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PROPOSED NEW DOUBLE STOREY HOUSE WITH LOFT APARTMENTS & SWIMMING POOL

FOR

MR. & MRS. EMMANUEL

ON

PORTION 292 OF FARM LOT 61 No 1521, SHEFFIELD BEACH

BALLITO

Geotechnical Report

July 2021

Executive Summary:

On the 9th June 2021, Mono Block submitted a quotation to Mr. Rob Emmanuel, for the civil and structural designs as well as the geotechnical investigations and report required for the proposed new house to be constructed on portion 292 of farm lot 61 number 1521 situated at number 99 Colwyn Drive in Sheffield Beach, Ballito. The submitted quotation was approved on the 8th July 2021 and Mono Block carried out the investigations on the 20th July 2021.

The professional team involved with this project includes the following:

- The client: Mr. Rob Emmanuel.
- Architect : MAP Architect
- Geotechnical Consultant: Mono Block Laboratories.

The preliminary architectural drawings number C 000 - 105 provided by Mr. Jarryd Murray, indicates that the existing dwelling on site will be demolish to the detriment of the following:

- A double storey house;
- Four garage loft apartments; and
- A swimming pool.

The natural ground on site is located on a moderate slope of approximately 8°. This natural slope has been benched during the previous earthwork and the actual platform where the existing house is built has a gentle to flat ground slope.

The fieldwork consisted of a subsurface investigation involving two test pits and a series of in situ soil tests. This fieldwork was followed by the required laboratory tests and this report detailing the findings of the investigation.

The test pit results show that the soil profile is made up of the fill materials, the transported soils and the weathered bedrock.

- The fill are homogeneous materials which occur from the top of the surface materials up to a depth of 0.70m. This layer is composed of clayey sand; silty sand; silty sand with clay; and the accumulation of construction rubble and PVC sewer pipe.

- The transported soils occur with thicknesses varying between 0.60m in TP1 and 1.60m in TP2. The soil compositions are made up of beach silty sand and coarse silty sand with less than 12% of clay.

  Groundwater table occurs in this layer at a depth of approximately 1.00m in TP1.

- The weathered diamictite bedrock occurs in both test pits at relatively variable depths of between 1.30m in the test pit TP1 and 2.30m in the test pit TP2.

The laboratory results show that both sands are considered to be inactive for movements and are anticipated to behave as cohesionless soils.

The Dynamic Penetrometer Light (DPL) tests reached refusal in the weathered diamictite bedrock at depths varying between 3.90 – 6.90m across the site.

Soft excavation in terms of SANS 1200D is generally anticipated from the top of fill materials to depths of between 3.90 – 6.90m using conventional earthwork equipment such the TLB. This assessment is based on the results of the DPL test which was advanced up to the DPL refusal recorded at depths varying between 3.90 – 6.90m. However, Intermediate excavation may locally occur at and below the DPL refusal.

The main expected geotechnical contraints on the site are:

- Potential for collapse / settlement, and
- Shallow perched water table.

The Residential Site Class Designations in accordance with the NHBRC are set out in Table 8 and 9. The site classifications is **P (groundwater table) R - C2**, where P signifies shallow groundwater table, C represents collapse and R corresponds to Bedrock.

This classification means that the house and associated structures may be founded according to site class designations using the ground beams spanning between the end bearing auger pile foundations.

The site is considered suitable for the construction of the proposed double storey house with loft apartments and swimming pool provided that the recommendations given in this report are adhered to.

Contents

1.0 Background:

Mono Block Laboratories was appointed by Mr. Rob Emmanuel to conduct the geotechnical investigations and report for the proposed new house to be built at number 99 Colwyn Drive in Sheffield Beach, Ballito. The investigation was carried out on the 20th July 2021.

1.1 Aims of the Investigation

The objectives of the investigation were:

- To assess the subsurface soil and groundwater conditions present; evaluate the bearing capacity and structural significance of the subsoils and to make recommendations for site works for the proposed new house.

- To identify relevant ground-related features and determine the variability of ground conditions and the effect of such variability on the proposed new dwelling.

1.2 Information Used in the Study

In accordance with the NHBRC regulations, the following sources were used in the investigation for information.

- 1: 250 000 Geological series Map 2930 Durban.
- Remote imagery (Google Earth Professional)
- The National Department of Housing, Generic Specification GFSH-2 (September 2002) document.
- The architect's drawings number C00 – C105 provided by Mr. Jarryd Murray.

This report contains the results of the investigation undertaken on site and provides recommendations for possible foundation method, earthworks, surface beds and stormwater management.

2.0 Site Description:

The area investigated is an existing property of approximately 4 033m^2 which has been divided into two separate lands. It is located at number 99 Colwyn Drive in Sheffield Beach, Ballito, Kwazulu Natal.

The site is situated approximately 10.7km northeast of Ballitoville. Access to the site is via Colwyn Drive which ties into Sheffield Beach Road and traverses the northwestern margins of the property. The current vegetation on site comprises scattered indigenous trees and grasses.

The property is pie shaped and elongated along northwest – southeast axis. The site is surrounded to the east and south by the beach, to the northwestern by Colwyn Drive and to the north by existing properties (Figure 1).

Topographically, the site is located on a moderate slope of approximately 8° falling towards the southeastern extent of the site at a moderate gradient becoming steep towards the end reaches of the site. The highest point on the site is at the northwestern end of the site where the elevation is approximately 20m above sea level.

The grid coordinates of the site are: S29°28'40.03" and E31° 15'48.56".

During the fieldwork, we have been told by the gardener that 3 septic tanks are possibly located in the areas presented in Figure 2.

Figure 1: View of the location of the project area at number 99 Colwyn Drive, Sheffield Beach

3.0 Fieldwork:

The fieldwork was conducted on the 20th July 2021, during the winter season, and comprised the following:

- Five Dynamic Penetrometer Light (DPL) Tests;
- Two Test Pits; and
- Two Disturbed Soil Samples.

3.1 Dynamic Penetrometer Light (DPL) Tests

Five in-situ Dynamic Penetrometer Light Tests, designated DPL1 through to DPL5, were carried out from the top of the surface materials up to the DPL refusal logged at depths varying between 3.90 – 6.90m below existing ground level.

The DPL tests were performed to determine the consistency of the subsurface soil materials and for the derivation of the soil bearing capacities across the site. The DPL tests were carried out at the approximate positions shown in Figure 2 of Appendix A.

The results of the tests have been summarized in Table 1 below while the full test result sheets are attached in Appendix C of this report.

Table 1: Summary of the DPL Test Results.

DPL No	Thickness of Material Consistency (m)				End of Test (m)
	Very Loose	Loose	Medium Dense	Dense	
1	0.00 – 1.50	1.50 – 2.10	2.10 – 4.20	-	4.20
2	0.00 – 1.50	1.50 – 3.90	3.90 – 5.40	-	5.40
3	0.00 - 0.60	0.60 – 3.30	3.30 – 4.80	-	4.80
4	0.00 – 1.50	1.50 – 5.70	5.70 – 6.90	-	6.90
5	0.00 – 0.60	0.60 – 2.40	2.40 – 3.60	3.60 – 3.90	3.90

Based on Table 1 above; the DPL results show the following:

- Very loose soils were recorded across the site, from the top of fill materials up to depths of between 0.60 – 1.50m. Thereafter, loose soils with isolated medium dense zones occur up to depths varying between 2.10 – 5.70m.

  There is a general increase in thickness of the loose soils towards the eastern extent of the site, where they attain a thickness of 5.70m in the vicinity of DPL4.

- Medium dense soils are present across the site and extend up to the DPL refusal recorded at depths of 3.60m in the vicinity of DPL5; 4.20m in the proximity of DPL1; 4.80m in the surrounding of DPL3; 5.40m in the proximity of DPL2 and 6.90m in vicinity of DPL4.

- Beneath these levels, dense soils occur in the surroundings of DPL5 up to the DPL refusal logged at 3.90m.

3.2 Test Pit / Auger

Two test pits, designated TP1 and TP2, were excavated from the top of fill materials up to a depth of 1.00m by hand using a pick and shovel, and to maximum depths of between 1.40m in TP1 and 2.40m in TP2 by means of a hand operated auger. The test pits were positioned and excavated in order to identify the geotechnical conditions on site.

The test pits were profiled immediately after excavation by a Mono Block Engineering Geologist in accordance with the method of Jennings *et* al., (1973). The test pits were loosely backfilled after profiling. The conditions found in the test pits were assumed to be representative of conditions at the proposed site.

A table listing the depths of individual horizons has been summarized in Table 2. While the full profiles are attached in Appendix B and the photos are included in Appendix E.

Table 2: Summary of interpreted depths of each major unit.

Layer Ref:	**Soil Description**	**Depth ranges encountered in test pits (m)**		**Soil Sample (m)**
		TP1	**TP2**	
Fill Materials	Slight moist, dark brownish grey, loose with isolated very loose zones, very fine to fine grained, Clayey SAND with abundant rootlets and negligible roots up to 10mm in diameter, PVC sewer pipe	0.00 – 0.25 Loose	0.00 – 0.40 Loose	
	Moist, greyish buffer, very loose, very fine to fine grained, Silty SAND with negligible roots.	0.25 – 0.70 Very Loose	0.40 – 0.70 Very loose	
Littoral Soils	Moist becoming saturated at 1.00m, yellowish grey, loose, very fine to fine grained, Clayey SAND	0.70 – 1.30 Loose P= 64-72kPa	0.70 – 2.30 Very loose - loose P= 40 –81kPa	1.00 – 1.40
Dwyka Formation	Dark reddish grey, highly weathered, very fine to fine grained, medium bedded, fractured, very soft rock, Diamictite.	1.30 – Soft Rock	2.30 – Soft Rock	

P: Anticipated Bearing Capacity of Soil Layers (kPa)

4.0 Regional Geology:

The regional geology of the area is shown in the extract presented in Figure 3 of Appendix A of this report and is taken from the 1: 250 000 Geological Series Map 2930 Durban prepared by the Council for Geosciences.

The regional geology is underlain by the diamictite, subordinate varved shale and boulder shale of the Dwyka Formation. This formation is overlain by the beach sand.

5.0 Site Geology:

The site is mainly underlain by the fill materials followed by the transported sediments which overlies the weathered diamictite of the dwyka formation. The transported sediments are made up of littoral sands.

6.0 Soil Profile:

The materials encountered on site are made up mainly of sands and rock; and can be divided into three categories as follows:

6.1 Fill Materials

This layer was intersected in both test pits, from the top of the surface materials to a depth of 0.70m. The fill was reworked materials derived from the construction rubble to enhance and probably raise the level of the current platform where the existing house is built on.

The soil compositions vary from dry, dark brownish grey, loose silty sand; to slightly moist, dark brownish grey, loose clayey sand; to moist, greyish buffer, very loose silty sand. The silty sandy layer has isolated very loose zones.

In addition to the above, these soils comprise abundant grass rootlets in the upper 5mm, considerable roots up to 20mm in diameter and abundant construction rubble.

6.2 Transported Sediments

Underlain the fill materials is a layer of transported soils logged in the form of Hillwash and Littoral soils.

- **Littoral Soils**

  The littoral soils were recorded below the fill materials in both test pits with thicknesses of between 0.60m in the vicinity of TP1 and 1.60m in the proximity of TP2.

  The soil compositions consist of moist becoming saturated at 1.00m, yellowish grey, loose sand with less than 12% of clay in TP1. In TP2; These soils range from moist, dark greyish brown, very loose silty sand to moist, dark brownish grey, loose coarse clayey sand.

  Groundwater table is located in this layer at a depth of approximately 1.00m in the proximity of TP1.

6.3 Bedrock

The Dwyka Formation (diamictite and shales) sediments have been interpreted as being deposited in a glacial environment. As such the rock consists of a wide variety of rock fragments assembled by the glaciers as they move over the original host rock. Upon melting the fragments which vary in size from clay fraction to boulders are deposited into fluvial and lacustrine environments that ultimately consolidated to form diamictite, conglomerate, varvite and shale and a direct consequence of the environment of deposition, it is not unusual for a lenticular body of competent, shale to occur within a predominantly weaker and weathered diamictite horizon, or vice versa.

This rock type does not generally weather to great depths; however, the highly weathered diamictite observed on site was described as dark reddish grey, highly weathered, very soft rock.

6.4 Groundwater

Groundwater seepage was encountered during the investigation in TP1 from a depth of 1.00m.

7.0 Soil Sampling:

Two representative disturbed soil samples recovered in TP1 at depths of between 1.00 – 1.30m and in TP2 at depths ranging between 1.00 – 1.40m were taken for laboratory testing to determine the various engineering soil properties. The tests conducted on the soil sample recovered in TP2 include:

- Particle Size Distribution;
- Atterberg Limit and Linear Shrinkage; and
- MOD AASTHO and CBR tests.

While the soils sampled in TP1 were limited only to the foundation indicator tests. The detailed test results sheets are reported in Appendix D with the test summaries given in Table 3.

Table 3: Summary of the laboratory test results

Test Pit	**Depth (m)**	**Material**	**LS**	**PI**	**LL**	**GM**	**Grading (% comprising)**				**Potential Expansiveness**
							Gr	Sa	Si	Cl	
TP1	1.00 – 1.30	Silty SAND	1	SP	SP	0.92	0	86	5	9	Low
TP2	1.00 – 1.40	Poorly Graded Silty SAND	0	NP	NP	1.30	5	88	4	3	Low

LS: Linear Shrinkage
PI: Plastic Index
LL: Liquid Limit
GM: Grading Modulus
SP: Slightly Plastic

Gr: Gravel
Sa: Sand
Si: Silt
Cl: Clay
NP: Non Plastic

8.0 Discussion of the Laboratory Testing Results:

From the available information obtained during the site investigation and from the laboratory results, the following comments on the relevant geotechnical characteristics of the site can be made.

8.1 Grading Test Results

According to the unified soil classification and AASHTO soil classification, the samples recovered on site are classified as follows:

- TP1: the results of the soil grading show that this sample is a silty sand. The soil compositions are made up of transitional granular soils which have fines that are non-plastic (silt).
- TP2: the grading results depict that the sample is a poorly graded silty sand. These sandy soils will have no cohesion and may require a construction excavation slope of 2H to 1V or flatter. When dry the material will be similar to dry beach sand.

The results obtained from the soil classification tests are presented in Table 4 below and indicate the following:

Table 4: Summary of soil classifications

Test Pit	Depth (m)	Materials Type	Soil Classification		
			Unified System	AASHTO System	TRH 14
TP1	1.00 – 1.30	Silty SAND	SM	A-2-4	*
TP2	1.00 – 1.40	Poorly Graded Silty SAND	SP-SM	A-3 / A-2-4	G7

*: CBR tests were not conducted in the clayey sandy soils

8.2 Atterberg Limit and Linear Shrinkage

The soil sample recovered in TP1 and TP2 will behave as cohesionless soils.

The grading moduli yield the coefficient values of 0.92 in the silty sandy soils and 1.30 in the poorly graded silty sandy soils. These values indicate that the silty sands have negligible coarse grain particles while the poorly graded silty sands have substantial coarse grain sizes and will have higher CBR values at 100% Mod AASHTO density.

8.3 Expansive Soils

Based on laboratory results, both sands are considered to be inactive for movements (shrink – swell potential) due to their granular nature and low clay content.

8.4 Dry Density and Optimum Moisture Content

The results obtained from the compaction test on the poorly graded silty sandy soils are summarised in Table 5 below and indicate the following:

- The laboratory results show that the poorly silty sand has moderate maximum dry density and moderate optimum moisture content. The soil sample yielded adequate CBR values at densities typically specified in the field (90% to 93%).

- The in-situ moisture content of 4.9% indicates that the soils were dry than the optimum moisture content at the time of sampling and will require additional water to achieve an Optimum Moisture Content of 6.2%.

Table 5: Summary of the density test results.

TP No	Depth (m)	Material Type	Moisture Content	OMC (%)	MDD (kg/m^3)	Swell (%)	CBR at various densities				TRH 14
							90%	93%	95%	100%	
TP2	1.00 – 1.40	Poorly Graded Silty SAND	4.9	6.2	1899	0.72	14	22	29	52	G7

9.0 Discussion of the Field Test Results:

The natural ground on site consists of moderate slope of approximately 8° falling towards the southeastern extent of the site.

At the time of the fieldworks, it was observed that the area investigated has undergone previous bulk earthworks on which the current stepped platform has been benched into the natural slope to depths of approximately 2.00m. The finished platforms where the existing house is built has a very gentle to flat ground slope.

The test pit results show that the soil profile is composed of the fill materials, transported soils and the weathered diamictite bedrock. These materials are as follows:

- The fill are reworked materials which are composed of clayey sand; silty sand; silty sand with clay; and the accumulation of construction rubble and PVC sewer pipe. This layer occur in both test pits from the top of surface materials up to 0.70m.

- The transported soils are made up of littoral silty sand and coarse silty sand with less than 12% of clay. This layer was logged with thicknesses varying between 0.60m in TP1 and 1.60m in TP2.

  Groundwater table is located in this layer at a depth of 1.00m in TP1.

- Weathered diamictite bedrock was encountered in both test pits at relatively variable depths. It occurs below 1.30m in the test pit TP1 and 2.30m in the test pit TP2.

The soils consistencies are highly variable across the site. Very loose and loose consistencies were encountered on the fill materials and transported soils. Medium dense consistency was found on the highly weathered diamictite.

The DPL test results have been used to determine the consistency of the above materials and to derive, empirically, Estimated Allowable Safe Bearing Pressures (EASBP) for the soils. The estimation of the EASBP's is based on Terzaghi's settlement chart for 25 mm of settlement, using SPT values estimated from the DPL test results.

The very loose soils were generally found to have SPT values varying between 1 and 3. Based on these values the soil is anticipated to have an estimated bearing pressure of between 40 and 52kPa.

Hereafter, loose soils were generally found to have SPT values varying between 4 and 10. Based on these values the soil is anticipated to have an estimated bearing pressure of between 54 and 85kPa.

Below these sediments, medium dense materials were expected to have SPT values of between 10 and 29. Based on these values the soil is anticipated to have an estimated bearing pressure of between 88 – 225kPa.

Dense materials occur below these layers. These materials have SPT "N" values of between 31 and 34. Based on these values, the soils are anticipated to have an estimated bearing pressure ≥ 241kPa.

9.1 Geotechnical Considerations

The following geotechnical considerations, which could influence the proposed new house were identified as follows:

- The fill materials occur to a depth of 0.70m. This horizon is insignificant to bear the foundation load.

- The littoral sands occur with thicknesses ranging between 0.60 – 1.60m. The laboratory results indicate that the littoral soils are homogeneously formed, but vary from silty sand to poorly graded silty sand. The consistency varies from very loose with isolated loose zones to loose; indicating a layer which is likely to exhibit a collapsible grains structure. If the house is founded on these soils, and should the moisture content change, undesirable differential vertical movements could occur with resultant cracking of the structures.

- Weathered diamictite was encountered below the depths of 1.30m in TP1 and 2.30m in TP2; and is described as highly weathered and very soft rock. The DPL results depict that this layer has medium dense consistency and extends up to depths of between 3.60 and 6.90m.

  Furthermore, this layer is associated with pockets of low bearing capacities suggesting potential for differential settlement. Therefore, these soils are also not considered suitable founding material for a double storey house. If the house is founded on these materials and the moisture content should increase, unacceptable differential, vertical movements could occur, with the possibility of subsequent cracking of the structure.

- Based on the DPL test results, the competent diamictite bedrock materials are likely to occur at and bellow the depths tabulated in Table 6. Therefore, these levels of the bedrock are considered to be the competent levels that are suitable for founding the proposed houses.

  Table 6: Anticipated depths to top of rock

DPL No	Depth – Top to Rock (m)
1	3.90
2	4.20
3	4.80
4	5.40
5	6.90

In light of the above, it is recommended that the new house and associated structures be founded on ground beams spanning between the end bearing auger pile foundations as detailed in section 11.3.2 and 11.3.2.1.

10.0 Geotechnical Evaluation:

10.1 Slope Stability

The platforms where the existing house is built has a very gentle to flat ground slope and is considered stable in its current conformation. However, the DPL results show that the soil profile is characterised by an accumulation of very loose soils up to depths of between 0.60 and 1.50m. These soils have low cohesion of approximately 5kPa and very poor angles of friction, indicating that the slope might be at the limit of its stability and thus, considered to be unstable. Therefore, any cutting or removal of the binding grass may likely increase instability and induce slope failure.

Care must be taken during construction so as to not introduce slope instability by aggressive cutting and filling while undertaking the bulk earthworks on site.

10.2 Collapse Potential

The inspection pitting show that the soils on site are made up of very loose and loose sands up to depths of between 1.30 – 2.30m. These soils are likely to have a moderate to high collapse potential when subjected to an abnormal increase in moisture content under load; in that it tends to undergo a densification and subsequent settlement. This form of collapse settlement may result in the cracking of rigid brick and tile structures.

Based on the DPL tests, the very loose and loose soils which are likely to have a collapsible fabric are in the upper 1.80m to 5.70m of the soil profiles.

10.3 Excavatability

In terms of SANS 1200D Earthworks, Soft excavation conditions are anticipated to depths of between 3.90 – 6.90m using conventional earthwork equipment such the TLB. This assessment is based on the results of the DPL test which was advanced up to the DPL refusal logged at depths of between 3.90 – 6.90m.

Intermediate excavation may locally occur at and below the DPL refusal. If encountered the weathered diamictite bedrock are expected to be rippeable using an excavator with a 25 ton capacity or more.

10.4 Material Suitability and Construction Materials

The soil sample was collected on site in order to:

- Provide an indication of near surface materials suitability for excavation and re-use in the proposed engineered fill, driveway and pavement layer works and general earthworks, and
- Identify potentially problematic soil horizons.

Considering the above, the suitability of the materials encountered throughout; the site has been classified in accordance with TRH 14 (1985) as well as the Revised US Classification and is summarised in Table 7 below.

Table 7: Summary of the material suitability on site

TP	Depth (m)	Materials	Class & Group Index	TRH14 (1985)
1	1.00 – 1.30	Silty SAND	A-2-4	*
2	1.00 – 1.40	Poorly Graded Silty SAND	A-3 / A-2-4	G7

*: CBR test was not conducted on the sample.

This classification indicates the following:

- The poorly graded silty sands recovered in TP2 are classified as G7 in quality in term of TRH 14 (1985) and as A-3 / A-2-4 materials in accordance with the Revised US Classification. This classification indicates that the materials will be good for engineering fill / backfill in housing and for use as subgrade materials in driveway layer works.
- Furthermore, as noted in the appendix on page 18, under the table for California Bearing Ratio, TRH20 (1990), which takes shrinkage product and grading coefficient into consideration, the poorly graded silty sands and well as the silty sands lack cohesion and are highly susceptible to the formation of loose materials (raveling) and corrugations.

10.5 Erosion Potential

The poorly graded silty sand and silty sand encountered in the upper part on site are considered susceptible to erosion by both wind and flowing water due to the low cohesion between individual particles; hence, strict control of any storm water run-off must be taken both during and after construction.

Any permanent cut and fill embankment must be adequately vegetated as soon as possible after construction.

11.0 Recommendations:

11.1 Cut Embankments

- Cut embankment in the transported sands must be restricted to a slope batter of 1: 2 (26°).
- Should medium weathered diamictite or shale of the Dwyka Formation be exposed on site, these materials may be steepened to a maximum batter of 1:1 (45°), depending on joints and bedding orientation.

Any trench excavations or temporary cut embankments deeper than 1.20m must be suitably battered back or shored to prevent the collapse of sides under adverse conditions. Cut embankment must be protected against surface erosion by the planting of vegetation immediately after construction.

Furthermore, it is recommended that exposed rock faces be inspected by a qualified Engineering Geologist or Geotechnical Engineer at the time of cutting in order to assess the weathering condition of the rock, the bedding planes and the joint/bedding orientation relative to the cut-face.

11.2 Fill embankment

Prior to the placement of any fill embankments; the natural ground surface must be stripped of all vegetation. Areas of fills must be constructed with sandy type soils in layers not exceeding 300 mm loose thickness and be compacted to at least 93% Mod AASHTO Density for the sandy material, prior to the placement of the next layer. Fills should be compacted to within 2% of the optimum moisture content (OMC) and should the material become wet beyond the OMC, it must be allowed to dry out until the OMC is obtained.

11.3 Evaluation of Founding Conditions

11.3.1 Site Classification

In accordance with the NHBRC guidelines for geotechnical investigations, the site class designation for the proposed new house with associated structures is **P (Groundwater table) R - C2.**

The NHBRC parameters for classifying the founding material are shown in Table 8 while the subsequent foundation recommendations are given in Table 9.

Table 8: Residential site class designations (from NHBRC Part 1, Section 2, Table 1)

TYPICAL FOUNDING MATERIAL	***CHARACTER OF FOUNDING MATERIAL***	***EXPECTED RANGE OF TOTAL SOIL MOVEMENTS (mm)***	***ASSUMED DIFFERENTIAL MOVEMENT (% OF TOTAL)***	***SITE CLASS***
Weathered Rock (Diamictite)	Stable	Negligible	-	R
Silty sands & Poorly graded silty sand	Compressible and potentially collapsible soils	> 10	75	C2

Table 9: Foundation design, building procedures and precautionary measures for residential structures founded on soil horizons subject to both consolidation and collapse settlement (from NHBRC Part 1, Section 2, Table 6).

SITE CLASS	***ESTIMATED TOTAL SETTLEMENT (mm)***	***CONSTRUCTION TYPE***	***FOUNDATION DESIGN AND BUILDING PROCEDURES (Expected damage limited to category 1)***
C2	>10	Stiffened strip footings, stiffened or cellular raft	• Stiffened strip footings or stiffened or cellular raft with lightly reinforced or articulated masonry • Bearing pressure not to exceed 50 kPa • Fabric reinforcement in floor slabs • Site drainage and service and plumbing precautions
		Deep strip foundations	• Normal construction with drainage precautions • Founding on competent horizon below the problem horizons • Fabric reinforcement in floor slabs
		Compaction of in situ soils below individual footings	• Remove in situ material below foundation to a depth and width of 1.5 times the foundation width or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1% to +2% of OMC. • Normal construction with light reinforced strip foundations and light reinforcement in masonry.
		Piled or pier foundation	• Reinforced concrete ground beams or solid slabs on piled or pier foundations • Ground slabs with fabric reinforcement • Good site drainage
		Soil raft	• Remove in situ material to 1,0 m beyond the perimeter of the building to a depth of 1.5 times the widest foundation or to a competent horizon and replace with material compacted to 93 % MOD AASHTO density at −1 % to +2 % of optimum moisture content. • Normal construction with lightly reinforced strip footings and light reinforcement in masonry

11.3.2 Founding Solutions

As discussed in section 8, 9 and 10 of this report; the in-situ materials encountered on site up to depths tabulated in Table 6 are considered unsuitable in their natural state to act as founding medium for the loading that will be imposed by the house for the following reasons:

- The very loose and loose soils can be potentially problematic in terms of collapse / settlement if saturated under load.

- The maximum new stress imposed by the foundations of the house exceeds the Estimated Allowable Safe Bearing Pressure (EASBP) of the in-situ soils. Materials with high shear strength are only expected at and below the depths presented in Table 6.

Considering the above assessment, conventional reinforced strip foundations should not be placed within the very loose or loose silty sands which are potentially compressible and collapsible.

11.3.2.1 Founding Solution Summary

- **Piled Foundations**

In order to avoid the potential collapse / settlement and to accommodate the loading of the proposed new house and associated structures; it is recommended that the house and associated structures be founded on ground beams spanning between the end bearing auger pile foundations. The end bearing piles should be socketed within an unweathered or slightly weathered diamictite bedrock.

The advantages of piled foundations are that differential settlements of piles are negligible, they can be rapidly installed and the necessity to excavate deep, large column base pads or strip footing excavations are eliminated.

Giving consideration to the nature of the in-situ soils, it is recommended that Continuous Flight Augured (CFA) piles, rather than conventional open hole auger piles are used and the piles should be designed to act as end bearing piles (Table 10).

Table 10: Summary of pilling systems (after Byrne, G. & Berry, A. D. (2008) pp. 68)

Pile Type	Shaft Diameter (mm)	Working Load (kN)	Max. Tension Load (kN)	Max. Rake	Max Depth (m)
CFA Pile	300 - 750	Up to 6 MPa on shaft	Determined by end bearing	1:10	25

The following foundation good practice is also recommended:

- Prior to pouring concrete, all foundation excavation inverts to be free of loose soil,
- Under no condition should conventional strip foundations be placed within the very loose to loose clayey sands.
- In order to minimize the possibility of cracking due to differential foundation movement, brick force is to be placed in all brick courses in all foundation walls as well as in all courses above windows and doors.

Please note that the types of foundations are dependent on both, the founding conditions as well as the imposed loading of the proposed new house with associated structures.

11.4 Surface Beds

Within cut areas the surface beds will need to be placed on a compacted in situ material with a minimum 93% MOD AASHTO density. A 125mm thick G5 layer will be required as subbase to the surface bed compacted to 95% MOD AASHTO density. Construction joints will be required within the surface beds at centres not exceeding 4.5m.

Within fill areas, all surface beds are to be designed and constructed as suspended reinforced concrete slabs that span between the supporting foundation walls, with a suitably designed slip joint between the walls and the surface bed.

11.5 Stormwater Management

All stormwater run-off from the roof of the proposed new house; the garage loft apartments; the swimming pool and the surface stormwater are to be channelled, after suitable attenuation to pre-development stormwater flows, into the existing stormwater system.

12.0 Conclusions:

This report and associated documentation was undertaken for the specific purpose described in the report and should not be relied on for other purposes. This report was prepared solely for the use by **Mr. and Mrs. Emmanuel on Portion 292 of Farm Lot 61 No 1521, Sheffield Beach** and any reliance assumed by other parties on this report shall be at such parties own risk.

This report presents the results of a geotechnical investigation conducted on Portion 292 of Farm Lot 61 No 1521 located at number 99 Colwyn Drive in Sheffield Beach, Ballito, on behalf of Mr. and Mrs. Emmanuel for the new house with associated structures.

The site is considered suitable for the new development provided the recommendations given in this report are adhered to.

We trust that this report of our findings and conclusions will be of assistance. Should you require clarity on any point please do not hesitate in contacting the undersigned.

Yours Sincerely,

Rowan Shuttleworth
BSc (Civ. Eng.) Pr. Eng. MSICE. MBA (UCT)
(unsigned as sent by email)

MONOBLOCK
LABORATORIES – CONCRETE & GEOTECH

Lot 89 Coconut Grove
Shakas Industrial Park
Shakas Head
CK No: 2014/189452/07

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Email: nadia@monoblock.co.za

VAT No: 4130269808

APPENDIX A: PLANS

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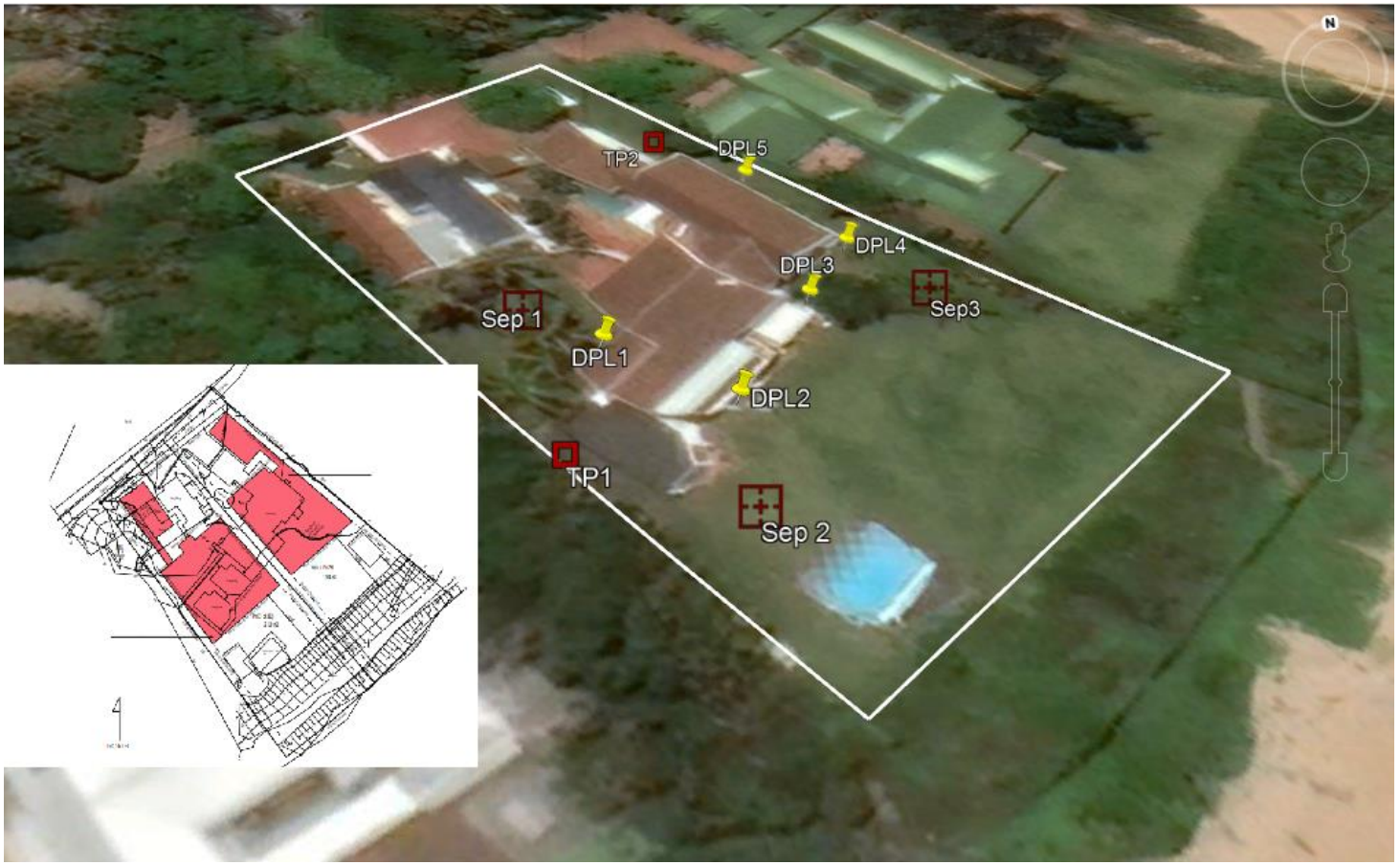

PROJECT: PROPOSED NEW DOUBLE STOREY HOUSES

CLIENT: Mr. ROB EMANUEL

FIGURE 2: VIEW OF THE PROJECT AREA – 99 COLWYN DRIVE, SHEFFIELD BEACH

KEY

DPL: Dynamic Penetrometer Light Test

TP: Test Pit

Sep: Septic Tank

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LABORATORIES – CONCRETE & GEOTECH

JOB NAME: PROPOSED NEW DOUBLE STOREY HOUSES

CLIENT: Mr. ROB EMANUEL

FIGURE 3: SITE GEOLOGY *(Ref: 2930 Geological Map Series)*

KEY C-Pd

DWYKA FORMATION

- Diamictite; subordinate varved shale and boulder shale.

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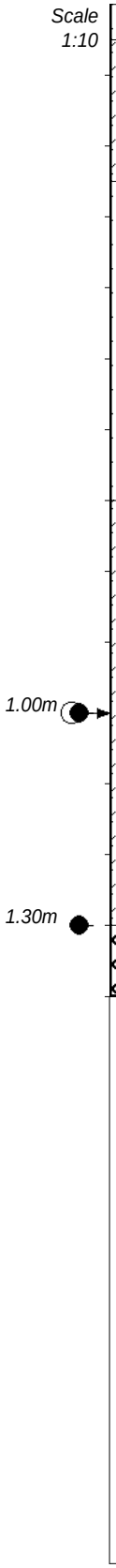
APPENDIX B: SOIL PROFILE LOGS

MONOBLOCK EST 1948
CONCRETE PRODUCTS - CIVIL & STRUCTURAL DESIGN

Mr. ROB EMANUEL
PROPOSED NEW DOUBLE STOREY HOUSES

HOLE No: TP1
Sheet 1 of 1

JOB NUMBER: MB 3628



0.00	Dry, dark greyish brown, loose, very fine to coarse grained, Silty SAND with gravel, abundant rootlets and scattered roots up to 5mm in diameter; Fill.
0.05	Slightly moist, dark brownish grey, loose with isolated very loose zones, very fine to fine grained, Clayey SAND with abundant rootlets and negligible roots up to 10mm in diameter, PVC sewer pipe; Fill.
0.25	Moist, greyish buffer, very loose, very fine to fine grained, Silty SAND with negligible roots; Fill.
0.70	Moist becoming saturated at 1.00m, yellowish grey, loose, very fine to fine grained, Clayey SAND; Littoral.
1.30	Dark reddish grey, highly weathered, very fine to fine grained, medium bedded, fractured, Very soft rock, Diamictite; Dwyka Formation.
1.40	

NOTES

1) Final depth at 1.40m.
2) Groundwater seepage at 1.00m.
3) No collapse.
4) Disturbed soil sample taken 1.00 - 1.30m.

CONTRACTOR : N/A
MACHINE : HAND EXCAVATION
DRILLED BY :
PROFILED BY : CHRISTIAN KAYER
TYPE SET BY : MONO BLOCK
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 20 JULY 2021
DATE : 23/07/2021 17:17
TEXT : ..vage\SoilprofileRev1.txt

ELEVATION :
X-COORD : 29d28'40.8"S
Y-COORD : 031d15'48.1"E

HOLE No: TP1

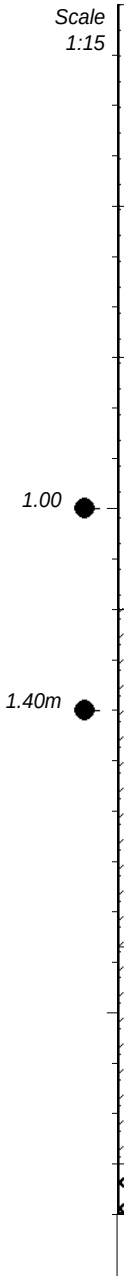
dotPLOT 7022

MONOBLOCK EST 1948
CONCRETE PRODUCTS - CIVIL & STRUCTURAL DESIGN

Mr. ROB EMANUEL
PROPOSED NEW DOUBLE STOREY HOUSES

HOLE No: TP2
Sheet 1 of 1

JOB NUMBER: MB 3628



0.00	Dry, dark brownish grey speckled white, loose with isolated very loose areas, very fine to coarse grained, Silty SAND with abundant rootlets in the upper 0.05m, considerable roots up to 20mm in diameter and abundant rubble; Fill.
0.40	Slightly moist, dark blueish grey speckled white, very loose, very fine to coarse grained, Silty SAND with Clay and abundant rootlets; Fill.
0.70	Moist, dark greyish brown speckled white, very loose, very fine to coarse grained, Silty SAND with negligible roots up to 10mm in diameter; Littoral.
1.20	Moist, dark brownish grey speckled white, loose, very fine to coarse grained, Coarse Clayey SAND, Littoral.
1.87	Moist, dark brownish grey speckled red, loose, very fine to coarse grained, Clayey SAND; Littoral.
2.30	Dark reddish grey, highly weathered, very fine to fine grained, medium bedded, fractured, very soft rock, Diamictite; Dwyka Formation.
2.40	

NOTES

1) Final depth at 2.40m.
2) No groundwater seepage.
3) No collapse.
4) Disturbed soil sample taken at 1.00 - 1.40m.

CONTRACTOR : N/A
MACHINE : HAND EXCAVATION
DRILLED BY :
PROFILED BY : CHRISTIAN KAYER

TYPE SET BY : MONO BLOCK
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 20 JULY 2021

DATE : 23/07/2021 17:17
TEXT : ..vage\SoilprofileRev1.txt

ELEVATION :
X-COORD : 29d28'39.4"S
Y-COORD : 031d15'48.6"E

HOLE No: TP2

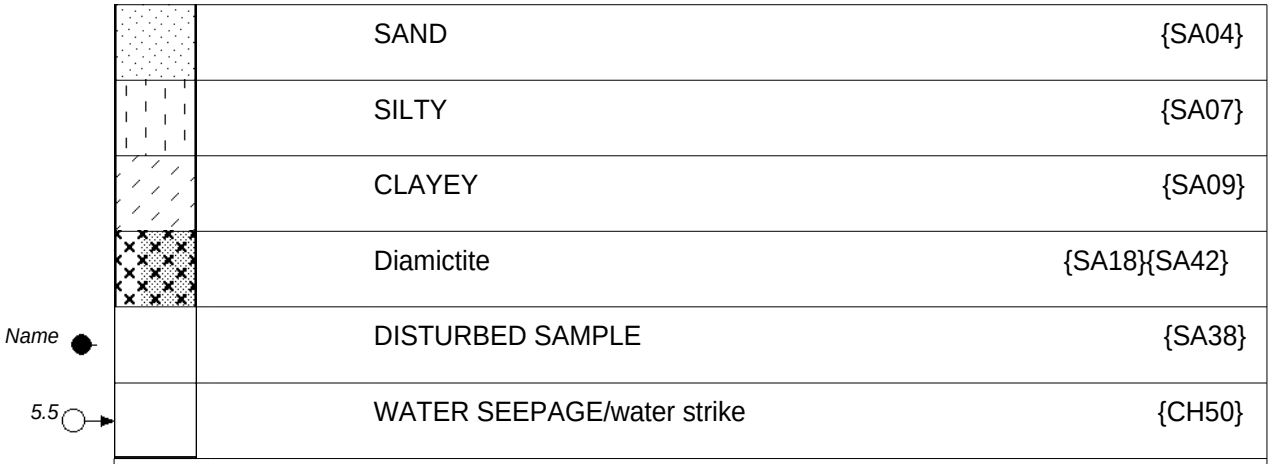
dotPLOT 7022

MONOBLOCK EST 1948
CONCRETE PRODUCTS - CIVIL & STRUCTURAL DESIGN

Mr. ROB EMANUEL
PROPOSED NEW DOUBLE STOREY HOUSES

LEGEND
Sheet 1 of 1

JOB NUMBER: MB 3628



CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY : MONO BLOCK
SETUP FILE : STANDARD.SET

DATE : 23/07/2021 17:17
TEXT : ..vage\SoilprofileRev1.txt

LEGEND
SUMMARY OF SYMBOLS

dotPLOT 7022

MONOBLOCK
LABORATORIES – CONCRETE & GEOTECH

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Shakas Head
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APPENDIX C: DYNAMIC PENETROMETER TESTS

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Shakas Head
CK No: 2014/189452/07

VAT No: 4130269808

Client : Mr. Rob Emmanuel
Project : House Emmanuel
Location : 99 Colwyn Drive, Sheffield Beach

Date : 20-Jul-21
Job Number : MB 3827

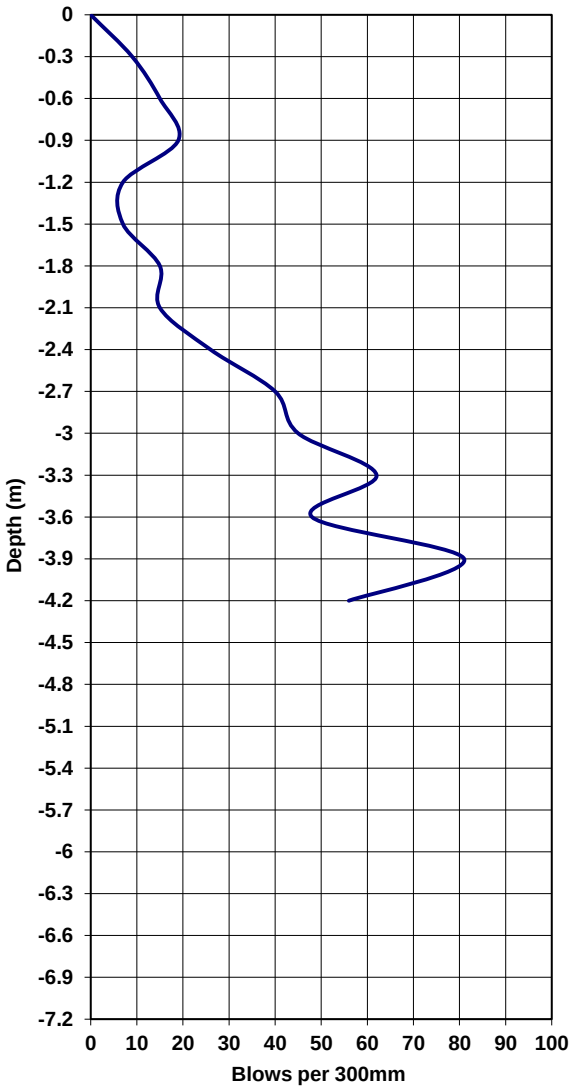
Coordinates Latitude S 29°28'40.40" Longitude E 31°15'48.32"

Dynamic Penetrometer Probe Light ---------- ***Test No. DPL 1***

THE ALLOWABLE BEARING PRESSURE DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Mass of Hammer = 10Kg falling 450mm; Cone Diameter = 25mm

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	9	V.Loose
0.6	15	Loose
0.9	19	Loose
1.2	7	V.Loose
1.5	7	V.Loose
1.8	15	Loose
2.1	15	Loose
2.4	26	Medium Dense
2.7	40	Medium Dense
3	45	Medium Dense
3.3	62	Medium Dense
3.6	48	Medium Dense
3.9	81	Dense
4.2	56	Medium Dense
	Refusal Bouncing	



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Shakas Head
CK No: 2014/189452/07

VAT No: 4130269808

Client : Mr. Rob Emmanuel
Project : House Emmanuel
Location : 99 Colwyn Drive, Sheffield Beach

Date : 20-Jul-21
Job Number : MB 3827

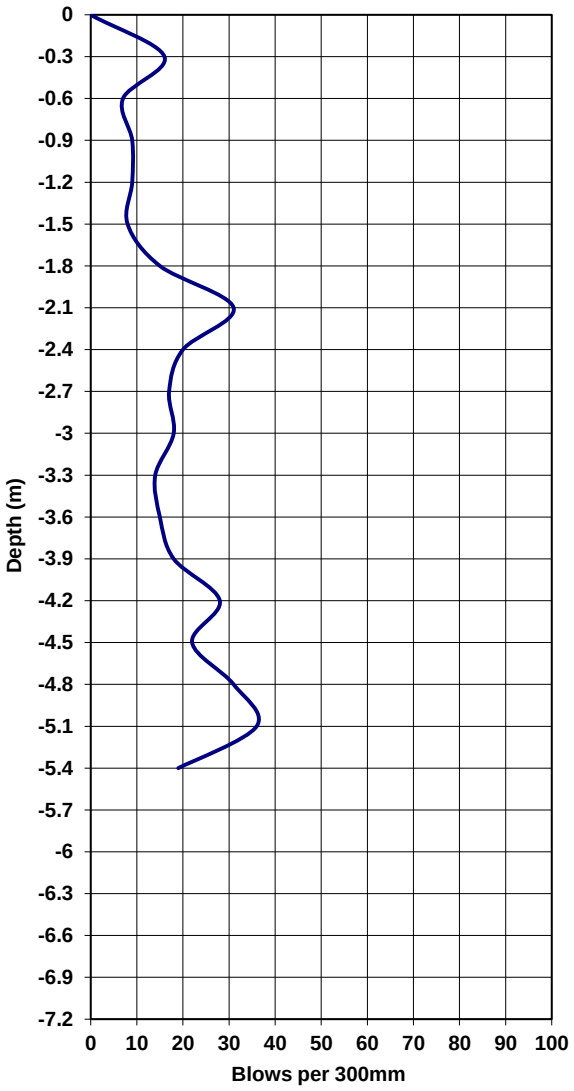
Coordinates Latitude S 29°28'40.57" Longitude E 31°15'48.65"

Dynamic Penetrometer Probe Light ---------- ***Test No. DPL 2***

THE ALLOWABLE BEARING PRESSURE DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Mass of Hammer = 10Kg falling 450mm; Cone Diameter = 25mm

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	16	Loose
0.6	7	V.Loose
0.9	9	V.Loose
1.2	9	V.Loose
1.5	8	V.Loose
1.8	15	Loose
2.1	31	Medium Dense
2.4	20	Loose
2.7	17	Loose
3	18	Loose
3.3	14	Loose
3.6	15	Loose
3.9	18	Loose
4.2	28	Medium Dense
4.5	22	Loose
4.8	31	Medium Dense
5.1	36	Medium Dense
5.4	19	Loose
	Refusal Bouncing	



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Shakas Head
CK No: 2014/189452/07

VAT No: 4130269808

Client : Mr. Rob Emmanuel
Project : House Emmanuel
Location : 99 Colwyn Drive, Sheffield Beach

Date : 20-Jul-21
Job Number : MB 3827

Coordinates Latitude S 29°28'40.14" Longitude E 31°15'48.96"

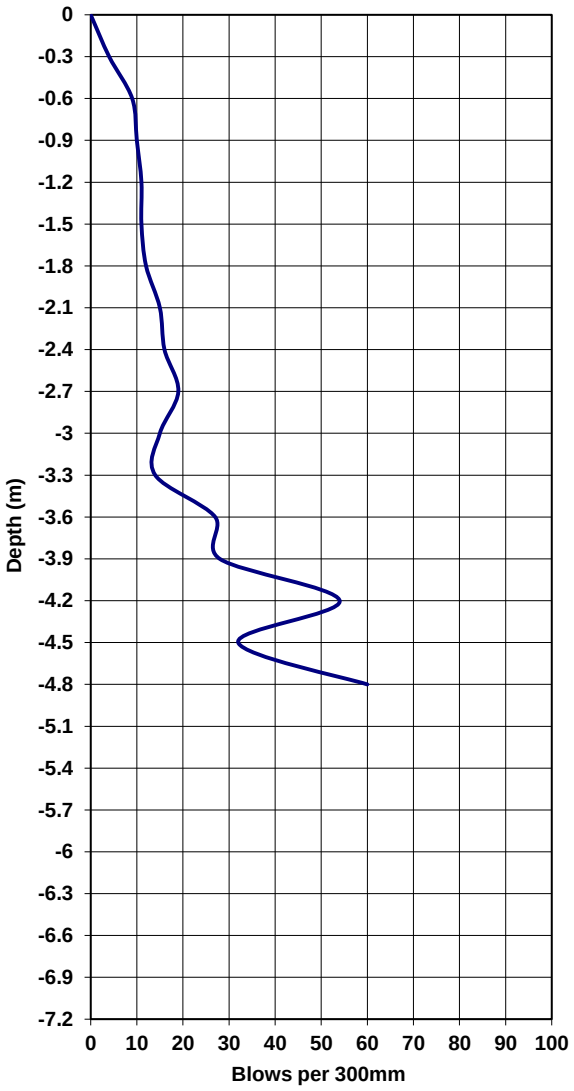
Dynamic Penetrometer Probe Light ---------- ***Test No. DPL 3***

THE ALLOWABLE BEARING PRESSURE DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Mass of Hammer = 10Kg falling 450mm; Cone Diameter = 25mm

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	4	V.Loose
0.6	9	V.Loose
0.9	10	Loose
1.2	11	Loose
1.5	11	Loose
1.8	12	Loose
2.1	15	Loose
2.4	16	Loose
2.7	19	Loose
3	15	Loose
3.3	14	Loose
3.6	27	Medium Dense
3.9	28	Medium Dense
4.2	54	Medium Dense
4.5	32	Medium Dense
4.8	60	Medium Dense

Refusal Bouncing



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Shakas Industrial Park
Shakas Head
CK No: 2014/189452/07

VAT No: 4130269808

Client : Mr. Rob Emmanuel
Project : House Emmanuel
Location : 99 Colwyn Drive, Sheffield Beach

Date : 20-Jul-21
Job Number : MB 3827

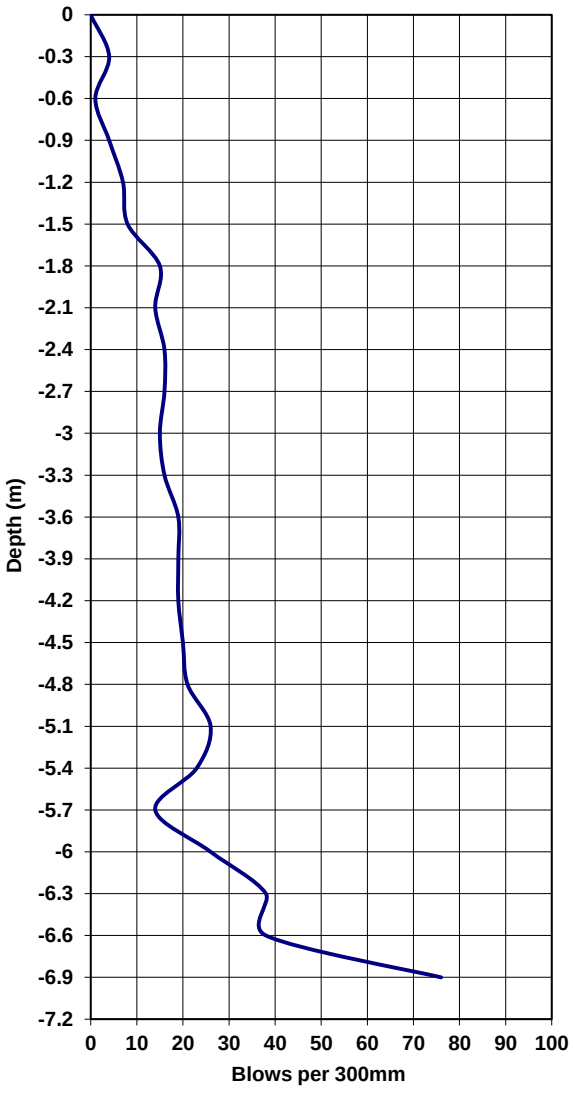
Coordinates Latitude S 29°28'39.88" Longitude E 31°15'49.15"

Dynamic Penetrometer Probe Light ---------- ***Test No. DPL 4***

THE ALLOWABLE BEARING PRESSURE DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Mass of Hammer = 10Kg falling 450mm; Cone Diameter = 25mm

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	4	V.Loose
0.6	1	V.Loose
0.9	4	V.Loose
1.2	7	V.Loose
1.5	8	V.Loose
1.8	15	Loose
2.1	14	Loose
2.4	16	Loose
2.7	16	Loose
3	15	Loose
3.3	16	Loose
3.6	19	Loose
3.9	19	Loose
4.2	19	Loose
4.5	20	Loose
4.8	21	Loose
5.1	26	Medium Dense
5.4	23	Loose
5.7	14	Loose
6	26	Medium Dense
6.3	38	Medium Dense
6.6	38	Medium Dense
6.9	76	Medium Dense
	Refusal Bouncing	



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Shakas Head
CK No: 2014/189452/07

VAT No: 4130269808

Client : Mr. Rob Emmanuel
Project : House Emmanuel
Location : 99 Colwyn Drive, Sheffield Beach

Date : 20-Jul-21
Job Number : MB 3827

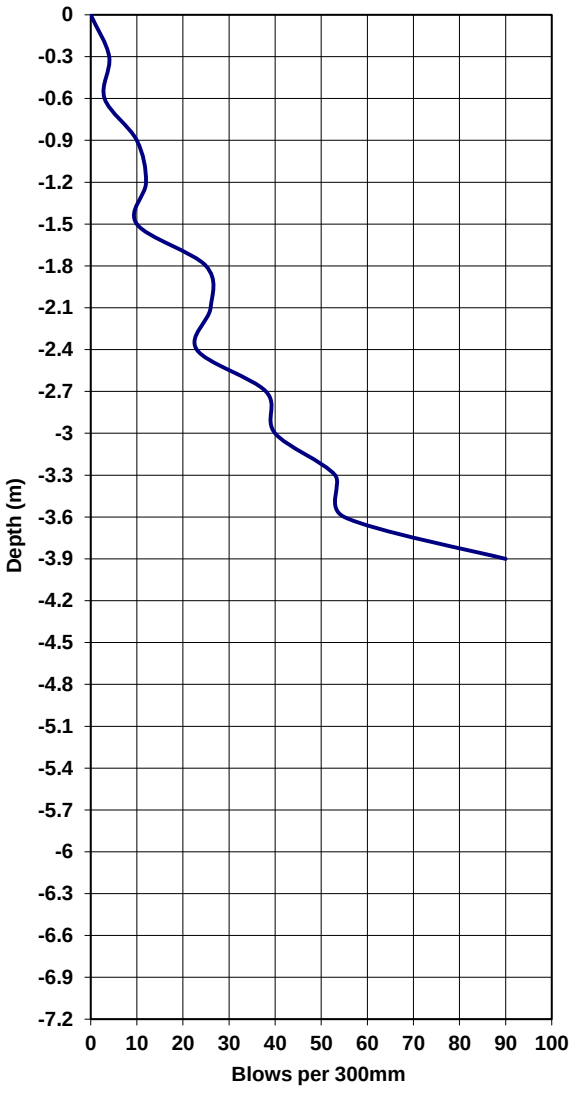
Coordinates Latitude S 29°28'39.59" Longitude E 31°15'48.91"

Dynamic Penetrometer Probe Light ---------- ***Test No. DPL 5***

THE ALLOWABLE BEARING PRESSURE DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Mass of Hammer = 10Kg falling 450mm; Cone Diameter = 25mm

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	4	V.Loose
0.6	3	V.Loose
0.9	10	Loose
1.2	12	Loose
1.5	10	Loose
1.8	25	Loose
2.1	26	Medium Dense
2.4	23	Loose
2.7	38	Medium Dense
3	40	Medium Dense
3.3	53	Medium Dense
3.6	55	Medium Dense
3.9	90	Dense
	Refusal Bouncing	



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VAT No: 4130269808

APPENDIX D: LAB RESULTS

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CONCRETE PRODUCTS - CIVIL & STRUCTURAL DESIGN
Consulting Civil, Geotechnical & Structural Engineers
Reg No. CK 9959460/23

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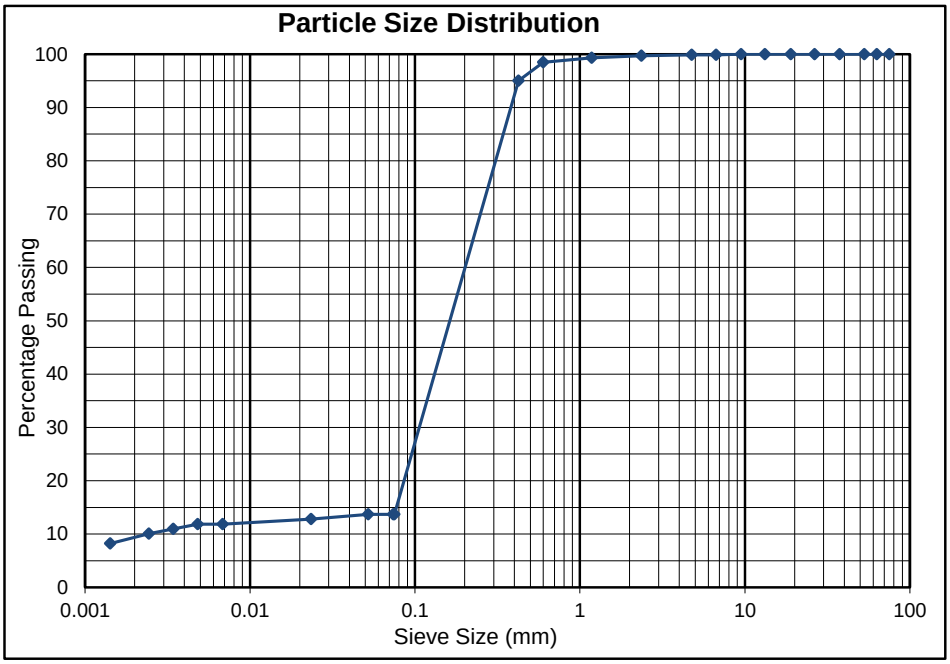
Web: www.monoblock.co.za

Customer :	Mr. Rob Emanuel	Project :	House Emanuel
	99 Colwyn Drive	Date Received :	26.06.2021
	Sheffield Beach	Date Reported :	26.07.2021
	4420	Req. Number :	MB 3627
Attention :	Mr. Rob Emanuel	No. of Pages :	1 of 1

TEST REPORT
FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

Sample Position (SV)		TP1
Depth (mm)		1000 - 1300
Sample No		1747
Materials Description	Source	In-situ
	Colour	Yellowish Grey
	Soil Type	Silty Sand
	Classification	NA

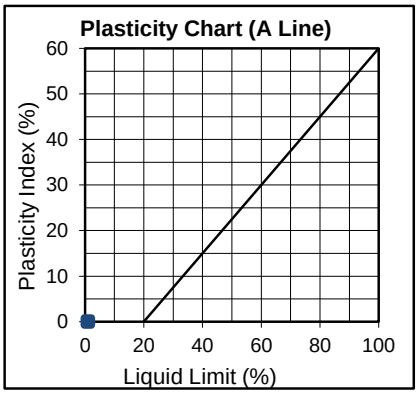
Sieve Size	% Passing
75.0	100
63.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	100
6.7	100
4.75	100
2.36	100
1.18	99
0.600	99
0.425	95
0.075	14
0.074	14
0.052	14
0.023	13
0.007	12
0.005	12
0.003	11
0.002	10
0.001	8

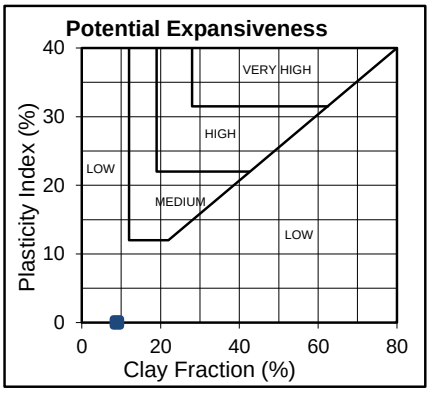


Liquid Limit (%)	SP
Plasticity Index (%)	SP
Linear Shrinkage (%)	1
Moisture Content (%)	14.5

% Clay	9
% Silt	5
% Sand	86
% Gravel	0

Unified Soil Classification	SM
AASHTO Soil Classification	A-2-4





- **Specimens sampled by Monoblock according to sampling Plan TMH 5 Methods MB1 & MC1**
- **Specimens sampled by : Christian Kayer**
- **The weather conditions are such that there is no detrimental effect on the sample taken.**

R Shuttleworth (Member)
For Monoblock cc.
Technical Signatory

1. The opinion column is an interpretation of the direct comparison between the quoted specification and the single test sample results obtained. The compliant (✓), non compliant (×) and uncertain (∗) 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 (∗) 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 (✓) or non compliant (×) 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 Members of Monoblock cc.
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.
5. While every care is taken to ensure the correctness of all tests and reports, neither Monoblock cc nor its employees shall be liable in any way whatever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequence thereof.

MONOBLOCK EST 1968
CONCRETE PRODUCTS - CIVIL & STRUCTURAL DESIGN
Consulting Civil, Geotechnical & Structural Engineers
Reg No. CK 9959460/23

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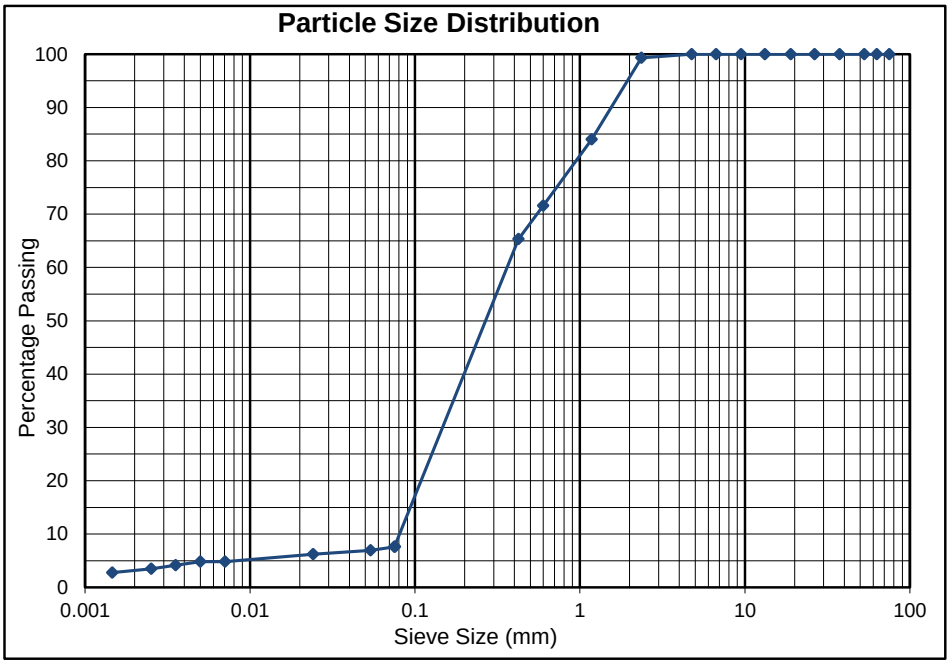
Customer :	Mr. Rob Emanuel	Project :	House Emanuel
	99 Colwyn Drive	Date Received :	26.06.2021
	Sheffield Beach	Date Reported :	26.07.2021
	4420	Req. Number :	MB 3627
Attention :	Mr. Rob Emanuel	No. of Pages :	1 of 1

TEST REPORT
FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

Sample Position (SV)		TP2
Depth (mm)		1000 - 1400
Sample No		1748
Materials Description	Source	In-situ
	Colour	Dark Brownish Grey
	Soil Type	Poorly Graded Silty Sand
	Classification	NA

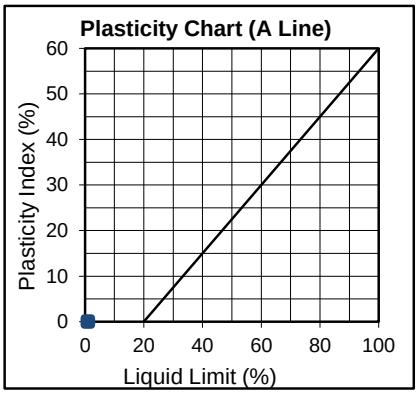
Sieve Size	% Passing
75.0	100
63.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	100
6.7	100
4.75	100
2.36	99
1.18	84
0.600	72
0.425	65
0.075	8
0.076	8
0.054	7
0.024	6
0.007	5
0.005	5
0.004	4
0.003	3
0.001	3

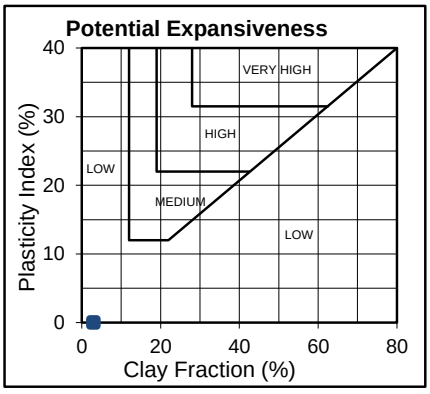


Liquid Limit (%)	NP
Plasticity Index (%)	NP
Linear Shrinkage (%)	0
Moisture Content (%)	4.9

% Clay	3
% Silt	4
% Sand	88
% Gravel	5

Unified Soil Classification	SP-SM
AASHTO Soil Classification	A-3 / A-2-4





- **Specimens sampled by Monoblock according to sampling Plan TMH 5 Methods MB1 & MC1**
- **Specimens sampled by : Christian Kayer**
- **The weather conditions are such that there is no detrimental effect on the sample taken.**

R Shuttleworth (Member)
For Monoblock cc.
Technical Signatory

1. The opinion column is an interpretation of the direct comparison between the quoted specification and the single test sample results obtained. The compliant (✓), non compliant (×) and uncertain (∗) opinion indicators are based on an approximate 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.
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5. While every care is taken to ensure the correctness of all tests and reports, neither Monoblock cc nor its employees shall be liable in any way whatever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequence thereof.

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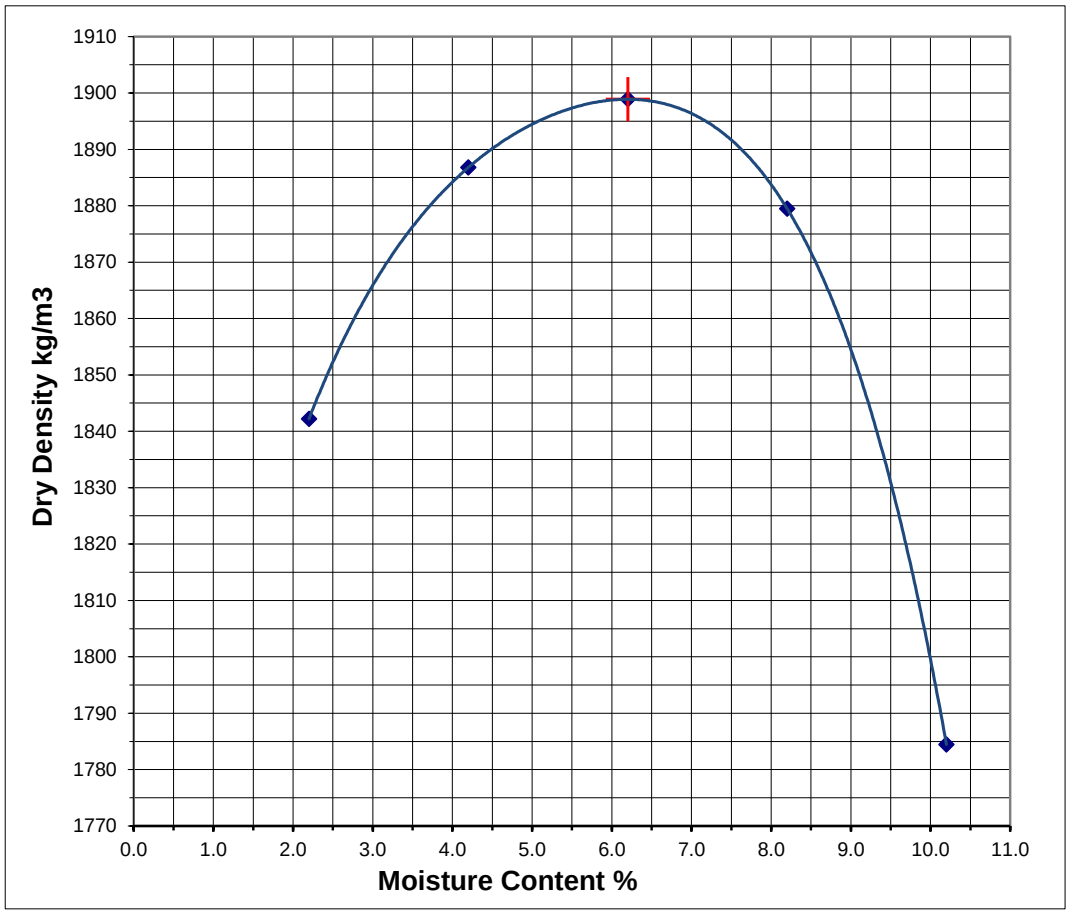
Web: www.monoblock.co.za

Customer :	Mr. Rob Emanuel	Project :	House Emanuel
	99 Colwyn Drive	Date Received :	20.07.2021
	Sheffield Beach	Date Reported :	22.07.2021
	4420	Req. Number :	MB 3627
Attention :	Mr. Rob Emanuel	No. of Pages :	1 of 1

TEST REPORT
MAXIMUM DRY DENSITY & OPTIMUM MOISTURE CONTENT - (SANS 3001 Method GR20 / GR30 / GR31)

Sample Position (SV)		TP2
Depth (mm)		1000 - 1400
Sample No		1748
Materials Description	Source	In-situ
	Colour	Dark Brownish Grey
	Soil Type	Poorly Graded Silty SAND
	Classification	-

Maximum Dry Density (kg/m3)	1899
Optimum Moisture Content (%)	6.2



- **Specimens sampled by Monoblock according to sampling Plan TMH 5 Methods MB1 & MC1**
- **Specimens sampled by : Christian Kayer**
- **The weather conditions are such that there is no detrimental effect on the sample taken.**
- **Samples prepared by scalping method.**

R Shuttleworth (Member)
For Monoblock cc.
Technical Signatory

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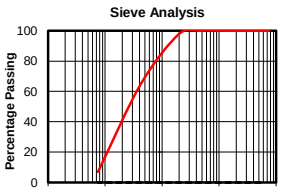
Customer :	Mr. Rob Emanuel	Project :	House Emanuel
	99 Colwyn Drive	Date Received :	20.07.2021
	Sheffield Beach	Date Reported :	26/07/2021
	4420	Req. Number :	MB 3627
Attention :	Mr. Rob Emanuel	No. of Pages :	1 of 1

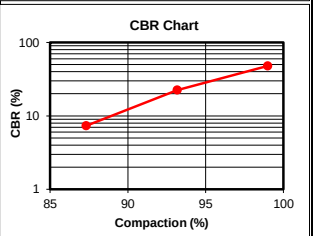
TEST REPORT

CALIFORNIA BEARING RATIO - (TMH 1 Method A1(a),A2,A3,A4,A5,A7,A8)

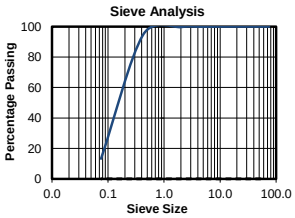
Material Indicators								
Sample Position (SV)		TP2	Spec.	Opinion	TP1			
Depth (mm)		1000 - 1400	G7 SSG - TRH 14		1000 - 1300			
Sample No		1748			1747			
Materials Description	Source	In-situ			In-situ			
	Colour	Dark Brownish Grey			Yellowish Grey			
	Soil Type	Poorly Graded Silty SAND			Silty SAND			
	Classification							
Max. Stone size in hole (mm)								
Percentage Passing	75.0 mm	100			100			
	63.0 mm	100			100			
	53.0 mm	100			100			
	37.5 mm	100			100			
	26.5 mm	100			100			
	19.0 mm	100			100			
	13.2 mm	100			100			
	4.75 mm	100			100			
	2.00 mm	98			100			
	0.425 mm	65			95			
	0.075 mm	7.0			13.3			
Soil Mortar & Constants								
Grading Modulus		1.30	≥0.75	✓	0.92			
Coarse Sand <2.0 >0.425		33.7			4.9			
Med. <0.250 >0.150		59.2			81.7			
Silt <0.075		7.1			13.3			
Liquid Limit (%)		NP			SP			
Plasticity Index (%)		NP	≤12	✓	SP			
Linear Shrinkage (%)		0.0			0.5			
CBR / Density Relationship								
MOD	Max Dry Density (kg/m³)	1899						
	Opt Moisture Content (%)	6.2						
	Mould Moisture Con. (%)	6.1						
	@100% Mod AASHTO	99.0						
	Swell (%)	0.72	≤1.5	✓				
NRB	100% NRB	93.2						
	Swell (%)	0.69						
Proc	100% Proctor	87.3						
	Swell (%)	0.00						
CBR	@ 100% Mod AASHTO	52						
	@ 98% Mod AASHTO	44						
	@ 95% Mod AASHTO	29						
	@ 93% Mod AASHTO	22	≥15	✓				
	@ 90% Mod AASHTO	14						
Insitu Moisture Content (%)		4.9			14.5			
Soil Classification								
TRH 14		G7						
AASTHO System		A-3 / A-2-4			A-2-4			
Unified System		SW-SM			SM			

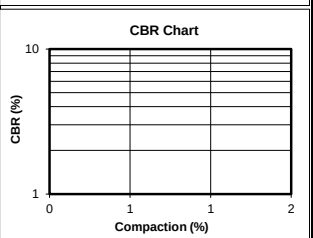
1748



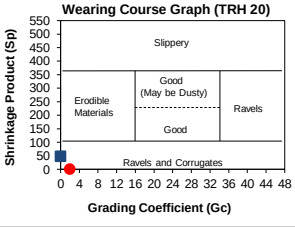


1747





● 1748 ■ 1747



- **Specimens sampled by Monoblock according to sampling Plan TMH 5 Methods MB1 & MC1**
- **Specimens sampled by : Christian Muteb**
- **The weather conditions are such that there is no detrimental effect on the sample taken.**

R Shuttleworth (Member)
For Monoblock cc.
Technical Signatory

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MONOBLOCK
LABORATORIES – CONCRETE & GEOTECH

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CK No: 2014/189452/07

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APPENDIX E: PHOTOGRAPHIC LOG

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UMHLALI
4390
Tel: (032) 947 0716
Fax: (032) 947 0718
Web: www.monoblock.co.za

PHOTOGRAPHIC LOG		No : 1
Client Name : Mr. Rob Emmanuel	Project: Proposed New Double Storey House	Project : MB 3627
Photo No :1 / Date : 20/05/2021 Description : TP1 Illustration of the side walls and depth of the trial pit TP1. Depth: 0.00 – 1.00m.		
Client Name : Mr. Rob Emmanuel	Project: Proposed New Double Storey House	Project : MB 3627
Photo No :2 / Date : 20/05/2021 Description : TP1 Illustration of the area where TP1 was dug.		

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PHOTOGRAPHIC LOG		No : 2
Client Name : Mr. Rob Emmanuel	Project: Proposed New Double Storey House	Project : MB 3627
Photo No :3 / Date : 20/05/2021 Description : TP2 Illustration of the side walls and depth of the trial pit TP1. Depth: 0.00 – 1.00m.		
Client Name : Mr. Rob Emmanuel	Project: Proposed New Double Storey House	Project : MB 3627
Photo No :4 / Date : 20/05/2021 Description : TP2 Illustration of the stockpile dug in TP2.		

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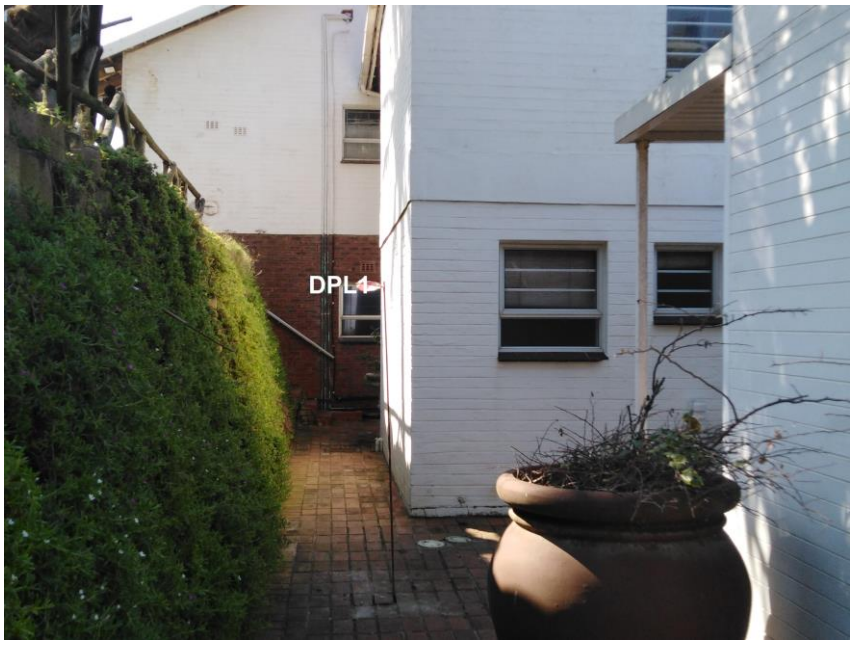
Web: www.monoblock.co.za

PHOTOGRAPHIC LOG		No :	3
Client Name : Mr. Rob Emmanuel	Project: Proposed New Double Storey House	Project : MB 3627	
Photo No :5 / Date : 20/05/2021			
Description : Illustration of the location of the DPL test DPL1			
Client Name : Mr. Rob Emmanuel	Project: Proposed New Double Storey House	Project : MB 3627	
Photo No :6 / Date : 20/05/2021			
Description : Illustration of the location of the DPL test DPL2			

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PHOTOGRAPHIC LOG		No :	4
Client Name : Mr. Rob Emmanuel	Project: Proposed New Double Storey House	Project : MB 3627	
Photo No :7 / Date : 20/05/2021			
Description : Illustration of the location of the DPL test DPL3			
Client Name : Mr. Rob Emmanuel	Project: Proposed New Double Storey House	Project : MB 3627	
Photo No :8 / Date : 20/05/2021			
Description : Illustration of the location of the DPL test DPL4 & DPL5			