REPORT ON THE GEOTECHNICAL INVESTIGATION CARRIED OUT FOR THE PROPOSED RESIDENTIAL DEVELOPMENT ON THE REMAINDER OF ERF 582 BEDFORDVIEW EXTENSION 113 GAUTENG PROVINCE

Requested by:

HAUZ DEVELOPMENTS

Detail reporting stage

Report by:

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1. INTRODUCTION

Geo Simplicity Geotechnical Engineering (Pty) Ltd was appointed to carry out a geotechnical investigation for the proposed residential development on the Remainder of Erf 582 Bedfordview Extension 113, Gauteng Province.

The proposed development comprises of double storey free-standing residential structures.

At the time of our fieldwork the site was cleared.

The investigation was carried out at the request of our Client, Messrs Hauz Developments.

Permission to proceed with the geotechnical investigation was granted via email and the fieldwork was carried out on 16 July 2024.

The samples for laboratory testing were handed over to Messrs Roadlab (Pty) Ltd for physical and chemical testing.

2. PURPOSE OF THE INVESTIGATION

The purpose of the geotechnical investigation is to:

- Establish the engineering properties of the soils and rock underlying the site, encountered during our fieldwork.
- Confirm the soil and rock horizons encountered during our fieldwork in accordance with standard practice.
- Identify any potential problem soils which may contribute to differential settlement and/or heave.
- Determine the allowable bearing capacity and settlement characteristics of the in-situ soils and/or rock.
- Determine excavatability within the in-situ materials.
- Confirm near surface groundwater occurrence and associated expected flow rates for dewatering purposes.
- Assess and provide recommendations with regards to slope stability.
- Provide recommendations with regards to the in-situ soils' corrosiveness.
- Provide the site class designation in accordance with the NHBRC.
- Put forward recommendations with regards to the founding of the proposed double storey structures.
- Provide recommendations with regards to road and surface bed preparation, layer works and road surfacing for access roads and parking areas.
- Provide an indication of the in-situ material's re-use potential with specific reference to bulk backfilling and pavement layers for access roads and parking pavements.

3. METHOD OF INVESTIGATION

3.1 *Desk study*

The desk study was completed utilising published literature and mapping of the area. Appropriate information was obtained from the following sources:

- The 1:250 000 geological series map East Rand, sheet 2628.
- An extract of the development description.
- References as listed under clause 6 of the report.

3.2 *Digging of test holes and soil profiling*

In total, 6No representative test holes were dug as such not to damage any known underground services, and where it was safe and accessible to carry out our fieldwork.

The test holes were dug by means of a CAT 428C Tractor Loader & Backactor (TLB) supplied by the Client.

The machine was in an excellent working condition with no mechanical problems to be reported, allowing effective advance to its maximum digging reach which was established to vary between 3,0m and 3,3m below Ground Level at Geotechnical (GLG) investigation stage, pending on the machine's orientation during digging.

The soil was profiled in-situ and it was carried out in accordance with the "Revised Guide to Soil Profiling for Civil Engineering Purposes in S.A." by Jennings, Brink and Williams, immediately after digging thereof by a professionally registered geotechnical engineer.

From a safety precautionary measure point of view, all test holes were thoroughly backfilled immediately after profiling was completed.

The test hole position locality plan (Figure 1: Test hole positions) is included in Annexure A of the report.

3.3 *Sampling and laboratory testing*

In total, 5No representative disturbed samples of the in-situ material were taken for laboratory testing.

The occurrence of scattered grass, plant and/or tree roots within the hillwash transported horizon, as well as the occurrence of gravel (pebblemarker specifically), ferricrete nodules especially within the reworked residual soils and relic jointing within the residual soils made undisturbed sampling impossible.

Nonetheless, sufficient visual information was gathered during soil profiling to carry out our assessment and to provide diligent and site-specific recommendations accordingly.

The following laboratory testing was carried out:

- 5No x Foundation Indicator Tests, which comprises of Atterberg Limits, dry and wet grading analysis (sieve analysis and hydrometer testing, respectively),
- 1No x Maximum Dry Density and Optimum Moisture (MOD) Tests,
- 1No x California Bearing Ratio (CBR) Tests, and
- 5No x pH and Conductivity Tests.

The main objective of tests are as follows:

- Foundation indicator testing: To provide basic classification of the soils in terms of potential expansiveness and to predict their re-use potential for backfill, and possibly, for pavement construction purposes.
- MOD and CBR testing: To confirm the re-use potential of specific in-situ soils with specific reference to pavement construction material identification.

- Chemical soil aggressiveness testing: To determine the proneness of the in-situ material to corrosivity with specific reference to underground services (stormwater, water reticulation and sewer pipes and electrical cables).

The laboratory test results are included in Annexure C of the report.

4. GEOLOGY AND GENERALIZED SOIL PROFILE

According to the 1:250 000 East Rand 2628 geological map, the site is underlain by Breccia, Conglomerate, Greywacke or Shale of the Platberg Group, Ventersdorp Supergroup.

However, based on the findings of our test pitting the site is in fact underlain by Lava of the Ventersdorp Supergroup.

In addition, recent transported horizons, of which both hillwash and pebblemarker transported horizons were encountered during test pitting.

The regional geology of the site and surrounding area, together with the various soil horizons encountered during profiling are illustrated in the figure included in Annexure A and summarized in the table following on the next page, respectively.

The detailed material horizons, with specific reference to moisture content, colour, soil consistency, structure, soil type and origin are summarized in the comprehensive test hole profiles forming part of this report – see Annexure B.

The test hole photographs, showing the different material horizons encountered, are attached (see Annexure D) to the report.

5. DISCUSSION AND RECOMMENDATIONS

5.1 *Topography and drainage*

The site falls slightly to moderately from the West to the East with an estimated slope of 5%.

Therefore, at the time of our fieldwork, adequate surface water run-off with a moderate probability of sporadic ponding is expected to occur on site, especially during downpours.

It is therefore advisable that all new structural platforms and road prisms be adequately shaped and drainage paths introduced in order to assist channelling of surface water run-off and to contribute towards the internal stability of structures.

In addition, we recommend that 0,8m wide (minimum) apron slabs be placed around the perimeter of all structures, purely as an attempt to assist with effective channelling of surface water run-off and to prevent moisture content fluctuations at near surface level which may contribute towards differential settlement within the near surface soils.

5.2 *Mode of weathering*

The weathering products of rock depend mainly on the rock forming minerals (parent material), the climatic conditions under which they had formed and the time of exposure to weathering processes.

In arid conditions, the weathering of rock results mainly from mechanical disintegration through wind erosion and temperature changes. The resultant soil consists mainly of the original rock forming minerals without significant changes that have taken place of the mineral composition.

In warm humid conditions chemical decomposition is the dominant mode of weathering which may change the original rock forming minerals into secondary minerals within the zone of weathering. Minerals in this zone react with water, oxygen and carbon dioxide at atmospheric pressures to produce residual soils.

Material description	Depth ranges encountered in test holes (m)					
	TH01	TH02	TH03	TH04	TH05	TH06
Dry to slightly moist, dark olive and orange-brown, speckled black, *medium dense, organic*, fine to medium grained silty and gravelly SAND with abundant scattered grass and plant roots in profile. Surficial topsoil.	-	0.0-0.25	-	-	-	0.0-0.2
Slightly moist, dark olive-brown, streaked dark reddish-brown with intermittent light brown zones, mottled and blotched red, *massive*, fine to coarse grained sandy GRAVEL with frequent scattered cobbles (up to 100mm in dia) and builder's rubble (bricks and concrete fragments) in profile. Non-engineered fill.	-	-	0.0-1.0 *Medium dense* P = <50kPa	0.0-0.3 *Medium dense* P = <50kPa	-	-
Ranging betweem dry to slightly moist and slightly moist, dark olive-brown, *ranging between apparently loose to medium dense and dense in profile but potentially compressible*, fine to medium grained SILT-SAND with scattered grass, plant and/or tree roots in places. Hillwash transported.	0.0-0.45 *Potentially compressible* P = <50kPa	0.25-0.8 *Potentially compressible* P = <50kPa	1.0-1.25 *Potentially compressible* P = <50kPa	0.3-0.6 *Potentially compressible* P = <50kPa	0.0-0.3 *Potentially compressible* P = <50kPa	0.2-1.05 *Potentially compressible* P = <50kPa
Ranging between dry to slightly moist and slightly moist to moist, dark olive-brown, speckled and mottled dusky white and yellow-orange, speckled black, *massive*, fine to coarse grained GRAVEL in a fine to medium grained SILT-SAND matrix with frequent scattered cobbles (up to 100mm in dia) in profile. Pebblemarker transported.	0.45-0.75 *Medium dense* P = 50kPa	0.8-1.2 *Medium dense to dense* P = 50kPa	1.25-1.4 *Dense* P = 80kPa	0.6-0.8 *Medium dense* P = 50kPa	-	1.05-1.55 *Medium dense* P = 50kPa
Ranging between dry to slightly moist and slightly moist to moist with shades of yellow, olive, red, orange and brown, *ferruginous and relic jointed*, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile. Reworked residual lava.	0.75-2.4 *Medium dense to dense* P = 80kPa	1.2-3.2 *Medium dense* P = 50kPa	1.4-3.05 *Medium dense to dense* P = 80kPa	0.8-1.4 *Medium dense* P = 50kPa 1.4-3.3 *Medium dense to dense* P = 80kPa	0.3-0.9 *Medium dense to dense* P = 50kPa 0.9-1.3 *Medium dense* P = 50kPa	1.55-2.3 *Medium dense* P = 50kPa 2.3-3.2 *Dense* P = 150kPa
Ranging between dry to slightly moist and slightly moist, light yellow-olive and slightly reddish-brown, streaked black, *relic jointed*, sandy and clayey SILT. Residual lava.	2.4-3.0 *Stiff* P = 150kPa	-	3.05-3.3 *Stiff* P = 150kPa	-	1.3-2.6 *Firm* P = 50kPa 2.6-3.2 *Stiff* P = 150kPa	-

Note:

P = Predicted allowable bearing capacity (total settlement < 10mm) should conventional shallow foundations be placed at horizon invert level (kPa).

Summary of soil horizons encountered

The residual soils produced are a mixture of resistant primary minerals such as quartz, insoluble weathering products such as alumina or silica and new or secondary minerals such as clays. It may also contain soluble products such as chloride, sulphate and bicarbonate of sodium, potassium, magnesium, or calcium, which may subsequently be leached out.

Climate does not only determine the mode of weathering which is likely to take place, but also the rate of weathering. The effect of climate on the weathering process (i.e. soil formation) is determined by the climatic N-value defined by Weinert. A climatic N-value of > 5, is associated with arid regions, where mechanical disintegration is the predominant rock weathering mode and an N-value of < 5 is associated with the humid warm areas and a surplus of water, where chemical decomposition is the predominant rock weathering mode.

The climatic N-value of the site is < 5, therefore chemical decomposition rather than mechanical disintegration of the parent rocks is deemed the principal mode of weathering.

5.3 *Problem soils*

5.3.1 *Collapse potential and immediate settlement*

A collapsible grain structure was **not** noted in any of the material horizons encountered on site.

Therefore, no problems associated with collapse potential are foreseen for this development.

5.3.2 *Compressibility and settlement*

When considering the behaviour of the in-situ soils, in terms of compressibility and associated potential settlement at *conventional, near surface shallow foundation elevation*, the following criteria needs to be considered:

- Bulk earthworks (cut/fill scenario) vs structural founding level/s.
- The structural column loads and associated bearing pressures for near surface founding purposes. An allowable bearing capacity requirement of 80kPa for the planned double storey structures, typically founded on conventional reinforced concrete shallow strip foundations, were used in our settlement analysis.
- The influence of the in-situ moisture content on the in-situ allowable bearing capacity and settlement of the different soil layers, especially when an increased in-situ moisture content and degree of saturation occur during the rainy season for instance.
- The consistency and structure of the in-situ soils in relation to the in-situ allowable bearing capacity and settlement of the different soil layers. Both parameters provides an indication of the material's inherent stiffness and associated strength.

At time of reporting nominal cut to fill operations associated with conventional platform preparation were planned for the stand.

Generally, intolerable settlement is expected to occur should conventional shallow foundations be placed within the hillwash transported, as well as the pebblemarker transported, reworked residual and residual lava with *continuous* in-situ soil consistency of *less than medium dense to dense*, respectively, should the allowable bearing capacity requirement of 80kPa be considered.

Therefore, no problems with regards to bearing capacity in relation to differential settlement are expected should foundations be placed within *continuous* *medium dense to dense and better*, pebblemarker, reworked residual and residual lava.

From a compressibility and settlement point of view, the following table provides an indication of the minimum expected founding depths, should an allowable bearing capacity requirement of 80kPa in relation to the different soil horizons encountered during our fieldwork, be considered:

Test hole	Depth to founding (m)
	$P_{Required}$ = 80kPa
TH01	0.75
TH02	NE
TH03	1.25
TH04	1.4
TH05	2.6
TH06	2.3

$P_{Required}$ = Predicted Allowable bearing capacity required (kPa)

NE = Not encountered within full TLB excavation reach

Minimum expected founding depths from a compressibility and settlement perspective

No problems are foreseen with regards to intolerable settlement (differential settlement > 10mm), should our founding recommendations, noted under clause 5.9.1 & 5.9.2, be employed.

Reference should be made to the comprehensive soil profiles included in Annexure B of the report for the predicted allowable bearing capacities with depth *vs* micro-positioning of structures in relation to material horizons encountered across the site.

5.3.3 *Potential Expansiveness*

The laboratory test results of the in-situ material, excluding the sandy and clayey SILT, residual lava, indicate that the Plasticity Index (PI) of representative samples of remaining material varies between 8% and 16% with the PI of the whole sample (PI_{whole} = PI x Percentage <0,425mm) of representative soil samples being calculated to vary 1,2 and 12,6% and the %Clay measured to vary between 0,9% and 12,4%.

It should be noted that both the PI_{whole} and %Clay of a specific horizon must be in excess of 12,5% in order for it to be considered potentially expansive.

According to Van der Merwe (1964) the abovementioned soil layers have a "Low" potential for swell and are not considered to be potential expansive.

However, a representative heave related laboratory test result of the sandy and clayey SILT, residual lava, indicate that the PI of these soils are expected to be in the order of 16% with the P_{whole} being calculated to be 13,6%, and the associated %Clay tested to be 20,9%.

According to Van der Merwe (1964) these soils have a potential for swell of "**Low to medium**" and are therefore considered to be prone towards heaving.

In order to determine the risk of heave the following combined factors, in addition to the plasticity and grading, need to be considered:

- The magnitude of the envisaged superimposed loads.
- The thickness of the potentially expansive soil layers.
- The in-situ moisture content of the potentially expansive soils.
- The likelihood of the in-situ potentially expansive soils to undergo especially a dry-to-wet moisture cycle.

The soil characteristics of the potentially expansive soils, insofar heave is concerned, can be summarized as follows:

Soil type & origin:	PI (%)	PI_W	h1 (m)	h2 (m)	% Clay	Vdm	Max Heave (mm)
Sandy and clayey SILT. Residual lava.	16	13.6	3.0	1.30	20.9	Low to medium	±13

With:
PI = Plasticity Index
PI_W = Weighted PI = PI x % passing the 0.425mm sieve
h1 = Maximum thickness of swelling layer expected based on past experience (m)
h2 = Minimum depth of swelling layer below GGL (m)
GGL = Ground level at geotechnical investigation stage
% Clay = % passing the 0.002mm sieve
Vdm = Heave class according to Van der Merwe (1964)
Max heave = Predicted maximum heave according to Van der Merwe (mm)

Heave prediction according to van der Merwe (1964)

At the time of our fieldwork (16 July 2024), the in-situ moisture content of the potentially expansive sandy and clayey SILT, residual lava was noted to vary between dry to slightly moisty and slightly moist, which indicates that the in-situ moisture content of these soils at the time of our fieldwork was between 3% and 5% *below* the Predicted Equilibrium Moisture Content (PEMC) of these soils.

Therefore, the anticipated heave of approximately 13mm may occur, especially should the in-situ sandy and clayey SILT, residual lava undergo a dry-to-wet moisture cycle for instance.

However, no problems are foreseen with regards to intolerable settlement (differential settlement > 10mm), should our founding recommendations, noted under clause 5.9.1 & 5.9.2, be employed.

5.3.4 *Erodibility of the Soil Horizons*

All material horizons encountered are expected to be erodible if subjected to surface water flow. Therefore, erodibility may pose a problem where the in-situ material daylight post construction.

Therefore, erosion protection measures with specific reference to non-surfaced areas, such as grassing, etc, should be introduced, especially should these non-cohesive soils be exposed to the atmosphere.

5.3.5 *Instability of Areas of Soluble Rock*

The site is not located in an area underlain by limestone or dolomite and no instability associated with these soluble rocks is therefore possible.

5.4 *Groundwater*

No groundwater seepage encountered in any of the test holes dug.

It should be noted that the fieldwork was carried out during the dry season (July 2024). Therefore, a perched groundwater table may occur at the contact of weaker and more competent material horizons with depth, especially during the rainy season.

We therefore recommend that proper surface run-off and subsurface drainage including damp proofing form part of the permanent works.

5.5 *Excavatibility*

Excavatability in accordance with SANS 1200D: Earthworks, is summarized in the following table, should the information gathered during test pitting be considered as a guideline.

Test hole No	Depth range in test holes in relation to GGL (m)				
	Soft excavation	Intermediate excavation	Hard excavation	Boulder A (>40% of excavation volume)	Boulder B (<40% of excavation volume)
TH01	0.0-3.0	NE	NE	NE	NE
TH02	0.0-3.2	NE	NE	NE	NE
TH03	1.0-3.3	NE	NE	NE	0.0-1.0
TH04	0.3-3.3	NE	NE	NE	0.0-0.3
TH05	0.0-3.2	NE	NE	NE	NE
TH06	0.0-3.2	NE	NE	NE	NE

Note: NE = Not encountered within test holes

Potential excavation categories encountered during test pitting

In addition, during its weathering process, lava is prone to the formation of corestones that may vary significantly in hardness from soft to extremely hard rock (1MPa < UCS > 70MPa) and is renowned to have a highly undulating bedrock profile which may vary significantly in hardness in both the horizontal and vertical plane and within short distances. HARD ROCK AND HARDER, lava bedrock occasionally daylights across the site.

Therefore, adequate allowances for the effective removal of material representing "**Intermediate**", "**Hard**" and "**Boulder class B**" excavation categories specifically should be allowed for bulk earthworks budget purposes to accommodate any variance with regards to excavatibility with depth.

Insofar excavation within "**Hard**" material is concerned, excavation by means of power tools, such as seismic pneumatic rock breaker attached to a 25t traxcavator for instance, should be considered as a minimum.

Allowance for the effective digging advance within the "**Boulder class B**" and potential "**Intermediate**" material by means of a 25t minimum traxcavator should preferably be allowed.

5.6 *Slope stability*

The test hole sidewalls appeared to be completely stable with no sidewall collapse noted during soil profiling.

However, sidewall stability can worsen drastically if water is to be encountered in excavations, albeit in the form of a perched water table and associated groundwater seepage, damaged water pipe or poor surface water run-off management which may result in water to accidently drain into excavations during construction.

Therefore, all near surface excavation sides deeper than say 1m, must either be battered back to 1:1,5 (vertical:horizontal) or shored; allowing safe working conditions for workers in excavations.

No deep *vertical* excavations are foreseen for this development. Therefore, lateral support systems are not expected to be required for this development.

However, design parameters for lateral support design purposes will be forwarded on request, should deep vertical or near vertical excavations and associated lateral support systems be required.

5.7 *Soil aggressiveness and corrosivity*

The pH and conductivity of soil is generally determined to get an indication of the potential corrosiveness of the soil. The pH of a soil gives an indication of the acidity of the soil. As a general guideline Evans [6.8] notes that corrosion may take place in soil with a pH of less than 6 and that should the pH be less than 4.5, the problem may be serious. It should however be borne in mind that a low pH value is not necessarily an indication of serious corrosiveness as the pH of the surrounding soil will generally start to rise as soon as corrosion starts.

Should one view the pH values only of the 5No samples tested (pH ranges between 6.34 and 7.66), then the in-situ soils appear not to be prone towards corrosivity at all.

However, corrosion is an electrochemical process whereby metals are changed, and electrical energy is released. The conductivity of the soil therefore has a profound influence on the rate of corrosion of buried metallic objects.

Duligal [6.9] provides the following table for evaluation of the conductivity of soil:

Soil conductivity (mS/m)	Corrosion classification
More than 50	Extremely corrosive
26 – 50	Very corrosive
21 – 25	Corrosive
10 – 20	Mildly corrosive
Less than 10	Not generally corrosive

The soil corrosion classification can be summarized as follows:

Soil origin	Soil conductivity (mS/m)	Corrosion classification
Non-engineered fill	84.5	Extremely corrosive
Hillwash transported	48.7	Very corrosive
Pebblemarker transported	37.3	Very corrosive
Reworked residual lava	26.5	Very corrosive
Residual lava	29.3	Very corrosive

However, we strongly recommend that a **"Very severe"** exposure condition rather be adopted for concrete placed within the in-situ horizons encountered all in accordance with SANS 1200G: Concrete (Structural), especially should the variable degree of corrosivity, the historical fluctuating perched groundwater table and past experience be considered. In addition, subsurface services (non-concrete) should be treated/sleeved to prevent possible damages due to corrosion.

According to SANS 1200G: Concrete (Structural), concrete used for foundations of structures within potentially aggressive soils should have the following minimum concrete cover and maximum water:cement ratio's:

Exposure conditions	Specified strength of concrete (MPa)					Minimum cover for various exposure conditions (mm)
	20	25	30	40	50	
Mild	20	20	15	15	15	
Moderate	40	40	30	25	20	
Severe	NA	50	40	40	35	
Very severe	NA	75	60	60	50	

Type of structures	Exposure conditions			
	Mild	Moderate	Severe	Very severe
Thin sections, reinforced piles, all sections with less than 25mm cover to reinforcement	*	0.53	0.48	0.4
Moderate sections, retaining walls, piers, beams	*	*	0.53	0.43
Exterior portions of mass concrete	*	*	0.53	0.43
Concrete slabs laid on ground	*	0.53	0.48	*
Concrete protected from the weather, inside buildings, or in ground below frost level	*	*	*	*
* In these cases the ratio will be based on strength for workability required				

5.8 *Site class designation*

The site, from a geotechnical site class designation point of view, class “**P(Uncontrolled fill/S2/H1**” where the non-engineered fill occur and “**S2/H1**” where no fill occur, all in accordance with the NHBRC site classification system.

5.9 *Founding recommendations*

5.9.1 *Structural founding*

We recommend that one of the following options per structure should be considered:

- Stiff reinforced concrete shallow strip foundations where near surface (<1,5m) competent founding is achieved,
- Soil mattress/soil replacement (new engineered fill) combined with stiff reinforced, raft foundations, or
- Soil mattress/soil replacement (new engineered fill of significant thickness) combined with stiff reinforced concrete shallow strip foundations.

Stiff reinforced concrete shallow strip foundations

Stiff reinforced shallow strip foundations must be placed within the pebblemarker transported and residual lava with *continuous* in-situ soil consistency of *medium dense to dense and better*, respectively, should the allowable bearing capacity requirement of 80kPa be considered.

The following table provides an indication of the minimum expected founding depths, should an allowable bearing capacity requirement of 80kPa in relation to the different soil horizons encountered during our fieldwork, be considered:

Test hole	**Depth to founding (m)**
	$P_{Required}$ = 80kPa
TH01	0.75
TH02	NE
TH03	1.25
TH04	1.4
TH05	2.6
TH06	2.3

$P_{Required}$ = Predicted Allowable bearing capacity required (kPa)

NE = Not encountered within full TLB excavation reach

Minimum expected founding depths from a compressibility and settlement perspective

Unfortunately, near surface economical *conventional* (<1,5m) founding is not achievable across the site.

To accommodate structural footprints where near surface economical shallow founding is not possible, or where bulk earthworks result in areas of fill, for instance, one of the following options should be considered.

Soil mattress/soil replacement (new engineered fill) combined with stiff, raft foundations

Remove all in-situ material across complete structural footprints to below the potentially compressible hillwash as a minimum, and up to the continuous occurrence of *medium dense or better*, pebblemarker transported or reworked residual lava as a minimum.

The remaining foundation bed must thoroughly be compacted to a minimum of 95% Mod AASHTO and to a minimum depth of 300mm, prior to engineered fill construction.

The existing competent engineered fill and granular pebblemarker transported, in-situ material, may be temporarily stockpiled once thoroughly mixed for re-use purposes to form **G6** quality new engineered fill. Representative quality control, construction stage laboratory testing must however be carried out to confirm the **G6** quality material though.

Import from stockpile or commercial resources **G6 minimum quality** material and compact to 95% of Mod AASHTO at the materials' optimum moisture content in 150mm thick engineered fill layers in order to provide a firm and level working platform.

Stiff, reinforced concrete raft foundations may then be formed within the new engineered fill.

A maximum allowable bearing capacity of 50kPa may then be used for design purposes.

Soil mattress/soil replacement combined with stiff reinforced concrete strip foundations:

Remove all in-situ material within foundation excavations or across the complete structural footprints to below the potentially compressible hillwash as a minimum, and as such to accommodate a new engineered fill with thickness of 0,9m ***below*** raft invert level (bottom of founding level). Foundation excavations should be 0,5m wider than the planned foundation thickness, should engineered fill be formed within foundation excavations.

The remaining foundation bed must thoroughly be compacted to a minimum of 95% Mod AASHTO and to a minimum depth of 300mm, prior to engineered fill construction.

The existing engineered fill and competent granular pebblemarker transported in-situ material may be temporarily stockpiled once thoroughly mixed for re-use to form **G6** quality new engineered fill. Representative quality control construction stage laboratory testing must however be carried out to confirm the **G6** quality material specified.

Import from stockpile or commercial resources **G6 minimum quality** material and compact to 95% of Mod AASHTO at the materials' optimum moisture content in 150mm thick engineered fill layers.

Assuming that 0,5m thick, stiff reinforced concrete strip foundations are to be considered, the total new engineered fill will then be a minimum thickness of 1,4m (0,5m foundation plus 0,9m thick engineered fill below foundation invert level).

Stiff, reinforced concrete strip foundations may then be formed within the new engineered fill.

A maximum allowable bearing capacity of 80kPa may then be used for design purposes.

The in-situ predicted allowable bearing capacities of all the material horizons are provided within the detailed soil profiles annexed to the report – refer to Annexure B.

Notwithstanding the final method of founding, we strongly recommend that 0,8m wide (minimum) apron slabs be constructed around the perimeter of all structures, purely as an attempt to assist with effective channelling of surface water run-off and to prevent moisture content fluctuations at near surface level which may contribute towards instability within the near surface soils.

We strongly recommend that a competent person check and accept all foundation excavations and engineered fill construction related installation methodologies and we confirm our availability to assist in arriving at a working model in this regard, should it be requested.

5.9.2 *Surface bed, access road and parking areas*

The founding of surface beds, *where engineered soil mattresses are not introduced over full structural footprints specifically*, access roads and parking areas are summarized as follows:

- Clear and temporary stockpile the upper organic topsoil for landscaping purposes, where encountered.

- Rip the upper say 300mm in-situ soils and compact to a minimum of 93% Mod AASHTO in-situ density.

- Import **G7** quality natural soils/gravels and compact in a 150mm thick engineered fill layer to 95% of Mod AASHTO at optimum moisture content for all surface bed preparation and selected road layer works construction purposes. A minimum of one layer for both surface bed preparation and selected road pavement construction purposes, should be considered.

- Import 1No x 150mm thick layer, comprising of **G6** material stabilized to **C4** for base quality material, should be considered for road pavement construction purposes.

- Interlocking block paving should preferably be considered as final road and parking area surfacing.

  In addition, we recommend that pavement shoulders be covered and adequately shaped to 0,8m beyond the perimeter of all road and parking areas, purely as an attempt to assist with effective channelling of surface water run-off and to prevent moisture content fluctuations at near surface level which may contribute towards differential settlement within the near surface soils.

5.10 *Re-use potential of the in-situ material*

The laboratory test results of the in-situ soils with their associated classification in accordance with TRH14, are summarized in the table following on the next two pages.

Based on the foundation indicator related laboratory test results, the hillwash transported class between **G10** and >**G10** material. Therefore, these soils may only be considered for bulk backfilling, should quality control related laboratory testing results meet the minimum **G10** requirement for fill material specifically.

The pebblemarker transported class between **G6** and **G7** and may therefore be considered for bulk backfilling, engineered fill up to and including base pavement layer construction purposes, should quality control related laboratory testing results meet the minimum **G6** for base layer and engineered fill, and **G7** for selected layer works construction purposes, respectively.

The existing non-engineered fill class as **G7** and may therefore be considered for bulk backfilling surface bed preparation and selected pavement layer construction, should quality control related laboratory testing results meet the minimum **G7** for selected layer works construction purposes, respectively.

We are of the opinion that the existing engineered fill and competent granular pebblemarker transported in-situ material may class as **G6** quality material once thoroughly mixed. Representative quality control construction stage laboratory testing must however be carried out to confirm the **G6** quality material, especially should the mixed material be considered for new engineered fill construction.

The reworked residual and residual lava class **>G10** and should therefore not be considered for bulk backfilling or for use in pavement layers at all. These horizons may be used for landscaping purposes only, if required.

All oversize and organic material must be removed prior to re-use though, where encountered.

All shortfall **G6** and **G7** material will have to be imported from commercial resources, if required.

We strongly recommend that confirmation quality assurance testing be carried out to confirm the tabled material classifications for construction stage purposes.

Soil type and origin	TH No	DS No	Depth range (m):	Layer thickness (m)	GM	PI	%<0,425	PI_{whole}	%Clay	Heave class	CBR			TRH14	Soil aggressiveness		
											90%	93%	95%		pH	Cond	Degree
Fine to medium grained SILT-SAND with occasionally scattered plant and tree roots in profile. Hillwash transported.	TH01	DS1	0.0-0.45	0.45	0.73	10	82	8.2	4.6	Low	-	-	-	G10/>G10[1]	7.08	48.7	Very corrosive
Fine to coarse grained GRAVEL in a fine to medium grained SILT-SAND matrix with frequent scattered cobbles (up to 100mm in dia) in profile. Pebblemarker transported.	TH01	DS2	0.45-0.75	0.30	2.27	12	26	3.1	1.1	Low	-	-	-	G6/G7[1]	6.35	37.3	Very corrosive
Fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile. Reworked residual lava.	TH01	DS3	0.75-2.4	1.65	0.90	16	79	12.6	12.4	Low	-	-	-	>G10[1]	6.34	26.5	Very corrosive
Fine grained sandy and clayey SILT. Residual lava.	TH01	DS4	2.4-3.0+	0.60+	0.70	16	85	13.6	20.9	Low to medium	-	-	-	>G10[1]	6.42	29.3	Very corrosive
Fine to coarse grained sandy GRAVEL with frequent scattered cobbles (up to 100mm in dia) and builder's rubble (bricks and concrete fragments) in profile. Non-engineered fill.	TH03	DS5	0.0-1.0	1.00	2.54	8	15	1.2	0.9	Low	12	16	20	G7	7.66	84.5	Extremely corrosive

[1] = TRH14 classification based on fieldwork related soil profiling and past experience. To be confirmed by means of representative quality assurance testing during construction.

All oversize and organic material was removed during sampling process for representative laboratory testing purposes.

Summary of laboratory test results

We trust that our report meets with your expectations. Should you wish to discuss the above in any further detail, please do not hesitate to contact the undersigned.

Yours faithfully,

Petrus van Straten
Pr Tech Eng, ECSA, MSAICE, NHBRC, BSc Hons (Applied Sciences) Geotechnical Engineering

Geo Simplicity Geotechnical Engineering (Pty) Ltd

6 REFERENCES

6.1 JENNINGS, J.E, BRINK, A.B.A & WILLIAMS, A.A.B. Revised Guide to Soil Profiling for Civil Engineering Purposes in Southern Africa. Trans. S Afr. Inst. Civ. Engrs. Vol. 15, No. 1, 1973, pp3 to 12.

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6.12 National Home Builders Registration Council (NHBRC) – Home Building Manual Part 1- 2.

6.13 Engineering Geology of Southern Africa – A.B.A. Brink, Volumes 1 to 4.

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6.15 Geotechnical Site Investigations for Housing Developments – GFSH-2. September 2002.

ANNEXURE A:

DRAWINGS

(TEST HOLE POSITIONS AND REGIONAL GEOLOGY)

GeoSimplicity

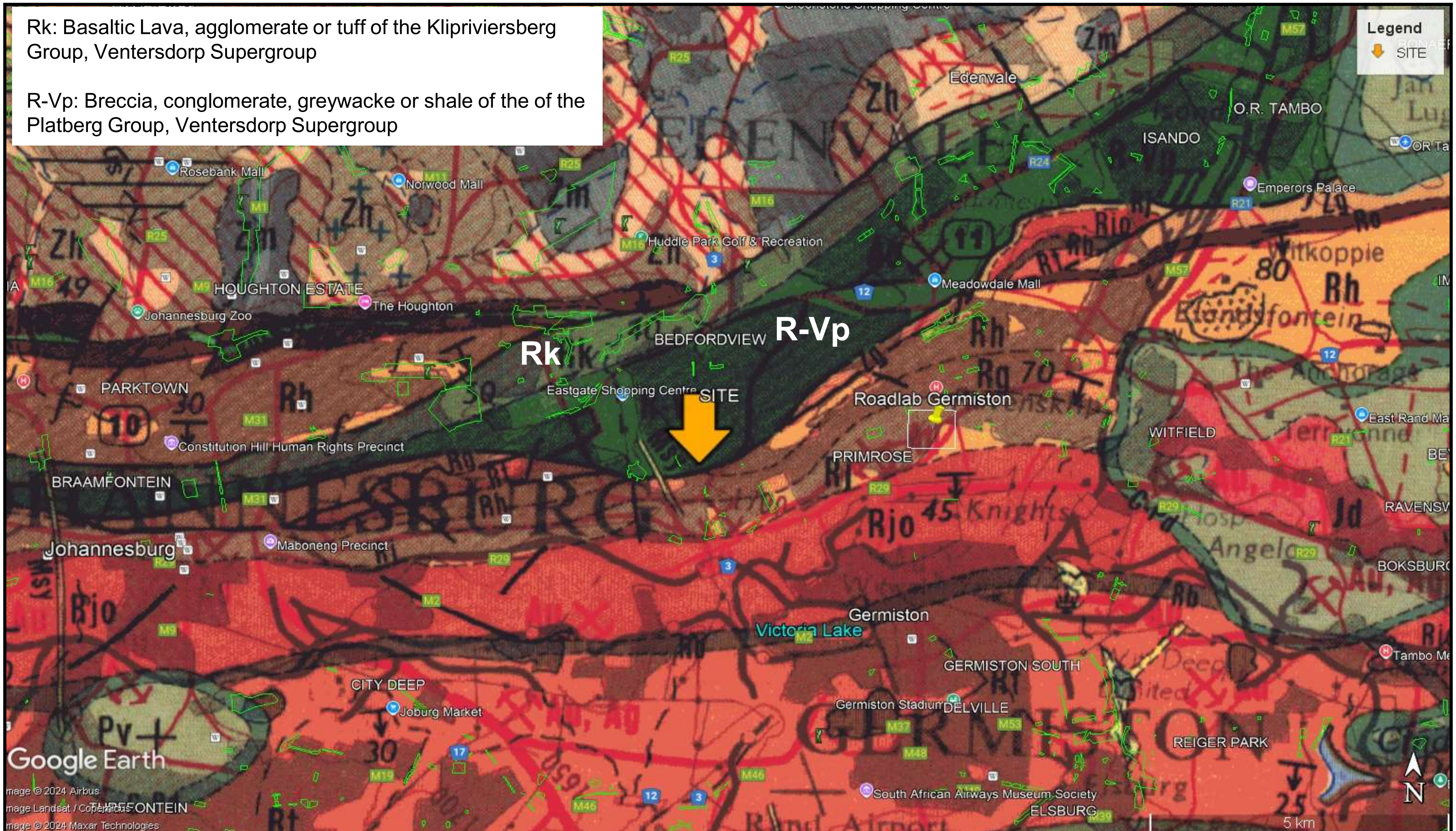
Test hole positions

Geotechnical Investigation on the Remainder of Erf 582 Bedfordview Extension 113 Gauteng Province

Date: September 2024

Client: Hauz Developments

Project No: G687

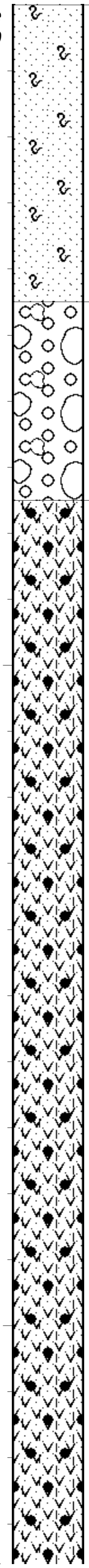


GeoSimplicity	**Regional geology** **Geotechnical Investigation on the Remainder of Erf 582 Bedfordview Extension 113 Gauteng Province**	**Date: September 2024** **Client: Hauz Developments** **Project No: G687**

ANNEXURE B:

TEST HOLE PROFILES

Scale 1:10



DS1
DS2
DS3

0.00

Slightly moist, dark olive-brown, apparently medium dense in profile but potentially compressible, fine to medium grained SILT-SAND with occasionally scattered plant and tree roots in profile.
Hillwash transported.
P = <50kPa

0.45

Slightly moist, dark olive-brown, speckled and mottled dusky white and yellow-orange, speckled black, medium dense, massive, fine to coarse grained GRAVEL in a fine to medium grained SILT-SAND matrix with frequent scattered cobbles (up to 100mm in dia) in profile.
Pebblemarker transported.
P = 50kPa

0.75

Slightly moist to moist, dark yellow-olive and reddish-brown, speckled black, medium dense to dense, ferruginous and relic jointed, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile.
Reworked residual lava.
P = 80kPa

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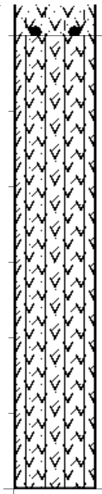
Hauz Developments
Geotechnical Investigation on the Remainder of Erf 582 Bedfordview Extension 113
Gauteng Province

HOLE No: TH01
Sheet 2 of 2

JOB NUMBER: G687



Slightly moist, light yellow-olive and slightly reddish-brown, streaked black, stiff, relic jointed, sandy and clayey SILT.
Residual lava.
P = 150kPa

NOTES

1) No groundwater seepage encountered in test hole.

2) Digging to the maximum reach of the machine - no refusal.

3) Test hole sidewalls appeared to be completely stable with no sidewall collapse noted during profiling.

4) P = Predicted allowable bearing capacity (differential settlement < 10mm) should conventional shallow foundations be considered.

5) GLG = Ground level at geotechnical investigation stage.

6) Disturbed sample DS1 at 0.2m for Foundation Indicator, pH and Conductivity related laboratory testing.
Disturbed sample DS2 at 0.6m for Foundation Indicator, pH and Conductivity related laboratory testing.
Disturbed sample DS3 at 1.5m for Foundation Indicator, pH and Conductivity related laboratory testing.
Disturbed sample DS4 at 2.7m for Foundation Indicator, pH and Conductivity related laboratory testing.

CONTRACTOR : Supplied by Client
MACHINE : CAT 428C TLB
DRILLED BY :
PROFILED BY : PF van Straten

TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 16/07/24

DATE : 20/09/2024 15:09
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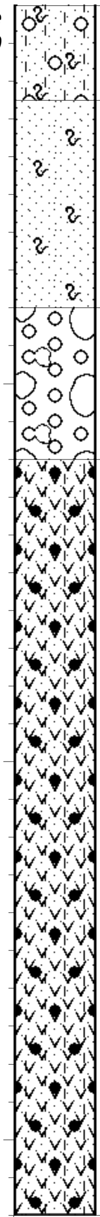
X-COORD : S 26°11'29.9"
Y-COORD : E 28°07'51.6"

HOLE No: TH01

Scale 1:20



0.00

Dry to slightly moist, dark olive and orange-brown, speckled black, medium dense, organic, fine to medium grained silty and gravelly SAND with abundant scattered grass and plant roots in profile.
Surficial topsoil.
P = -

0.25

Dry to slightly moist, dark olive-brown, apparently dense in profile but potentially compressible, fine to medium grained SILT-SAND with abundant scattered plant and tree roots in profile.
Hillwash transported.
P = <50kPa

0.80

Dry to slightly moist, dark olive-brown, speckled and mottled dusky white and yellow-orange, mottled and blotched light yellow-olive, speckled black, medium dense to dense, massive, fine to coarse grained GRAVEL in a fine to medium grained SILT-SAND matrix with frequent scattered cobbles (up to 100mm in dia) in profile.
Pebblemarker transported.
P = 50kPa

1.20

Slightly moist to moist, dark yellow-olive and reddish-brown, speckled black, medium dense, ferruginous and relic jointed, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile.
Reworked residual lava.
P = 50kPa

3.20

NOTES

1) No groundwater seepage encountered in test hole.

2) Digging to the maximum reach of the machine - no refusal.

3) Test hole sidewalls appeared to be completely stable with no sidewall collapse noted during profiling.

4) P = Predicted allowable bearing capacity (differential settlement < 10mm) should conventional shallow foundations be considered.

5) GLG = Ground level at geotechnical investigation stage.

CONTRACTOR : Supplied by Client
MACHINE : CAT 428C TLB
DRILLED BY :
PROFILED BY : PF van Straten

TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 16/07/24

DATE : 20/09/2024 15:09
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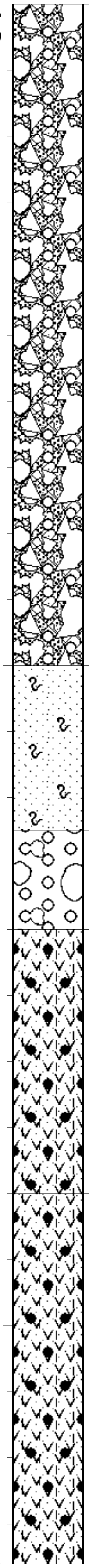
ELEVATION : GLG
X-COORD : S 26°11'29.1"
Y-COORD : E 28°07'51.3"

HOLE No: TH02

Scale 1:10

DS5



0.00

Slightly moist, dark olive-brown, streaked dark reddish-brown with intermittent light brown zones, mottled and blotched red, medium dense, massive, fine to coarse grained sandy GRAVEL with frequent scattered cobbles (up to 100mm in dia) and builder's rubble (bricks and concrete fragments) in profile.
Non-engineered fill.
P = <50kPa

1.00

Dry to slightly moist, dark olive-brown, apparently dense in profile but potentially compressible, fine to medium grained SILT-SAND with occasionally scattered plant and tree roots in profile.
Hillwash transported.
P = <50kPa

1.25

Dry to slightly moist, dark olive-brown, speckled and mottled dusky white and yellow-orange, speckled black, dense, massive, fine to coarse grained GRAVEL in a fine to medium grained SILT-SAND matrix with frequent scattered cobbles (up to 100mm in dia) in profile.
Pebblemarker transported.
P = 80kPa

1.40

Slightly moist, dark olive and reddish-brown, speckled black, medium dense to dense, ferruginous and relic jointed, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile.
Reworked residual lava.
P = 80kPa

1.80

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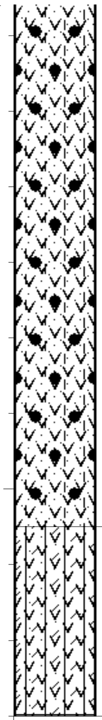
Hauz Developments
Geotechnical Investigation on the Remainder of Erf 582 Bedfordview Extension 113
Gauteng Province

HOLE No: TH03
Sheet 2 of 2

JOB NUMBER: G687



Slightly moist, dark reddish-brown, speckled black, medium dense to dense, ferruginous and relic jointed, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile.
Reworked residual lava.
P = 80kPa

3.05

Dry to slightly moist, light yellow-olive and slightly reddish-brown, streaked black, stiff, relic jointed, sandy and clayey SILT.
Residual lava.
P = 150kPa

3.30

NOTES

1) No groundwater seepage encountered in test hole.

2) Digging to the maximum reach of the machine - no refusal.

3) Test hole sidewalls appeared to be completely stable with no sidewall collapse noted during profiling.

4) P = Predicted allowable bearing capacity (differential settlement < 10mm) should conventional shallow foundations be considered.

5) GLG = Ground level at geotechnical investigation stage.

6) Disturbed sample DS5 at 0.6m for Foundation Indicator, MOD, CBR, pH and Conductivity related laboratory testing.

CONTRACTOR : Supplied by Client
MACHINE : CAT 428C TLB
DRILLED BY :
PROFILED BY : PF van Straten

TYPE SET BY :
SETUP FILE : STANDARD.SET

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X-COORD : S 26°11'29.3"
Y-COORD : E 28°07'52.2"

HOLE No: TH03

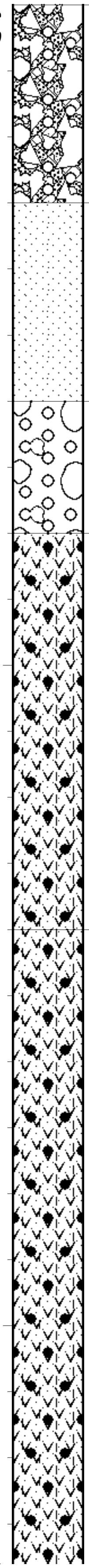
Geo Simplicity Geotechnical Engineering (Pty) Ltd

Hauz Developments
Geotechnical Investigation on the Remainder of Erf 582 Bedfordview Extension 113
Gauteng Province

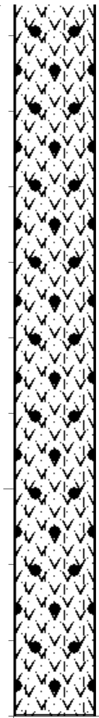
HOLE No: TH04
Sheet 1 of 2

JOB NUMBER: G687

Scale 1:10



0.00 – 0.30	Slightly moist, dark olive-brown, streaked dark reddish-brown with intermittent light brown zones, mottled and blotched red, medium dense, massive, fine to coarse grained sandy GRAVEL with frequent scattered cobbles (up to 100mm in dia) and builder's rubble (bricks and concrete fragments) in profile. **Non-engineered fill**. **P = <50kPa**
0.30 – 0.60	Dry to slightly moist, dark olive-brown, apparently dense in profile but potentially compressible, fine to medium grained SILT-SAND. **Hillwash transported**. **P = <50kPa**
0.60 – 0.80	Dry to slightly moist, dark olive-brown, speckled and mottled dusky white and yellow-orange, speckled black, medium dense, massive, fine to coarse grained GRAVEL in a fine to medium grained SILT-SAND matrix with frequent scattered cobbles (up to 100mm in dia) in profile. **Pebblemarker transported**. **P = 50kPa**
0.80 – 1.40	Slightly moist, dark yellow-olive and reddish-brown, speckled black, medium dense, ferruginous and relic jointed, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile. **Reworked residual lava**. **P = 50kPa**
1.40 –	Slightly moist, dark reddish-brown, mottled and blotched light yellow-olive, speckled and streaked black, medium dense to dense, ferruginous, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile. **Reworked residual lava**. **P = 80kPa**



3.30

NOTES

1) No groundwater seepage encountered in test hole.

2) Digging to the maximum reach of the machine - no refusal.

3) Test hole sidewalls appeared to be completely stable with no sidewall collapse noted during profiling.

4) P = Predicted allowable bearing capacity (differential settlement < 10mm) should conventional shallow foundations be considered.

5) GLG = Ground level at geotechnical investigation stage.

CONTRACTOR : Supplied by Client
MACHINE : CAT 428C TLB
DRILLED BY :
PROFILED BY : PF van Straten

TYPE SET BY :
SETUP FILE : STANDARD.SET

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DATE : 16/07/24

DATE : 20/09/2024 15:09
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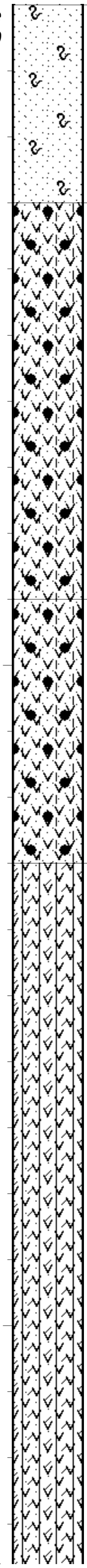
Y-COORD : E 28°07'52.6"

HOLE No: TH04

Scale 1:10



0.00

Slightly moist, dark olive-brown, apparently dense in profile but potentially compressible, fine to medium grained SILT-SAND with occasionally scattered grass roots in profile.
Hillwash transported.
P = <50kPa

0.30

Slightly moist to moist, dark olive-brown and slightly reddish-brown, speckled black, medium dense to dense, ferruginous and relic jointed, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile.
Reworked residual lava.
P = 50kPa

0.90

Slightly moist, dark olive-brown and slightly reddish-brown, speckled black, medium dense, ferruginous and relic jointed, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile.
Reworked residual lava.
P = 50kPa

1.30

Slightly moist, light yellow-olive and slightly reddish-brown, streaked black, firm, relic jointed, sandy and clayey SILT.
Residual lava.
P = 50kPa

2.60

Slightly moist, light yellow-olive and slightly reddish-brown, streaked black, stiff, relic jointed, sandy and clayey SILT.
Residual lava.
P = 150kPa

3.20

NOTES

1) No groundwater seepage encountered in test hole.

2) Digging to the maximum reach of the machine - no refusal.

3) Test hole sidewalls appeared to be completely stable with no sidewall collapse noted during profiling.

4) P = Predicted allowable bearing capacity (differential settlement < 10mm) should conventional shallow foundations be considered.

5) GLG = Ground level at geotechnical investigation stage.

CONTRACTOR : Supplied by Client
MACHINE : CAT 428C TLB
DRILLED BY :
PROFILED BY : PF van Straten

TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 16/07/24

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ELEVATION : GLG
X-COORD : S 26°11'29.8"
Y-COORD : E 28°07'53.4"

HOLE No: TH05

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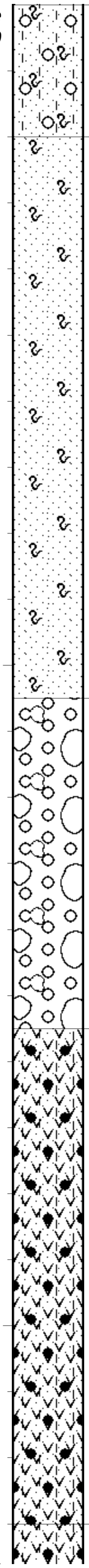
Hauz Developments
Geotechnical Investigation on the Remainder of Erf 582 Bedfordview Extension 113
Gauteng Province

JOB NUMBER: G687

Scale 1:10



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Dry to slightly moist, dark olive and orange-brown, speckled black, medium dense, organic, fine to medium grained silty and gravelly SAND with abundant scattered grass and plant roots in profile.
Surficial topsoil.
P = -

0.20

Slightly moist, dark olive-brown, apparently loose to medium dense in profile but potentially compressible, fine to medium grained SILT-SAND with occasionally scattered grass roots in profile.
Hillwash transported.
P = <50kPa

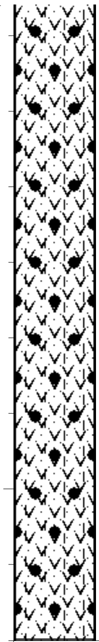
1.05

Slightly moist to moist, dark olive-brown, speckled and mottled dusky white and yellow-orange, speckled black, medium dense, massive, fine to coarse grained GRAVEL in a fine to medium grained SILT-SAND matrix with frequent scattered cobbles (up to 100mm in dia) in profile.
Pebblemarker transported.
P = 50kPa

1.55

Slightly moist to moist, dark olive-brown, speckled black and orange-red, medium dense, ferruginous and relic jointed, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile.
Reworked residual lava.
P = 50kPa

2.30



Slightly moist to moist, dark reddish and olive-brown, speckled black, dense, ferruginous and relic jointed, fine grained silty SAND with abundant scattered highly weathered, ferricrete nodules in profile.
Reworked residual lava.
P = 150kPa

3.20

NOTES

1) No groundwater seepage encountered in test hole.

2) Digging to the maximum reach of the machine - no refusal.

3) Test hole sidewalls appeared to be completely stable with no sidewall collapse noted during profiling.

4) P = Predicted allowable bearing capacity (differential settlement < 10mm) should conventional shallow foundations be considered.

5) GLG = Ground level at geotechnical investigation stage.

CONTRACTOR : Supplied by Client
MACHINE : CAT 428C TLB
DRILLED BY :
PROFILED BY : PF van Straten

TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
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DATE : 16/07/24

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X-COORD : S 26°11'28.9"
Y-COORD : E 28°07'53.3"

HOLE No: TH06

Geo Simplicity Geotechnical Engineering (Pty) Ltd

Hauz Developments
Geotechnical Investigation on the Remainder of Erf 582 Bedfordview Extension 113
Gauteng Province

LEGEND
Sheet 1 of 1

JOB NUMBER: G687

GRAVEL	{SA02}
GRAVELLY	{SA03}
SAND	{SA04}
SANDY	{SA05}
SILT	{SA06}
SILTY	{SA07}
CLAYEY	{SA09}
LAVA	{SA19}
FERRICRETE NODULES	{SA24}
RUBBLE	{SA31}
FILL	{SA32}
CONCRETE	{SA34}
Name DISTURBED SAMPLE	{SA38}
ROOTS	{SA40}
COBBLES	{SA58}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE :

DATE : 20/09/2024 15:09
TEXT : ..ppydays\dotPLOT\G687.TXT

ELEVATION :
X-COORD :
Y-COORD :

LEGEND
SUMMARY OF SYMBOLS

ANNEXURE C:

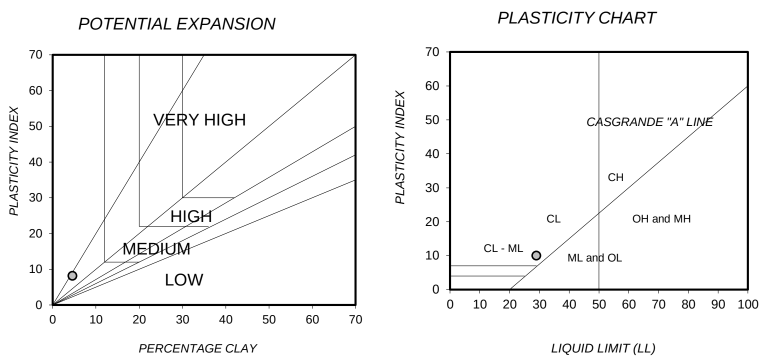
LABORATORY TEST RESULTS

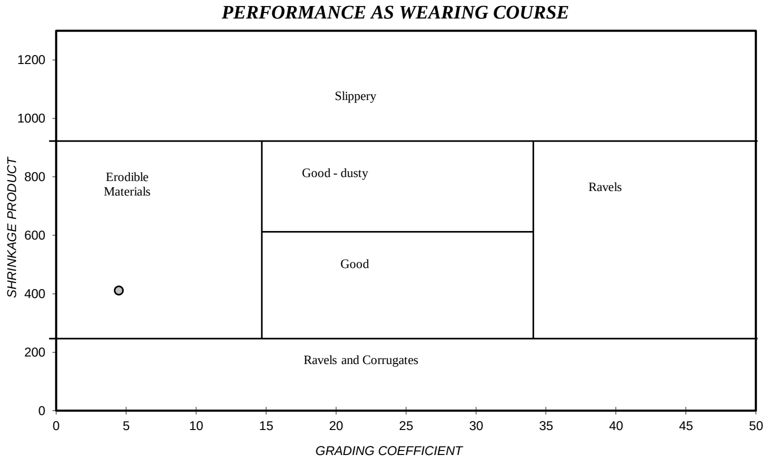
Roadlab Laboratories Pty Ltd
Materials Testing
Geotechnical & Road Investigations
Mobile Lab Services
Specialised Concrete & Forensic Investigations
+27 11 828 0279
info@roadlab.co.za
www.roadlab.co.za
207 Rietfontein Rd,
Germiston, JHB, 1400

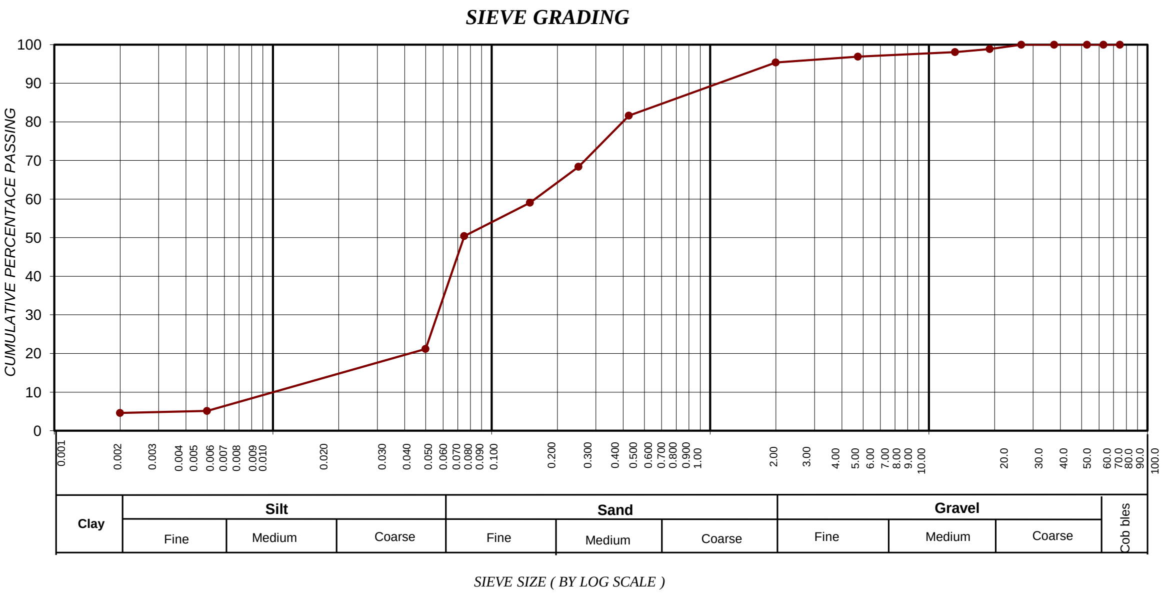
OUR REF : 92/GEO013-18-0001/24
DATE RECEIVED : 2024-07-17
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD
CHAINAGE : TH01/DS1
SITE : G687 GI ON THE REM OF ERF 582 BEDFORDVIEW EXT 113
LAYER : 0.2m
SAMPLE No. : 24/S2257
SAMPLE DESCRIPTION : Dark Brown Sandy Silt

FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)

Weighted PI		**8.2**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	99
	13.2	98
	4.75	97
	2.000	95
	0.425	82
	0.250	68
	0.150	59
	0.075	50
	0.050*	21
	0.005*	5
	0.002*	4.6
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	14
	0.425 - 0.250	14
	0.250 - 0.150	10
	0.150 - 0.075	9
	< 0.075	53
Effective size		0.019
Uniformity Coefficient		8.6
Curvature Coefficient		1.1
Oversize Index		0.0
Shrinkage Product		411.3
Grading Coefficient		4.5
Grading modulus		0.73
Atter-berg Limits	Liquid Limit	29
	Plasticity Index	10
	Linear Shrinkage	5.0
	PI < 0.075	14
Unified Soil Classification		SM
U.S. Highway Classification		A-6(7)
pH - Value		N/A
Conductivity mS/cm		N/A







CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
4.6	45.4	45.4	4.6

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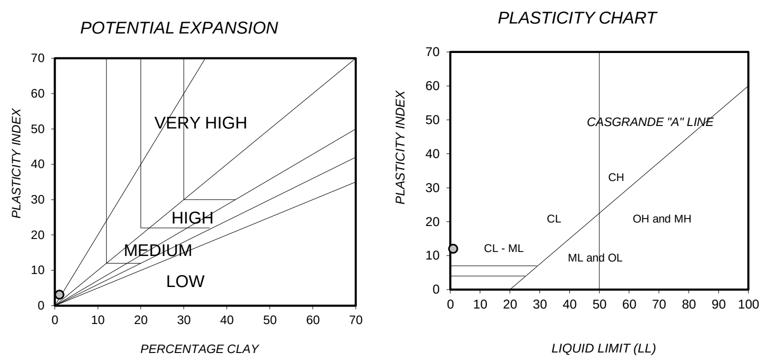
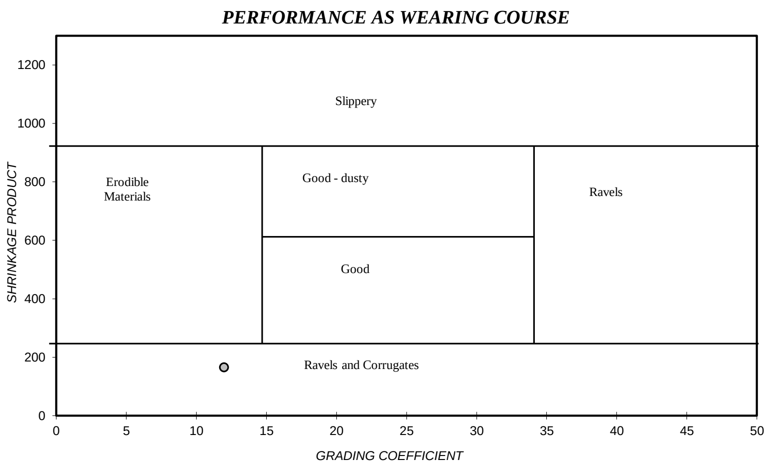
OUR REF : 92/GEO013-18-0001/24
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD
SITE : G687 GI ON THE REM OF ERF 582
BEDFORDVIEW EXT 113

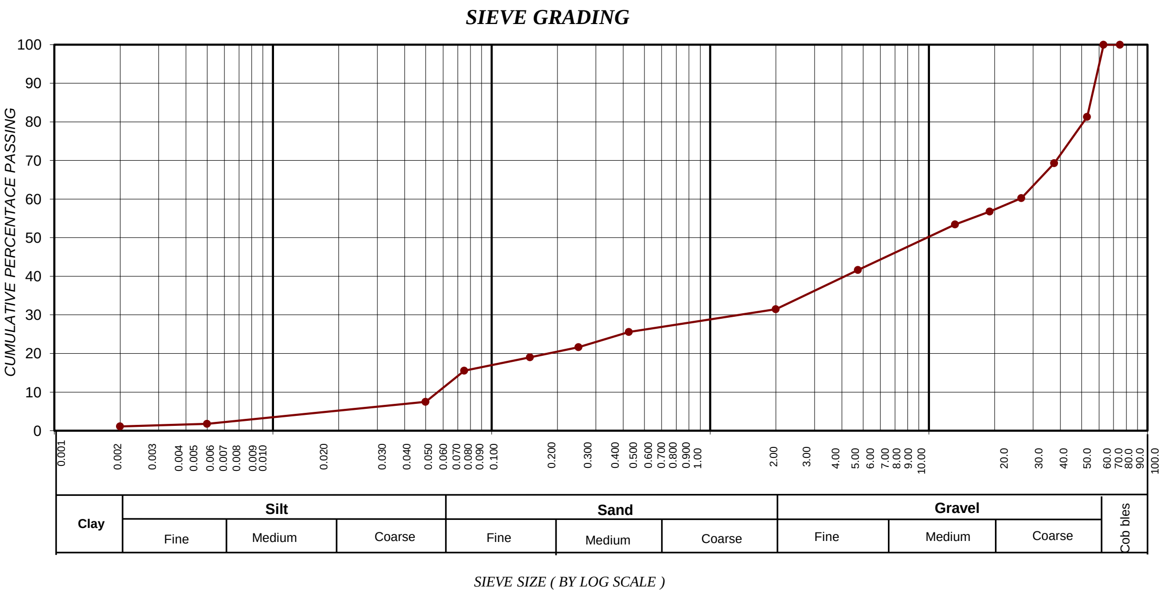
DATE RECEIVED : 2024-07-17
CHAINAGE : TH01/DS2
LAYER : 0.6m
SAMPLE No. : 24/S2258
SAMPLE DESCRIPTION : Dark Yellow Silty Sandy Gravel

*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)*

Weighted PI		**3.1**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	81
	37.5	69
	26.5	60
	19.0	57
	13.2	53
	4.75	42
	2.000	31
	0.425	26
	0.250	22
	0.150	19
	0.075	16
	0.050*	8
	0.005*	2
	0.002*	1.1
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	19
	0.425 - 0.250	13
	0.250 - 0.150	8
	0.150 - 0.075	11
	< 0.075	49
Effective size		0.058
Uniformity Coefficient		449.4
Curvature Coefficient		1.7
Oversize Index		30.7
Shrinkage Product		165.6
Grading Coefficient		12.0
Grading modulus		2.27
Atter-berg Limits	Liquid Limit	34
	Plasticity Index	12
	Linear Shrinkage	6.5
	PI < 0.075	19
Unified Soil Classification		GC
U.S. Highway Classification		A-6(7)
pH - Value		N/A
Conductivity mS/cm		N/A







CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
1.1	14.9	15.5	68.5

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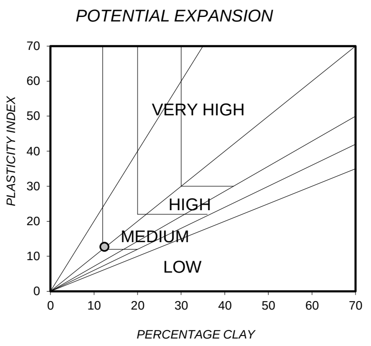
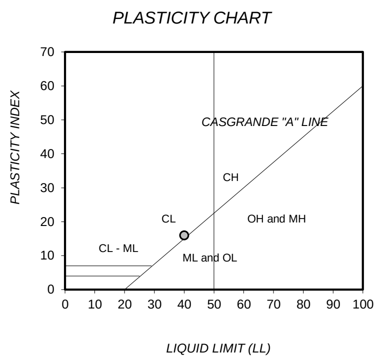
OUR REF :	92/GEO013-18-0001/24	**DATE RECEIVED :**	2024-07-17
CLIENT :	GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD	**CHAINAGE :**	TH01/DS3
SITE :	G687 GI ON THE REM OF ERF 582	**LAYER :**	1.5m
	BEDFORDVIEW EXT 113	**SAMPLE No. :**	24/S2259
		SAMPLE DESCRIPTION :	Dark Red Orange Gravelly Clayey Silty Sand

FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)

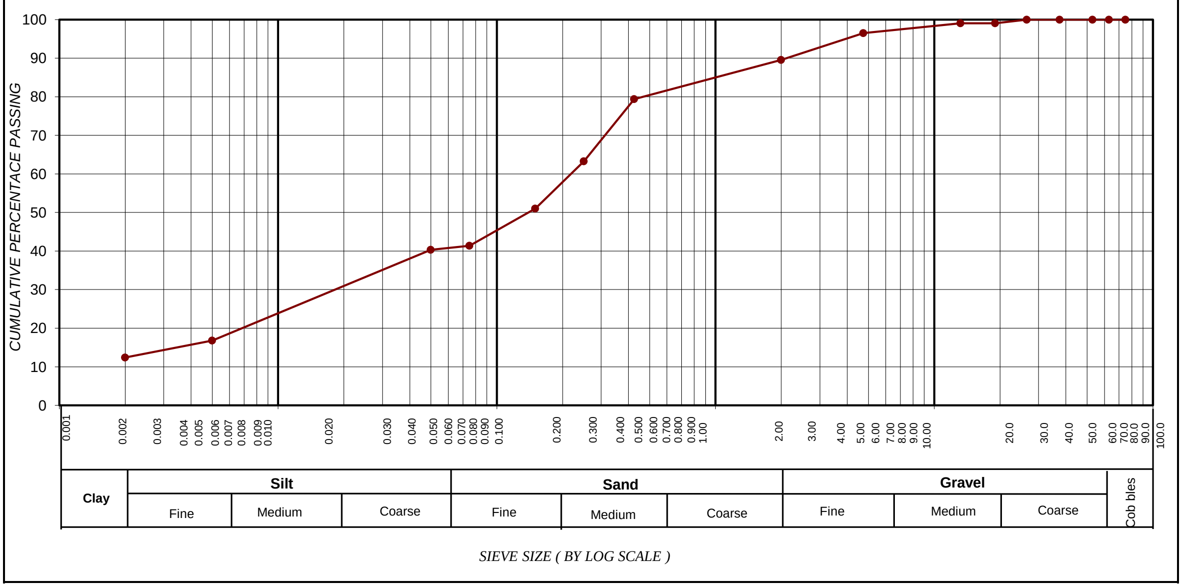
Weighted PI		**12.7**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	99
	13.2	99
	4.75	96
	2.000	90
	0.425	79
	0.250	63
	0.150	51
	0.075	41
	0.050*	40
	0.005*	17
	0.002*	12.4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	11
	0.425 - 0.250	18
	0.250 - 0.150	14
	0.150 - 0.075	11
	< 0.075	46
Effective size		0.002
Uniformity Coefficient		111.7
Curvature Coefficient		2.1
Oversize Index		0.0
Shrinkage Product		654.0
Grading Coefficient		10.1
Grading modulus		0.90
Atter-berg Limits	Liquid Limit	40
	Plasticity Index	16
	Linear Shrinkage	8.2
	PI < 0.075	24
Unified Soil Classification		SC
U.S. Highway Classification		A-6(7)
pH - Value		N/A
Conductivity mS/cm		N/A





PERFORMANCE AS WEARING COURSE

SIEVE GRADING



CLAY (%) (0.001-0.002)	**SILT (%) (0.002-0.060)**	**SAND (%) (0.060-2.00)**	**GRAVEL (%) (2.00-60.0)**
12.4	**28.6**	**48.6**	**10.4**

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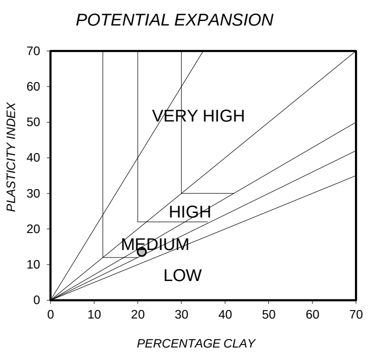
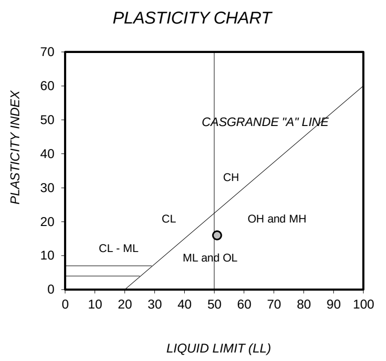
OUR REF : 92/GEO013-18-0001/24
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD
SITE : G687 GI ON THE REM OF ERF 582
BEDFORDVIEW EXT 113

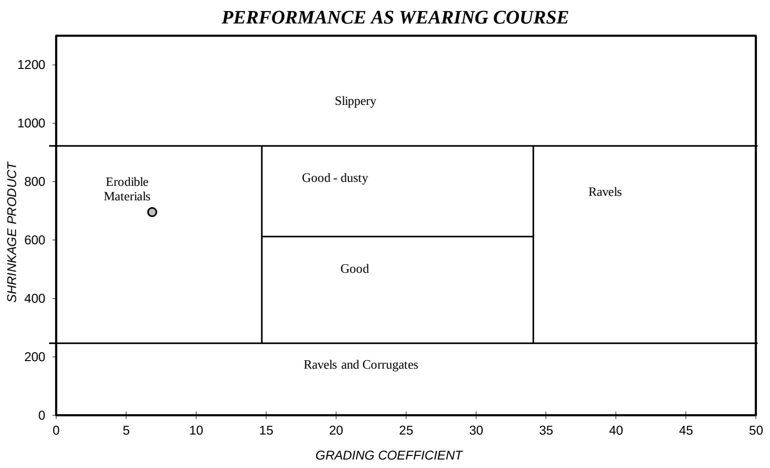
DATE RECEIVED : 2024-07-17
CHAINAGE : TH01/DS4
LAYER : 2.7m
SAMPLE No. : 24/S2260
SAMPLE DESCRIPTION : Light Red Orange Clayey Silty Sand

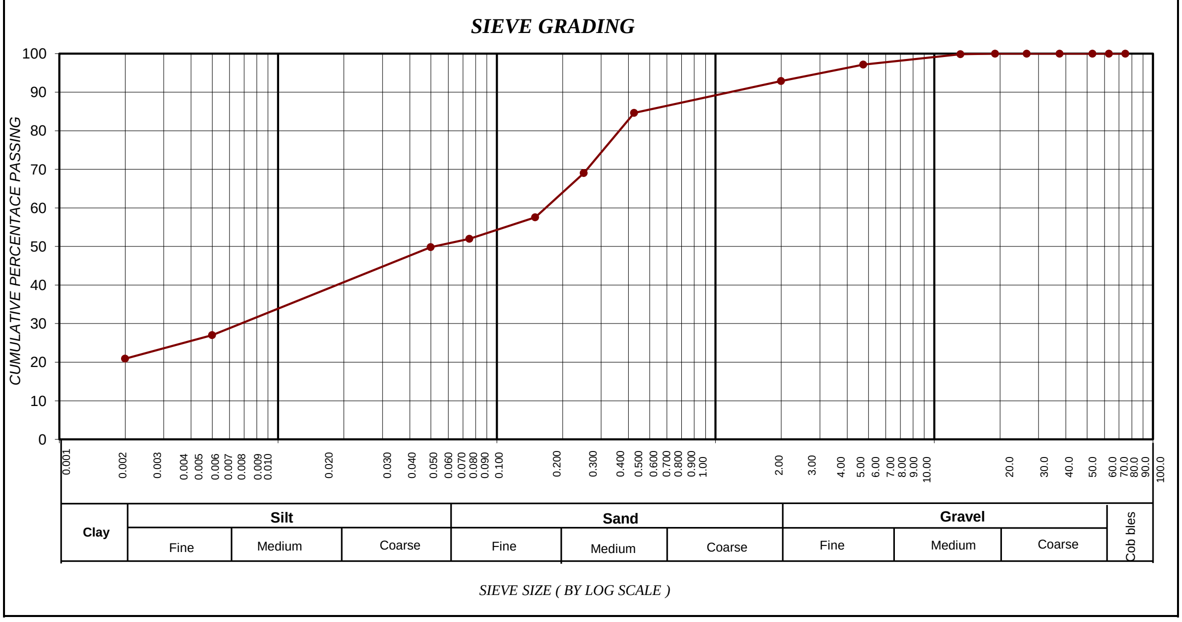
FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)

Weighted PI		**13.5**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	97
	2.000	93
	0.425	85
	0.250	69
	0.150	58
	0.075	52
	0.050*	50
	0.005*	27
	0.002*	20.9
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	9
	0.425 - 0.250	17
	0.250 - 0.150	12
	0.150 - 0.075	10
	< 0.075	52
Effective size		0.002
Uniformity Coefficient		85.7
Curvature Coefficient		0.3
Oversize Index		0.0
Shrinkage Product		695.6
Grading Coefficient		6.9
Grading modulus		0.70
Atter-berg Limits	Liquid Limit	51
	Plasticity Index	16
	Linear Shrinkage	8.2
	PI < 0.075	22
Unified Soil Classification		SC
U.S. Highway Classification		A-6(7)
pH - Value		N/A
Conductivity mS/cm		N/A









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
20.9	31.1	40.9	7.1

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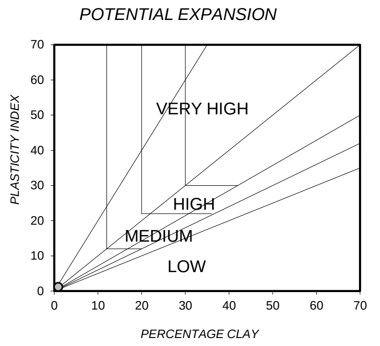
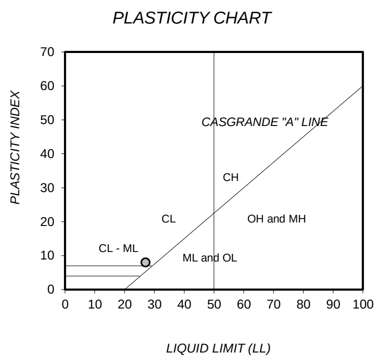
OUR REF : 92/GEO013-18-0001/24
CLIENT : GEO SIMPLICITY GEOTECHNICAL ENGINEERING (PTY) LTD
SITE : G687 GI ON THE REM OF ERF 582
BEDFORDVIEW EXT 113

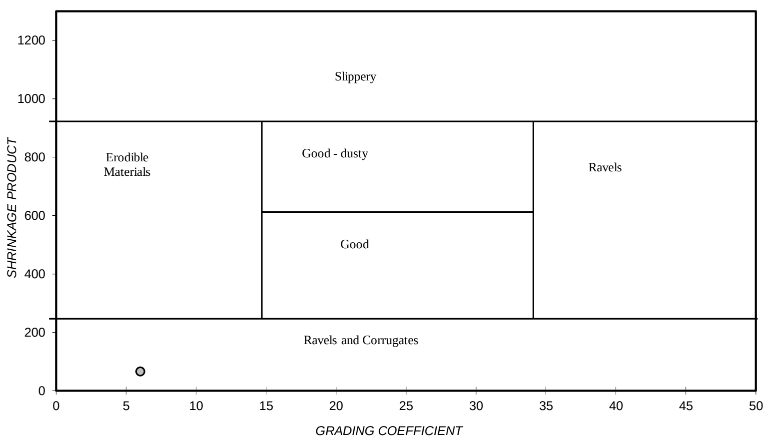
DATE RECEIVED : 2024-07-17
CHAINAGE : TH03/DS5
LAYER : 0.6m
SAMPLE No. : 24/S2261
SAMPLE DESCRIPTION : Dark Brown Sandy Gravel

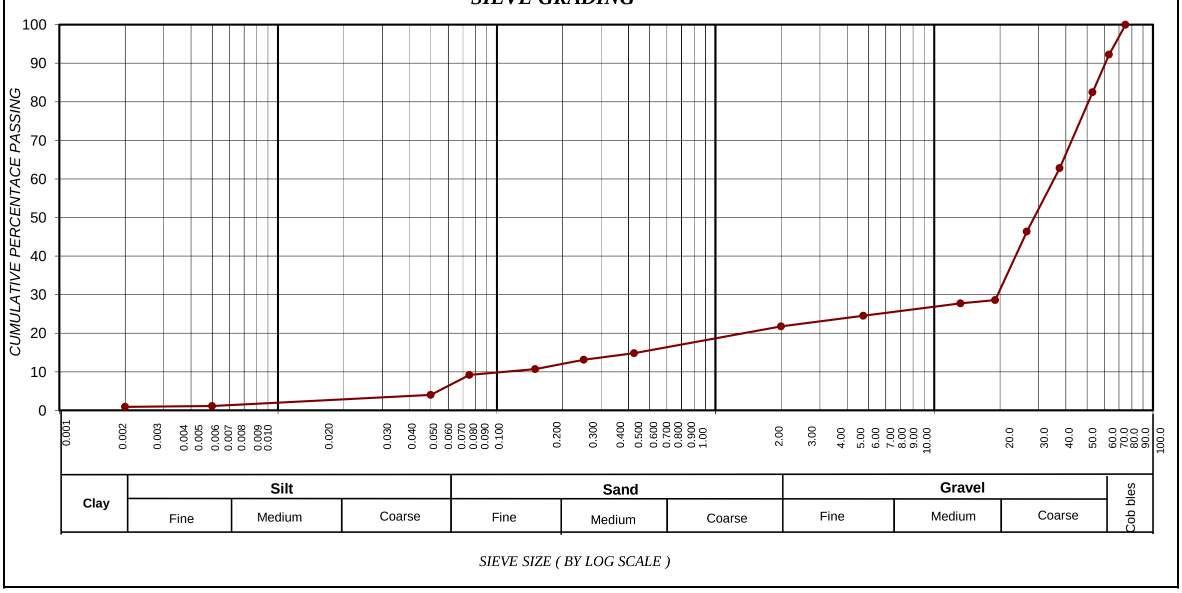
FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *SANS 3001-GR3:2014)

Weighted PI		**1.2**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	92
	53.0	82
	37.5	63
	26.5	46
	19.0	29
	13.2	28
	4.75	25
	2.000	22
	0.425	15
	0.250	13
	0.150	11
	0.075	9
	0.050*	4
	0.005*	1
	0.002*	0.9
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	32
	0.425 - 0.250	8
	0.250 - 0.150	11
	0.150 - 0.075	7
	< 0.075	42
Effective size		0.114
Uniformity Coefficient		311.3
Curvature Coefficient		94.1
Oversize Index		37.2
Shrinkage Product		66.0
Grading Coefficient		6.0
Grading modulus		2.54
Atter-berg Limits	Liquid Limit	27
	Plasticity Index	8
	Linear Shrinkage	4.5
	PI < 0.075	13
Unified Soil Classification		GW-GP
U.S. Highway Classification		A-6(7)
pH - Value		N/A
Conductivity mS/cm		N/A









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
0.9	8.1	12.8	78.2

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92/GEO013-18-0001/24 **RG 28201** Date - 2024-07-29

Geo Simplicity Engineering (Pty) Ltd
1 Killoran Place
Bedfordview
2007

Attention: **Mr Petrus Van Straten**

Dear Sir

Test Report : **G687 GI ON THE REM OF ERF 582 BEDFORVIEW EXT 113 - CBR TEST RESULTS (TRACE NO. 35354)**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (PTY)Ltd. In Primrose, Germiston.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		24/S2261			
CONTAINER USED FOR SAMPLING		Clients Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TH 03			
ROAD No. OR NAME		DS 5			
LAYER TESTED / SAMPLED FROM		0.6m			
DATE SAMPLED		2024-07-17			
DATE RECEIVED		2024/07/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Dark Brown			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANA - LYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	90			
	53.0	77			
	37.5	67			
	26.5	45			
	19.0	38			
	13.2	37			
	4.75	33			
	2.00	29			
	0.425	20			
	0.075	12			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986; TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%	27.0			
	P.I.	8.0			
	LS%	4.5			
GM		2.39			
CLASSIFI - CATION	H.R.B.*	A-2-4(0)			
	COLTO*	G7			
	T.R.H. 14*	G7			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7 & A8)					
MOD AASHTO **(TMH A7)**	OMC%	12.4			
	MDD(KG/M^3)	1915			
	COMP MC %	12.4			
	% SWELL	0.22			
C.B.R. **(TMH A8)**	100%	48			
	98%	34			
	97%	27			
	95%	20			
	93%	16			
	90%	12			
MOD ITS : DRY (kPa) (A16T)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB	-			
	ON SITE	Neat			
TEST TYPE		IND / CBR			
SAMPLED BY		Client			
DELIVERED BY		Client			
SAMPLING METHOD		**N/A**			
ENVIRONMENTAL CONDITION WHEN SAMPLED		N/A			
REMARKS & NOTES		None			

Kind Regards

Mr R Potgieter
TECHNICAL SIGNATORY / MANAGER

Remarks :
*Opinions & Interpretations are not included in our schedule of Accreditation
SANAS Accredited Laboratory No. T 0296
The samples were subjected to analysis according to TMH 1
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab
Documents may only be reproduced or published in their full context
Compiled By : Kristen Spaumer

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92/GEO013-18-0001/24 RG 28201 2024/07/29

Geo Simplicity Engineering (Pty) Ltd
1 Killoran Place
Bedfordview
2007

ATTENTION: **Mr Petrus Van Straten**

Test Report : **G687 GI ON THE REM OF ERF 582 BEDFORDVIEW EXT 113 -PH & CONDUCTIVITY TEST RESULTS**

Clients Marking: None
Sample Number: 24/S2257-24/S2261
Sample delivered to: Roadlab

Date Sampled: 2024/07/17
Date Received: 2024/07/17

Sample Number	Layer / Road :	Temperature (°C) : Conductivity	Conductivity (ms/m)	Temperature (°C) : pH	pH Value
24/S2257	TH01-DS1/0.2m	22°C	48.7	22°C	7.08
24/S2258	TH01-DS2/0.6m	22°C	37.3	22°C	6.35
24/S2259	TH01-DS3/1.5m	22°C	26.5	22°C	6.34
24/S2260	TH01-DS4/2.7m	22°C	29.3	22°C	6.42
24/S2261	TH03-DS5/0.6m	22°C	84.5	22°C	7.66

Kind Regards

Mr R Potgieter
Technical Signatory

Remarks :
The samples were subjected to analysis according to TMH 1
The results reported relate only to the sample tested
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ANNEXURE D:

FIELDWORK PHOTOGRAPHS

Digging of test holes

Upper hillwash transported underlain by the pebblemarker transported with depth

Left: Reworked residual lava, and
Right: Residual lava encountered

Close-up view of stiff, residual lava, where encountered