with depth, fine SAND with occasional roots. TRANSPORTED
	1.2		
	1.4		
	1.6		
	1.70		
	1.8		Moist becoming wet, light brown speckled orange brown, probably loose to medium dense, fine to medium SAND. TRANSPORTED (Littoral)
	2.0		
	2.2		
	2.4		
	2.40		
FI	2.4		Moist to wet, orange brown to brown, probably medium dense, silty medium SAND. TRANSPORTED.
	2.6		
	2.8		
	2.9+		

NOTES:

- 1: Seepage at 2.15m
- 2: Side walls collapse from 2.20m
- 3: Test Pit stopped at 2.90m (Side walls unstable)
- 4: MOD CBR and Foundation Indicator samples taken at 0.00 - 0.50m
- 5: Foundation Indicator sample taken from 1.70 - 3.00m
- 6: DCP test conducted at surface

Date excavated: 2023/02/09
Date profiled: 2023/02/09
Contractor: Steyn Wilson
Excavated by:
Machine: TLB

Profiled by: JvdW
Checked by: LHendricks

Elevation: 50.285masl
X Coordinate: 3759074.105
Y Coordinate: 35187.720
Coordinate System:

Sample Name and Type	Depth (m)	Graphic Log	Material Description
FI, DCP	0.2		Dry becoming slightly moist, light brown, probably very loose, silty fine to very fine SAND with roots until 0.5m. TRANSPORTED(AEOLIAN).
	0.4		
	0.6		
	0.65		
MOD CBR, FI	0.8		Slightly moist, dark brown, loose to medium dense, silty SAND with occasional rootlets. TRANSPORTED (FILL). #tree trunk encountered(possible levels)
	1.0		
	1.1		
	1.2		
	1.4		
	1.6		
	1.8		
	2.0		
	2.2		
	2.4		
	2.6		
	2.8		
	3.0		
	3.2		
	3.4		
	3.5		

NOTES:

- 1: Side walls collapse at 2.70m
- 2: No ground water encountered
- 3: Test pit stopped at 3.50m due to side wall collapse
- 4: Foundation indicator sample taken at 0.00 - 0.65m
- 5: MOD CBR and Foundation indicator sample taken at 1.10 - 3.50m
- 6: DCP test at surface

Date excavated: 2023/02/09
 Date profiled: 2023/02/09
 Contractor: Steyn Wilson
 Excavated by:
 Machine: TLB

Profiled by: JvdW
 Checked by: LHendricks

Elevation: 51.463masl
 X Coordinate: 3759302.069
 Y Coordinate: 35244.384
 Coordinate System:

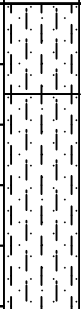
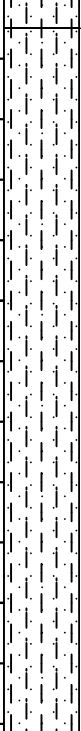
Sample Name and Type	Depth (m)	Graphic Log	Material Description
DCP ●	0.2		0.11 Dry dark grey, very loose, fine SAND with roots. TRANSPORTED(AEOLIAN).
	0.4		Slightly moist, light grey off white, loose, fine SAND with roots. TRANSPORTED(AEOLIAN).
	0.6		
	0.8		
	1.0		
	1.2		
	1.4		1.40
	1.6		Moist, dark grey, probably medium dense, medium SAND. TRANSPORTED
	1.8		
MOD CBR, FI ●	2.0		
	2.2		

NOTES: 1: DCP test at surface
 2: MOD CBR and Foundation indicator samples taken at 2.30 - 2.57m
 3: No Seepage was encountered.
 4: Test pit stopped due to side wall collapse

Date excavated: 2023/02/09
 Date profiled: 2023/02/09
 Contractor: Steyn Wilson
 Excavated by:
 Machine: TLB

Profiled by: LHendricks
 Checked by: JvdW

Elevation: 50.771masl
 X Coordinate: 3760588.687
 Y Coordinate: 34467.047
 Coordinate System:

Sample Name and Type	Depth (m)	Graphic Log	Material Description
DCP	0.2		Dry becoming slightly moist, light brown, probably very loose, silty fine to very fine SAND with roots. TRANSPORTED (AEOLIAN).
	0.4		Slightly moist, dark brown, medium dense, silty SAND with occasional rootlets. TRANSPORTED(FILL).
	0.6		
DCP	0.8		
	1.0		
	1.10		Slightly moist, brown, probably medium dense, silty fine SAND. TRANSPORTED (FILL). #Asphalt layer encountered at 2.0m
	1.2		
	1.4		
	1.6		
	1.8		
	2.0		
	2.2		
	2.4		
FI	2.6		
	2.8		
	3.0		
	3.2		
	3.4		
	3.50		

NOTES: 1: DCP tests at surface and 1.40m
 2: Foundation indicator sample taken at 1.70 - 3.50m

Date excavated: 2023/02/09
 Date profiled: 2023/02/09
 Contractor: Steyn Wilson
 Excavated by:
 Machine: TLB

Profiled by: JvdW
 Checked by: LHendricks

Elevation: 51.732masl
 X Coordinate: 3759586.100
 Y Coordinate: 35083.713
 Coordinate System:

Sample Name and Type	Depth (m)	Graphic Log	Material Description
DCP	0.2 0.4 0.6		Dry becoming slightly moist, light brown, very loose to medium dense, silty fine SAND with roots and mole activity. TRANSPORTED (AEOLIAN).
	0.60 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8		Slightly moist becoming moist from 1.40m, dark brown becoming grey, probably medium dense, slightly silty fine to very fine SAND with inconsistent gravel lenses (0.80m) of sub angular to angular coarse granitic gravel. TRANSPORTED (Fill). #Mole activity
MOD CBR, FI	2.8		
	2.80 3.0 3.2		Moist becoming wet, light brown blotched brown and dark brown, silty clayey SAND. TRANSPORTED(AEOLIAN).
MOD CBR			

NOTES: 1: DCP test at surface
2: MOD CBR and Foundation indicator samples taken at 1.40 - 2.70m
3: MOD CBR sample taken at 2.80 - 3.20m
4: Sidewall collapse at 2.80m
5: Seepage encountered at 2.80m.
6: Hole stopped due to side wall collapse at 3.20m

Date excavated: 2023/02/09
Date profiled: 2023/02/09
Contractor: Steyn Wilson
Excavated by:
Machine: TLB

Profiled by: JvdW
Checked by: LHendricks

Elevation: 51.257masl
X Coordinate: 3759493.304
Y Coordinate: 34979.461
Coordinate System:

Sample Name and Type	Depth (m)	Graphic Log	Material Description
DCP MOD CBR, FI	0.2	0.20	Dry, light grey, very loose, very fine SAND with roots. Transported(AEOLIAN).
	0.4		Dry, light brown, very loose, fine SAND, with bricks rubbel and roots. TRANSPORTED (FILL).
	0.6		
	0.8		
	1.0		
	1.2		
	1.4		
	1.6	1.60	Dry, light brown, probably loose, silty fine SAND. TRANSPORTED (AEOLIAN).
	1.8		
	2.0		
	2.2		
	2.4	2.50	

NOTES: 1: DCP test at surface
 2: Side walls collapse from 0.70m
 3: MOD CBR and Foundation indicator samples taken at 0.00 - 1.50m
 4: Test pit stopped due to side wall collapse

Date excavated: 2023/02/09
 Date profiled: 2023/02/09
 Contractor: Steyn Wilson
 Excavated by:
 Machine: TLB

Profiled by: LHendricks
 Checked by: JvdW

Elevation: 55.406masl
 X Coordinate: 3759220.984
 Y Coordinate: 34786.251
 Coordinate System:

11. Appendix B - Lab Results



STEYN-WILSON
LABORATORIES

CIVIL ENGINEERING TESTING LABORATORIES



11 Gooderson Road Blackheath

PO Box 58 Blackheath 7581

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Email: info@steynwilson.co.za

Web: www.steynwilson.co.za

Client: **Aecom SA (Pty) Ltd**

Project: **ACSA**

Attention: **Mr Jaco Van Der Walt**

Your Ref. No: **-**

Date Reported **16/02/23**

TEST REPORT REFERENCE NUMBER / JOB NUMBER :

SWL26903

Dear Sir / Madam

Herewith please find the original reports pertaining to the above mentioned project.

Test Requested

2 x MOD / CBR

4 x FOUNDATION INDICATORS

Site Sampling and Materials Information

Sampling Method

Specimens sampled by Steyn Wilson Laboratory according to TMH5 MA2 - Sampling from a sampling pit in natural gravel

Environmental Condition

Sunny & Hot

Deviation from the prescribed test method

No deviation from standard test method.

Responsibility of information disclaimer



FINAL REPORT

We would like to take this opportunity to thank you for your valued support.

Should you have any further enquiries please don't hesitate to contact me.

Yours Faithfully

STEYN-WILSON LABORATORIES (PTY) LTD

Remarks:

1. Information contained herein is confidential to STEYN-WILSON PTY LTD and the addressee
2. Opinions & Interpretations are not included in our schedule of Accreditation.
3. The samples were subjected and analysed according to ASTM.
4. The results reported relate only to the sample tested, Further use of the attached information is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.
5. This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from a director of STEYN-WILSON LABORATORIES (PTY) LTD.
6. Measuring equipment is traceable to national standards (Where applicable).
7. Should there be any deviation from the prescribed test method comments will be made thereof, pertaining to the test on the relevant materials report.
8. Uncertainty of measurement is calculated and corresponds to a coverage probability of approximately 95%. Available on request.
9. The decision rule states that the measurement of uncertainty can be applied by the customer to the test results, on request. It is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.

Mr. R. Wilson
Technical Signatory

DIRECTORS: **Mr. J. Steyn ND-Civil (Managing) | Mr. R. Wilson B-Tech Civil (Operations)**



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Email: info@steynwilson.co.zaWeb: www.steynwilson.co.zaCustomer : **Aecom SA (Pty) Ltd**

Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive

Bellville

7530

Attention : Mr Jaco Van Der Walt

Project : ACSA

Date Received : 09/02/23

Date Reported : 16/02/23

Req. Number : -

MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*

Material Description:	Light Yellowish Brown Fine Sand	Sample Number:	26903 / 3		
Position:	TP2	Liquid Limit	NP	Linear Shrinkage	0,0
Depth:	0-0.5m	Plasticity Index	NP	Insitu M/C%	0

pH
(TMH1 A20)Conductivity s.m⁻¹
(TMH1 A21T)SG
(TMH1 A12T)*

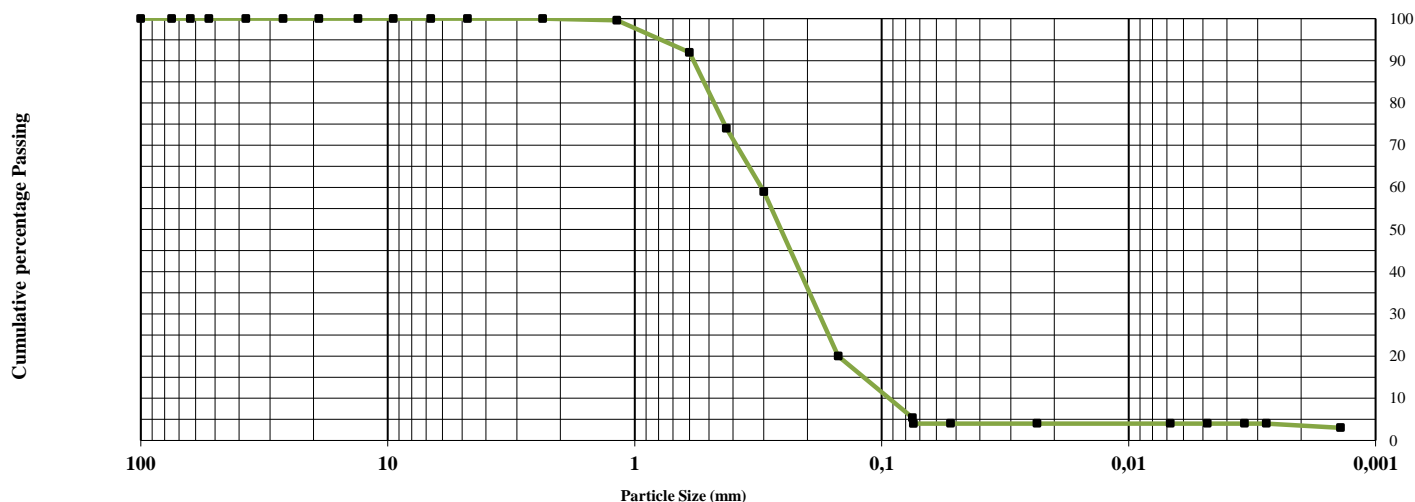
2,604

SIEVE ANALYSIS (TMH 1 A1a)***HYDROMETER ASTM D422**

100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,074	0,053	0,023	0,007	0,005	0,003	0,003	0,001
100	100	100	100	100	100	100	100	100	100	100	100	99,6	92	74	59	20	5,4	4	4	4	4	4	4	4	3

% Passing**MOD AASHTO SANS 3001 GR30****CBR SANS 3001 GR40**

OMC%	12,2	COMP MC	% SWELL	100%	98%	97%	95%	93%	90%
MDD(KG/M ³)	1844	12,2	0,0	22	19	17	14	12	9

Particle Size Distribution

% Gravel

% Sand

96

% Silt

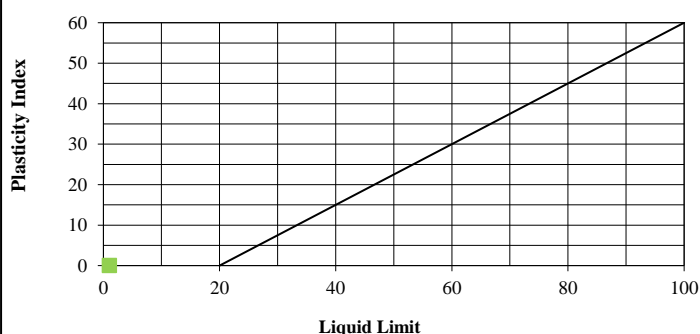
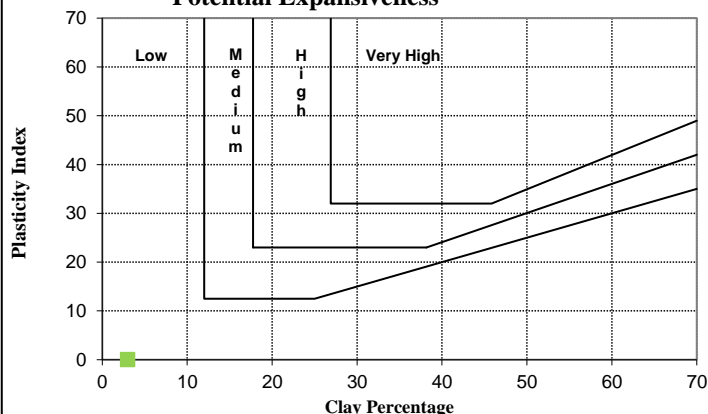
1

% Clay

3

Plasticity Chart

A Line

**Potential Expansiveness**

NOTE: All tests marked with (*) means that those test methods are not accredited.



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Customer : **Aecom SA (Pty) Ltd**

Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive

Bellville

7530

Attention : Mr Jaco Van Der Walt

Project : ACSA

Date Received : 09/02/23

Date Reported : 16/02/23

Req. Number : -

MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*

Material Description:	White Fine Sand	Sample Number:	26903 / 7		
Position:	TP2	Liquid Limit	NP	Linear Shrinkage	0,0
Depth:	1.7-3.0m	Plasticity Index	NP	Insitu M/C%	

pH
(TMH1 A20)

Conductivity s.m⁻¹
(TMH1 A21T)

SG
(TMH1 A12T)*

2,604

SIEVE ANALYSIS (TMH 1 A1a)*

HYDROMETER ASTM D422

100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,074	0,053	0,023	0,007	0,005	0,003	0,003	0,001
100	100	100	100	100	100	100	100	100	100	100	100	99,4	89	64	43	14	3,7	3	3	3	2	2	2	2	1

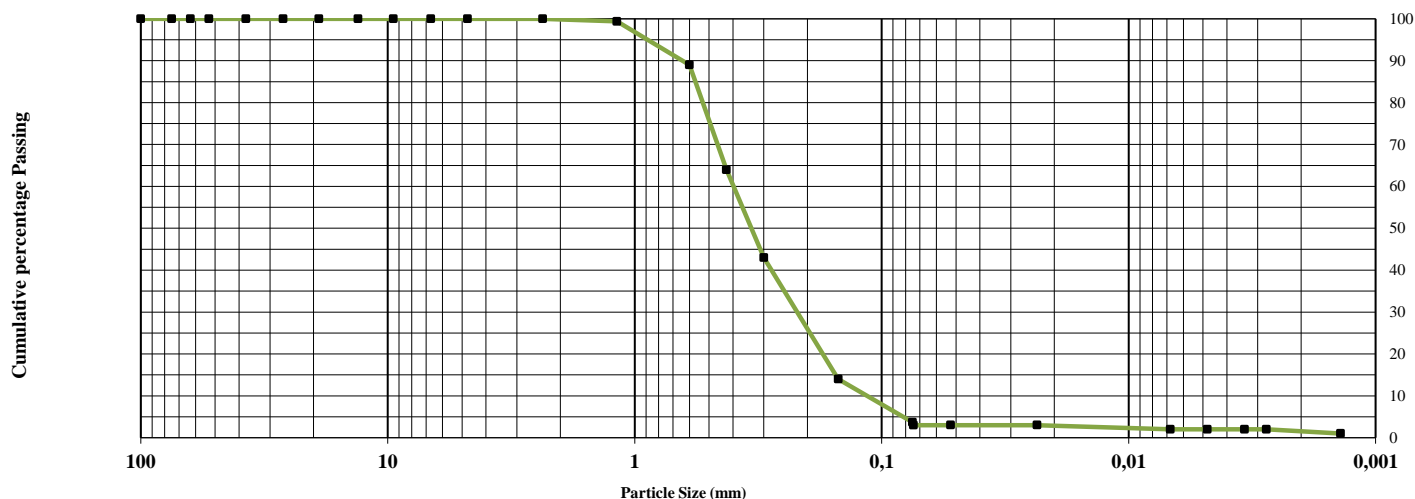
% Passing

MOD AASHTO SANS 3001 GR30

CBR SANS 3001 GR40

OMC%		COMP MC	% SWELL	100%	98%	97%	95%	93%	90%
MDD(KG/M ³)									

Particle Size Distribution



% Gravel

% Sand

97

% Silt

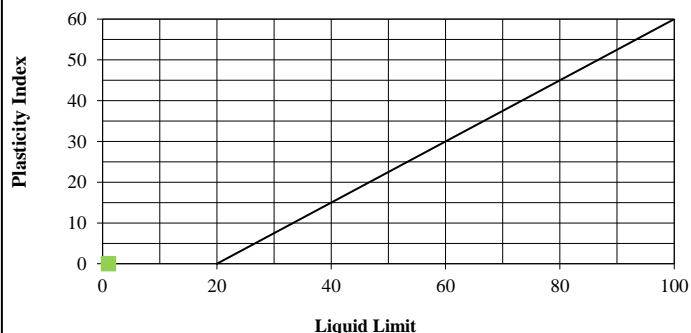
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% Clay

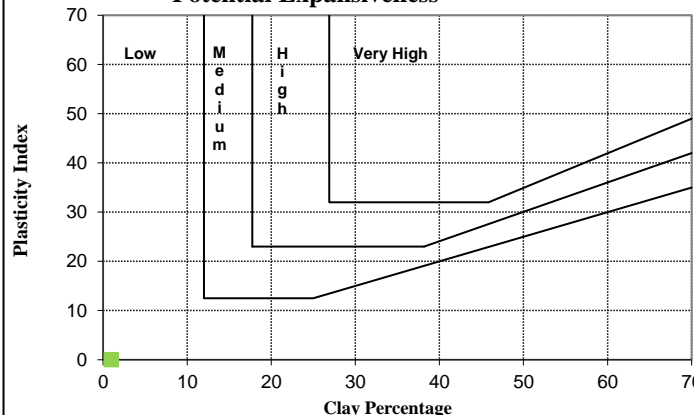
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Plasticity Chart

A Line



Potential Expansiveness



NOTE: All tests marked with (*) means that those test methods are not accredited.



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Web: www.steynwilson.co.za

Customer : **Aecom SA (Pty) Ltd**

Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive

Bellville

7530

Attention : Mr Jaco Van Der Walt

Project : ACSA

Date Received : 09/02/23

Date Reported : 16/02/23

Req. Number : -

MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*

Material Description:	White Fine Sand	Sample Number:	26903 / 2		
Position:	TP3	Liquid Limit	NP	Linear Shrinkage	0,0
Depth:	0-0.65m	Plasticity Index	NP	Insitu M/C%	

pH
(TMH1 A20)

Conductivity s.m⁻¹
(TMH1 A21T)

SG
(TMH1 A12T)*

2,604

SIEVE ANALYSIS (TMH 1 A1a)*

HYDROMETER ASTM D422

100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,075	0,053	0,024	0,007	0,005	0,003	0,003	0,001
100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	92	33	4,6	3	2	1	1	1	1	1	1

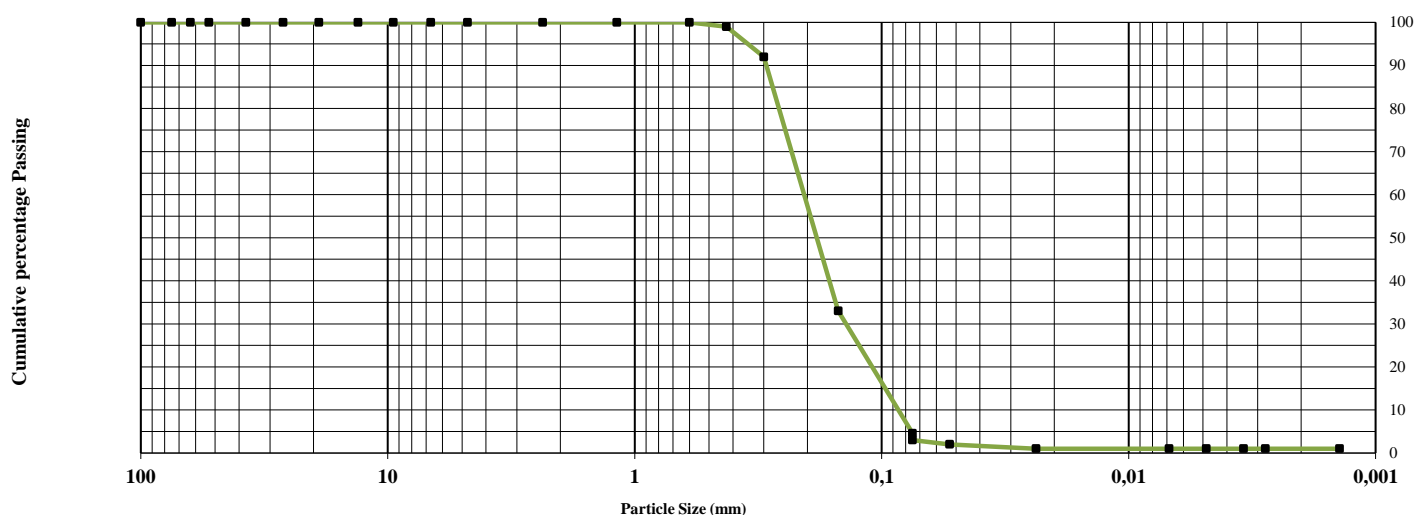
% Passing

MOD AASHTO SANS 3001 GR30

CBR SANS 3001 GR40

OMC%	COMP MC	% SWELL	100%	98%	97%	95%	93%	90%
MDD(KG/M ³)								

Particle Size Distribution



% Gravel

% Sand

98

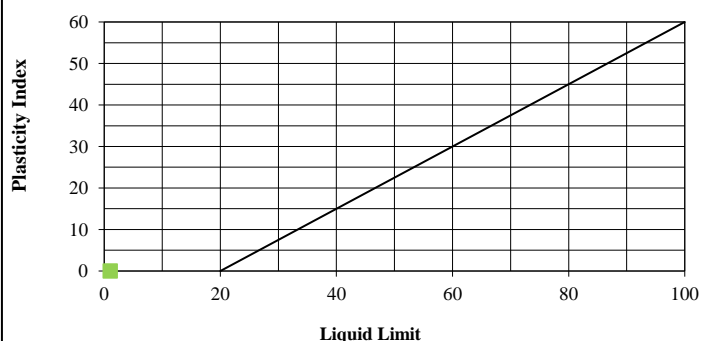
% Silt

1

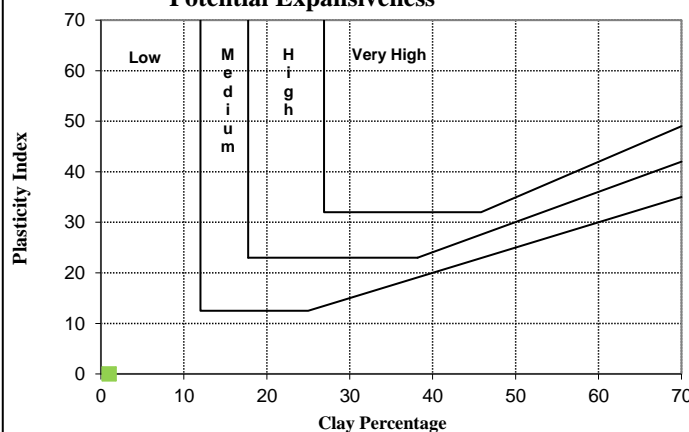
% Clay

1

Plasticity Chart
A Line



Potential Expansiveness



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Customer : **Aecom SA (Pty) Ltd**

Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive

Bellville

7530

Attention : Mr Jaco Van Der Walt

Project : ACSA

Date Received : 09/02/23

Date Reported : 16/02/23

Req. Number : -

MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*

Material Description:	Light Brown Sand	Sample Number:	26903 / 1
Position:	TP3	Liquid Limit	Linear Shrinkage
Depth:	1.1-3.5m	Plasticity Index	Insitu M/C%

pH
(TMH1 A20)

Conductivity s.m⁻¹
(TMH1 A21T)

SG
(TMH1 A12T)*

SIEVE ANALYSIS (TMH 1 A1a)*

HYDROMETER ASTM D422

100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,074	0,052	0,023	0,007	0,005	0,003	0,003	0,001
100	100	100	100	100	100	100	100	100	100	100	100	99	88	62	41	13	5	4	3	2	1	1	1	1	1

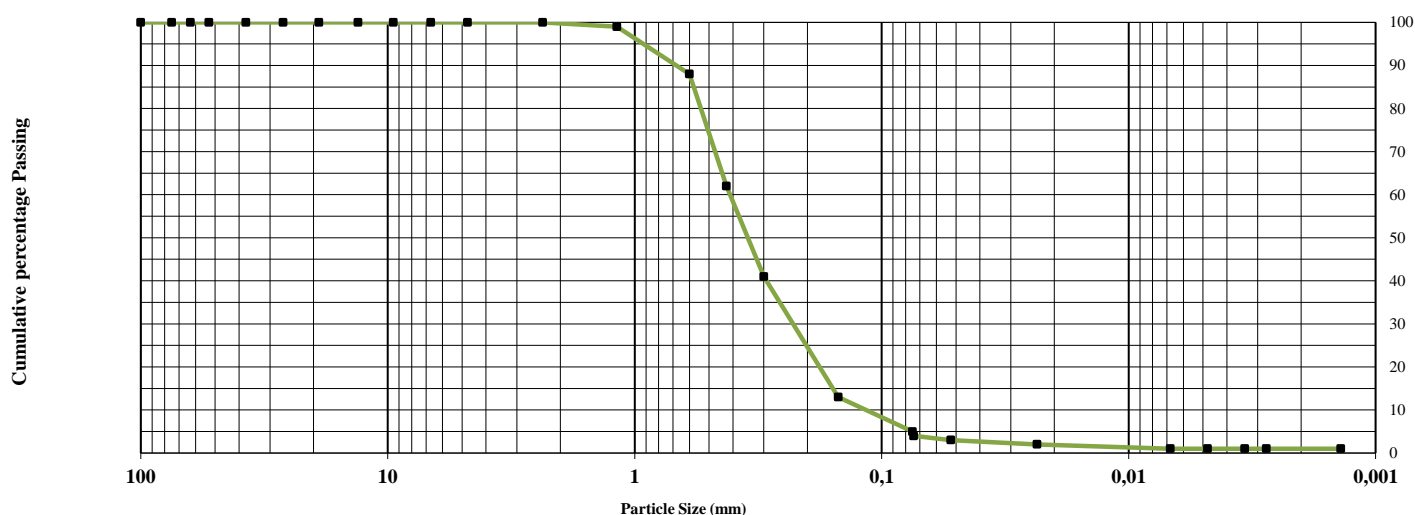
% Passing

MOD AASHTO SANS 3001 GR30

CBR SANS 3001 GR40

OMC%	10,2	COMP MC	% SWELL	100%	98%	97%	95%	93%	90%
MDD(KG/M ³)	1712	10,2	0,0	18	16	15	13	11	9

Particle Size Distribution



% Gravel

% Sand

97

% Silt

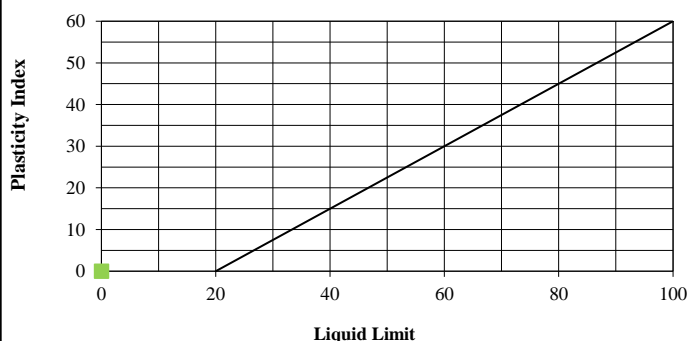
2

% Clay

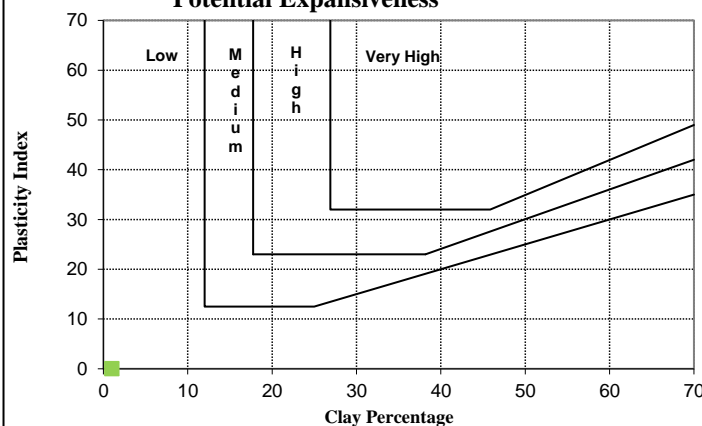
1

Plasticity Chart

A Line



Potential Expansiveness



NOTE: All tests marked with (*) means that those test methods are not accredited.



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Email: info@steynwilson.co.za

Web: www.steynwilson.co.za

Client: **Aecom SA (Pty) Ltd**

Project: **ACSA**

Attention: **Mr Jaco Van Der Walt**

Your Ref. No: **-**

Date Reported **16/02/23**

TEST REPORT REFERENCE NUMBER / JOB NUMBER :

SWL26903

Dear Sir / Madam

Herewith please find the original reports pertaining to the above mentioned project.

Test Requested

Site Sampling and Materials Information

3 x MOD / CBR

Sampling Method

Specimens sampled by Steyn Wilson Laboratory according to TMH5 MA2 - Sampling from a sampling pit in natural gravel

3 x FOUNDATION INDICATORS

Environmental Condition

Sunny & Hot

Deviation from the prescribed test method

No deviation from standard test method.

Responsibility of information disclaimer



FINAL REPORT

We would like to take this opportunity to thank you for your valued support.

Should you have any further enquiries please don't hesitate to contact me.

Yours Faithfully

STEYN-WILSON LABORATORIES (PTY) LTD

Remarks:

1. Information contained herein is confidential to STEYN-WILSON PTY LTD and the addressee
2. Opinions & Interpretations are not included in our schedule of Accreditation.
3. The samples were subjected and analysed according to ASTM.
4. The results reported relate only to the sample tested, Further use of the attached information is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.
5. This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from a director of STEYN-WILSON LABORATORIES (PTY) LTD.
6. Measuring equipment is traceable to national standards (Where applicable).
7. Should there be any deviation from the prescribed test method comments will be made thereof, pertaining to the test on the relevant materials report.
8. Uncertainty of measurement is calculated and corresponds to a coverage probability of approximately 95%. Available on request.
9. The decision rule states that the measurement of uncertainty can be applied by the customer to the test results, on request. It is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.

Mr. R. Wilson
Technical Signatory

DIRECTORS: **Mr. J. Steyn ND-Civil (Managing) | Mr. R. Wilson B-Tech Civil (Operations)**



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Customer : **Aecom SA (Pty) Ltd**

Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive

Bellville

7530

Attention : Mr Jaco Van Der Walt

Project : ACSA

Date Received : 09/02/23

Date Reported : 16/02/23

Req. Number : -

MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*

Material Description:	Light Brown Med Coarse Sand	Sample Number:	26903 / 9		
Position:	TP4	Liquid Limit	NP	Linear Shrinkage	0,0
Depth:	2.3-3.0m	Plasticity Index	NP	Insitu M/C%	0

pH
(TMH1 A20)

Conductivity s.m⁻¹
(TMH1 A21T)

SG
(TMH1 A12T)*

2,604

SIEVE ANALYSIS (TMH 1 A1a)*

HYDROMETER ASTM D422

100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,075	0,053	0,024	0,007	0,005	0,003	0,003	0,001
100	100	100	100	100	100	100	100	100	100	100	100	99,7	93	80	67	21	3,7	3	3	3	3	2	2	2	2

% Passing

MOD AASHTO SANS 3001 GR30

CBR SANS 3001 GR40

OMC%	10,3	COMP MC	% SWELL	100%	98%	97%	95%	93%	90%
MDD(KG/M ³)	1760	10,3	0,0	20	16	14	11	9	6

Particle Size Distribution



% Gravel

% Sand

97

% Silt

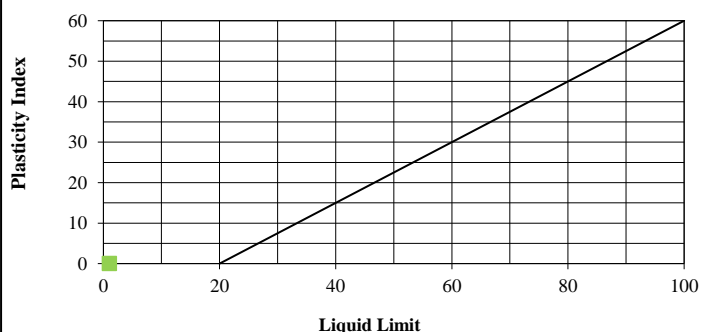
1

% Clay

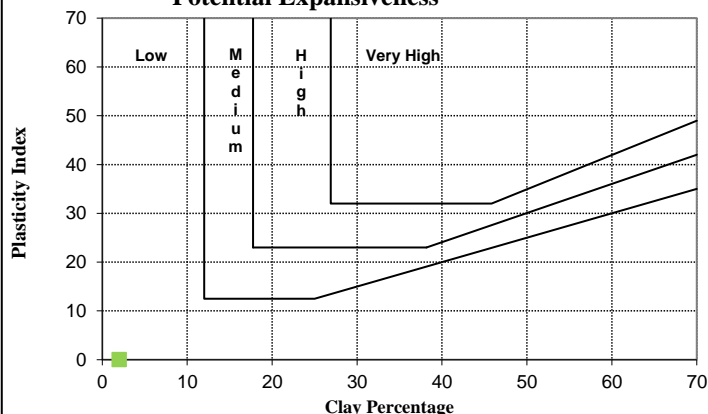
2

Plasticity Chart

A Line



Potential Expansiveness



NOTE: All tests marked with (*) means that those test methods are not accredited.



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Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive

Bellville

7530

Attention : Mr Jaco Van Der Walt

Project : ACSA

Date Received : 09/02/23

Date Reported : 16/02/23

Req. Number : -

MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*

Material Description:	Dark Brown Fine Sand	Sample Number:	26903 / 3		
Position:	TP5	Liquid Limit	NP	Linear Shrinkage	0,0
Depth:	1.7-3.5m	Plasticity Index	NP	Insitu M/C%	

pH
(TMH1 A20)

Conductivity s.m⁻¹
(TMH1 A21T)

SG
(TMH1 A12T)*

2,604

SIEVE ANALYSIS (TMH 1 A1a)*

HYDROMETER ASTM D422

100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,074	0,052	0,023	0,007	0,005	0,003	0,003	0,001
100	100	100	100	100	100	100	100	100	100	100	100	100	98	91	80	29	7,2	5	4	3	3	3	3	3	2

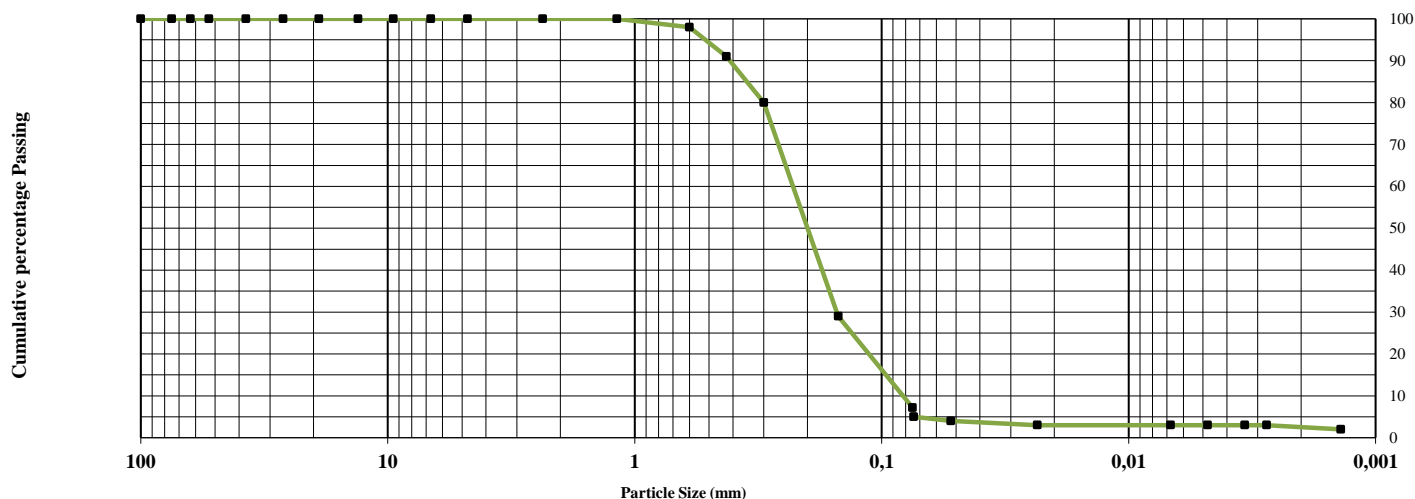
% Passing

MOD AASHTO SANS 3001 GR30

CBR SANS 3001 GR40

OMC%		COMP MC	% SWELL	100%	98%	97%	95%	93%	90%
MDD(KG/M ³)									

Particle Size Distribution



% Gravel

% Sand

96

% Silt

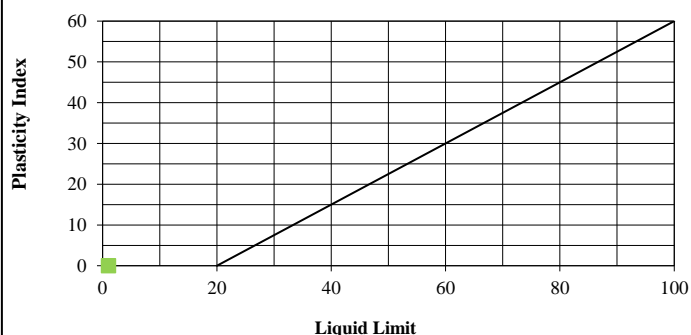
2

% Clay

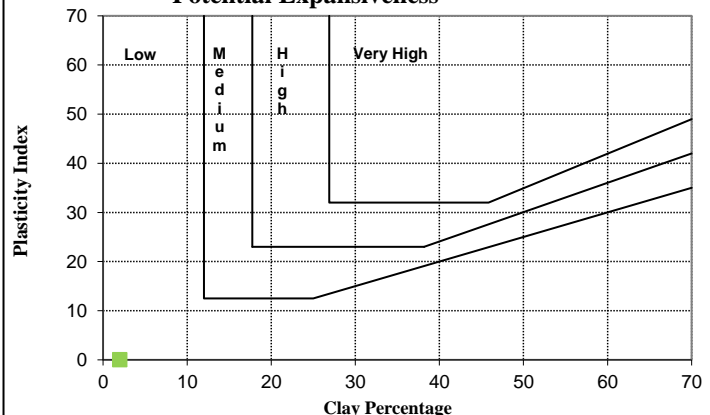
2

Plasticity Chart

A Line



Potential Expansiveness



NOTE: All tests marked with (*) means that those test methods are not accredited.



STEYN-WILSON
LABORATORIES

CIVIL ENGINEERING TESTING LABORATORIES



11 Gooderson Road Blackheath

PO Box 58 Blackheath 7581

Tel: 021 905 0435

Fax: 086 499 9482

Email: info@steynwilson.co.za

Web: www.steynwilson.co.za

Customer : **Aecom SA (Pty) Ltd**

Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive

Bellville

7530

Attention : Mr Jaco Van Der Walt

Project : ACSA

Date Received : 09/02/23

Date Reported : 16/02/23

Req. Number : -

MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*

Material Description:	Dark Fine Sand	Sample Number:	26903 / 4		
Position:	TP6	Liquid Limit	NP	Linear Shrinkage	0,0
Depth:	1.4-2.7m	Plasticity Index	NP	Insitu M/C%	

pH
(TMH1 A20)

Conductivity s.m⁻¹
(TMH1 A21T)

SG
(TMH1 A12T)*

2,604

SIEVE ANALYSIS (TMH 1 A1a)*

HYDROMETER ASTM D422

100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,075	0,053	0,024	0,007	0,005	0,003	0,003	0,001
100	100	100	100	100	100	100	99	99	99	98	98	98,2	95	87	76	26	7,3	6	6	6	6	5	5	4	3

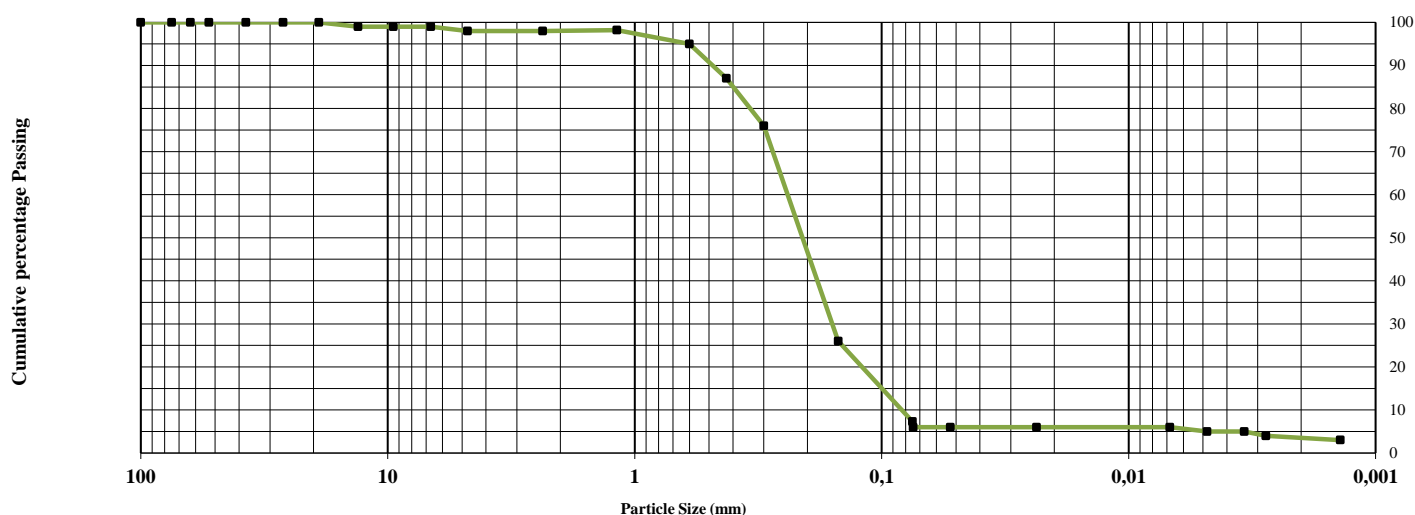
% Passing

MOD AASHTO SANS 3001 GR30

CBR SANS 3001 GR40

OMC%		COMP MC	% SWELL	100%	98%	97%	95%	93%	90%
MDD(KG/M ³)									

Particle Size Distribution



% Gravel

2

% Sand

92

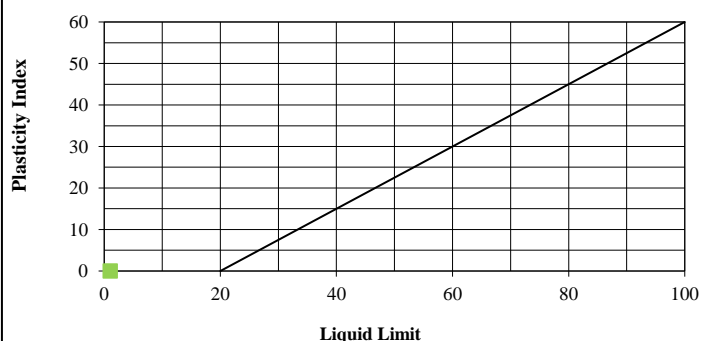
% Silt

3

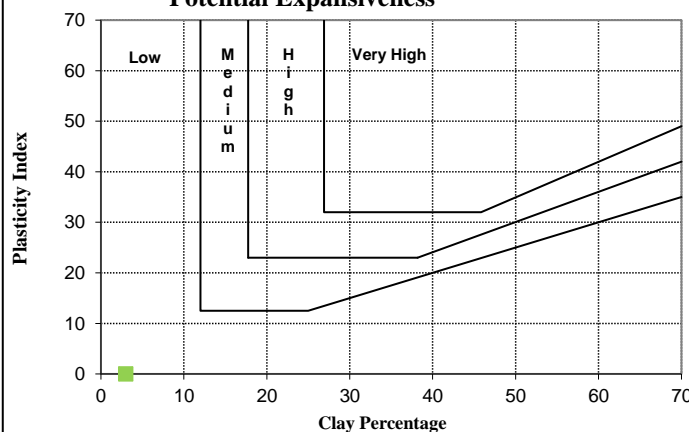
% Clay

3

Plasticity Chart
A Line



Potential Expansiveness



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PO Box 58 Blackheath 7581
Tel: 021 905 0435
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Web: www.steynwilson.co.za

Customer : **Aecom SA (Pty) Ltd**

Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive

Bellville

7530

Attention : Mr Jaco Van Der Walt

Project : ACSA

Date Received : 09/02/23

Date Reported : 16/02/23

Req. Number : -

MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*

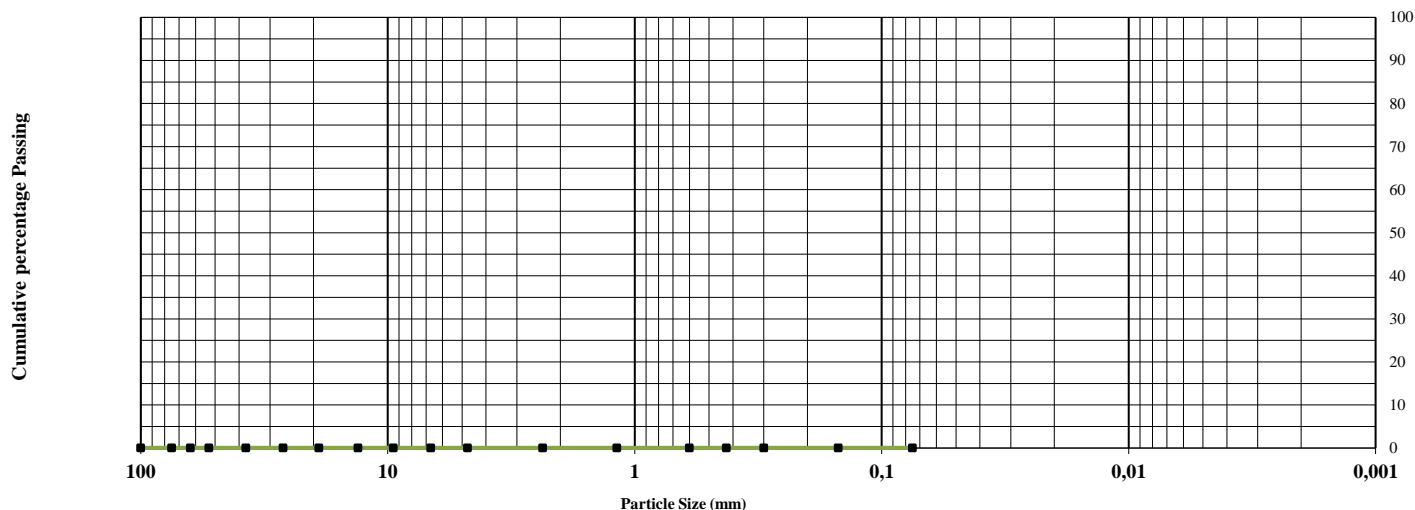
Material Description:	Light Brown Fine Sand	Sample Number:	26903 / 5
Position:	TP6	Liquid Limit	Linear Shrinkage
Depth:	2.8-3.2m	Plasticity Index	Insitu M/C%

pH
(TMH1 A20)Conductivity s.m⁻¹
(TMH1 A21T)SG
(TMH1 A12T)***SIEVE ANALYSIS (TMH 1 A1a)*****HYDROMETER ASTM D422**

100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

% Passing**MOD AASHTO SANS 3001 GR30****CBR SANS 3001 GR40**

OMC%	10,2	COMP MC	% SWELL	100%	98%	97%	95%	93%	90%
MDD(KG/M ³)	1765	10,1	0,0	25	21	20	16	14	11

Particle Size Distribution

% Gravel

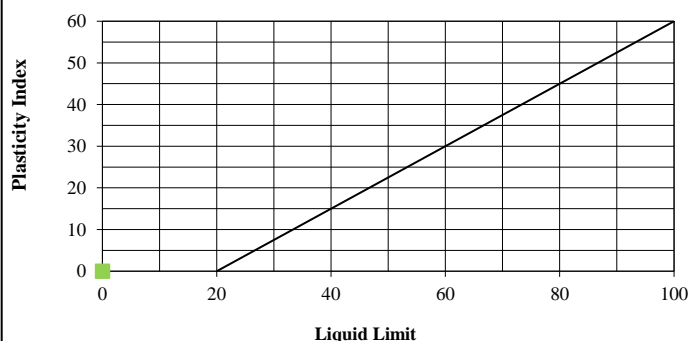
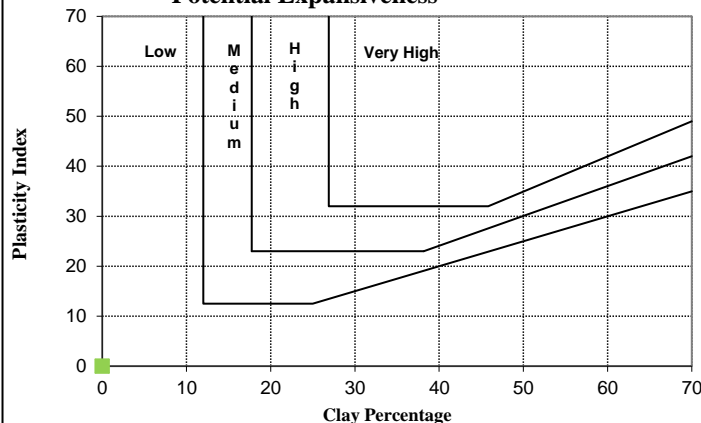
% Sand

% Silt

% Clay

Plasticity Chart

A Line

**Potential Expansiveness**

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Client: **Aecom SA (Pty) Ltd**

Project: **ACSA**

Attention: **Mr Jaco Van Der Walt**

Your Ref. No: **-**

Date Reported **16/02/23**

TEST REPORT REFERENCE NUMBER / JOB NUMBER :

SWL26903

Dear Sir / Madam

Herewith please find the original reports pertaining to the above mentioned project.

Test Requested

Site Sampling and Materials Information

1 x MOD / CBR

Sampling Method

Specimens sampled by Steyn Wilson Laboratory according to TMH5 MA2 - Sampling from a sampling pit in natural gravel

1 x FOUNDATION INDICATORS

Environmental Condition

Sunny & Hot

Deviation from the prescribed test method

No deviation from standard test method.

Responsibility of information disclaimer



FINAL REPORT

We would like to take this opportunity to thank you for your valued support.

Should you have any further enquiries please don't hesitate to contact me.

Yours Faithfully

STEYN-WILSON LABORATORIES (PTY) LTD

Remarks:

- Information contained herein is confidential to STEYN-WILSON PTY LTD and the addressee
- Opinions & Interpretations are not included in our schedule of Accreditation.
- The samples were subjected and analysed according to ASTM.
- The results reported relate only to the sample tested, Further use of the attached information is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.
- This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from a director of STEYN-WILSON LABORATORIES (PTY) LTD.
- Measuring equipment is traceable to national standards (Where applicable).
- Should there be any deviation from the prescribed test method comments will be made thereof, pertaining to the test on the relevant materials report.
- Uncertainty of measurement is calculated and corresponds to a coverage probability of approximately 95%. Available on request.
- The decision rule states that the measurement of uncertainty can be applied by the customer to the test results, on request. It is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.

Mr. R. Wilson
Technical Signatory

DIRECTORS: **Mr. J. Steyn ND-Civil (Managing) | Mr. R. Wilson B-Tech Civil (Operations)**



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Customer : **Aecom SA (Pty) Ltd**

Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive

Bellville

7530

Attention : Mr Jaco Van Der Walt

Project : ACSA

Date Received : 09/02/23

Date Reported : 16/02/23

Req. Number : -

MOD / CBR / FOUNDATION INDICATOR - ASTM D422 / SANS 3001 GR10 / SANS 3001 GR12 / SANS 3001 GR30 / SANS 3001 GR40 / TMH1 A1* / TMH1 A12T*

Material Description:	Light Brown Sand with Stone	Sample Number:	26903 / 8		
Position:	TP7	Liquid Limit	NP	Linear Shrinkage	0,0
Depth:	0-1.5m	Plasticity Index	NP	Insitu M/C%	0

pH
(TMH1 A20)

Conductivity s.m⁻¹
(TMH1 A21T)

SG
(TMH1 A12T)*

2,604

SIEVE ANALYSIS (TMH 1 A1a)*

HYDROMETER ASTM D422

100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,074	0,053	0,024	0,007	0,005	0,003	0,003	0,001
100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	95	29	4,1	3	3	3	3	3	3	3	2

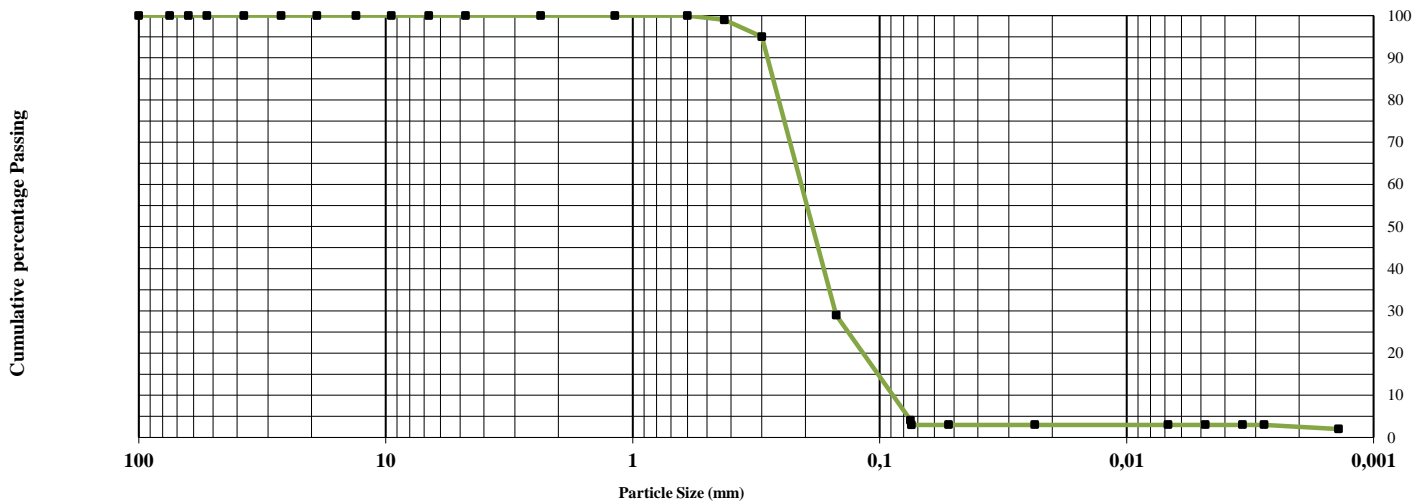
% Passing

MOD AASHTO SANS 3001 GR30

CBR SANS 3001 GR40

OMC%	10,3	COMP MC	% SWELL	100%	98%	97%	95%	93%	90%
MDD(KG/M ³)	1669	10,2	0,0	24	20	19	16	13	10

Particle Size Distribution



% Gravel

% Sand

97

% Silt

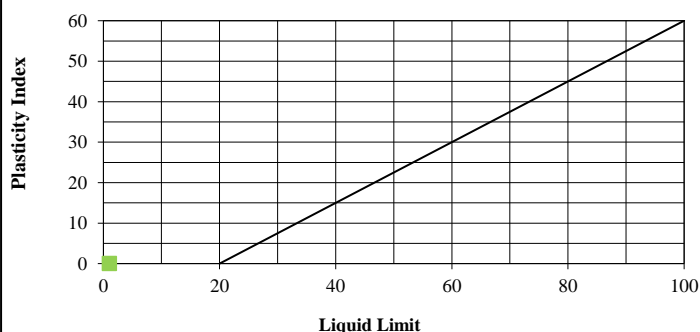
1

% Clay

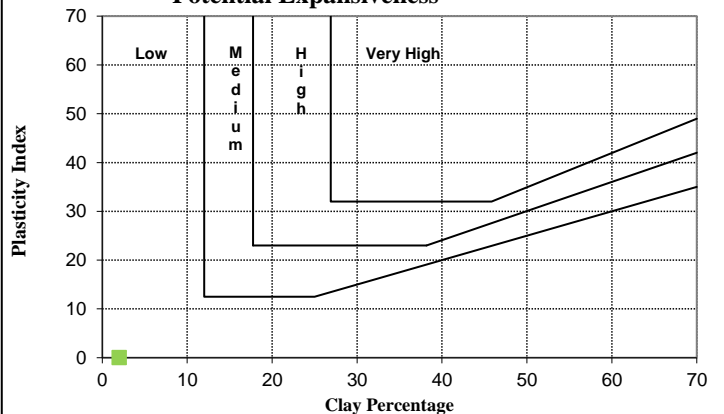
2

Plasticity Chart

A Line



Potential Expansiveness



NOTE: All tests marked with (*) means that those test methods are not accredited.

12. Appendix C - DCP Results



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Email: info@steynwilson.co.za

Web: www.steynwilson.co.za

Client: **Aecom SA (Pty) Ltd**

Project: ACSA

Attention: Mr Jaco Van Der Walt

Your Ref. No: -

Date Reported 16/02/23

Date Tested 09/02/23

TEST REPORT REFERENCE NUMBER / JOB NUMBER :

SWL26903

Dear Sir / Madam

Herewith please find the original reports pertaining to the above mentioned project.

Test Requested

7 x 2m DCP tests

Site Sampling and Materials Information

Test Method

TMH6 Method ST6

Environmental Condition

Sunny & Hot

Deviation from the prescribed test method

*2,0m DCP was requested by the customer

Responsibility of information disclaimer



FINAL REPORT

We would like to take this opportunity to thank you for your valued support.

Should you have any further enquiries please don't hesitate to contact me.

Yours Faithfully

STEYN-WILSON LABORATORIES (PTY) LTD

Remarks:

- Information contained herein is confidential to STEYN-WILSON PTY LTD and the addressee
- Opinions & Interpretations are not included in our schedule of Accreditation.
- The samples were subjected and analysed according to TMH6 ST6.
- The results reported relate only to the sample tested, Further use of the attached information is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.
- This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from a director of STEYN-WILSON LABORATORIES (PTY) LTD.
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- Uncertainty of measurement is calculated and corresponds to a coverage probability of approximately 95%. Available on request.
- The decision rule states that the measurement of uncertainty can be applied by the customer to the test results, on request. It is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.

Mr. R. Wilson
Technical Signatory

DIRECTORS: **Mr. J. Steyn ND-Civil (Managing) | Mr. R. Wilson B-Tech Civil (Operations)**



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JOB No: SWL26903 **Ref. No:** - **Date:** 16/02/23

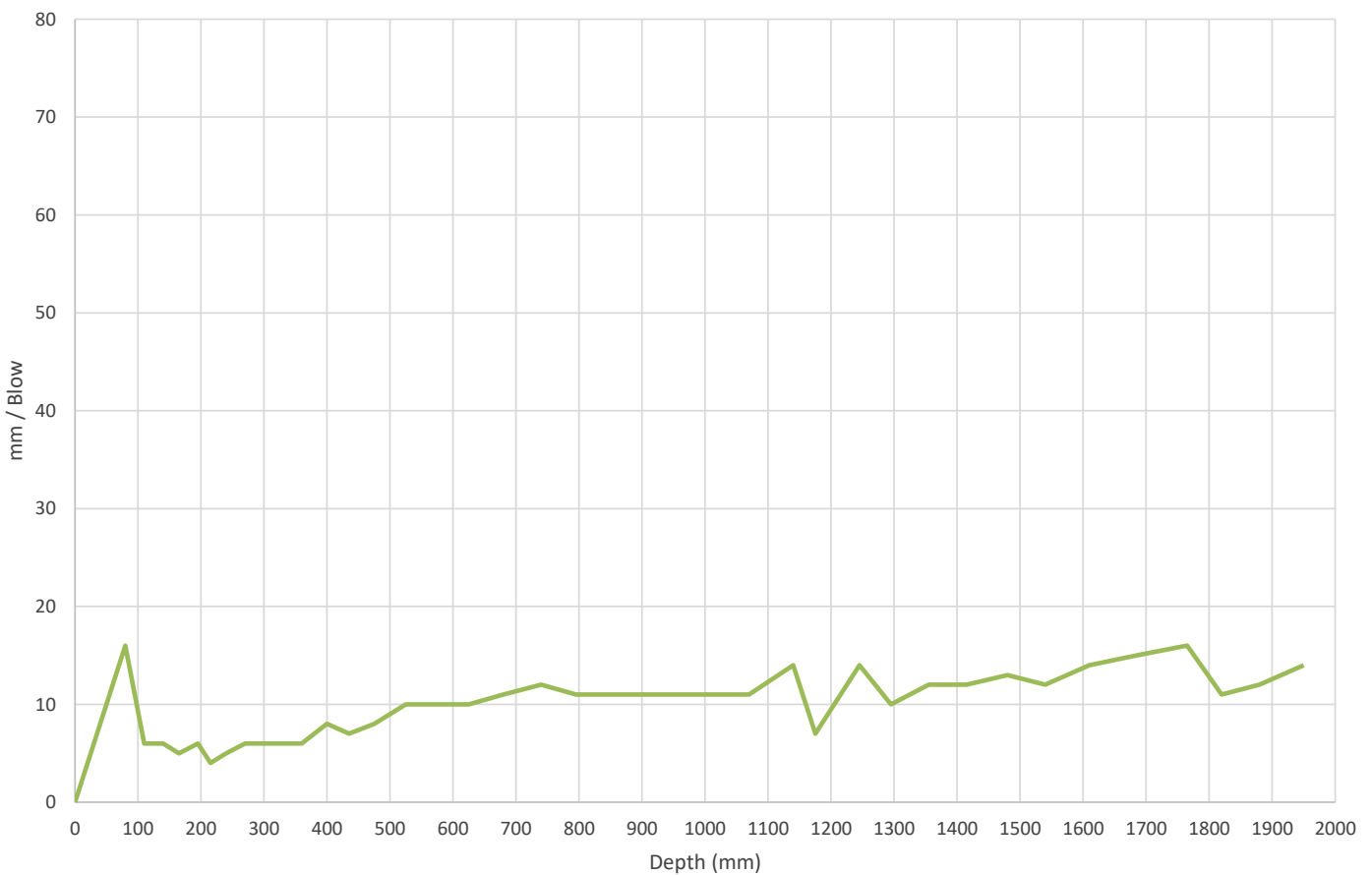
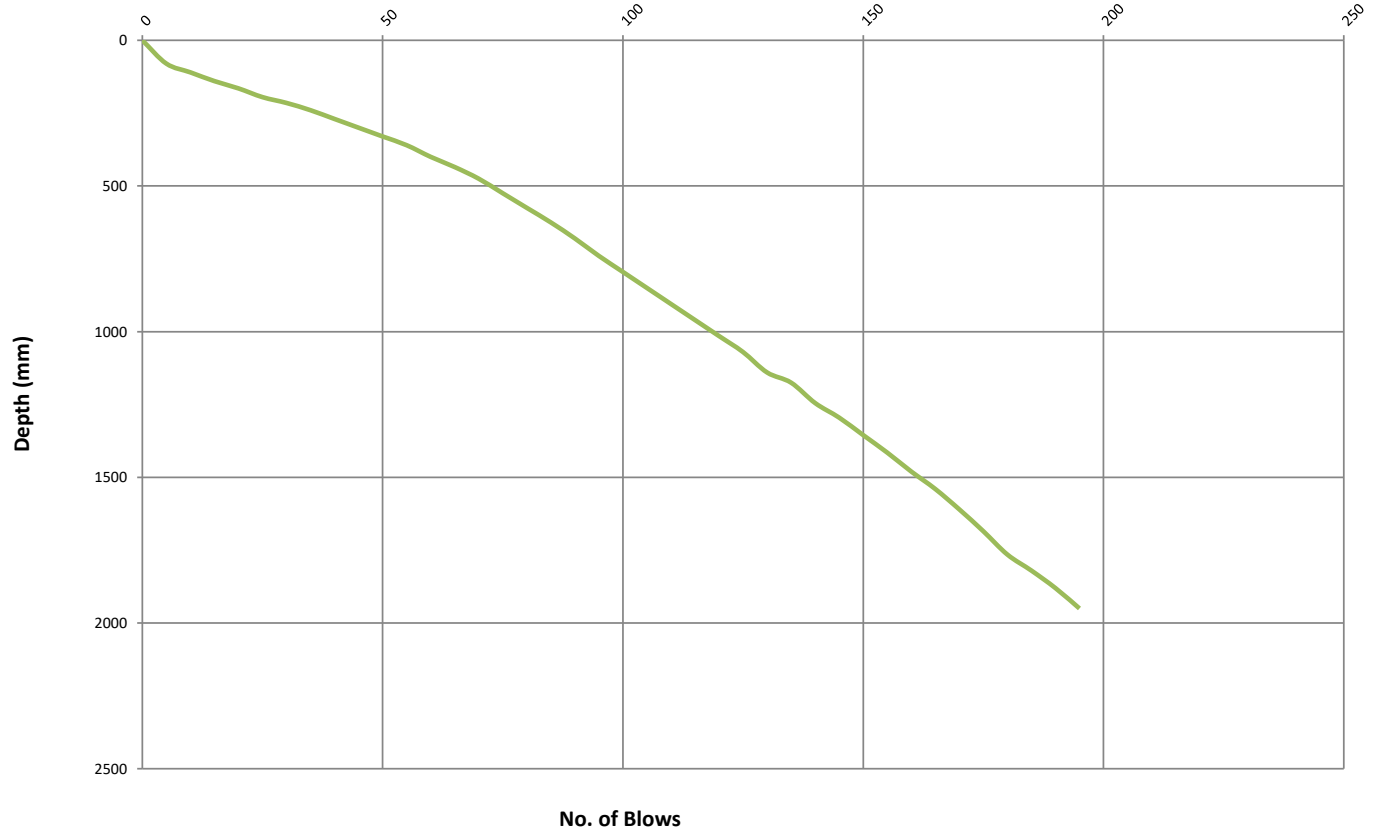
Client: Aecom SA (Pty) Ltd
Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive
Bellville
7530
Attention: Mr Jaco Van Der Walt

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	ACSA	LEVEL:	NGL
TEST POSITION:	TP2	FOUNDATION:	N/A
TEST DEPTH:	*DCP 2 m (This is not a standard nor an accredited Method)	STARTING DEPTH:	105mm
MATERIAL TYPE:	Sandy Materials	Max. penetration depth:	1950mm
CONSTRUCTION TYPE:	Structural	REFUSAL:	None
INSTRUMENT (DCP) SET No:	DCP 2m - BT2/0008	NOB/TEST:	5
DATE TESTED:	09/02/23		

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr. (dn) mm/blow
0	105	0		
5	185	80	80	16
10	215	110	30	6
15	245	140	30	6
20	270	165	25	5
25	300	195	30	6
30	320	215	20	4
35	345	240	25	5
40	375	270	30	6
45	405	300	30	6
50	435	330	30	6
55	465	360	30	6
60	505	400	40	8
65	540	435	35	7
70	580	475	40	8
75	630	525	50	10
80	680	575	50	10
85	730	625	50	10
90	785	680	55	11
95	845	740	60	12
100	900	795	55	11
105	955	850	55	11
110	1010	905	55	11
115	1065	960	55	11
120	1120	1015	55	11
125	1175	1070	55	11
130	1245	1140	70	14
135	1280	1175	35	7
140	1350	1245	70	14
145	1400	1295	50	10
150	1460	1355	60	12
155	1520	1415	60	12
160	1585	1480	65	13
165	1645	1540	60	12
170	1715	1610	70	14
175	1790	1685	75	15
180	1870	1765	80	16
185	1925	1820	55	11
190	1985	1880	60	12
195	2055	1950	70	14

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6



NOTE: All tests marked with (*) means that those test methods are not accredited.



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JOB No: SWL26903 **Ref. No:** - **Date:** 16/02/23

Client: Aecom SA (Pty) Ltd
Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive
Bellville
7530
Attention: Mr Jaco Van Der Walt

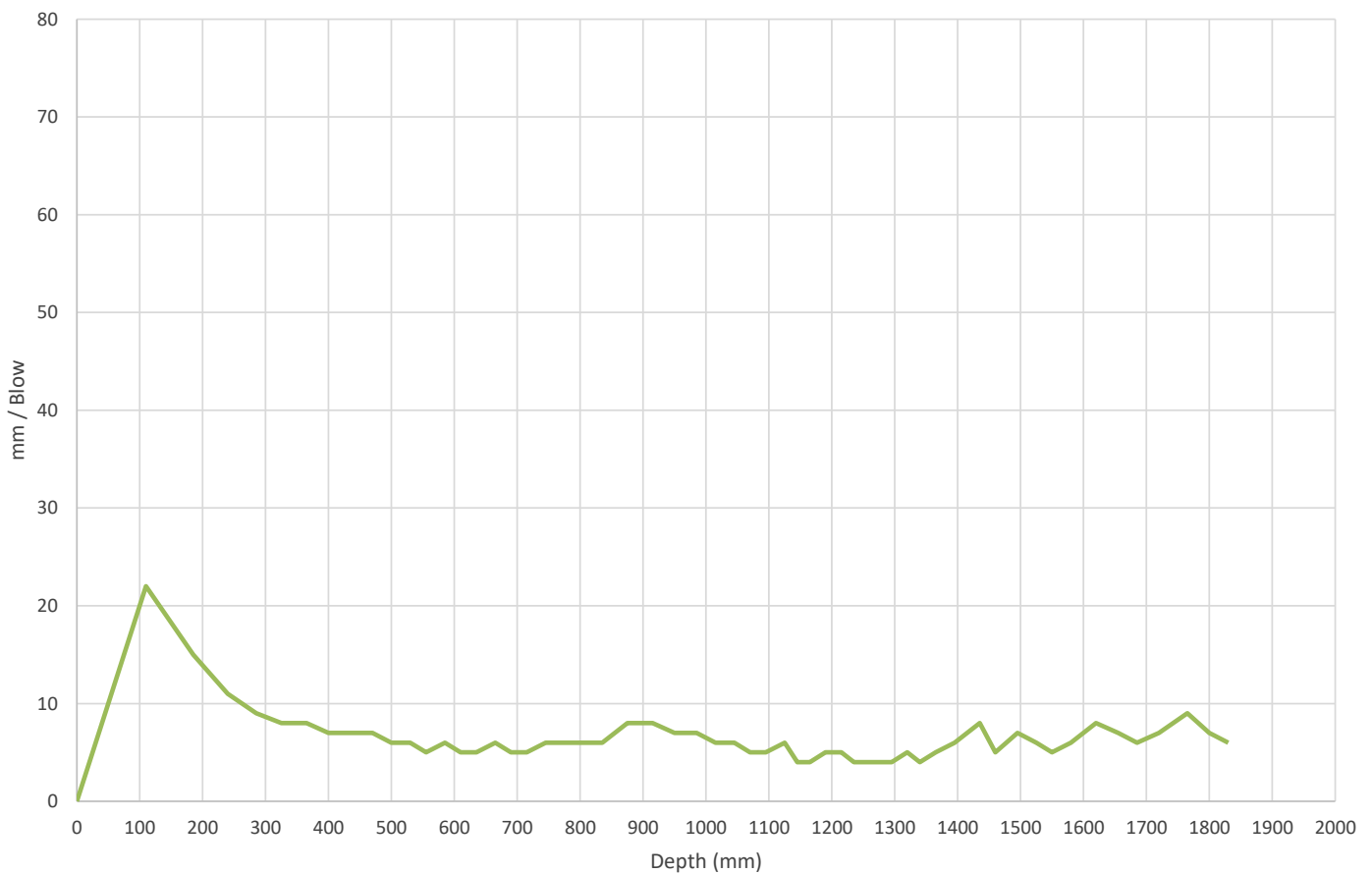
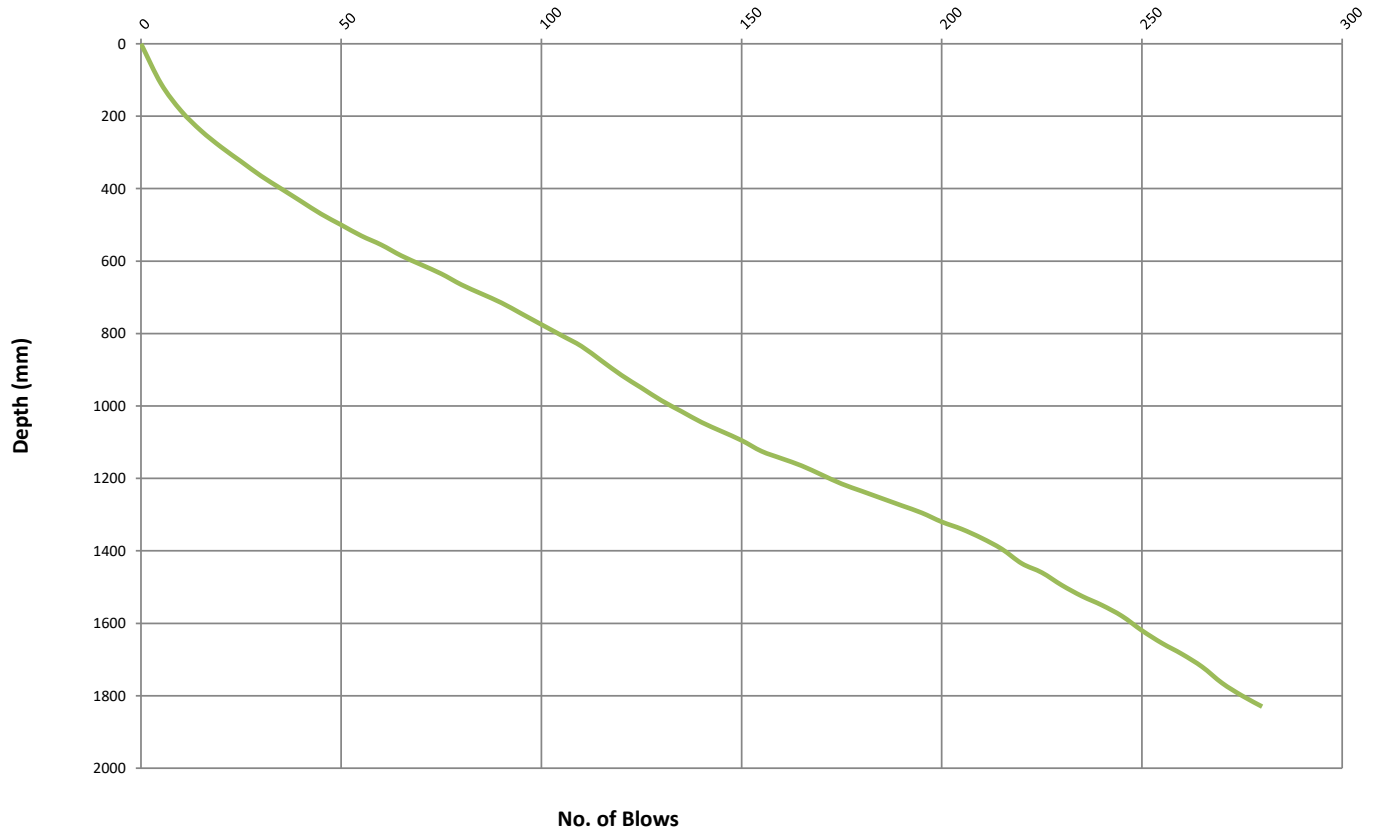
DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	ACSA	LEVEL:	NGL
TEST POSITION:	TP3	FOUNDATION:	N/A
TEST DEPTH:	*DCP 2 m (This is not a standard nor an accredited Method)	STARTING DEPTH:	180mm
MATERIAL TYPE:	Sandy Materials	Max. penetration depth:	1830mm
CONSTRUCTION TYPE:	Structural	REFUSAL:	None
INSTRUMENT (DCP) SET No:	DCP 2m - BT2/0008	NOB/TEST:	5
DATE TESTED:	09/02/23		

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr. (dn) mm/blow
0	180	0		
5	290	110	110	22
10	365	185	75	15
15	420	240	55	11
20	465	285	45	9
25	505	325	40	8
30	545	365	40	8
35	580	400	35	7
40	615	435	35	7
45	650	470	35	7
50	680	500	30	6
55	710	530	30	6
60	735	555	25	5
65	765	585	30	6
70	790	610	25	5
75	815	635	25	5
80	845	665	30	6
85	870	690	25	5
90	895	715	25	5
95	925	745	30	6
100	955	775	30	6
105	985	805	30	6
110	1015	835	30	6
115	1055	875	40	8
120	1095	915	40	8
125	1130	950	35	7
130	1165	985	35	7
135	1195	1015	30	6
140	1225	1045	30	6
145	1250	1070	25	5
150	1275	1095	25	5
155	1305	1125	30	6
160	1325	1145	20	4
165	1345	1165	20	4
170	1370	1190	25	5
175	1395	1215	25	5
180	1415	1235	20	4
185	1435	1255	20	4
190	1455	1275	20	4
195	1475	1295	20	4
200	1500	1320	25	5
205	1520	1340	20	4
210	1545	1365	25	5
215	1575	1395	30	6
220	1615	1435	40	8
225	1640	1460	25	5
230	1675	1495	35	7
235	1705	1525	30	6
240	1730	1550	25	5
245	1760	1580	30	6

250	1800	1620	40	8
255	1835	1655	35	7
260	1865	1685	30	6
265	1900	1720	35	7
270	1945	1765	45	9
275	1980	1800	35	7
280	2010	1830	30	6

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6



NOTE: All tests marked with (*) means that those test methods are not accredited.



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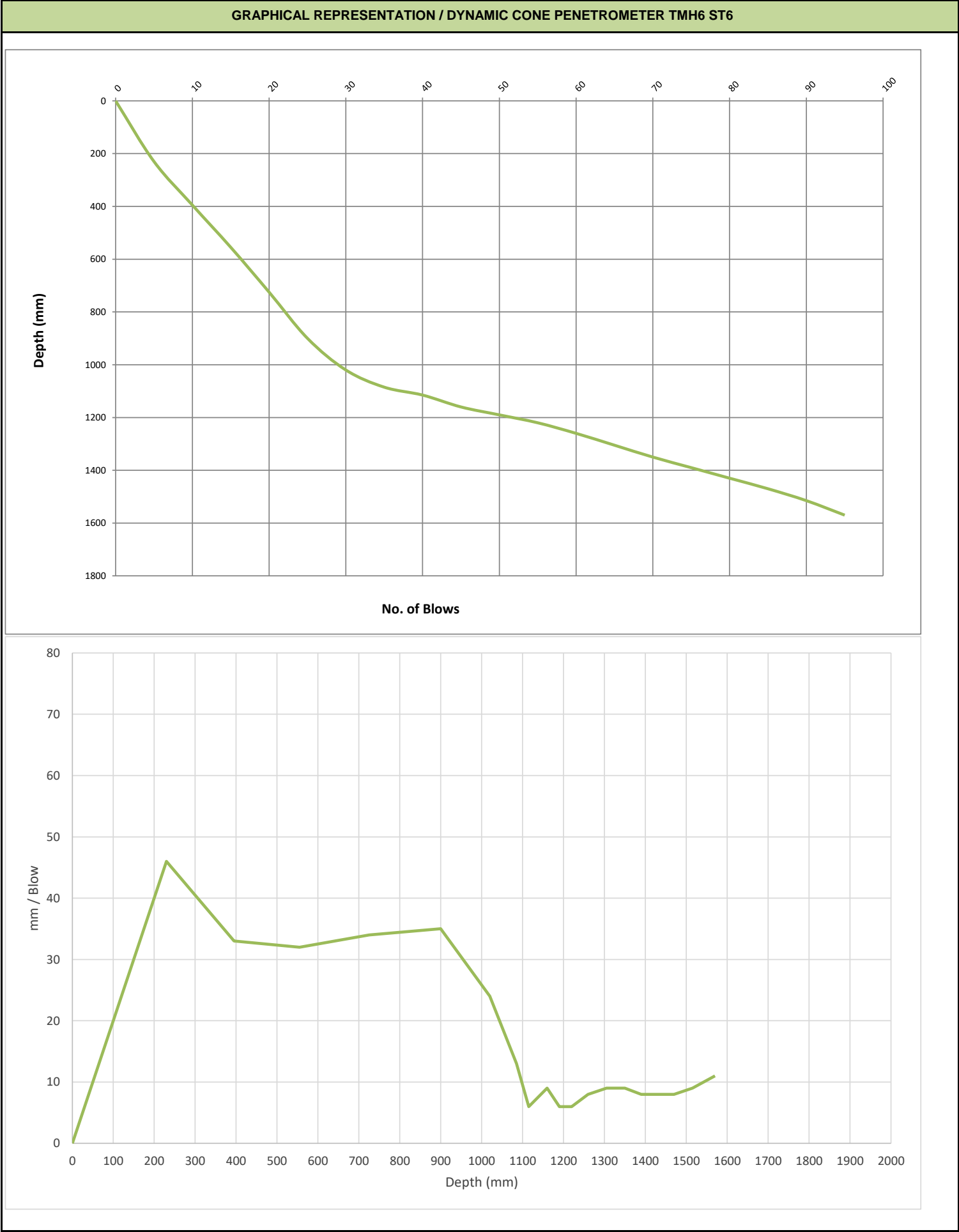
JOB No: SWL26903 **Ref. No:** - **Date:** 16/02/23

Client: Aecom SA (Pty) Ltd
Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive
Bellville
7530
Attention: Mr Jaco Van Der Walt

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	ACSA	LEVEL:	NGL
TEST POSITION:	TH4	FOUNDATION:	N/A
TEST DEPTH:	*DCP 2 m (This is not a standard nor an accredited Method)	STARTING DEPTH:	465mm
MATERIAL TYPE:	Sandy Materials	Max. penetration depth:	1570mm
CONSTRUCTION TYPE:	Structural	REFUSAL:	None
INSTRUMENT (DCP) SET No:	DCP 2m - BT2/0008	NOB/TEST:	5
DATE TESTED:	09/02/23		

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr. (dn) mm/blow
0	465	0		
5	695	230	230	46
10	860	395	165	33
15	1020	555	160	32
20	1190	725	170	34
25	1365	900	175	35
30	1485	1020	120	24
35	1550	1085	65	13
40	1580	1115	30	6
45	1625	1160	45	9
50	1655	1190	30	6
55	1685	1220	30	6
60	1725	1260	40	8
65	1770	1305	45	9
70	1815	1350	45	9
75	1855	1390	40	8
80	1895	1430	40	8
85	1935	1470	40	8
90	1980	1515	45	9
95	2035	1570	55	11



NOTE: All tests marked with (*) means that those test methods are not accredited.



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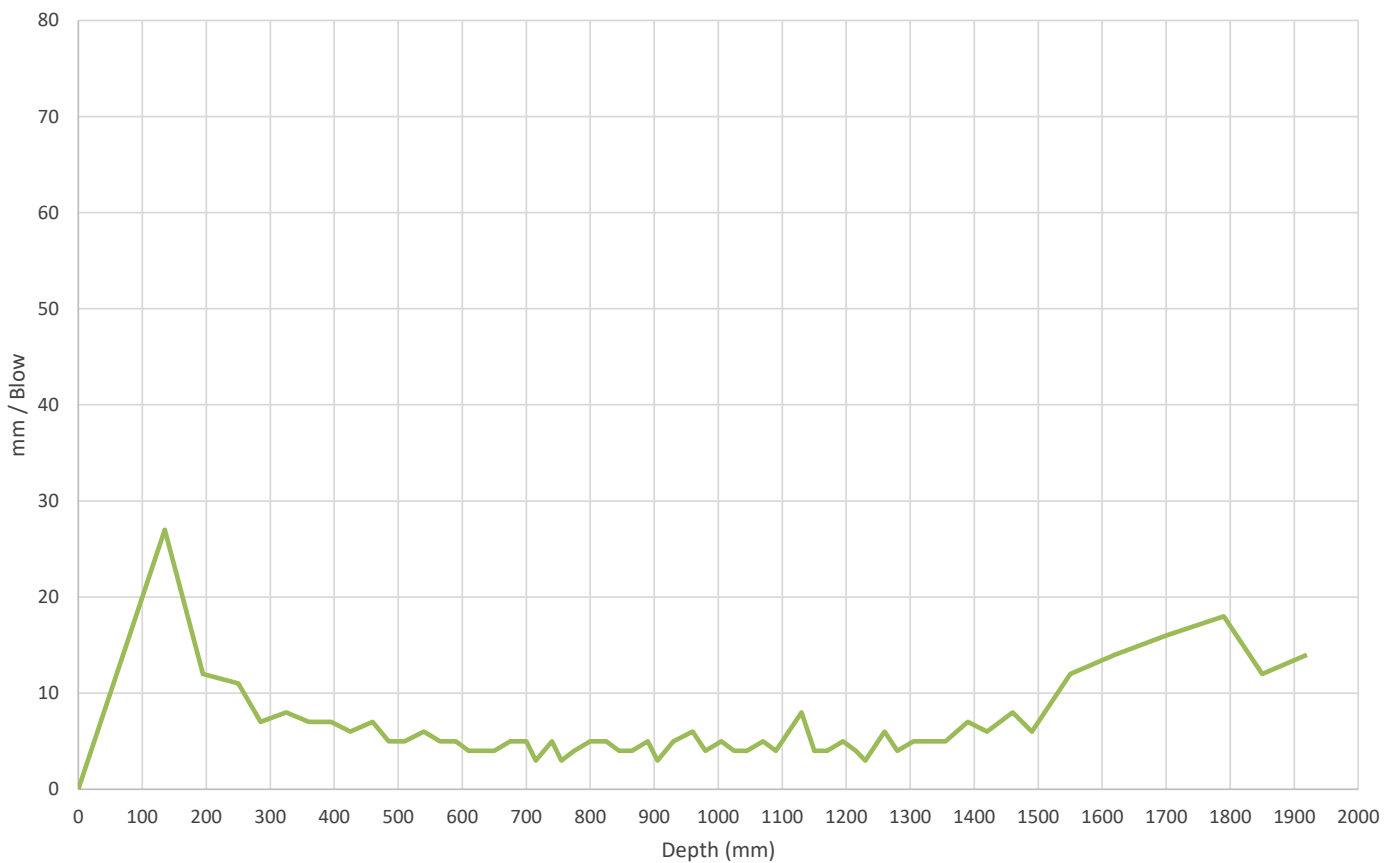
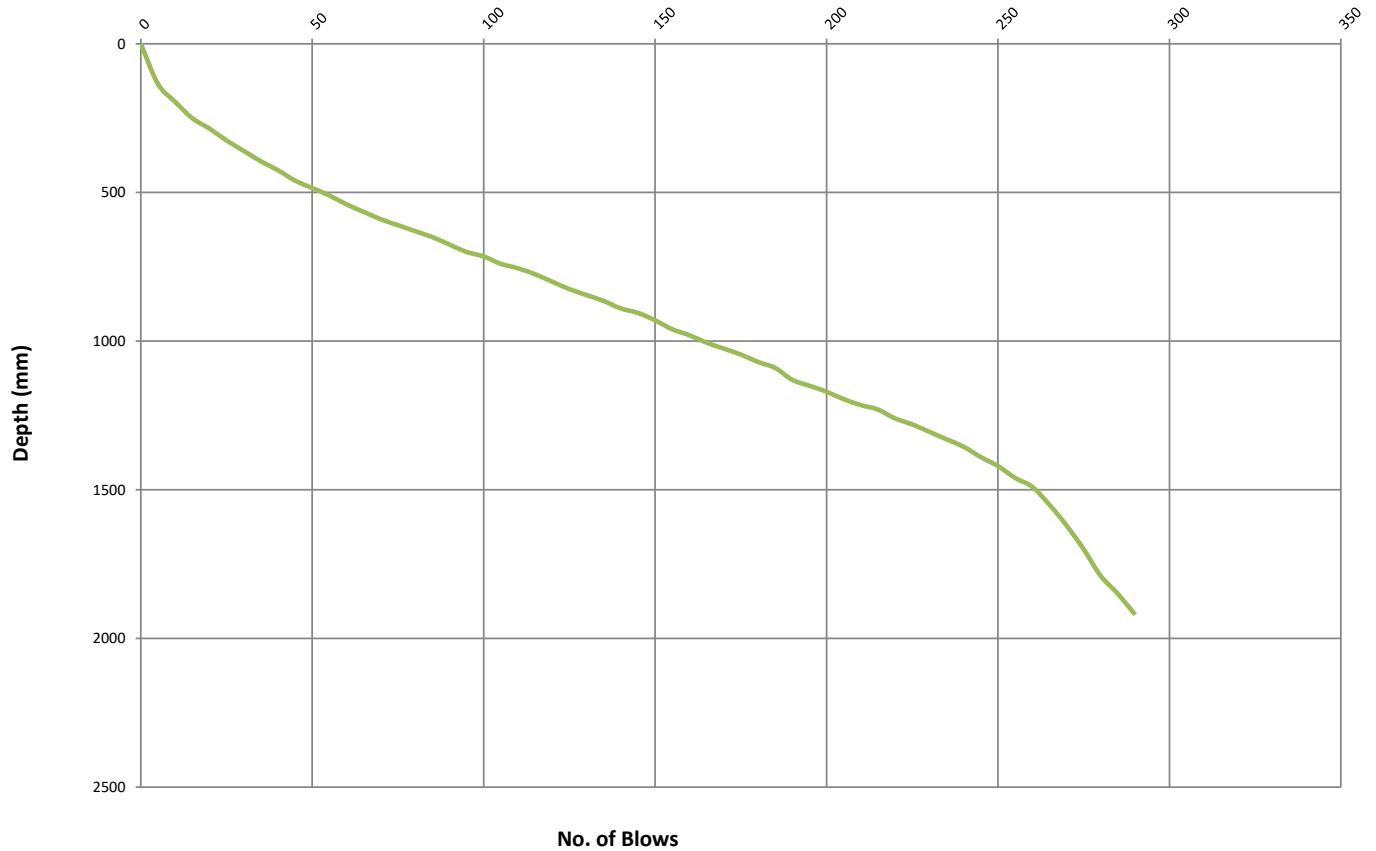
DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	ACSA	LEVEL:	NGL
TEST POSITION:	TP5	FOUNDATION:	N/A
TEST DEPTH:	*DCP 2 m (This is not a standard nor an accredited Method)	STARTING DEPTH:	145mm
MATERIAL TYPE:	Sandy Materials	Max. penetration depth:	1920mm
CONSTRUCTION TYPE:	Structural	REFUSAL:	None
INSTRUMENT (DCP) SET No:	DCP 2m - BT2/0008	NOB/TEST:	5
DATE TESTED:	09/02/23		

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr. (dn) mm/blow
0	145	0		
5	280	135	135	27
10	340	195	60	12
15	395	250	55	11
20	430	285	35	7
25	470	325	40	8
30	505	360	35	7
35	540	395	35	7
40	570	425	30	6
45	605	460	35	7
50	630	485	25	5
55	655	510	25	5
60	685	540	30	6
65	710	565	25	5
70	735	590	25	5
75	755	610	20	4
80	775	630	20	4
85	795	650	20	4
90	820	675	25	5
95	845	700	25	5
100	860	715	15	3
105	885	740	25	5
110	900	755	15	3
115	920	775	20	4
120	945	800	25	5
125	970	825	25	5
130	990	845	20	4
135	1010	865	20	4
140	1035	890	25	5
145	1050	905	15	3
150	1075	930	25	5
155	1105	960	30	6
160	1125	980	20	4
165	1150	1005	25	5
170	1170	1025	20	4
175	1190	1045	20	4
180	1215	1070	25	5
185	1235	1090	20	4
190	1275	1130	40	8
195	1295	1150	20	4
200	1315	1170	20	4
205	1340	1195	25	5
210	1360	1215	20	4
215	1375	1230	15	3
220	1405	1260	30	6
225	1425	1280	20	4
230	1450	1305	25	5
235	1475	1330	25	5
240	1500	1355	25	5
245	1535	1390	35	7

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GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6



NOTE: All tests marked with (*) means that those test methods are not accredited.



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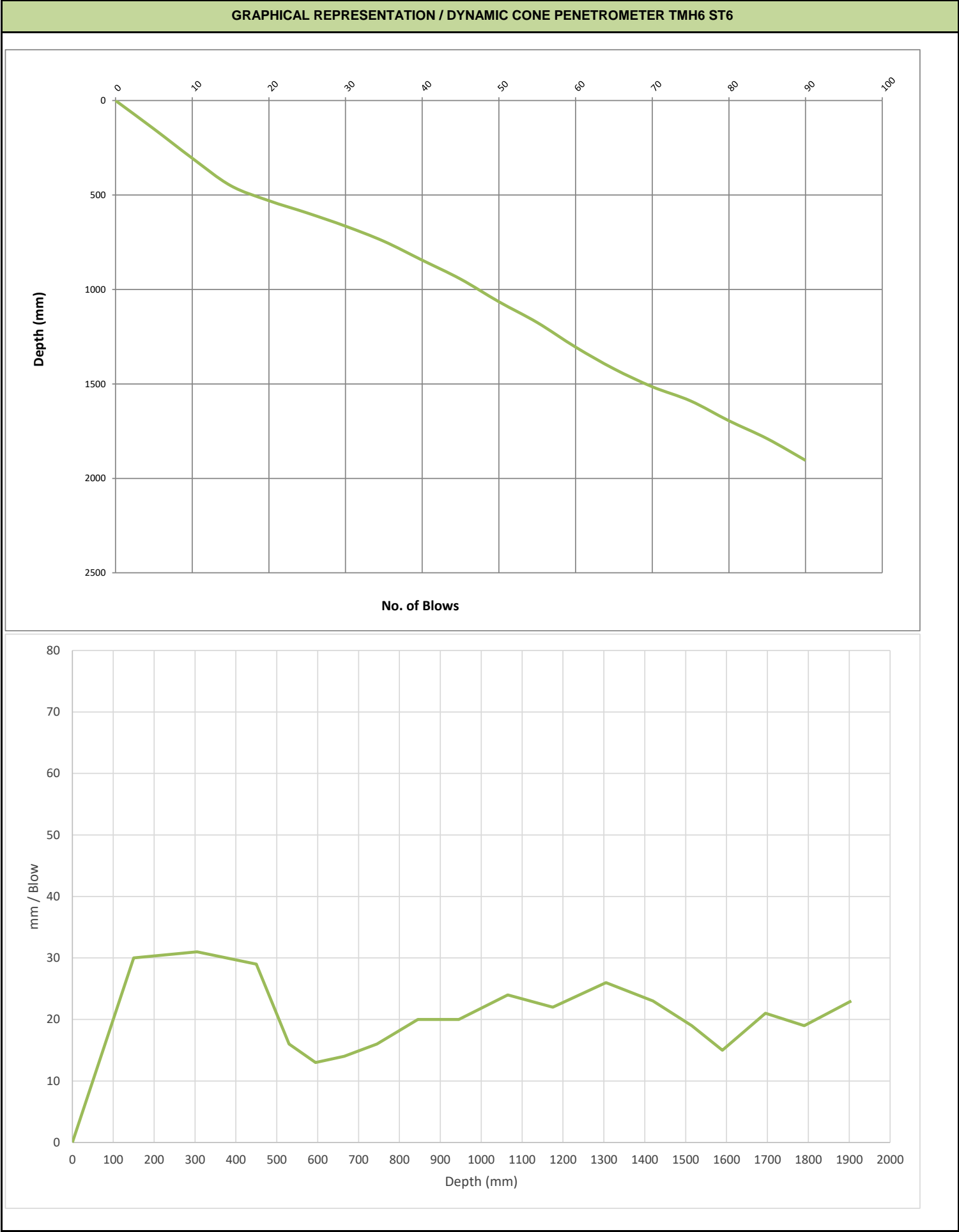
JOB No: SWL26903 **Ref. No:** - **Date:** 16/02/23

Client: Aecom SA (Pty) Ltd
Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive
Bellville
7530
Attention: Mr Jaco Van Der Walt

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	ACSA	LEVEL:	1.4m BNGL
TEST POSITION:	TP5	FOUNDATION:	N/A
TEST DEPTH:	*DCP 2 m (This is not a standard nor an accredited Method)	STARTING DEPTH:	140mm
MATERIAL TYPE:	Sandy Materials	Max. penetration depth:	1905mm
CONSTRUCTION TYPE:	Structural	REFUSAL:	None
INSTRUMENT (DCP) SET No:	DCP 2m - BT2/0008	NOB/TEST:	5
DATE TESTED:	09/02/23		

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr. (dn) mm/blow
0	140	0		
5	290	150	150	30
10	445	305	155	31
15	590	450	145	29
20	670	530	80	16
25	735	595	65	13
30	805	665	70	14
35	885	745	80	16
40	985	845	100	20
45	1085	945	100	20
50	1205	1065	120	24
55	1315	1175	110	22
60	1445	1305	130	26
65	1560	1420	115	23
70	1655	1515	95	19
75	1730	1590	75	15
80	1835	1695	105	21
85	1930	1790	95	19
90	2045	1905	115	23



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JOB No: SWL26903 **Ref. No:** - **Date:** 16/02/23

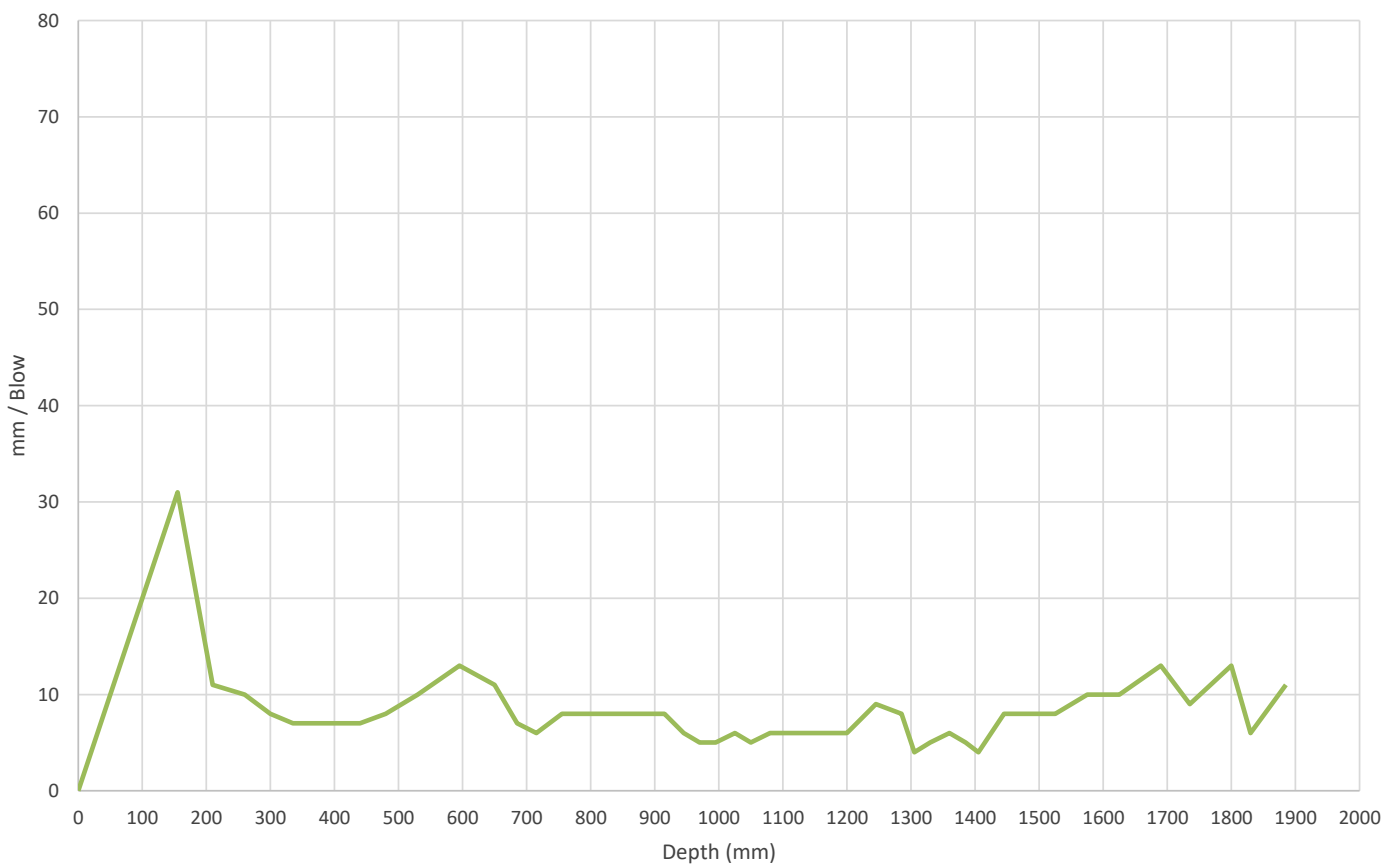
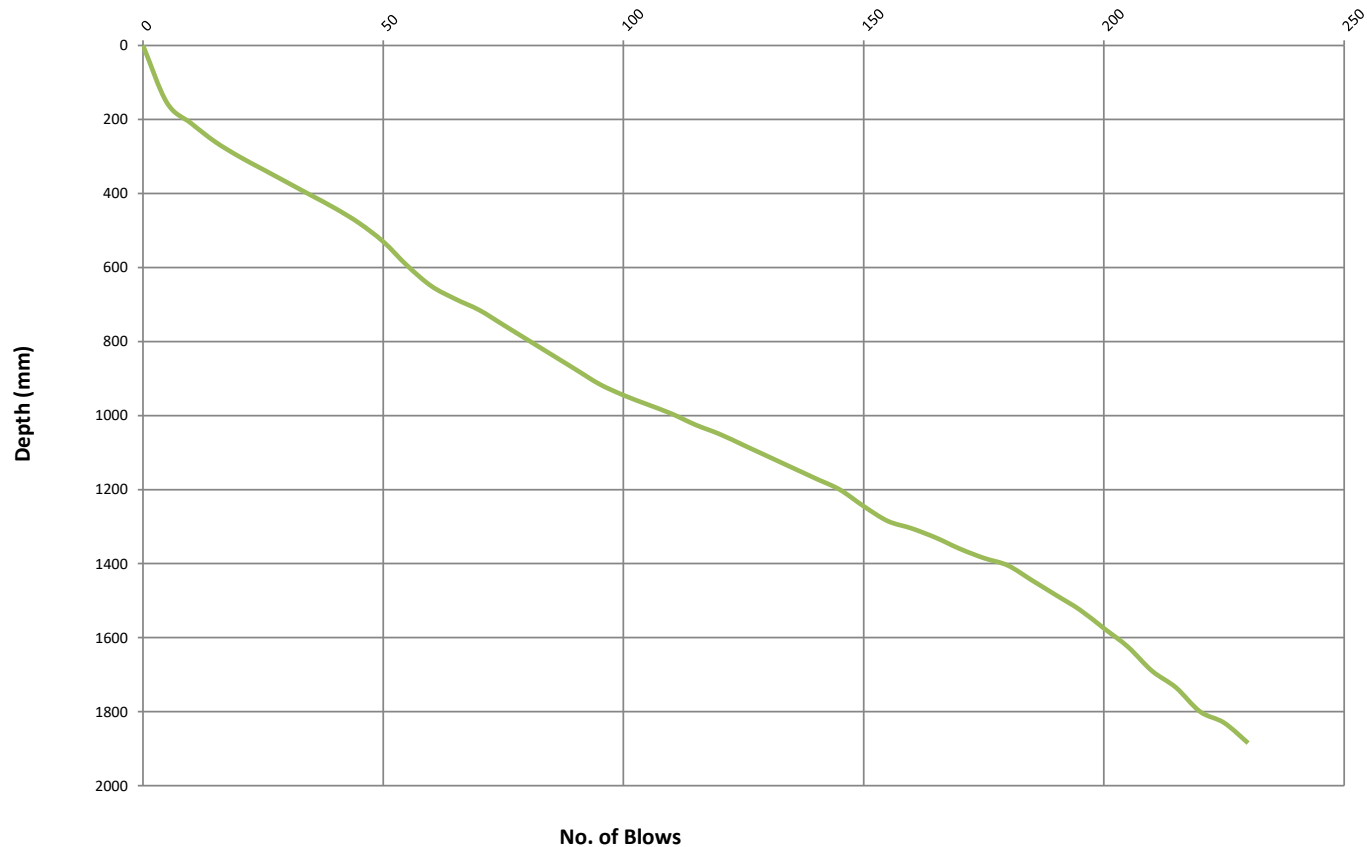
Client: Aecom SA (Pty) Ltd
Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive
Bellville
7530
Attention: Mr Jaco Van Der Walt

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	ACSA	LEVEL:	NGL
TEST POSITION:	TP6	FOUNDATION:	N/A
TEST DEPTH:	*DCP 2 m (This is not a standard nor an accredited Method)	STARTING DEPTH:	170mm
MATERIAL TYPE:	Sandy Materials	Max. penetration depth:	1885mm
CONSTRUCTION TYPE:	Structural	REFUSAL:	None
INSTRUMENT (DCP) SET No:	DCP 2m - BT2/0008	NOB/TEST:	5
DATE TESTED:	09/02/23		

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr. (dn) mm/blow
0	170	0		
5	325	155	155	31
10	380	210	55	11
15	430	260	50	10
20	470	300	40	8
25	505	335	35	7
30	540	370	35	7
35	575	405	35	7
40	610	440	35	7
45	650	480	40	8
50	700	530	50	10
55	765	595	65	13
60	820	650	55	11
65	855	685	35	7
70	885	715	30	6
75	925	755	40	8
80	965	795	40	8
85	1005	835	40	8
90	1045	875	40	8
95	1085	915	40	8
100	1115	945	30	6
105	1140	970	25	5
110	1165	995	25	5
115	1195	1025	30	6
120	1220	1050	25	5
125	1250	1080	30	6
130	1280	1110	30	6
135	1310	1140	30	6
140	1340	1170	30	6
145	1370	1200	30	6
150	1415	1245	45	9
155	1455	1285	40	8
160	1475	1305	20	4
165	1500	1330	25	5
170	1530	1360	30	6
175	1555	1385	25	5
180	1575	1405	20	4
185	1615	1445	40	8
190	1655	1485	40	8
195	1695	1525	40	8
200	1745	1575	50	10
205	1795	1625	50	10
210	1860	1690	65	13
215	1905	1735	45	9
220	1970	1800	65	13
225	2000	1830	30	6
230	2055	1885	55	11

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6



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JOB No: SWL26903 **Ref. No:** - **Date:** 16/02/23

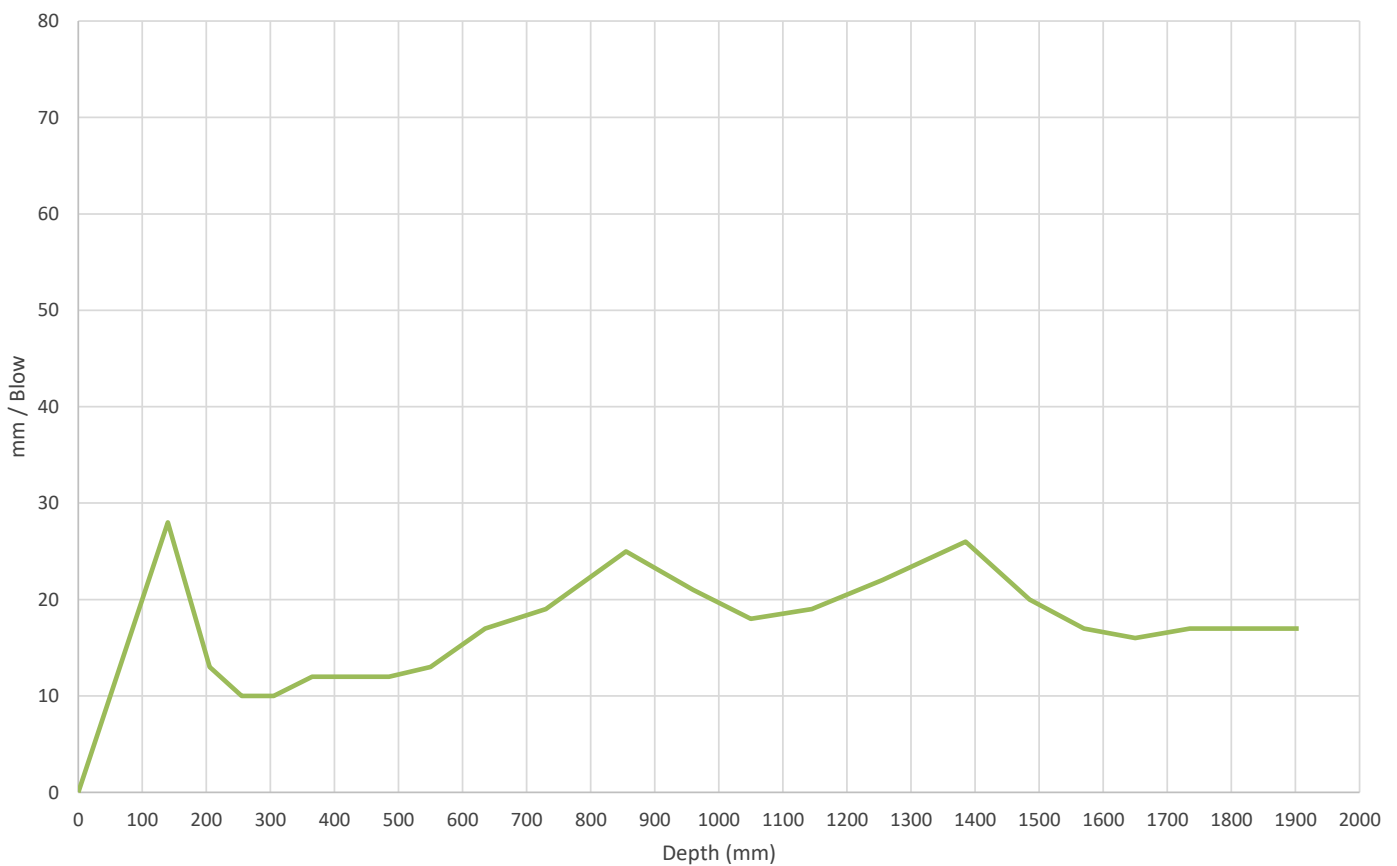
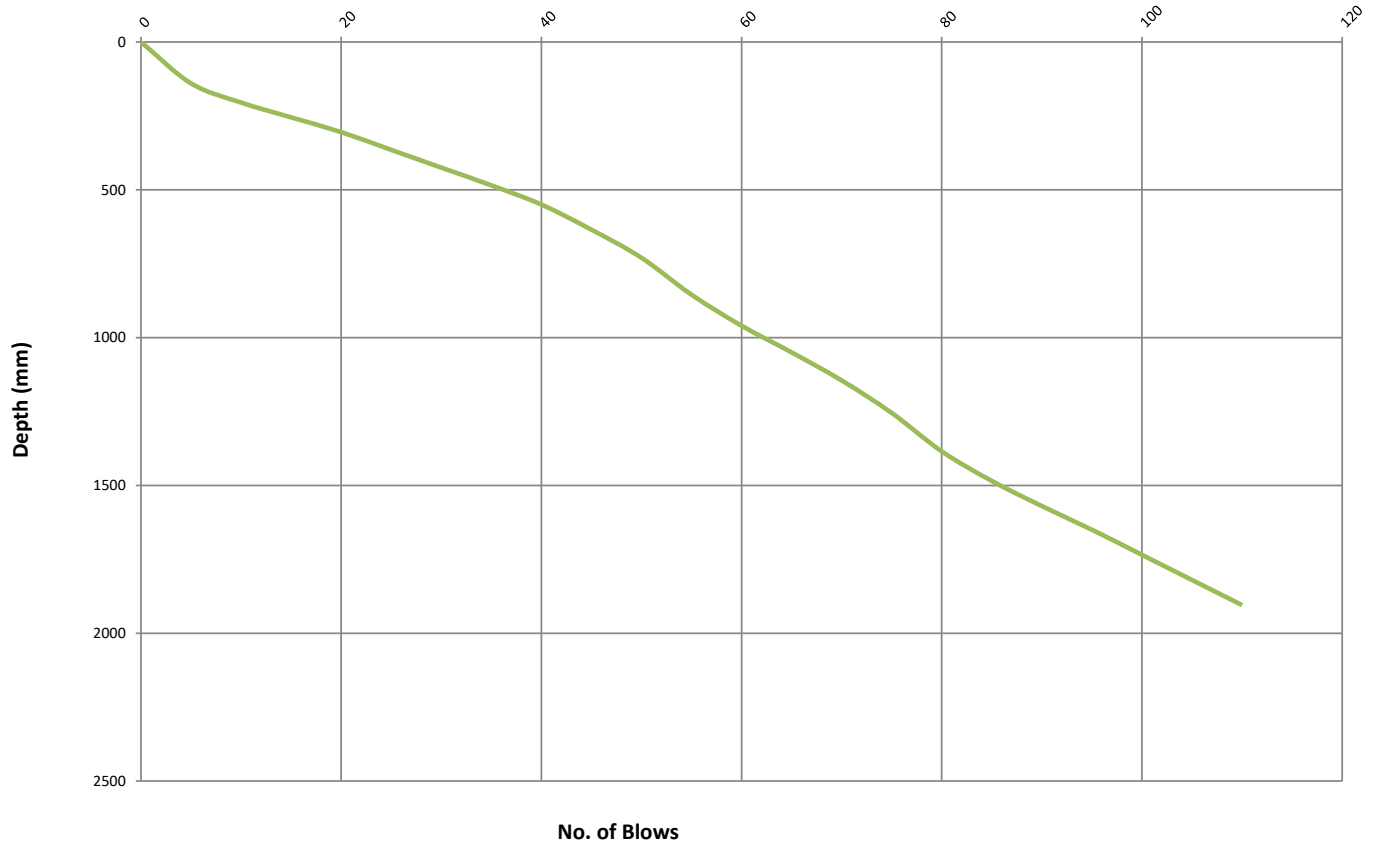
Client: Aecom SA (Pty) Ltd
Waterside Place, Tyger Waterfront Southgate, Carl Cronje Drive
Bellville
7530
Attention: Mr Jaco Van Der Walt

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	ACSA	LEVEL:	NGL
TEST POSITION:	TP7	FOUNDATION:	N/A
TEST DEPTH:	*DCP 2 m (This is not a standard nor an accredited Method)	STARTING DEPTH:	105mm
MATERIAL TYPE:	Sandy Materials	Max. penetration depth:	1905mm
CONSTRUCTION TYPE:	Structural	REFUSAL:	None
INSTRUMENT (DCP) SET No:	DCP 2m - BT2/0008	NOB/TEST:	5
DATE TESTED:	09/02/23		

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr. (dn) mm/blow
0	105	0		
5	245	140	140	28
10	310	205	65	13
15	360	255	50	10
20	410	305	50	10
25	470	365	60	12
30	530	425	60	12
35	590	485	60	12
40	655	550	65	13
45	740	635	85	17
50	835	730	95	19
55	960	855	125	25
60	1065	960	105	21
65	1155	1050	90	18
70	1250	1145	95	19
75	1360	1255	110	22
80	1490	1385	130	26
85	1590	1485	100	20
90	1675	1570	85	17
95	1755	1650	80	16
100	1840	1735	85	17
105	1925	1820	85	17
110	2010	1905	85	17

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6



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13. Appendix D - Test Pit Locations

