Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists

GEOSURE (Pty) Ltd

- Geotechnical Engineering Services
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- Geotechnical Monitoring Systems
- Road Pavement Materials and Design
- Project Management

Report to Delca Systems on the Results of a Geotechnical Investigation for the Proposed New Municipality Clinic in Dannhauser, KwaZulu-Natal

Reference: 128-11.R01

Dated: 13 May 2011

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Plate 1

Plate 2

Plates 1 and 2: General views towards the north across the study area

5. FIELDWORK

The fieldwork for the investigation was carried out on 21 April 2011 and comprised the following:

- Inspection Pits; and
- CBR Dynamic Cone Penetrometer (DCP) Tests

5.1 Inspection Pits

Four (4No.) inspection pits, designated IP1 through IP4, were excavated using hand tools at the approximate positions given in Figure 1. The inspection pits were advanced to final depths in the range 1,4 (IP3) to 1,5 (IP1, IP3 and IP4) metres below existing ground level.

The inspection pits were profiled using the South African Geoterminology Guidelines (1990)[1], sampled and reinstated on completion. Copies of the detailed profiles are given in Appendix A.

5.2 CBR Dynamic Cone Penetrometer Tests

Six (6No.) Dynamic Cone Penetrometer (DCP) tests, designated DC1 through DC6, were carried out at the approximate positions given in Figure 1. The DCP tests were advanced to refusal depths in the range 2,4 (DC6) to 4,0 (DC1) metres below existing ground level.

The results of the DCP test comprising plots of blow counts versus depth are given in Appendix B.

6. GEOLOGY AND SUBSOILS

The geology of the site is characterised by colluvial soils which are underlain by residual dolerite soils (silty clays) derived from the weathering of the underlying Karoo-age dolerite bedrock.

[1] Geoterminology Workshop (1990) – Guidelines for Soil and Rock Logging – SAIEG – AEG – SAICE (Geotechnical Division) pp 47.

Table 1: Summary of Results of Particle Size Distribution Analysis and Atterberg Limit Determinations, Compaction, CBR and Hydrometer Testing

IP No	Depth (m)	Description	Particle Size %				*Atterberg Limits %			GM	OMC (%)	MDD (kg/m3)	Insitu Moisture Content %	%Swell	CBR (%)						Material Code & Classification
			Clay	Silt	Sand	Gravel	LL	PI	LS						90	93	95	97	98	100	
COLLUVIUM																					
IP2	0-0,6	Dark greyish brown slightly silty CLAY	77		22	1	48	24	12,5	0,34	15,4	1770	-	1,5	0,4	0,6	0,8	1	1,1	1,4	A-7-6(19) CL CBD (>G10)
RESIDUAL DOLERITE																					
IP1	0,6-1,3	Light yellowish grey CLAY	83		16	1	48	31	15	0.23	14,1	1836	-	1	0,6	0,8	1	1,2	1,3	1,6	A-7-6(26) CL CBD (>G10)
IP2	0,6-1,1	Light olive green grey slightly silty CLAY	87		11	2	55	33	17,5	0,23	15,4	1770	-	0,8	0,5	0,6	0,7	0,8	0,9	1	A-7-6(31) CH CBD (>G10)
IP3	0,8-1,4	Light olive grey CLAY	51	33	15	1	57	36	18,5	0.2	-	-	14,5	-	-	-	-	-	-	-	A-7-6(17) CH *High

LL - Liquid Limit
PI - Plasticity Index
CBR- California Bearing Ratio
G7 - Classification in Terms of TRH14 (1985)
CL - Unified Classification

OMC - Optimum Moisture Content
MDD - Maximum Dry Density
LS - Linear Shrinkage
*High - Potential Expansiveness According to van der Merwe (1964)
A-2-4 - AASHTO Classification

Placement of fill layers should be undertaken in layers not exceeding 200mm thick when placed loose and compacted using suitable compaction plant to achieve 93% Modified AASHTO maximum dry density.

Due to the clayey nature of the residual soils, difficulties with compacting these materials when wet may be experienced i.e. materials will heave when wet. Furthermore, these clays will soften significantly when saturated, which could lead to excessive settlement of any supporting structure or paving. These clayey subsoils may also be impassable to construction vehicles when wet.

Terraces should be graded to direct water away from the fill edges, and small earth bunds should be constructed along the crests of fills, to prevent overtopping and erosion of fill embankment slopes. These bunds should be a minimum 450mm wide and 300mm high. Density control of placed fill material should be undertaken at regular intervals during fill construction.

Boulders larger than 200mm diameter or $^1/_3$ of the layer thickness when loose should be removed from the fill material as these could complicate the compaction works, and also cause piping within fills. Furthermore, large boulders in fills could cause later problems during construction of foundations.

Cut slopes in soils should be formed to batters of 1 vertical to 1,75 horizontal and to a height not greater than 2 metres where retaining walls are not provided. Engineered fill slopes should be formed to batters of 1 vertical to 1,5 horizontal provided that the edge of fills are over constructed and thereafter trimmed back to the required position.

Cut and fill heights greater than 2,0 metres would need to be inspected and approved by an engineering geologist or geotechnical engineer.

9.5 Drainage

The most important factor in the stable development of the site is the control and removal of both surface and groundwater from the site. It should be noted that a natural stormwater runoff drain was encountered within the site.

Earthworks and drainage measures should be designed in such a way as to prevent ponding of, or high concentrations of, stormwater or groundwater anywhere on the site, both during and after the development.

The terrace should be shaped to a gradient to prevent water ponding on the surface and should be graded to direct water away from the fill edges and foundations.

9.6 Subgrade Treatment for Roads, Parking Areas & Surface Beds

The same criteria in terms of depth of cut and height of fills as that recommended in the creation of building platforms applies to road construction and surface beds. The following comments for the study area have relevance in this regard:

- The existing colluvial and residual material does not satisfy the criteria for a G10 or better quality material should this be a required subgrade.

Foundation loads were not available at the time of preparation of this report and should be discussed with Geosure when finalised. However, it is anticipated that foundation loads are likely to be low.

Due to the subsoils high potential for heave, convetional strip footings will not be suitable for this site. The following foundation options can be considered (see Table 4):

- Stiffened or cellular raft;
- Soil Raft;
- Piled Foundation.

9.7.1 Stiffened or Cellular Raft

It is recommended that the stiffened or cellular raft be placed on the firm to stiff residual soils where a maximum nett allowable bearing pressure of 50kN/m^2 is considered applicable.

Founding depths will depend on the final level of the proposed platform. Inferring from the field tests founding depths are likely to be in the range 0,6 to 0,8 metres below existing ground level. Founding depths will depend on the final level of the proposed platform.

9.7.2 Soil Raft

Alternatively, for greater bearing pressures a soil raft foundation can also be considered. This will require the removal of all necessary parts of the expansive horizon to 1,0 m beyond the perimeter of the building to a depth 1,5 times the widest foundation and replacing it with a suitable granular backfill of at least G7 quality compacted to 93% MOD AASHTO density at –1% to +2% of optimum moisture content. Should this method be adopted then a maximum nett allowable bearing pressure of 75 kN/m^2 is considered.

9.7.3 Piled Foundation

Alternatively, for greater bearing pressures it is recommended that the proposed structures be supported on a piled foundation. In this regard, it is considered that the small diameter Pressure Grouted Continuous Flight Auger (CFA) pile would be best suited for the relatively light foundation loads anticipated. Consideration could also be given to Driven Cast Insitu (DCI) piles. The piles may have a minimum length of 5m.

9.7.4 Foundation Precautions

The construction of a 1m wide concrete apron around the structure is recommended in order to minimize seasonal subsurface moisture fluctuations beneath the structure that could lead to heave. The surrounding ground should also be graded away from the structure to limit infiltration of water into the subsoils immediately beneath the building.

A provision for possible movements between floors and walls should be allowed for in the design e.g. provision of construction joints and use of appropriate softboard between walls and floors as per structural engineer's detail. All brickwork and foundations will need to be reinforced as determined by a structural engineer. The use of movement joints should also be considered.

8 June 2011

Author – A. Ramroop BSc Eng (civil) *Date*

Reviewed By: D. Naidoo Pr. Sci. Nat.

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APPENDIX A

INSPECTION PIT PROFILES

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Delca Systems
Municipality Clinic- Dannhauser

HOLE No: TP2
Sheet 1 of 1

JOB NUMBER: 128-11

Scale 1:25

0.00 Slightly moist to moist, dark greyish brown, firm to stiff, slightly silty CLAY (insect burrows, few thick roots, many roots, black rounded, light brown ellipsoidal stones). Colluvium.

0.60 Slightly moist to moist, light olive green grey, firm to stiff, CLAY (fine roots, black rounded stones, light brown ellipsoidal stones-uniform sized). Residual Dolerite.

1.50

NOTES

1) No ground water seepage observed.

2) Sample taken at:
S1 0m--0,60m (Ind)
S2 0,60m--1,50m (Ind)

3) Area scattered with few dolerite cobbles and boulders.

4) Final depth at 1,5m.

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : M. Reddy

TYPE SET BY :
SETUP FILE : COMPRESS.SET

INCLINATION :
DIAM :
DATE : 21 April 2011
DATE : 21 April 2011

DATE : 09/06/11 16:26
TEXT : ..\2011\128\LOGS\PITS.TXT

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP2

dot.PLOT 5004 J&W

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Delca Systems
Municipality Clinic- Dannhauser

HOLE No: IP4
Sheet 1 of 1

JOB NUMBER: 128-11

Scale 1:25

0.00 Slightly moist to moist. dark greyish brown, firm to soft, slightly silty CLAY (insect burrows, few thick roots, black rounded, light brown ellipsoidal stones). Colluvium.

0.74 Slightly moist to moist, light olive green grey, firm to soft, CLAY (fine roots, black rounded stones, light brown ellipsoidal stones-uniform sized). Residual Dolerite.

1.50

NOTES

1) No ground water seepage observed.

2) Final depth at 1,5m.

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : M. Reddy
TYPE SET BY :
SETUP FILE : COMPRESS.SET

INCLINATION :
DIAM :
DATE : 21 April 2011
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TEXT : ..\2011\128\LOGS\PITS.TXT

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: IP4

dot.PLOT 5004 J&W

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Reference: 128-11.R01 **Date: 13 May 2011**

1. TERMS OF REFERENCE

Geosure (Pty) Ltd was requested by Delca Systems to carry out a geotechnical investigation for the proposed new municipality clinic in Dannhauser, KwaZulu-Natal.

2. SCOPE OF REPORT

This report details the results of a geotechnical investigation for the proposed new municipality clinic in Dannhauser, KwaZulu-Natal.

The subsoil conditions beneath the site are described and comment is made on the general stability of the site. Recommendations for earthworks, drainage, materials excavatability/rippability, foundations and subgrade treatment for roads are provided.

3. INFORMATION SUPPLIED

For the purposes of assisting with this investigation Geosure was provided with the telephone number of Ms. Mispha, who is the Head Nurse at the existing clinic in Dannhauser.

The Dannhauser Municipality allowed Geosure to view a typical plan layout of the municipality clinic.

An aerial photograph of the site sourced from Google Earth 2009 was also utilised for the purposes of this project.

4. SITE DESCRIPTION

The site for the proposed development is located in Dannhauser, approximately 40km south of Newcastle, KwaZulu-Natal. The approximate GPS coordinates for the site are 28°01'15,70"S, 30°03'04,62"E.

The study area is characterised by a relatively flat vegetated landform.

Plates 1 and 2 below provide an indication of the study area.

Plate 1

Plate 2

Plates 1 and 2: General views towards the north across the study area

5. FIELDWORK

The fieldwork for the investigation was carried out on 21 April 2011 and comprised the following:

- Inspection Pits; and
- CBR Dynamic Cone Penetrometer (DCP) Tests

5.1 Inspection Pits

Four (4No.) inspection pits, designated IP1 through IP4, were excavated using hand tools at the approximate positions given in Figure 1. The inspection pits were advanced to final depths in the range 1,4 (IP3) to 1,5 (IP1, IP3 and IP4) metres below existing ground level.

The inspection pits were profiled using the South African Geoterminology Guidelines (1990)[1], sampled and reinstated on completion. Copies of the detailed profiles are given in Appendix A.

5.2 CBR Dynamic Cone Penetrometer Tests

Six (6No.) Dynamic Cone Penetrometer (DCP) tests, designated DC1 through DC6, were carried out at the approximate positions given in Figure 1. The DCP tests were advanced to refusal depths in the range 2,4 (DC6) to 4,0 (DC1) metres below existing ground level.

The results of the DCP test comprising plots of blow counts versus depth are given in Appendix B.

6. GEOLOGY AND SUBSOILS

The geology of the site is characterised by colluvial soils which are underlain by residual dolerite soils (silty clays) derived from the weathering of the underlying Karoo-age dolerite bedrock.

[1] Geoterminology Workshop (1990) – Guidelines for Soil and Rock Logging – SAIEG – AEG – SAICE (Geotechnical Division) pp 47.

The colluvial soils comprise slightly moist, light/dark greyish brown, firm to stiff, clayey sandy SILT to slightly silty CLAY. The colluvial soils extend to an average depth of 0,7 metres below existing ground level.

The colluvial soils are in turn underlain by residual dolerite soils and can be described as slightly moist, yellowish olive greenish grey, firm to stiff, intact, CLAY. The residual soils extend to depths in excess of 1,4 metres below existing ground level.

Plate 3 below provides an indication of the typical subsoil geology encountered across the site.

Plate 3: Typical subsoils encountered in the study area

7. GROUNDWATER OCCURRENCE

Groundwater seepage was not encountered during the course of the geotechnical investigation. A shallow perched groundwater table is considered both during and after periods of heavy rainfall and/or during the high rainfall summer season. Due cognisance of this likely perched water table will need to be taken into account during the construction phase.

8. LABORATORY TESTS RESULTS

In order to evaluate engineering properties and the suitability of the in-situ soils for use in construction, the following laboratory tests were carried out on representative soil samples:

- Grading Analysis to 0,075mm sieve with Atterberg Limit Determinations;
- Modified AASHTO tests;
- California Bearing Ratio (CBR) tests; and
- Hydrometer Tests.

The results of the laboratory tests are given in Appendix C and summarised in Table 1 below.

Table 1: Summary of Results of Particle Size Distribution Analysis and Atterberg Limit Determinations, Compaction, CBR and Hydrometer Testing

IP No	Depth (m)	Description	Particle Size %				*Atterberg Limits %			GM	OMC (%)	MDD (kg/m3)	Insitu Moisture Content %	%Swell	CBR (%)						Material Code & Classification
			Clay	Silt	Sand	Gravel	LL	PI	LS						90	93	95	97	98	100	
COLLUVIUM																					
IP2	0-0,6	Dark greyish brown slightly silty CLAY	77		22	1	48	24	12,5	0,34	15,4	1770	-	1,5	0,4	0,6	0,8	1	1,1	1,4	A-7-6(19) CL CBD (>G10)
RESIDUAL DOLERITE																					
IP1	0,6-1,3	Light yellowish grey CLAY	83		16	1	48	31	15	0,23	14,1	1836	-	1	0,6	0,8	1	1,2	1,3	1,6	A-7-6(26) CL CBD (>G10)
IP2	0,6-1,1	Light olive green grey slightly silty CLAY	87		11	2	55	33	17,5	0,23	15,4	1770	-	0,8	0,5	0,6	0,7	0,8	0,9	1	A-7-6(31) CH CBD (>G10)
IP3	0,8-1,4	Light olive grey CLAY	51	33	15	1	57	36	18,5	0,2	-	-	14,5	-	-	-	-	-	-	-	A-7-6(17) CH *High

LL - Liquid Limit
PI - Plasticity Index
CBR- California Bearing Ratio
G7 - Classification in Terms of TRH14 (1985)
CL - Unified Classification

OMC - Optimum Moisture Content
MDD - Maximum Dry Density
LS - Linear Shrinkage
*High - Potential Expansiveness According to van der Merwe (1964)
A-2-4 - AASHTO Classification

8.1 Classification of Material and Recommended Usage

The subgrade materials underlying the site have been classified in terms of their suitability for use in earthworks and road construction on the basis of field observations and laboratory testing. The classification is summarised in Table 2 below.

Table 2: Materials Classification and Usage

Material Type	Description	Classification Details	Recommended Use
COLLUVIUM	Dark greyish brown slightly silty CLAY	PI=24 GM = 0,34 CBR @ 90% Mod AASHTO = 0,4 CBR @ 93% Mod AASHTO = 0,6 TRH14: >G10	The clayey colluvial soils are poor to very poor subgrade material., These soils will require undercutting and replacement with a granular soil where encountered at or below subgrade level. Should be stockpiled and used as topsoil.
RESDIUAL DOLERITE	Light yellowish grey/olive green slightly silty CLAY	PI=48 - 57 GM = 0,2 – 0,34 CBR @ 90% = 0,5 – 0,6 CBR @ 93% = 0,6 – 0,8 TRH 14: >G10	The clayey colluvial soils are poor to very poor subgrade material., These soils will require undercutting and replacement with a granular soil where encountered at or below subgrade level.

9. DISCUSSION

9.1 Proposed Development

It is understood that the proposed development will comprise a single storey structure and associated parking areas.

9.2 General Stability of the Site

Based on the results of the fieldwork undertaken during this investigation, it is considered that this site is generally stable and suitable for development, provided that the recommendations given in this report are adhered to.

9.3 Excavatability and Rippability Assessment

It is considered that SOFT excavation in terms of SANS 1200 DA criteria can be expected to at least 2,5metres below existing ground level. These soils can be easily removed by hand tools or a tractor loader backhoe (TLB) of flywheel power approximately 0,10kW per millimetre of tined bucket width. Thereafter, INTERMEDIATE to HARD excavations can be anticipated. Occasional corestones may require pneumatic tools to break these down.

9.4 General Earthworks

All earthworks should be carried out in a manner to promote stable development of the site. It is recommended that earthworks be carried out along the guidelines given in SANS 1200 (current version).

Placement of fill layers should be undertaken in layers not exceeding 200mm thick when placed loose and compacted using suitable compaction plant to achieve 93% Modified AASHTO maximum dry density.

Due to the clayey nature of the residual soils, difficulties with compacting these materials when wet may be experienced i.e. materials will heave when wet. Furthermore, these clays will soften significantly when saturated, which could lead to excessive settlement of any supporting structure or paving. These clayey subsoils may also be impassable to construction vehicles when wet.

Terraces should be graded to direct water away from the fill edges, and small earth bunds should be constructed along the crests of fills, to prevent overtopping and erosion of fill embankment slopes. These bunds should be a minimum 450mm wide and 300mm high. Density control of placed fill material should be undertaken at regular intervals during fill construction.

Boulders larger than 200mm diameter or $^1/_3$ of the layer thickness when loose should be removed from the fill material as these could complicate the compaction works, and also cause piping within fills. Furthermore, large boulders in fills could cause later problems during construction of foundations.

Cut slopes in soils should be formed to batters of 1 vertical to 1,75 horizontal and to a height not greater than 2 metres where retaining walls are not provided. Engineered fill slopes should be formed to batters of 1 vertical to 1,5 horizontal provided that the edge of fills are over constructed and thereafter trimmed back to the required position.

Cut and fill heights greater than 2,0 metres would need to be inspected and approved by an engineering geologist or geotechnical engineer.

9.5 Drainage

The most important factor in the stable development of the site is the control and removal of both surface and groundwater from the site. It should be noted that a natural stormwater runoff drain was encountered within the site.

Earthworks and drainage measures should be designed in such a way as to prevent ponding of, or high concentrations of, stormwater or groundwater anywhere on the site, both during and after the development.

The terrace should be shaped to a gradient to prevent water ponding on the surface and should be graded to direct water away from the fill edges and foundations.

9.6 Subgrade Treatment for Roads, Parking Areas & Surface Beds

The same criteria in terms of depth of cut and height of fills as that recommended in the creation of building platforms applies to road construction and surface beds. The following comments for the study area have relevance in this regard:

- The existing colluvial and residual material does not satisfy the criteria for a G10 or better quality material should this be a required subgrade.

- Accordingly, where poor road subgrade or surface bed material, as described above, is exposed, undercutting into the unsuitable materials (depending on the road formation level or surface bed level) to the specified depth to accommodate a select layer comprising material of at least G8 quality and compacted to at least 93% Modified AASHTO dry density is recommended. Provided the above recommendations are followed, a design CBR of 10 can be adopted.

The pavement formation layer for the proposed roads and parking areas should be designed taking into account anticipated traffic loads, volumes and design life of the parking area and road.

9.7 Foundation Recommendations

The clayey residual dolerite soils have a calculated potential heave of approximately 90mm (Weston's Method 1980). Therefore, according to the guidelines provided by the National Home Builder's Registration Council (NHBRC), the site classifies as **H3**.

The criteria for this classification are listed below in Table 3, taken from the NHBRC manual.

Table 3: NHBRC Classification of the Site

TYPICAL FOUNDING MATERIAL	CHARACTER OF FOUNDING MATERIAL	EXPECTED RANGE OF TOTAL SOIL MOVEMENTS (mm)	ASSUMED DIFFERENTIAL MOVEMENT (% OF TOTAL)	SITE CLASS
Fine grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	EXPANSIVE SOILS	>30	50%	H3

According to the guidelines provided by the NHBRC, the following foundation types listed in Table 4 below are considered applicable to the above site designations.

Table 4: Foundation Design, Building Procedures and Precautionary Measures for Single Storey Residential Structures Founded on Expansive Soil Horizons (from NHBRC Part 1, Section 2, Table 1)

Site Class	Estimated Total Heave (mm)	Construction Type	Foundation Design and Building Procedures (Expected Damage Limited to Category 1)
H3	>30	Stiffened or cellular raft	✓ Stiffened or cellular raft of articulated lightly reinforced masonry. ✓ Site drainage and plumbing / service precautions.
		Piled Construction	✓ Piled foundations with suspended floor slabs with or without ground beams. ✓ Site drainage and plumbing / service precautions.
		Soil Raft	✓ Remove all necessary parts of expansive horizon to 1,0 m beyond the perimeter of the building and replace with inert backfill 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 if residual movements are <7,5 mm, or construction type appropriate to residual movements. ✓ Site drainage and plumbing / service precautions.

Foundation loads were not available at the time of preparation of this report and should be discussed with Geosure when finalised. However, it is anticipated that foundation loads are likely to be low.

Due to the subsoils high potential for heave, convetional strip footings will not be suitable for this site. The following foundation options can be considered (see Table 4):

- Stiffened or cellular raft;
- Soil Raft;
- Piled Foundation.

9.7.1 Stiffened or Cellular Raft

It is recommended that the stiffened or cellular raft be placed on the firm to stiff residual soils where a maximum nett allowable bearing pressure of 50kN/m^2 is considered applicable.

Founding depths will depend on the final level of the proposed platform. Inferring from the field tests founding depths are likely to be in the range 0,6 to 0,8 metres below existing ground level. Founding depths will depend on the final level of the proposed platform.

9.7.2 Soil Raft

Alternatively, for greater bearing pressures a soil raft foundation can also be considered. This will require the removal of all necessary parts of the expansive horizon to 1,0 m beyond the perimeter of the building to a depth 1,5 times the widest foundation and replacing it with a suitable granular backfill of at least G7 quality compacted to 93% MOD AASHTO density at –1% to +2% of optimum moisture content. Should this method be adopted then a maximum nett allowable bearing pressure of 75 kN/m^2 is considered.

9.7.3 Piled Foundation

Alternatively, for greater bearing pressures it is recommended that the proposed structures be supported on a piled foundation. In this regard, it is considered that the small diameter Pressure Grouted Continuous Flight Auger (CFA) pile would be best suited for the relatively light foundation loads anticipated. Consideration could also be given to Driven Cast Insitu (DCI) piles. The piles may have a minimum length of 5m.

9.7.4 Foundation Precautions

The construction of a 1m wide concrete apron around the structure is recommended in order to minimize seasonal subsurface moisture fluctuations beneath the structure that could lead to heave. The surrounding ground should also be graded away from the structure to limit infiltration of water into the subsoils immediately beneath the building.

A provision for possible movements between floors and walls should be allowed for in the design e.g. provision of construction joints and use of appropriate softboard between walls and floors as per structural engineer's detail. All brickwork and foundations will need to be reinforced as determined by a structural engineer. The use of movement joints should also be considered.

The following precautions should also be taken to prevent the clayey subsoils from wetting up and causing heave:

- Gardens which are located against the external perimeter of the house should not be excessively watered;
- Leaks in plumbing associated damage must be attended to as soon as possible without any delay;
- No plumbing and drainage to be placed under floor slabs;
- 1,0 m^2 concrete aprons to be provided at all downpipes; and
- No large shrubs and trees being planted within 1,5 metres of structures.

10. CONCLUSION

This report details the results of a geotechnical investigation for the proposed new municipality clinic in Dannhauser, KwaZulu-Natal.

The geology of the site is characterised by colluvial soils which is in turn are underlain by residual dolerite soils (silty clays) derived from the weathering of the underlying Karoo-age dolerite bedrock.

Groundwater seepage was not encountered during the course of the geotechnical investigation. A shallow perched groundwater table is considered both during and after periods of heavy rainfall and/or during the high rainfall summer season. Due cognisance of this likely perched water table will need to be taken into account during the construction phase.

Based on the results of the fieldwork undertaken during this investigation, it is considered that this site is generally stable and suitable for development, provided that the recommendations given in this report are adhered to.

All earthworks should be carried out in a manner to promote stable development of the site. It is recommended that earthworks be carried out along the guidelines given in SANS 1200 (current version).

The clayey residual dolerite soils have a calculated potential heave of approximately 90mm (Weston's Method 1980). Therefore, according to the guidelines provided by the National Home Builder's Registration Council (NHBRC), the site classifies as **H3**.

Due to the subsoils high potential for heave convetional strip footings will not be suitable for this site. The following foundation options can be considered:

- Stiffened or cellular raft;
- Soil Raft;
- Piled Foundation.

The ground conditions given in this report refer specifically to the field tests carried out on site. It is therefore possible that conditions at variance with those given in this report could be encountered elsewhere on site during construction. It is therefore important that Geosure (Pty) Ltd be appointed to carry out periodic inspections during construction. Any change from the anticipated ground conditions could then be taken into account to avoid unnecessary expense.

8 June 2011

Author – A. Ramroop BSc Eng (civil) *Date*

Reviewed By: D. Naidoo Pr. Sci. Nat.

GEOSURE (PTY) LTD
Geotechnical, Environmental & Groundwater Engineering Consultants
Civil Engineering Soils Laboratory

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www.geosure.co.za

APPENDIX A

INSPECTION PIT PROFILES

GEOSURE (Pty) Ltd
Geotechnical, Environmental & Groundwater Engineering
Pile Integrity Testing & Civil Engineering Laboratory
P O Box 1461, Westville, 3630, South Africa
Tel (031) 266-0458
email. geosure@iafrica.com
Fax (031) 266-8179
www.geosure.co.za

Delca Systems
Municipality Clinic- Dannhauser

HOLE No: IP1
Sheet 1 of 1

JOB NUMBER: 128-11

Scale 1:25

0.60m--1.50m

0.00 Slightly moist, light greyish brown, firm to stiff, clayey sandy SILT (rootlets, insect burrows, black rounded stones of uniform size). Colluvium.

0.60 Slightly moist to moist, light yellowish olive green grey speckled orange, firm to stiff, CLAY (black rounded stones of uniform size, light yellowish brown ellipsoidal stones, fine roots). Residual Dolerite.

1.50

NOTES

1) No ground water seepage observed.

2) Sample taken at:
S1 0,60m--1,50m (Ind)

3) Area scattered withfew dolerite cobbles and boulders.

4) Final depth at 1,5m.

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : M. Reddy

TYPE SET BY :
SETUP FILE : COMPRESS.SET

INCLINATION :
DIAM :
DATE : 21 April 2011
DATE : 21 April 2011

DATE : 09/06/11 16:26
TEXT : ..\2011\128\LOGS\PITS.TXT

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: IP1

dot.PLOT 5004 J&W

GEOSURE (Pty) Ltd
Geotechnical, Environmental & Groundwater Engineering
Pile Integrity Testing & Civil Engineering Laboratory
P O Box 1461, Westville, 3630, South Africa
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Fax: (031) 266-8179
www.geosure.co.za

Delca Systems
Municipality Clinic- Dannhauser

HOLE No: IP2
Sheet 1 of 1

JOB NUMBER: 128-11

Scale 1:25

0.60m--1.50m

0.00 Slightly moist to moist, dark greyish brown, firm to stiff, slightly silty CLAY (insect burrows, few thick roots, many roots, black rounded, light brown ellipsoidal stones). Colluvium.

0.60 Slightly moist to moist, light olive green grey, firm to stiff, CLAY (fine roots, black rounded stones, light brown ellipsoidal stones-uniform sized). Residual Dolerite.

1.50

NOTES

1) No ground water seepage observed.

2) Sample taken at:
S1 0m--0,60m (Ind)
S2 0,60m--1,50m (Ind)

3) Area scattered with few dolerite cobbles and boulders.

4) Final depth at 1,5m.

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : M. Reddy
TYPE SET BY :
SETUP FILE : COMPRESS.SET

INCLINATION :
DIAM :
DATE : 21 April 2011
DATE : 21 April 2011
DATE : 09/06/11 16:26
TEXT : ..\2011\128\LOGS\PITS.TXT

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: IP2

dot.PLOT 5004 J&W

GEOSURE (Pty) Ltd
Geotechnical, Environmental & Groundwater Engineering
Pile Integrity Testing & Civil Engineering Laboratory
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Delca Systems
Municipality Clinic- Dannhauser

HOLE No: IP3
Sheet 1 of 1

JOB NUMBER: 128-11

Scale 1:25

0.80m--1.40m

0.00 Slightly moist, light greyish brown, firm to stiff, clayey sandy SILT (roots, insect burrows, black rounded stones of uniform size). Colluvium.

0.80 Slightly moist to moist, light yellowish olive green grey speckled orange, firm to stiff, CLAY (black rounded stones of uniform size, light yellowish brown ellipsoidal stones, fine roots). Residual Dolerite.

1.40

NOTES

1) No ground water seepage observed.

2) Sample taken at:
S1 0,80m--1,40m (Ind)

3) Numerous termite mounds in area around inspection pit3.

4) Final depth at 1,40m.

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : M. Reddy

TYPE SET BY :
SETUP FILE : COMPRESS.SET

INCLINATION :
DIAM :
DATE : 21 April 2011
DATE : 21 April 2011

DATE : 09/06/11 16:26
TEXT : ..\2011\128\LOGS\PITS.TXT

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: IP3

dot.PLOT 5004 J&W

GEOSURE (Pty) Ltd
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Delca Systems
Municipality Clinic- Dannhauser

HOLE No: IP4
Sheet 1 of 1

JOB NUMBER: 128-11

Scale 1:25

0.00 Slightly moist to moist, dark greyish brown, firm to soft, slightly silty CLAY (insect burrows, few thick roots, black rounded, light brown ellipsoidal stones). Colluvium.

0.74 Slightly moist to moist, light olive green grey, firm to soft, CLAY (fine roots, black rounded stones, light brown ellipsoidal stones-uniform sized). Residual Dolerite.

1.50

NOTES

1) No ground water seepage observed.

2) Final depth at 1,5m.

CONTRACTOR :
MACHINE : By Hand
DRILLED BY :
PROFILED BY : M. Reddy
TYPE SET BY :
SETUP FILE : COMPRESS.SET

INCLINATION :
DIAM :
DATE : 21 April 2011
DATE : 21 April 2011
DATE : 09/06/11 16:26
TEXT : ..\2011\128\LOGS\PITS.TXT

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: IP4

dot.PLOT 5004 J&W

APPENDIX B

CBR DYNAMIC CONE PENETROMETER (DCP) TESTS

GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants
Tel: 0861 436 7873

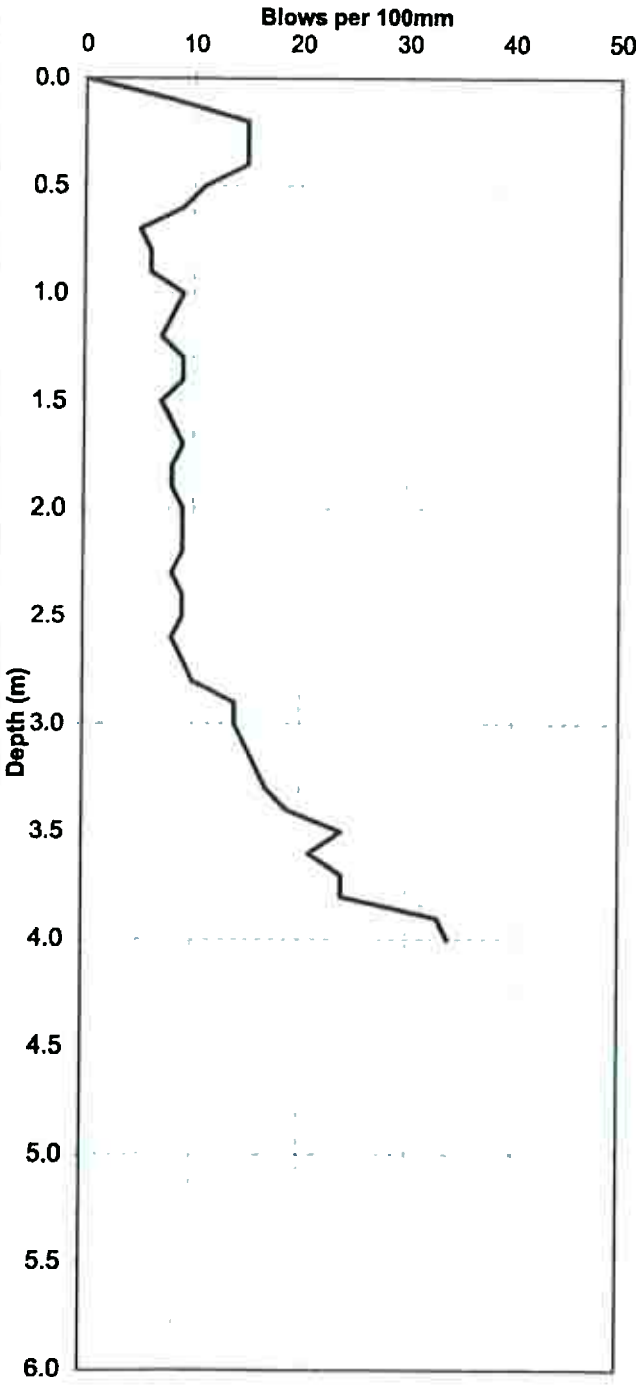
Email: geosure@iafrica com
Fax: 086 689 5506

Client:	Delca Systems	Ref. No.:	128-11
Project:	Municipality Clinic-Dannhauser	Date:	21-04-2011
Section:		Operator:	M. Reddy

CBR DYNAMIC CONE PENETROMETER PROBE — TEST No DC1

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	8	Firm	65 kPa	14
0.2	15	Stiff	125 kPa	27
0.3	15	Stiff	125 kPa	27
0.4	15	Stiff	125 kPa	27
0.5	11	Stiff	90 kPa	19
0.6	9	Stiff	75 kPa	15
0.7	5	Firm	40 kPa	8
0.8	6	Firm	50 kPa	10
0.9	6	Firm	50 kPa	10
1.0	9	Stiff	75 kPa	15
1.1	8	Firm	65 kPa	14
1.2	7	Firm	60 kPa	12
1.3	9	Stiff	75 kPa	15
1.4	9	Stiff	75 kPa	15
1.5	7	Firm	60 kPa	12
1.6	8	Firm	65 kPa	14
1.7	9	Stiff	75 kPa	15
1.8	8	Firm	65 kPa	14
1.9	8	Firm	65 kPa	14
2.0	9	Stiff	75 kPa	15
2.1	9	Stiff	75 kPa	15
2.2	9	Stiff	75 kPa	15
2.3	8	Firm	65 kPa	14
2.4	9	Stiff	75 kPa	15
2.5	9	Stiff	75 kPa	15
2.6	8	Firm	65 kPa	14
2.7	9	Stiff	75 kPa	15
2.8	10	Stiff	85 kPa	17
2.9	14	Stiff	115 kPa	25
3.0	14	Stiff	115 kPa	25
3.1	15	Stiff	125 kPa	27
3.2	16	Stiff	130 kPa	29
3.3	17	Stiff	140 kPa	31
3.4	19	Very Stiff	>150 kPa	35
3.5	24	Very Stiff	>150 kPa	47
3.6	21	Very Stiff	>150 kPa	40
3.7	24	Very Stiff	>150 kPa	47
3.8	24	Very Stiff	>150 kPa	47
3.9	33	Very Stiff	>150 kPa	>55
4.0	34	Very Stiff	>150 kPa	>55
4.1	Refusal			
4.2				
4.3				
4.4				
4.5				
4.6				
4.7				
4.8				
4.9				
5.0				
5.1				
5.2				
5.3				
5.4				
5.5				
5.6				
5.7				
5.8				
5.9				




6.0

GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

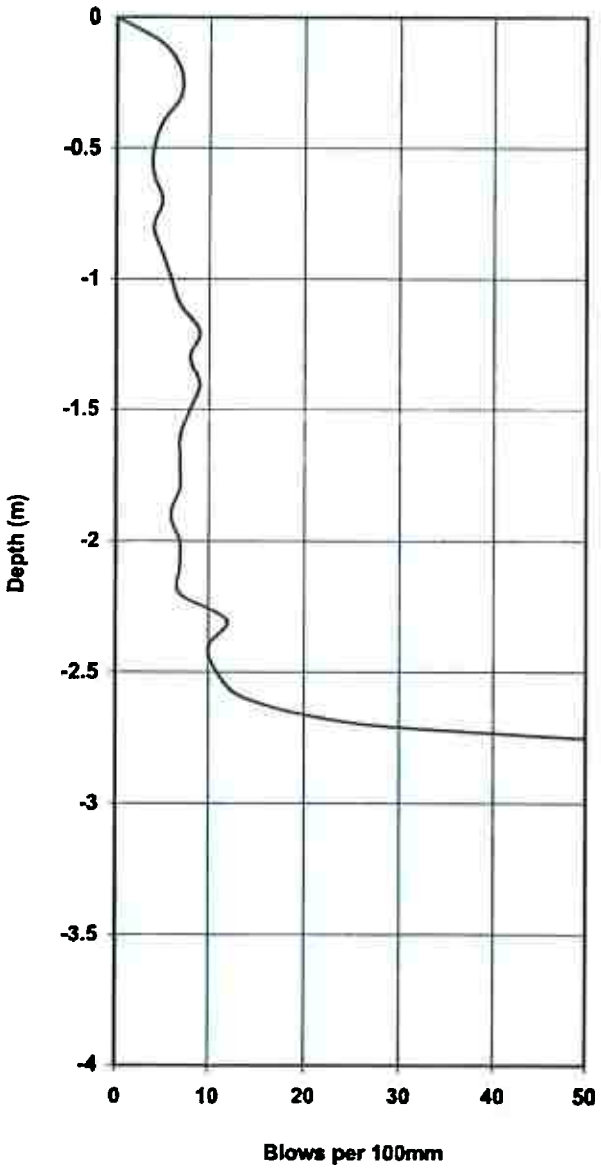
Tel: 0861 436 7873 Fax: 086 689 5506 Email: geosure@iafrica.com

Client:	Delca Systems	Ref.No. 128-11
Project:	Municipality Clinic-Dannhauser	Date: 21-04-2011
Section:		Operator: M. Reddy

CBR Penetrometer Probe ---------- Test No. DC 2

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	5	Firm	40 kPa	8
0.2	7	Firm	60 kPa	12
0.3	7	Firm	60 kPa	12
0.4	5	Firm	40 kPa	8
0.5	4	Soft	35 kPa	7
0.6	4	Soft	35 kPa	7
0.7	5	Firm	40 kPa	8
0.8	4	Soft	35 kPa	7
0.9	5	Firm	40 kPa	8
1	6	Firm	50 kPa	10
1.1	7	Firm	60 kPa	12
1.2	9	Stiff	75 kPa	15
1.3	8	Firm	65 kPa	14
1.4	9	Stiff	75 kPa	15
1.5	8	Firm	65 kPa	14
1.6	7	Firm	60 kPa	12
1.7	7	Firm	60 kPa	12
1.8	7	Firm	60 kPa	12
1.9	6	Firm	50 kPa	10
2	7	Firm	60 kPa	12
2.1	7	Firm	60 kPa	12
2.2	7	Firm	60 kPa	12
2.3	12	Stiff	100 kPa	21
2.4	10	Stiff	85 kPa	17
2.5	11	Stiff	90 kPa	19
2.6	14	Stiff	115 kPa	25
2.7	27	Very Stiff	>150 kPa	54
2.8	68	Hard	>300 kPa	>55
	Refusal			



GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

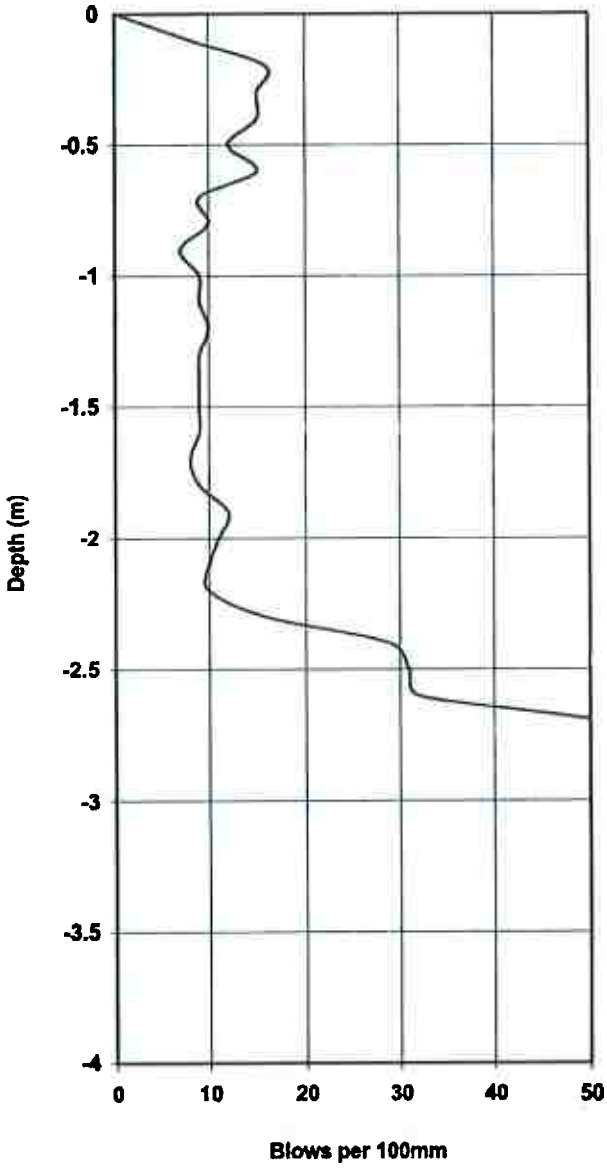
Tel: 0861 436 7873 Fax: 086 689 5506 Email: geosure@iafrica.com

Client:	**Delca Systems**	Ref.No. 128-11
Project:	**Municipality Clinic-Dannhauser**	Date: 21-04-2011
Section:		Operator: M. Reddy

CBR Penetrometer Probe ---------- Test No. DC 3

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	8	Firm	65 kPa	14
0.2	16	Stiff	130 kPa	29
0.3	15	Stiff	125 kPa	27
0.4	15	Stiff	125 kPa	27
0.5	12	Stiff	100 kPa	21
0.6	15	Stiff	125 kPa	27
0.7	9	Stiff	75 kPa	15
0.8	10	Stiff	85 kPa	17
0.9	7	Firm	60 kPa	12
1	9	Stiff	75 kPa	15
1.1	9	Stiff	75 kPa	15
1.2	10	Stiff	85 kPa	17
1.3	9	Stiff	75 kPa	15
1.4	9	Stiff	75 kPa	15
1.5	9	Stiff	75 kPa	15
1.6	9	Stiff	75 kPa	15
1.7	8	Firm	65 kPa	14
1.8	9	Stiff	75 kPa	15
1.9	12	Stiff	100 kPa	21
2	11	Stiff	90 kPa	19
2.1	10	Stiff	85 kPa	17
2.2	10	Stiff	85 kPa	17
2.3	16	Stiff	130 kPa	29
2.4	29	Very Stiff	>150 kPa	>55
2.5	31	Very Stiff	>150 kPa	>55
2.6	32	Very Stiff	>150 kPa	>55
	Refusal			



GEOSURE (PTY) LTD.

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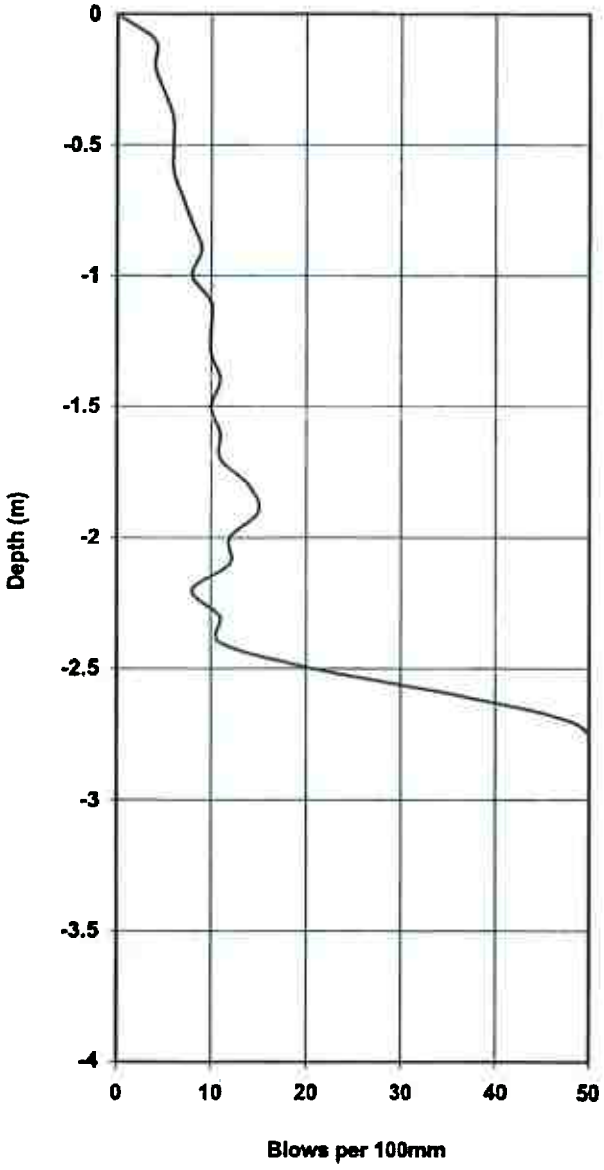
Tel: 0861 436 7873 Fax: 086 689 5506 Email. geosure@iafrica.com

Client:	Delca Systems	Ref.No. 128-11
Project:	Municipality Clinic-Dannhauser	Date: 21-04-2011
Section:		Operator: M. Reddy

CBR Penetrometer Probe ---------- Test No. DC 4

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	4	Soft	35 kPa	7
0.2	4	Soft	35 kPa	7
0.3	5	Firm	40 kPa	8
0.4	6	Firm	50 kPa	10
0.5	6	Firm	50 kPa	10
0.6	6	Firm	50 kPa	10
0.7	7	Firm	60 kPa	12
0.8	8	Firm	65 kPa	14
0.9	9	Stiff	75 kPa	15
1	8	Firm	65 kPa	14
1.1	10	Stiff	85 kPa	17
1.2	10	Stiff	85 kPa	17
1.3	10	Stiff	85 kPa	17
1.4	11	Stiff	90 kPa	19
1.5	10	Stiff	85 kPa	17
1.6	11	Stiff	90 kPa	19
1.7	11	Stiff	90 kPa	19
1.8	14	Stiff	115 kPa	25
1.9	15	Stiff	125 kPa	27
2	12	Stiff	100 kPa	21
2.1	12	Stiff	100 kPa	21
2.2	8	Firm	65 kPa	14
2.3	11	Stiff	90 kPa	19
2.4	11	Stiff	90 kPa	19
2.5	21	Very Stiff	>150 kPa	40
2.6	36	Very Stiff	>150 kPa	>55
2.7	48	Very Stiff	>150 kPa	>55
	Refusal			



GEOSURE (PTY) LTD.

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Fax: 086 689 5506

Client:	Delca Systems	Ref. No.:	128-11
Project:	Municipality Clinic-Dannhauser	Date:	21-04-2011
Section:		Operator:	M. Reddy

CBR DYNAMIC CONE PENETROMETER PROBE — TEST No DC5

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	7	Firm	60 kPa	12
0.2	12	Stiff	100 kPa	21
0.3	13	Stiff	110 kPa	23
0.4	15	Stiff	125 kPa	27
0.5	11	Stiff	90 kPa	19
0.6	13	Stiff	110 kPa	23
0.7	12	Stiff	100 kPa	21
0.8	9	Stiff	75 kPa	15
0.9	7	Firm	60 kPa	12
1.0	8	Firm	65 kPa	14
1.1	8	Firm	65 kPa	14
1.2	9	Stiff	75 kPa	15
1.3	9	Stiff	75 kPa	15
1.4	8	Firm	65 kPa	14
1.5	7	Firm	60 kPa	12
1.6	8	Firm	65 kPa	14
1.7	8	Firm	65 kPa	14
1.8	8	Firm	65 kPa	14
1.9	9	Stiff	75 kPa	15
2.0	11	Stiff	90 kPa	19
2.1	9	Stiff	75 kPa	15
2.2	9	Stiff	75 kPa	15
2.3	10	Stiff	85 kPa	17
2.4	10	Stiff	85 kPa	17
2.5	8	Firm	65 kPa	14
2.6	9	Stiff	75 kPa	15
2.7	11	Stiff	90 kPa	19
2.8	14	Stiff	115 kPa	25
2.9	13	Stiff	110 kPa	23
3.0	13	Stiff	110 kPa	23
3.1	11	Stiff	90 kPa	19
3.2	15	Stiff	125 kPa	27
3.3	14	Stiff	115 kPa	25
3.4	16	Stiff	130 kPa	29
3.5	18	Stiff	150 kPa	33
3.6	24	Very Stiff	>150 kPa	47
3.7	28	Very Stiff	>150 kPa	>55
3.8	30	Very Stiff	>150 kPa	>55
3.9	32	Very Stiff	>150 kPa	>55
4.0	Refusal			
4.1				
4.2				
4.3				
4.4				
4.5				
4.6				
4.7				
4.8				
4.9				
5.0				
5.1				
5.2				
5.3				
5.4				
5.5				
5.6				
5.7				
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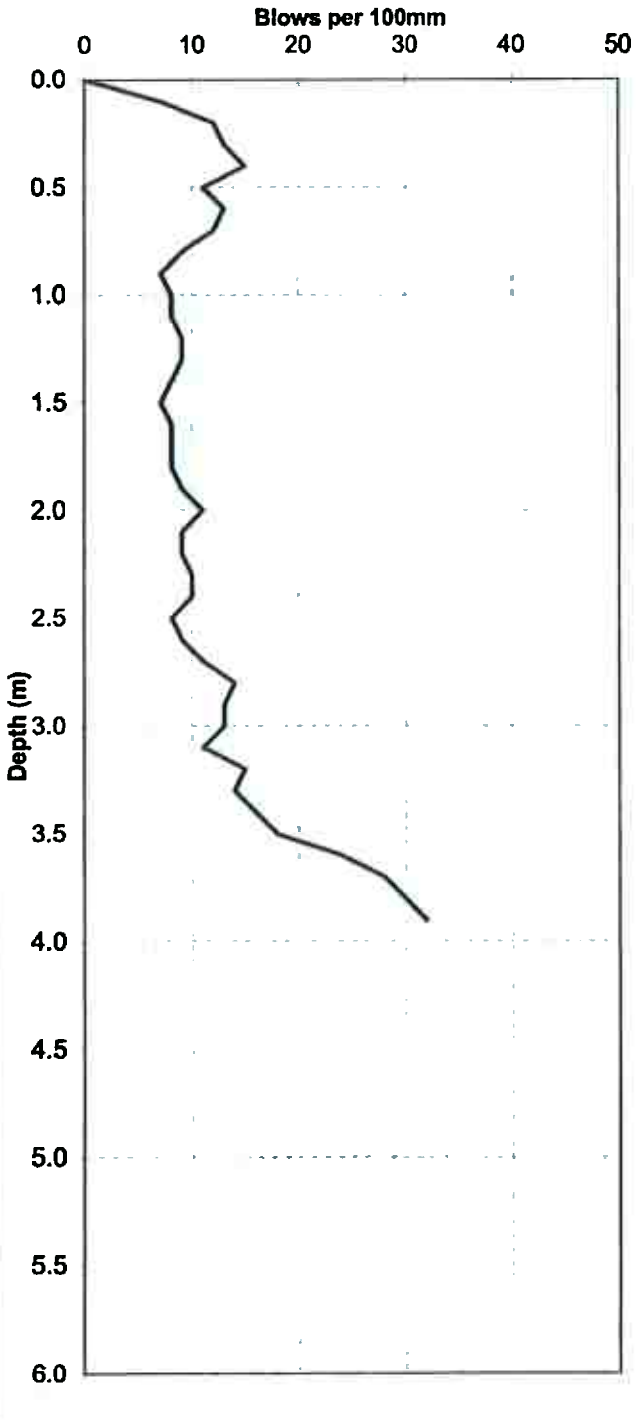
5.9				



GEOSURE (PTY) LTD.

Geotechnical Engineering Consultants

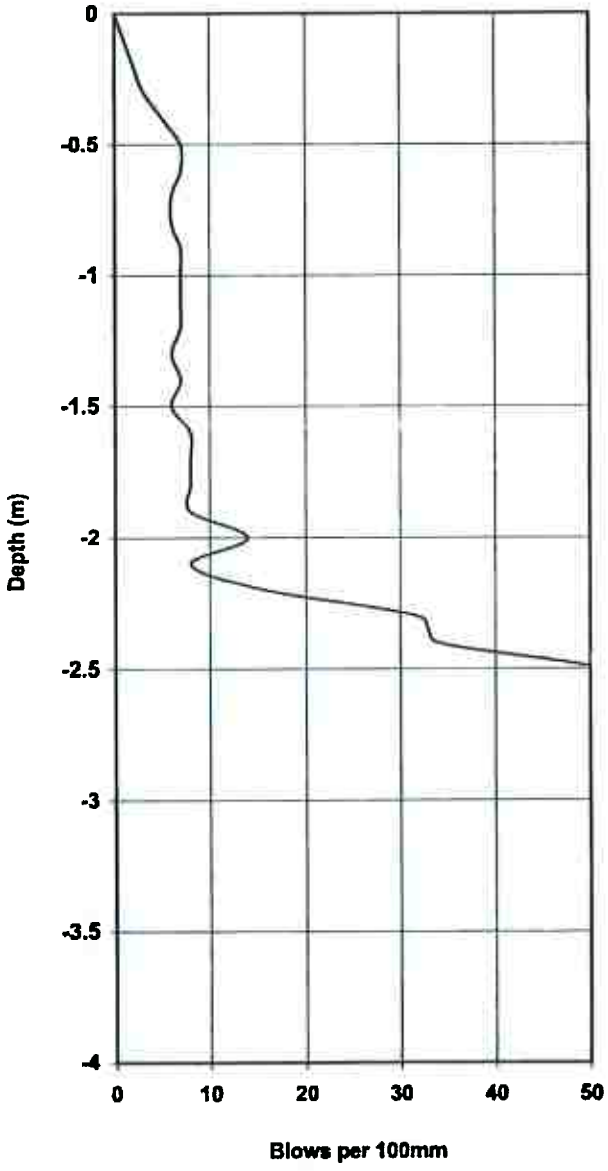
Tel: 0861 436 7873 Fax: 086 689 5506 Email: geosure@iafrica.com

Client:	Delca Systems	Ref.No. 128-11
Project:	Municipality Clinic-Dannhauser	Date: 21-04-2011
Section:		Operator: M. Reddy

CBR Penetrometer Probe ---------- Test No. DC 6

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0.1	1	Very Soft	<20 kPa	2
0.2	2	Soft	20 kPa	3
0.3	3	Soft	25 kPa	5
0.4	5	Firm	40 kPa	8
0.5	7	Firm	60 kPa	12
0.6	7	Firm	60 kPa	12
0.7	6	Firm	50 kPa	10
0.8	6	Firm	50 kPa	10
0.9	7	Firm	60 kPa	12
1	7	Firm	60 kPa	12
1.1	7	Firm	60 kPa	12
1.2	7	Firm	60 kPa	12
1.3	6	Firm	50 kPa	10
1.4	7	Firm	60 kPa	12
1.5	6	Firm	50 kPa	10
1.6	8	Firm	65 kPa	14
1.7	8	Firm	65 kPa	14
1.8	8	Firm	65 kPa	14
1.9	8	Firm	65 kPa	14
2	14	Stiff	115 kPa	25
2.1	8	Firm	65 kPa	14
2.2	16	Stiff	130 kPa	29
2.3	32	Very Stiff	>150 kPa	>55
2.4	34	Very Stiff	>150 kPa	>55
	Refusal			



APPENDIX C

LABORATORY TEST RESULTS

Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists

GEOSURE (Pty) Ltd

sanas Testing Laboratory T0483

CLIENT : Geosure (Pty) Ltd
ADDRESS : P.O. Box 1461
Westville
3630
ATTENTION : Mr A. Ramroop
PROJECT : Municipality Clinic in Dannhauser

TEST REPORT REFERENCE NUMBER: 8054

Dear Sir/Madam,
Enclosed herewith, please find the original reports pertaining to the above-mentioned project.

Date Received	**10.05.2011**
Date Tested	17.05.2011 to 23.05.2011
Sample Location	N/A
Sampling Method	N/A
Sample Condition	Moist
Sampling Environmental Condition	N/A
Sampler(s) Name	N/A
Total Number of Pages	10

Test Carried Out			
TMH1 Method A1, B4, A5	✓	TMH1 Method C3	
TMH1 Method A2, A3, A4	✓	TMH1 Method C4a	
TMH1 Method A7	✓	TMH1 Method B6	
TMH1 Method A8, A9	✓	Hydrometer Analysis - ASTM D422	✓
TMH1 Method A10(b)		SANS 5863	
TMH1 Method A13T + A14app		SANS 5862-1	
TMH1 Method A15d		SANS 5860, 5861-1, 5861-2, 5861-3	
TMH1 Method A13T + A16T		TRH 20	

✓ - Tick denotes tests that were carried out.

We would like to take this opportunity of thanking you for your continued support.
Should you have any queries please do not hesitate to contact me.

Yours faithfully

K. Veeran

Laboratory Manager,
Kris Veeran for Geosure (Pty) Ltd.

Head Office
1 Nelson Road, Essex Gardens, Suite 4A Buckhurst, Westville, 3630, South Africa
PO Box 1461, Westville, 3630
Tel.: +27 (0)861 GEOSURE / 0861 436 7873
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Civil Engineering Laboratory
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Tel: 031 701 9732
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Mobile: 082 567 9870
E-mail: lab@geosure.co.za

Gauteng Branch
P. O. Box 32381, Kyalami 1684
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Email: gauteng@geosure.co.za

Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists

GEOSURE (Pty) Ltd

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Suite 4A, Buckhurst Building, Westville, 3630
Tel: +27 (0)861 GEOSURE / 0861 436 7873
email: geosure@iafrica.com www.geosure.co.za

Client : Geosure (Pty) Ltd
Project : Municipality Clinic in Dannhauser
Attention : Mr A. Ramroop

Your Ref No. : -
Our Ref No. : 8054
Date Reported : 23.05.2011

Test Report

Sample No.	15091	15092	15094		
Field No.	IP 1	IP 2	IP 2		
Position					
Depth (m)	0.6 - 1.5	0.0 - 0.6	0.6 - 1.5		
Material Description	Lt.Yell.Gr. Speck.Or.Clay. Residual Dolerite	Dk.Gr.Br. Slightly Silty Clay. Colluvium	Lt.Ol.Gr.Clay. Residual Dolerite		

Sieve Analysis (Wet Preparation) TMH1 - Method A1 (a) - Percent Passing Sieve Size						
Sieve Aperture (mm)	75.00					
	63.00					
	53.00					
	37.50					
	26.50					
	19.00					
	13.20	100	100	100		
	4.750	100	100	99		
	2.000	99	99	98		
	0.425	95	90	92		
	0.075	83	77	87		
Grading Modulus		0.23	0.34	0.23		
Mechanical analysis - TMH1 - Method A5 - Percent of Soil Mortar (<2 mm) for Grain Size range						
Coarse Sand	2.000 - 0.425	4	9	6		
Coarse-Fine Sand	0.425 - 0.250	2	4	2		
Medium-Fine Sand	0.250 - 0.150	5	4	2		
Fine-Fine Sand	0.150 - 0.075	4	6	2		
Silt and Clay	< 0.075	84	77	89		
Atterberg Limits TMH 1 - Methods A2, A3, A4 on <0.425 mm fraction						
Liquid Limit	% or symbol	48	48	55		
Plasticity Index	% or symbol	31	24	33		
Linear Shrinkage	%	15.0	12.5	17.5		
Maximum Dry Density and Optimum Moisture Content - TMH1 - Method A7						
Maximum Dry Density (kg/m³)		1836	1719	1770		
Optimum moisture content (%)		14.1	11.7	15.4		
California Bearing Ratio - TMH1 - Method A8						
CBR @100% Compaction	%	1.6	1.4	1.0		
CBR @ 98% Compaction	%	1.3	1.1	0.9		
CBR @ 97% Compaction	%	1.2	1.0	0.8		
CBR @ 95% Compaction	%	1.0	0.8	0.7		
CBR @ 93% Compaction	%	0.8	0.6	0.6		
CBR @ 90% Compaction	%	0.6	0.4	0.5		
Swell @100% Compaction	%	1.0	1.5	0.8		
TRH 14 Classification (1985)		CBD	CBD	CBD		
AASHTO Classification (Group Index)		A-7-6 (26)	A-7-6 (19)	A-7-6 (31)		
Unified Classification		CL	CL	CH		

Remarks:
Sample delivered by Client.

K. Veeran

Kris Veeran, Laboratory Manager, for Geosure (Pty) Ltd

Consulting Engineering Geologists, Geotechnical Engineers,
Geotechnicians & Geotechnical Quality Assurance Specialists
GEOSURE (Pty) Ltd

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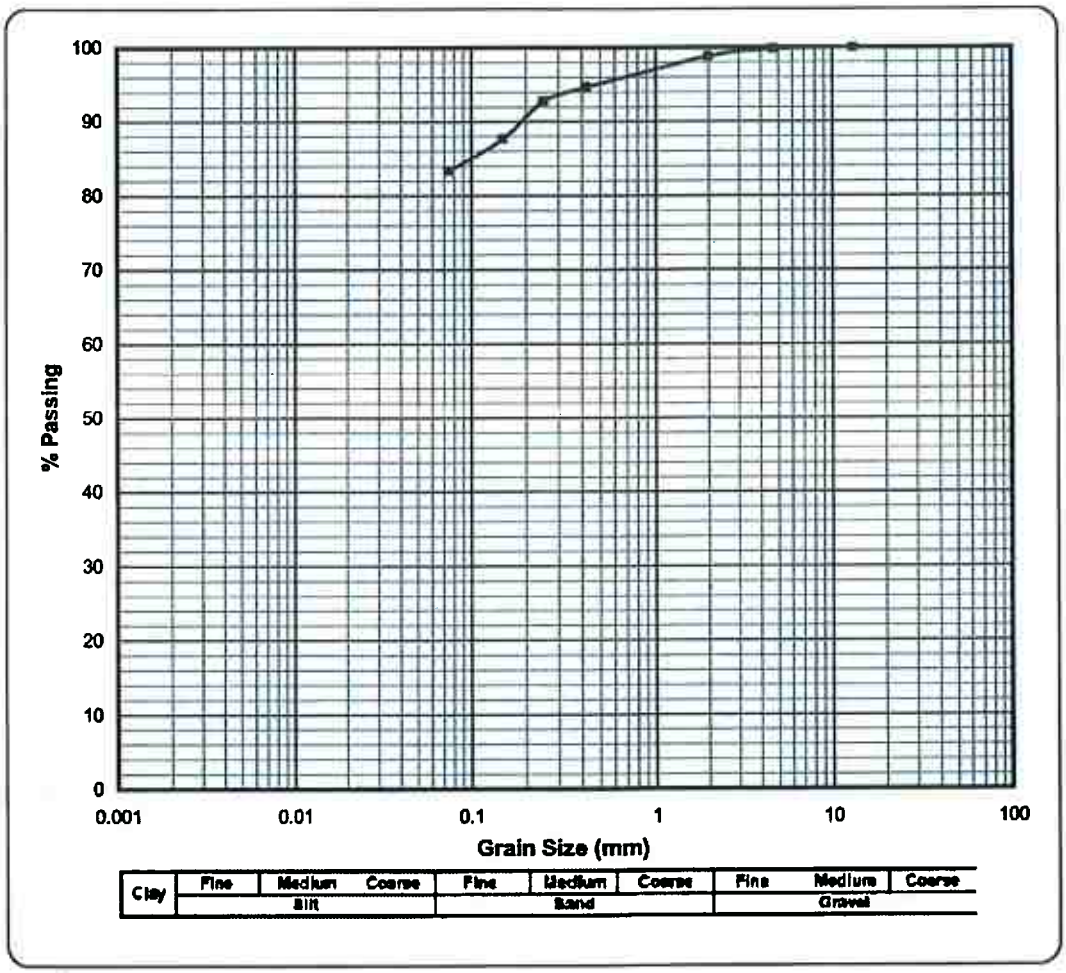
Tel: +27 (0)861 GEOSURE / 0861 436 7873
email: geosure@iafrica.com www.geosure.co.za

Client : Geosure (Pty) Ltd
Project : Municipality Clinic in Dannhauser
Attention : Mr A. Ramroop

Your Ref No.: -
Our Ref No. : 8054
Date Reported : 23.05.2011

Grading Curve for Sample 15091 – TMH1 Method A1 (a)



K. Veeran

Kris Veeran, Laboratory Manager, for Geosure (Pty) Ltd

Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists

GEOSURE (Pty) Ltd

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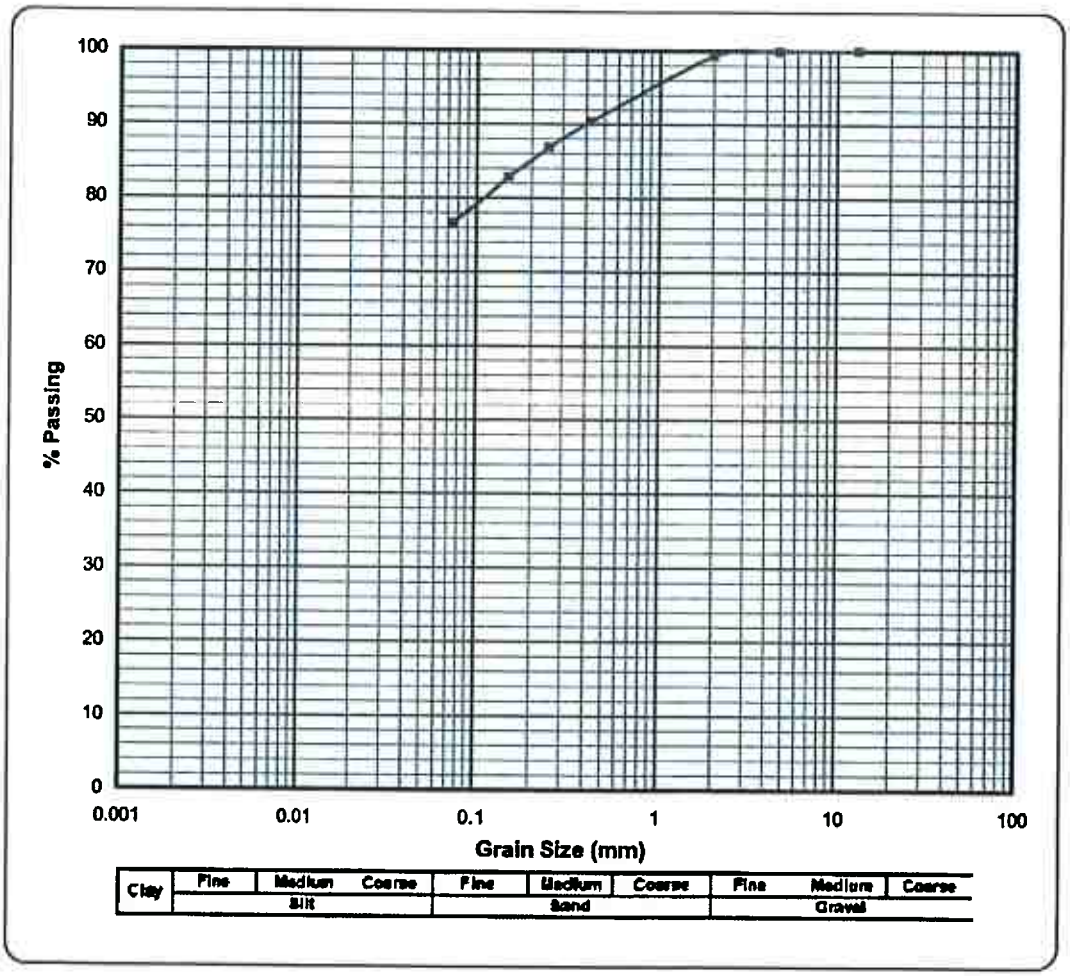
Client : Geosure (Pty) Ltd
Project : Municipality Clinic in Dannhauser
Attention : Mr A. Ramroop

Your Ref No.: -
Our Ref No. : 8054
Date Reported : 23.05.2011

Grading Curve for Sample 15092 – TMH1 Method A1 (a)



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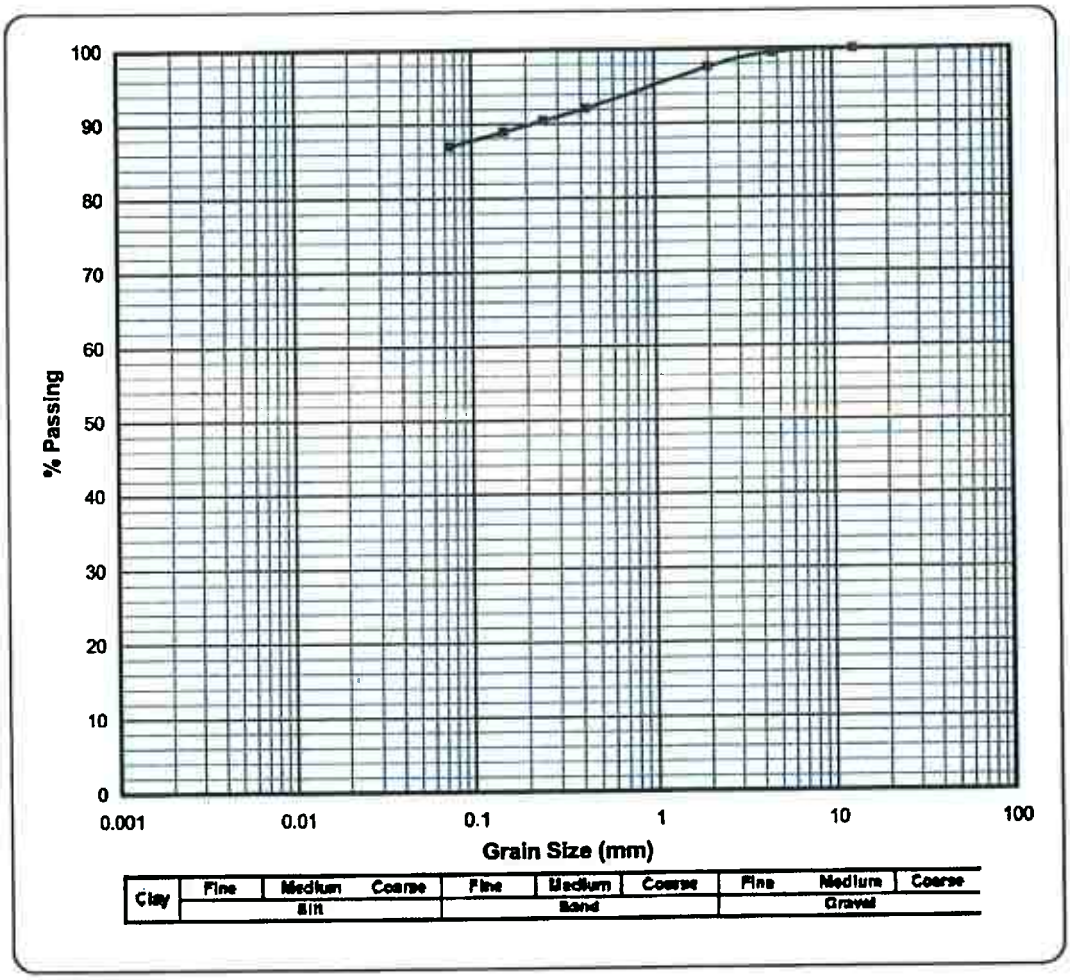
Client : Geosure (Pty) Ltd
Project : Municipality Clinic in Dannhauser
Attention : Mr A. Ramroop

Your Ref No.: -
Our Ref No. : 8054
Date Reported : 23.05.2011

Grading Curve for Sample 15094 – TMH1 Method A1 (a)



K. Veeran

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email: geosure@iafrica.com www.geosure.co.za

Client : Geosure (Pty) Ltd
Project : Municipality Clinic in Dannhauser
Attention : Mr A. Ramroop

Your Ref No. : 128-11
Our Ref No. : 8054
Date Reported : 20.05.2011

Moisture/Density Relationship (TMH1: Method A7)

Sample No. : 15091

Natural/Stabilised : Natural
Material Description : Lt.Yell.Gr.Speck.Or.Clay. Residual Dolerite

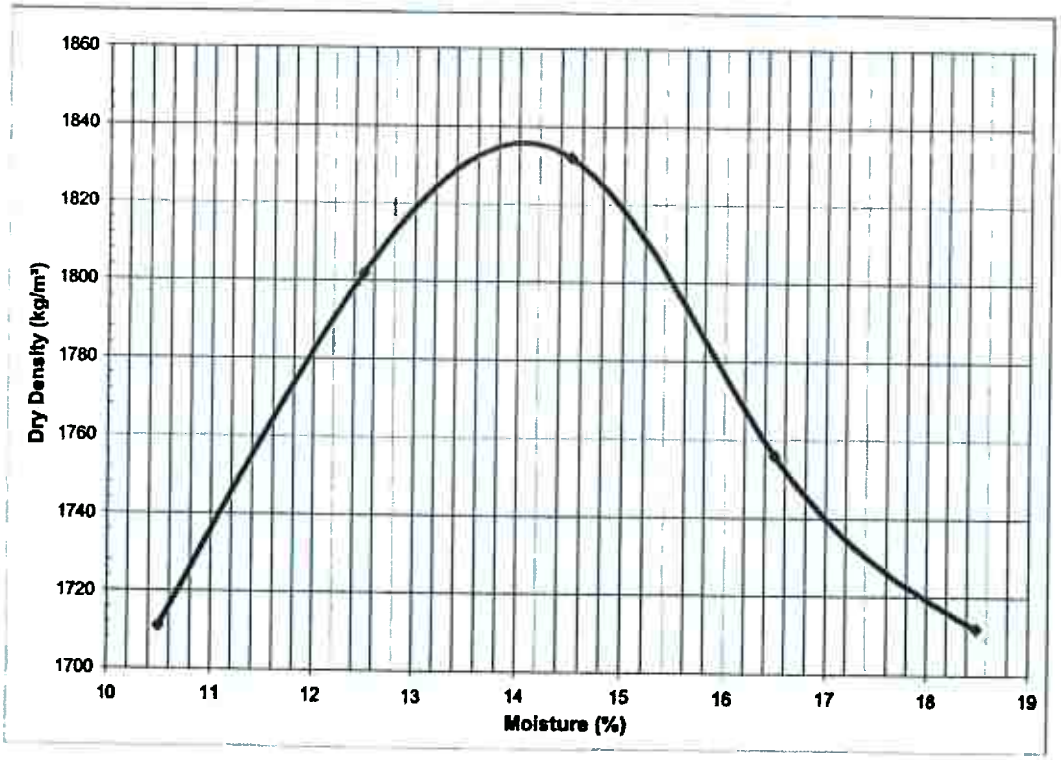
Field No. : IP 1
Depth (m) : 0.6-1.5
Origin :
Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) 1836

Optimum Moisture Content (%) 14.1

Plotted Values:

Moisture (%)	10.5	12.5	14.5	16.5	18.5
Dry Density (kg/m³)	1711	1802	1832	1756	1712



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Sample delivered by Client.

K. Veeran

Kris Veeran, Laboratory Manager, for Geosure (Pty) Ltd

Consulting Engineering Geologists, Geotechnical Engineers, Geotechnicians & Geotechnical Quality Assurance Specialists

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Suite 4A, Buckhurst Building, Westville, 3630
Tel: +27 (0)861 GEOSURE / 0861 436 7873
email: geosure@iafrica.com www.geosure.co.za

Client : **Geosure (Pty) Ltd**
Project : **Municipality Clinic in Dannhauser**
Attention : **Mr A. Ramroop**

Your Ref No. : **128-11**
Our Ref No. : **8054**
Date Reported : **20.05.2011**

Moisture/Density Relationship (TMH1: Method A7)

Sample No. : 15092

Natural/Stabilised : Natural
Material Description : Dk.Gr.Br.Slightly Silty Clay. Colluvium

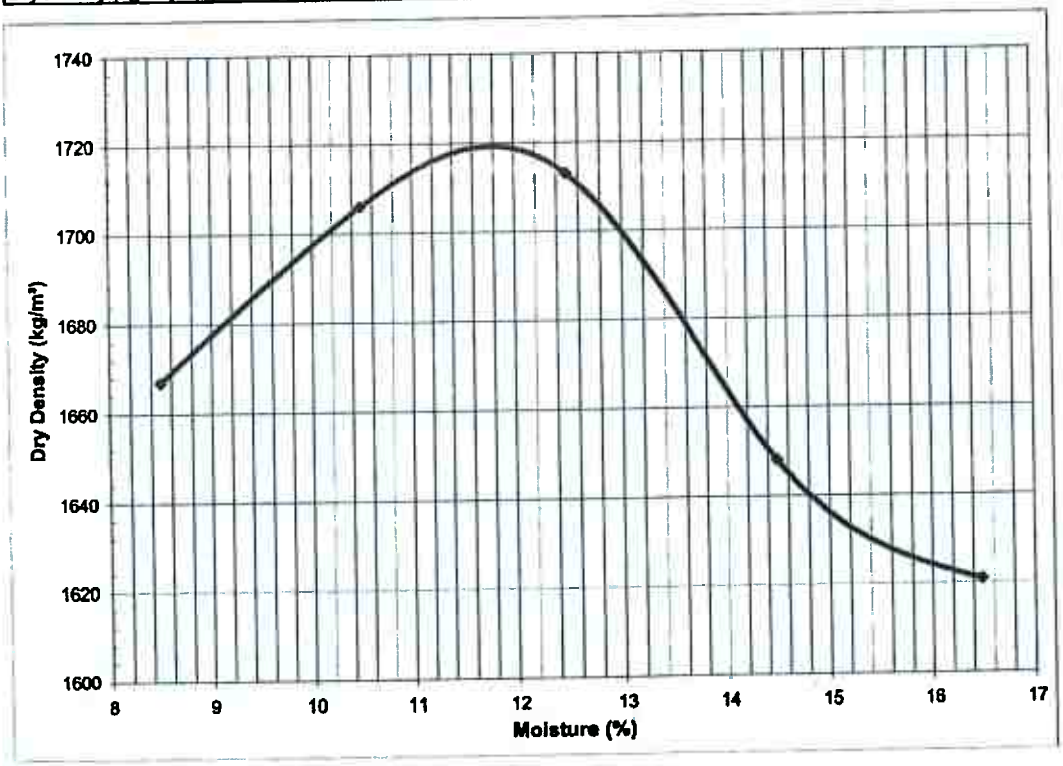
Field No. : IP 2
Depth (m) : 0.0-0.6
Origin :
Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) **1719**

Optimum Moisture Content (%) **11.7**

Plotted Values:

Moisture (%)	8.5	10.5	12.5	14.5	16.5
Dry Density (kg/m³)	1667	1706	1713	1648	1621



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Client : **Geosure (Pty) Ltd**
Project : **Municipality Clinic in Dannhauser**
Attention : **Mr A. Ramroop**

Your Ref No. : **128-11**
Our Ref No. : **8054**
Date Reported : **20.05.2011**

Moisture/Density Relationship (TMH1: Method A7)

Sample No. : 15094

Natural/Stabilised : Natural
Material Description : Lt.Ol.Gr.Clay. Residual Dolerite

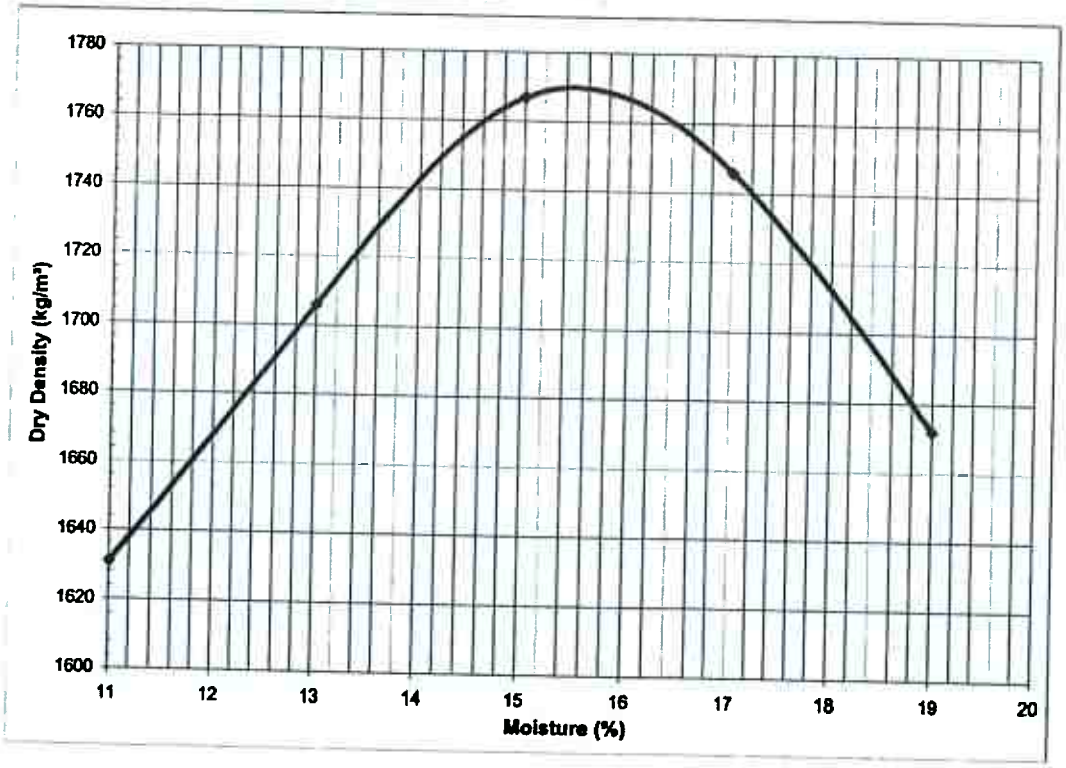
Field No. : IP 2
Depth (m) : 0.6-1.5
Origin :
Compaction Effort : Mod AASHTO

Maximum Dry Density (kg/m³) **1770**

Optimum Moisture Content (%) **15.4**

Plotted Values:

Moisture (%)	11.0	13.0	15.0	17.0	19.0
Dry Density (kg/m³)	1631	1706	1767	1746	1672



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Sample delivered by Client.

K. Veeran

Kris Veeran, Laboratory Manager, for Geosure (Pty) Ltd

GEOSURE (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 92/03145/07

UNIT 6, COWIES PARK, 22 OLIVIER ROAD, PINETOWN, 3600 P.O.BOX 1461, WESTVILLE, 3630

TELEPHONE (031) 701 9732 FAX : (031) 701 2962 email : lab@geosure.co.za

Client	: Geosure (Pty) Ltd	Our Ref.	: 8054
Project	: Municipality Clinic in Dannhauser	Your Ref.	: 128-11
		Date Tested	: 17.05.2011 to 20.05.2011
Attention	: Mr A. Ramroop	Date Reported	: 23.05.2011

Sample No.		15095				
Field No.		IP 3				
Position in Field						
Depth (m)		0.8 - 1.4				
Material Description		Light Olive Grey Clay. Residual Dolerite				
Sieve Analysis (ASTM - D422)						
% Passing	63.0 mm	100				
	53.0 mm	100				
	37.5 mm	100				
	26.5 mm	100				
	19.0 mm	100				
	13.2 mm	100				
	4.75 mm	100				
	2.00 mm	99				
	0.425 mm	95				
	0.075 mm	90				
Hydrometer Analysis (ASTM - D422)						
% Passing	0.060 mm	84				
	0.050 mm	75				
	0.040 mm	71				
	0.026 mm	67				
	0.015 mm	65				
	0.010 mm	61				
	0.0074 mm	57				
	0.0036 mm	53				
	0.0020 mm	51				
	0.0015 mm	49				
Soil Mortar Analysis						
Coarse Sand	%	4				
Coarse Fine Sand	%	1				
Medium Fine Sand	%	1				
Fine Fine Sand	%	2				
Silt & Clay	%	90				
Grading Modulus		0.2				

Liquid Limit	%	57				
Plasticity Index	%	36				
Linear Shrinkage	%	18.5				
AASHTO Classification (Group Index)		A-7-6 (17)				
Unified Classification		CH				
Moisture Content	%	14.5				
Remarks:	Date Received: 10.05.2011					
	Sample delivered by Client.					

K Veeran

Kris Veeran for Geosure (Pty) Ltd.
Laboratory Manager

GEOSURE (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 92/03145/07
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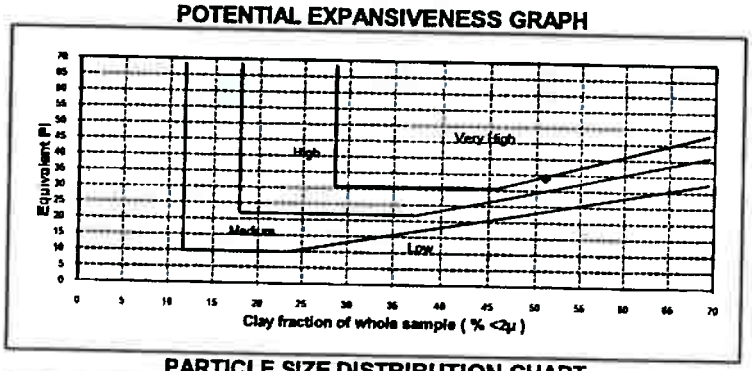
TELEPHONE (031) 7019732 FAX : (031) 7012962 e-mail: lab@geosure.co.za

Client	: Geosure (Pty) Ltd	**Job No.**	: 8054
Project	: Municipality Clinic in Dannhauser	**Your Ref.No.**	: 128-11
		Date Tested	: 17.05.2011 to 20.05.2011
Attention	: Mr A. Ramroop	**Date Reported**	: 23.05.2011

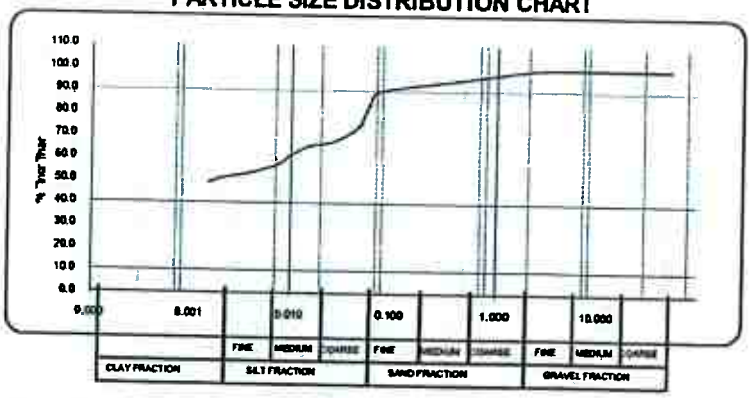
Sample Number : 15095
Field No. : IP 3
Sample Description : Light Olive Grey Clay. Residual Dolerite

Equivalent PI : 34 **Clay fraction of whole sample (% <2μ)** : 51

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART

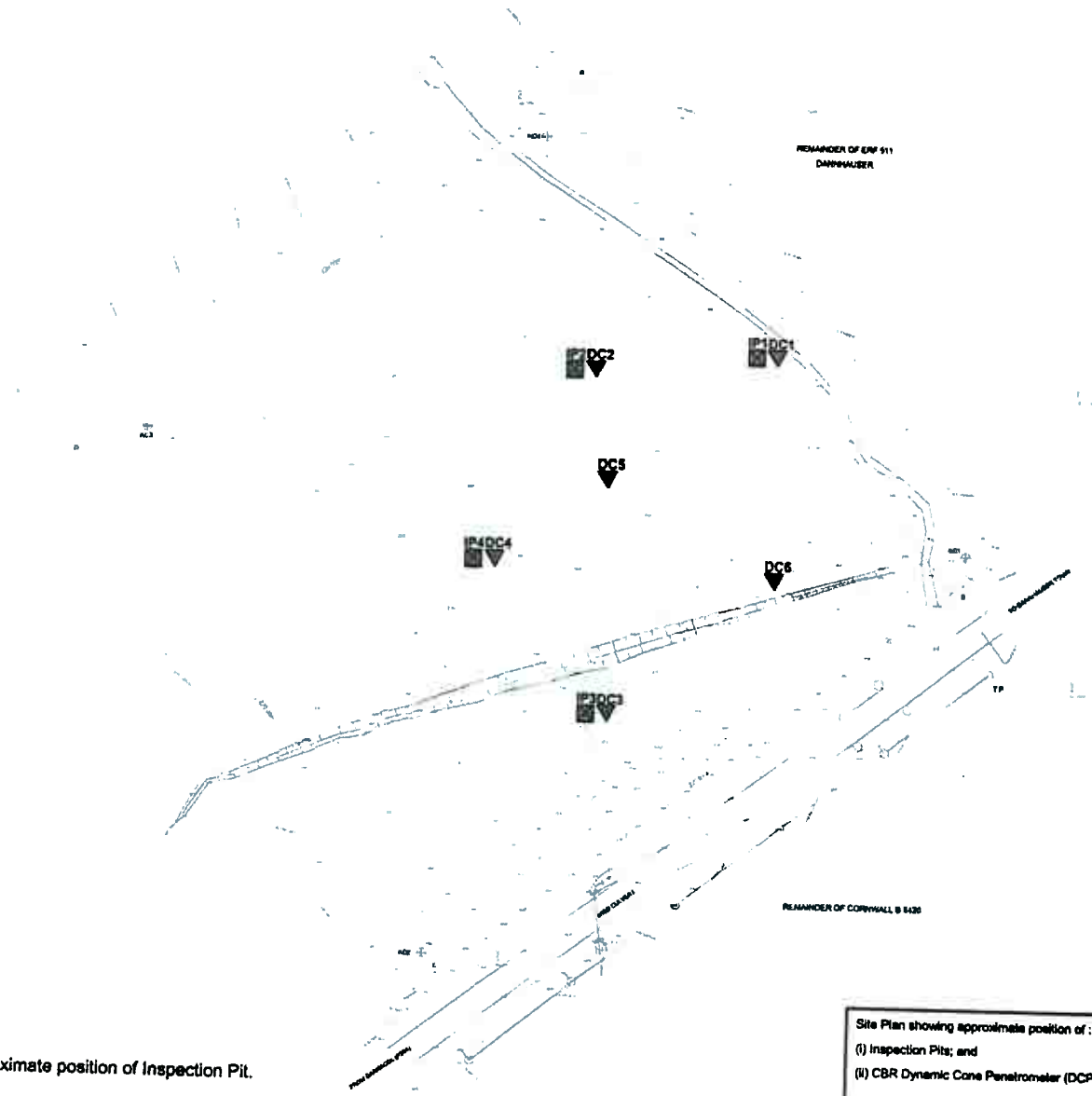


K. Veeran

Kris Veeran for Geosure (Pty) Ltd.
Laboratory Manager

FIGURE 1

SITE PLAN



KEY:

IP1 — Approximate position of Inspection Pit.

DC1 — Approximate position of CBR Dynamic Cone Penetrometer (DCP) Test.

Site Plan showing approximate position of :
(i) Inspection Pits; and
(ii) CBR Dynamic Cone Penetrometer (DCP) Tests.

Scale 1:1500

Delca Systems
Dannhauser Clinic

GEOSURE (PTY) LTD

17-05-2011
V. Goundan
D. Naidoo
128-11
Figure 1

(Insert Your Company Logo)

(This shall serve as the cover page on employment contracts for local labour)

EMPLOYMENT AGREEMENT

BETWEEN

CONTRACTOR NAME.....

AND

WORKER NAME.....

1. PARTIES

The Parties to this Agreement are -

1.1. Contractor....., herein represented by ..... duly authorised thereto

And

1.2. MR / MS. .....

2. DEFINITIONS AND INTERPRETATION

2.1 In this Agreement and any Annexure thereto, unless inconsistent with or otherwise indicated by the context-

"*Agreement*" means the contents of this Agreement.

"*Company*"	means the company that employs the worker
"Department"	means the Department of Public Works
"*Worker*"	is a person that performs a specific or necessary task or who completes tasks in a certain way
"*EPWP*"	The Expanded Public Works Programme is a government programme aimed at the alleviation of poverty and unemployment. The programme ensures the full engagement on Labour Intensive Methods of Construction (LIC) to contractors for skills development. The EPWP focuses at reducing unemployment by increasing economic growth by means of improving skills levels through education and training and improving the enabling environment for the industry to flourish

3. PURPOSE

The purpose of this agreement is to:-

Ensure that the agreement is biding to both the Worker and the Employer.

4. TERMS AND CONDITIONS

- The worker will have **no entitlement** to the benefits **of a full time employee** of .....
- The worker should not have the expectation that this contract will be renewed or extended.
- The worker will be subject to all laws, rules, policies, codes and procedures applicable to the .....
- The worker must meet the standards and requirements of the contractor
- The worker must render his/her services during normal working hours of minimum of forty to fifty five hours in any week; which comprise of an eight-hour working day in a five-day week.

5. REMUNERATION

The worker will receive compensation to the amount of R ..... 00 which must be paid on fortnightly-basis.

6. ROLES AND RESPONSIBILITIES

5.1 Employer / Worker

- Work for ..... in terms of the period as specified in the employment agreement contract.
- Be available for and participate in all learning and work experience required by the company.
- Comply with workplace policies and procedures.
- Complete any attendance or any written assessment tools supplied by the contractor to record relevant workplace experience.
- Demonstrate willingness to grow and learn through work experience.
- Provide the following documentation to the employer,
  - ✓ Certified identity document not longer than 3 months
  - ✓ ID size photos
  - ✓ Signed employment contract

5.2 Employer

- Employ the worker for a period specified in the agreement.
- Provide the worker with appropriate work based experience in the work environment.
- Facilitate payments of wages / stipends.
- Keep accurate records of workers.
- Where a worker/ learner is disabled, the employer will have to provide in the additional needs e.g. special materials, learning aids and in some cases physical or professional support (such aids remain the property of the employer).
- Keep up to date records of learning and discuss progress with the intern on a regular basis.
- Apply fair disciplinary, grievance and dispute resolution procedures to the worker.
- Prepare an orientation/ induction course to introduce worker/ learner to the workplace and specific workplace requirements.
- Ensure the daily attendance register is signed by the worker.

7. DURATION

This agreement commences on ..... and expires on .....

8. BREACH

If either party commits any breach of the terms of this contract (and fails to rectify it within 30 days of receipt of a written notice calling it to do so, then) the other party shall be entitled to terminate the contract or to claim specific performance without prejudice to any of its other legal rights, including its rights to claim damages.

9. CONDITIONS OF EMPLOYMENT

9.1. Meal Breaks

9.2A worker may not work for more than five hours without taking a meal break of at least thirty minutes duration.

9.3An employer and worker may agree on longer meal breaks.

9.4A worker may not work during a meal break. However, an employer may require a worker to perform duties during a meal break if those duties cannot be left unattended and cannot be performed by another worker. An employer must take reasonable steps to ensure that a worker is relieved of his or her duties during the meal break.

9.5A worker is not entitled to payment for the period of a meal break. However, a worker who is paid on the basis of time worked must be paid if the worker is required to work or to be available for work during the meal break.

9.2. Special Conditions for Security Guards (Only applicable to security Guards)

92.1 A security guard may work up to 55 hours per week and up to eleven hours per day.

92.2 A security guard who works more than ten hours per day must have a meal break of at least one hour or two breaks of at least 30 minutes each.

9.3. Weekly Rest Period

Every worker must have two days off every week. A worker may only work on their day off to perform work which must be done without delay and cannot be performed by workers during their ordinary hours of work ("emergency work").

9.4. Work on Sundays and Public Holidays

9.4.1 A worker may only work on a Sunday or public holiday to perform emergency or security work.

9.4.2 Work on Sundays is paid at the ordinary rate of pay.

9.4.3 A task-rated worker who works on a public holiday must be paid:

(a) the worker's daily task rate, if the worker works for less than four hours;

(b) double the worker's daily task rate, if the worker works for more than four hours.

9.4.4 A time-rated worker who works on a public holiday must be paid

(a) the worker's daily rate of pay, if the worker works for less than four hours on the public holiday;

(b) double the worker's daily rate of pay, if the worker works for more than four hours on the public holiday.

9.5 Sick leave

9.5.1 Only workers who work more than 24 hours per month have the right to claim sick-pay in terms of this clause.

9.5.2 A worker who is unable to work on account of illness or injury is entitled to claim one day's paid sick leave for every full month that the worker has worked in terms of a contract.

9.5.3 A worker may accumulate a maximum of twelve days' sick leave in a year.

9.5.4 Accumulated sick-leave may not be transferred from one contract to another contract.

9.5.5 An employer must pay a task-rated worker the worker's daily task rate for a day's sick leave.

9.5.6 An employer must pay a time-rated worker the worker's daily rate of pay for a day's sick leave.

9.5.7 An employer must pay a worker sick pay on the worker's usual payday.

9.5.8 Before paying sick-pay, an employer may require a worker to produce a certificate stating that the worker was unable to work on account of sickness or injury if the worker is

(a) absent from work for more than two consecutive days; or

(b) absent from work on more than two occasions in any eight-week period.

9.5.9 A medical certificate must be issued and signed by a medical practitioner, a qualified nurse or a clinic staff member authorised to issue medical certificates indicating the duration and reason for incapacity.

9.5.10 A worker is not entitled to paid sick-leave for a work-related injury or occupational disease for which the worker can claim compensation under the Compensation for Occupational Injuries and Diseases Act.

9.6. Maternity Leave

9.6.1 A worker may take up to four consecutive months' **unpaid** maternity leave.

9.6.2 A worker is not entitled to any payment or employment-related benefits during maternity leave.

9.6.3 A worker must give her employer reasonable notice of when she will start maternity leave and when she will return to work.

9.6.4 A worker is not required to take the full period of maternity leave. However, a worker may not work for four weeks before the expected date of birth of her child or for six weeks after the birth of her child, unless a medical practitioner, midwife or qualified nurse certifies that she is fit to do so.

9.6.5 A worker may begin maternity leave as follows;

(a) four weeks before the expected date of birth; or
(b) on an earlier date
(i) if a medical practitioner, midwife or certified nurse certifies that it is necessary for the health of the worker or that of her unborn child; or

(ii) if agreed to between employer and worker; or
(c) on a later date, if a medical practitioner, midwife or certified nurse has certified that the worker is able to continue to work without endangering her health.

10.6 A worker who has a miscarriage during the third trimester of pregnancy or bears a stillborn child may take maternity leave for up to six weeks after the miscarriage or stillbirth.

9.7. Family responsibility leave

9.7.1 Workers, who work for at least four days per week, are entitled to three days paid family responsibility leave each year in the following circumstances
(a) when the employee's child is born;

(b) when the employee's child is sick;

(c) in the event of a death of

(i) the employee's spouse or life partner;

(ii) the employee's parent, adoptive parent, grandparent, child, adopted child, grandchild or sibling.

9.8. Keeping Records

9.8.1 Every employer must keep a written record on site for the duration of the project and three (3) year after completion records should consists of at least the following
(a) the worker's name and position;

(b) copy of an acceptable worker identification

(c) in the case of a task-rated worker the number of tasks completed by the worker;

(d) in the case of a time-rated worker, the time worked by the worker;

(e) payments made to each worker in a form of Proof of Payment, Payroll registers and the acknowledgement of payment receipt signed by the worker.

9.8.2 The employer must keep this record for a period of at least **three years** after the completion of the EPWP.

9.9. Payment

9.9.1 An employer must pay all wages at least monthly in cash or by cheque or into a bank account.

9.9.2 A worker may not be paid less than the Ministerial Determination wage rate.

9.9.3 A task-rated worker will only be paid for tasks that have been completed.

9.9.4 An employer must pay a task-rated worker within five weeks of the work being completed and the work having been approved by the manager or the contractor having submitted an invoice to the employer.

9.9.5 A time-rated worker will be paid at the end of each month.

9.9.6 Payment must be made in cash, by cheque or by direct deposit into a bank account designated by the worker.

9.9.7 Payment in cash or by cheque must take place
(a) at the workplace or at a place agreed to by the worker;

(b) during the worker's working hours or within fifteen minutes of the start or finish of work;

(c) in a sealed envelope which becomes the property of the worker.

9.9.8 An employer must give a worker the following information in writing
(a) the period for which payment is made;

(b) the numbers of tasks completed or hours worked;

(c) the worker's earnings;

(d) any money deducted from the payment;

(e) the actual amount paid to the worker.

9.9.9 If the worker is paid in cash or by cheque, this information must be recorded on the envelope and the worker must acknowledge receipt of payment by signing for it.

9.9.10 If a worker's employment is terminated, the employer must pay all monies owing to that worker within one month of the termination of employment.

9.10. Inclement weather

If no work has begun on site, and if an employee has reported for work, the employee will be paid for four hours. Should work be stopped after the first four hours, the employee will be paid for the hours worked. Where the employer has given employees notice on the previous working day that no work will be available due to inclement weather, then no payment will be made.

9.11. Deductions

9.11.1 An employer may not deduct money from a worker's payment unless the deduction is required in terms of a law.

9.11.2 An employer must deduct and pay to the SA Revenue Services any income tax that the worker is required to pay.

9.11.3 An employer who deducts money from a worker's pay for payment to another person must pay the money to that person within the time period and other requirements specified in the agreement of Law; court order or arbitration

9.11.4 It is the responsibility of the employers to arrange for all persons employed on a Project to be covered in terms of the Unemployment Insurance Fund Contributions Act, 2002 (Act No. 4 of 2002)

9.11.5 An employer may not require or allow a worker to

(a) repay any payment except an overpayment previously made by the employer by mistake;

(b) state that the worker received a greater amount of money than the employer actually paid to the worker; or

(c) pay the employer or any other person for having been employed.

9.12. Health and Safety

9.12.1 Employers must take all reasonable steps to ensure that the working environment is healthy and safe.

9.12.2 A worker must

(a) work in a way that does not endanger his/her health and safety or that of any other person;

(b) obey any health and safety instruction;

(c) use any personal protective equipment or clothing issued by the employer;

(d) report any accident, near-miss incident or dangerous behaviour by another person to their employer or manager.

9.13. Compensation for Injuries and Diseases

9.13.1 It is the responsibility of the employers to arrange for all persons employed on a Project to be covered in terms of the Compensation for Occupational Injuries and Diseases Act, 130 of 1993 as amended by COIDA Act 61, 1997.

9.13.2 A worker must report any work-related injury or occupational disease to their employer or manager.

9.13.3 The employer must report the accident or disease to the Compensation Commissioner.

9.13.4 An employer must pay a worker who is unable to work because of an injury caused by an accident at work 75% of their earnings for up to three months. The employer will be refunded this amount by the Compensation Commissioner. This does NOT apply to injuries caused by accidents outside the workplace such as road accidents or accidents at home.

9.14. Termination

9.14.1 The employer may terminate the employment of a worker for good cause after following a fair procedure.

9.14.2 A worker will not receive severance pay on termination.

9.14.3 A worker is not required to give notice to terminate employment. However, a worker who wishes to resign should advise the employer in advance to allow the employer to find a replacement.

9.14.4 A worker **who is absent for more than three consecutive days** without informing the employer of an intention to return to work will have terminated the contract. However, the worker may be re-engaged if a position becomes available.

9.14.5 A worker who does not attend required training events, without good reason, will have terminated the contract. However, the worker may be re-engaged if a position becomes available.

Notice procedure is as follows

- One week if employed for four weeks or less
- Two weeks if employed for more than four weeks but not more than a year
- Four weeks of employed for one (1) year or more

9.15.Certificate of Service

9.15.1 On termination of employment, a worker is entitled to a certificate stating

(a) the worker's full name;

(b) the name and address of the employer;

(c) the Project on which the worker worked;the work performed by the worker;

(e) any training received by the worker;

(f) the period for which the worker worked on the Project; and

(g) any other information agreed on by the employer and worker.

9.16. DOMICILE

The address to which notices and all legal documents may be delivered or served are as follows:

Employee Details

Name & Surname:.....

ID No:.....

Residential Address:.....

.....

Contact No:.....

Date of Employment:.....

To be supervised by Main Contractor..... or Sub Contractor:.....

Category of employment: Skilled..... Semi-skilled..... Unskilled.....

For Skilled & Semi-skilled state the trade:.....

Period of employment: ***Fixed for until when your services are still required on site***

I confirm that I have been inducted and fully understand the condition of my appointment

Employee Signature:.....

Witness by SGB/CLO:.....

Signature by Witness:.....

Employer Details

Name & Surname:.....

Designation:.....

Contact No:.....

Signature:.....

The Attendance Register for on-site Workers

Reporting month: _____ Cell No: _____

Project Name: _____ WIMS no: _____

Surname: _____ First Name: _____

IDENTITY NUMBER:

Day	Date	Time In	Signature	Time Out	Signature	Report On Any Formal Training Provided In The Reporting Month
WEEK 1						
MONDAY						
TUESDAY						
WEDNESDAY						
THURSDAY						
FRIDAY						
WEEK 2						
MONDAY						
TUESDAY						
WEDNESDAY						
THURSDAY						
FRIDAY						
WEEK 3						
MONDAY						
TUESDAY						
WEDNESDAY						
THURSDAY						
FRIDAY						
WEEK 4						
MONDAY						
TUESDAY						
WEDNESDAY						
THURSDAY						
FRIDAY						
WEEK 5						
MONDAY						
TUESDAY						
WEDNESDAY						
THURSDAY						
FRIDAY						
Total Days worked						

KZN PUBLIC WORKS
Monthly Data collection form

EXPANDED PUBLIC WORKS PROGRAMME

Name of Contractor:_____ WIMS No:_____ Project location name (area):_____
Name of Project:_____ Reporting month:_____ Project location (Ward No.):_____

Beneficiary Details														Experience/Literacy				Location Details				Household Details		
No	First Name	Initial	Surname	ID number	D.O.B	Gender Y/N	Disability Y/N	Start Date on the current month	End Date on the current month	Total days worked	Are you receiving any Gov grant?	1st Language	Other Language 1	Other Language 2	Education Level See Codes Below	Highest Level of Education	Address	Ward No.	Cell No.	Nationality	No. of people in household	No. of Dependants in Household	No. of Children attending school
1																							
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							

- Education Levels – use the codes (1,2,3) on the excel spreadsheet

o (1) Unknown	(3) Grade 1-3 (Sub A – Std 1)	(5) Grade 5-6 (Std 3-4) ABET 2	(7) Grade 9 (Std 7) ABET 4	(9) Grade 12 (Std 10)
o (2) No Schooling	(4) Grade 4 (Std 2) ABET 1	(6) Grade 7-8 (Std 5-6) ABET 3	(8) Grade 10-11 (Std 8-9)	(10) Post Matric

Contractor sign:_____
Designation:_____
Date:_____
Contact no:_____

DPW Official sign:_____
Designation:_____
Date:_____
Contact no:_____

EPWP Official sign:_____
Designation:_____
Date_____
Contact no:_____

KZN PUBLIC WORKS

Worker payment capture form

EXPANDED PUBLIC WORKS PROGRAMME

Name of Contractor:_____ WIMS No:_____

Name of Project:_____ Reporting month:_____

Payment Upload

No.	First Nam	Initials	Surname	Identity N	D.O.B	Daily Wage Rate	Total Paid Days	Total Amount Paid	Total days Worked Days	Training Days Paid	Training Days Not Paid	Total Training Days
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Contractor sign:_____ **DPW Official sign:**_____ **EPWP Official sign:**_____

Designation:_____ **Designation:**_____ **Designation:**_____

Date:_____ **Date:**_____ **Date:**_____

Contact no:_____ **Contact no:**_____ **Contact no:**_____

KZN PUBLIC WORKS
Worker Training capture form

EXPANDED PUBLIC WORKS PROGRAMME

Name of Contractor:_____
Name of Project:_____

WIMS No:_____
Reporting month:_____

Training											
No	Name	Surname	ID No.	Course Name	Was training Accredited or Non - accredited by a relevant SETA	Start date on current month	End date on current month	Number of Training Days	Cost per trainee	Is training complete or on going	Name of Training Provider
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											

Contractor sign:_____
Designation:_____
Date:_____
Contact no:_____

DPW Official sign:_____
Designation:_____
Date:_____
Contact no:_____

EPWP Official sign:_____
Designation:_____
Date:_____
Contact no:_____

Contractor's Payment Register for Local EPWP Beneficiaries on Infrastructure projects: Name of the Project.. Payment period: From................ To ....

	Job Description	Name	Surname	ID No	Main Contractor or Sub Contractor employee	Date of Employment on this project	Bank A/c	No of Normal days worked	Overtime hours worked	Total Hours Worked	Total Number of Days worked	Rate of Pay per hour or per task	Gross salary paid	UIF Deducted	Less other deduction	Nett Amount Paid to the local beneficiary	Beneficiary Signature	Date of payment

KZN Department of Public Works
EPWP Acknowledgement of receipt of Payment

EXPANDED PUBLIC WORKS PROGRAMME

AKNOWLEDGEMENT OF RECIEPT OF PAYMENT OF SALARIES BY WORKERS

Name of Contractor:_____

Name of Project:_____

WIMS No:_____

Reporting month:_____

No	Name	Surname	Identity Number	Job designation	Days Worked	Training Days	Daily Wage Rate	Total paid to employee	Employee Signature
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
Total									

PREPARED BY: NAME & SURNAME..... SIGNATURE ..... DATE ..... CONTACT No.....
DESIGNATION:.....

Reference No	
Profile ID	
Project Name	
Project Details	
Project Name	
Project Reference Number	
Project description	
Project Start Date	
Project End Date	
Estimated Budget	
Project Location	
Province	
District/Metro Municipality	
Local Municipality/Metro Region	
Latitude (in decimal format)	
Longitude (in decimal format)	
Public Body Details	
Public body sphere	
Reporting public body that is the project owner (and will report on the project)	
Implementing public body type	
Public body that will implement the project	
IDP reference number allocated to the project	
EPWP Details	
EPWP Sector	
EPWP Program	
EPWP Sub programme	
Budget Amount	
April 2014/March 2015	
April 2015/March 2016	
Total Budget Amount	
Wages	
UIF	
COIDA	
Training	
Administration	
Equipment and materials	

Other	
Describe other	
Outputs and Training	
Output	
Despription	
Target Quantity	
Number of persons to be trained	
Contact person	
Title	
Initials	
First Name	
Surname	
Email	
Tel (Office)	
Fax Number	
Cell Number	
Physical Address 1	
Physical Address 2	
Physical Address 3	
Physical Address 4	
Postal Address 1	
Postal Address 2	
Postal Address 3	
Postal Address 4	

PROJECT FILE CHECKLIST

Project Name: _____ **Name of Contractor:**_____

Project Profile ID: _____**Contractor's Contact Details:**

_____

Region: _____

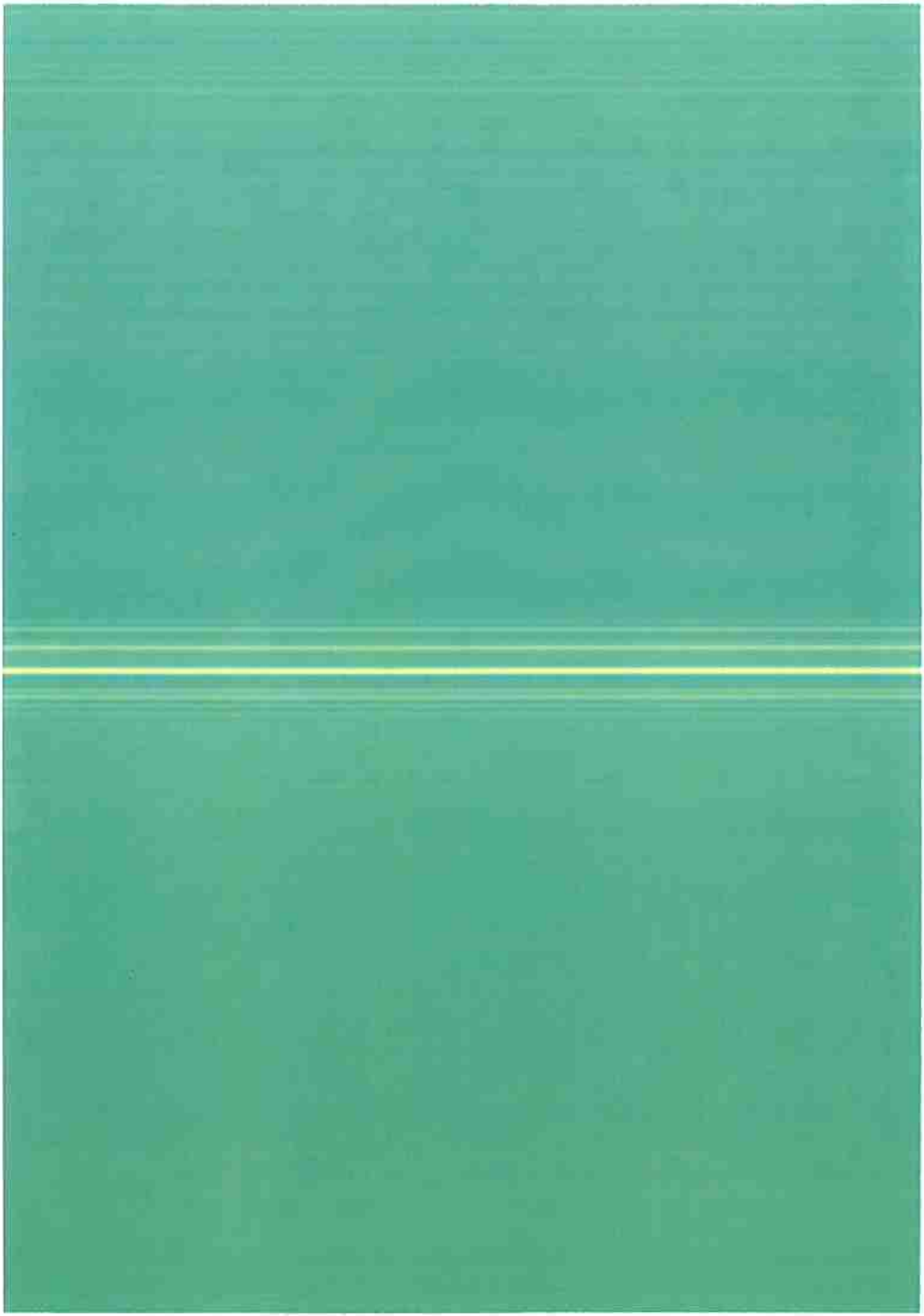
No	Item	Submitted (Y/N)	Comments
1.	Registration & Business Plan (submitted by Programme management once at an initial stage of a project).		
2.	Participant Monthly Data Collection Form " Annexure A" (Mandatory)		
3.	Monthly Payment Upload "Annexure B" (Mandatory)		
4.	Training Capture Form (if there is training)" Annexure C" (optional)		
5.	Monthly Attendance Register for local workers on – site. "Annexure D" (Mandatory)		
6.	Employment Contract (applies to new work opportunities created (upload once off) " Annexure E" (Mandotory)		
7.	Certified copies of IDs (submitted once if new employee has been appointed) Mandatory		
8.	ID size Photo (submitted once if new employee has been appointed) Mandatory		
9.	Proof of UIF registration (submitted once if new employee has been appointed)		
10	Proof of COIDA registration (submitted once if new employee has been appointed)		
11	Proof of Payment by Contractor "Annexure F"		
12	Acknowledgement of receipt of payment (applies where there is no payslip or proof of payment) "Annexure G" Mandatory		

Checked by: _____

Signature: _____ Date: _____

PAGE NO	ITEM NO	DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
1		**BILL NO 1**				
1		**EMPLOYMENT AND TRAINING OF LABOUR ON THE EPWP BENEFICIARY INFRASTRUCTURE PROJECTS**				
1		**PREAMBLES**				
1		Tenderers are advised to study the Additional Specification SL: Employment and training of Labour on the Expanded Public Works Programme (EPWP) Infrastructure Projects as bound elsewhere in the Bills of Quantities and then price this Bill accordingly				
1		**TRAINING OF EPWP BENEFICIARY**				
1		(TARGET: 15 EPWP BENEFICIARY)				
1		***Skills development and Technical training:***				
1	1	Skills development and technical training for EPWP beneficiary for an average of 10 days (ref. SL11.01.01)	Item	1		
1	2	Penalty due to not meeting the target as in SL 11.01.02	Y/Work	R 2 000,00		
1		**TRAVELLING AND ACCOMMODATION DURING OFF SITE TRAINING:**				
1		Life skills training for 26 days (ref. SL 11.02.01)				
1	3	Travelling (based on 200km/EPWP beneficiary)	km	3000		
1	4	Profit and attendance on Items 1, 2 & 3	%			
1		**EMPLOYMENT OF EPWP BENEFICIARY**				
1	5	Employment of EPWP beneficiary (10 youth) [Structural repairs to Dannhauser CHC]	Item	1		
1		The unit of measurement shall be the number of EPWP beneficiary at the statutory labour rates of R 160/day multiplied by the period employed in months and the rate tendered shall include full compensation for all costs associated with the employment of EPWP beneficiary and for complying with the conditions of contract. The cost for training shall be excluded from this item. This item is based on 12 months appointment for EPWP beneficiary				
		TOTAL CARRIED TO SUMMARY				

			UNIT	QUANTITY	RATE	AMOUNT
2	6	Employment of EPWP beneficiary(160 youth) []	Item	1		
2		The unit of measurement shall be the number of EPWP beneficiary at the statutory labour rates of R 160/day multiplied by the period employed in months and the rate tendered shall include full compensation for all costs associated with the employment of EPWP beneficiary and for complying with the conditions of contract. The cost for training shall be excluded from this item. This item is based on 12 months appointment for EPWP beneficiary				
2		**PROVISION OF EPWP DESIGNED OVERALLS TO YOUTH WORKERS**				
2	7	Supply EPWP designed overalls to EPWP beneficiary (ref. SL 11.05.01) for 30 workers	Item	1		
2	8	Profit and attendance on Items 5 - 8 (ref. SL 11.05.02)	%	7,5		
2		**PROVISION OF SMALL TOOLS FOR EPWP BENEFICIARY**				
2	9	Supply of small tools to EPWP beneficiary. Specification to be supplied by the EPWP-NYS Serviced Provider for the respective trades (ref. SL 11.06.01) for 30 workers	Item	1		
2	10	Profit and attendance (ref. SL 11.06.02)	%	7,5		
2		**APPOINTMENT OF YOUTH TEAM LEADERS**				
2	11	Appointment of EPWP beneficiary Team Leaders for the duration of the contract (ref. SL 11.07)	Item	1		
2	12	Liaison with Service Provider (ref. SL 11.08)	Hrs	30		
2	13	Profit and attendance on Items 12 & 13	%	7,5		
		FINAL TOTAL CARRIED TO PRELIMINARY AND GENERAL IN BILL OF QUANTITIES				



SUPPLEMENTARY PREAMBLES

The following Supplementary Preambles are to be read in conjunction with the "Standard Preambles to all Trades WB20" included herebefore and are to apply to this Contract.

Where these "Supplementary Preambles" are at variance with the "Standard Preambles to all Trades" referred to above, such variances are to take precedence and are to apply to this Contract.

ALTERATIONS

All Notes, Preambles, etc. applicable for the various trades in the Bills of Quantities, will apply equally to the trades in this Bill.

Tenderers are advised to visit the site and satisfy themselves as to the nature and extent of the work to be done, and also to examine the condition of the existing building.

Tenderers are advised that all materials from the pulling down (except where described to be re-used or handed over to the Director) will become the property of the Contractor, and all these materials, together with all rubbish and debris, must be immediately carted away, and the site left clean and unencumbered. Materials, etc. which are described to be handed over to the Director are to be carefully dismantled where necessary, and neatly stacked where directed on site. Items described as removed shall be removed from site.

Credit for the value of the materials from the pulling down may be allowed for on the Final Summary page.

Prior to the removal of any timbers from the site, they are to be inspected by the Government Entomologist as laid down in Section 32 of the Government Forest and Veld Conservation Act of 1941 (Act 13 of 1941) as amended. If any of the timbers are infested with wood destroying agencies, they are to be disposed of in the manner prescribed by the Government Entomologist.

The Contractor is to give ample notice to the Director and Local Authorities regarding any disconnections necessary prior to the removal or interruption of electric light or telephone cables, water and sanitary services, etc.

Tenderers are advised that adjacent sections of this building will be occupied during the building operations, and the Contractor is required to carry out the work with as little noise, dust and disturbance as possible. Undisturbed access is to be given to patients, staff and visitors.

The Contractor is advised to check all dimensions affecting the existing building as he will be held solely responsible for all new work being of the correct size. All sizes stated are approximate and under no circumstances will claims be entertained should actual sizes of existing items on site vary marginally from the sizes stated in this document.

The Contractor will be held solely responsible for any damage to persons, property, and equipment and for the safety of the structure throughout the whole of the Contract, and must make good at his own expense any damage that may occur.

The Contractor must obey the instructions of the Director in carrying out any portion of the work which in his opinion requires expediting, and the Contractor shall give priority to such work as and when directed.

Anodised coatings on aluminium are to comply with SABS 999 as applicable.

Rates are to include for setting up and building in as well as for isolation material between the aluminium surfaces and adjacent surfaces of a differing material.

All visible surfaces are to be covered with a temporary protective tape, later to be removed. -

Float glass for glazing is to comply wth SABS CKS 55 and BS 952 as applicable.

Safety and security glazing materials for buildings is to comply with SABS 1263(1) unless otherwise described. All panes are to be marked so as to be visible. Laminated safety glass is to carry a written five year guarantee.

Windows and doors are to be watertight.

Silicon pointing to windows and doors is elsewhere.

PLASTERING

Rates for new plaster, screeds, etc. to existing surfaces are to include for all preparatory work and forming a key.

Removal of paint and/or varnish as well as the roughening of the existing face brick surfaces both externally and internally to receive new plaster has been measured separately.

Plaster and screeds, etc. in patches is generally of an isolated nature and to existing surfaces. Portion of the work may be in narrow widths.

Where alterations are to be done to the existing structure, the new plaster, etc. has been measured to a point 300 mm beyond the line of the alteration on the existing structure.

TILING

Ceramic Wall and Floor Tiles are to comply with SABS 1449 as applicable.

PLUMBING AND DRAINAGE

Water Supply and Drainage for Buildings is to comply with SABS Code of Practice 0252 as applicable.

Water Supply and Distribution System Components is to comply with SABS 1808 as applicable.

Electrical Water Heater	-	Storage Heaters to comply with SABS 151.
	-	Instantaneous Heaters to comply with SABS 1356 and IEC 335(2-35).

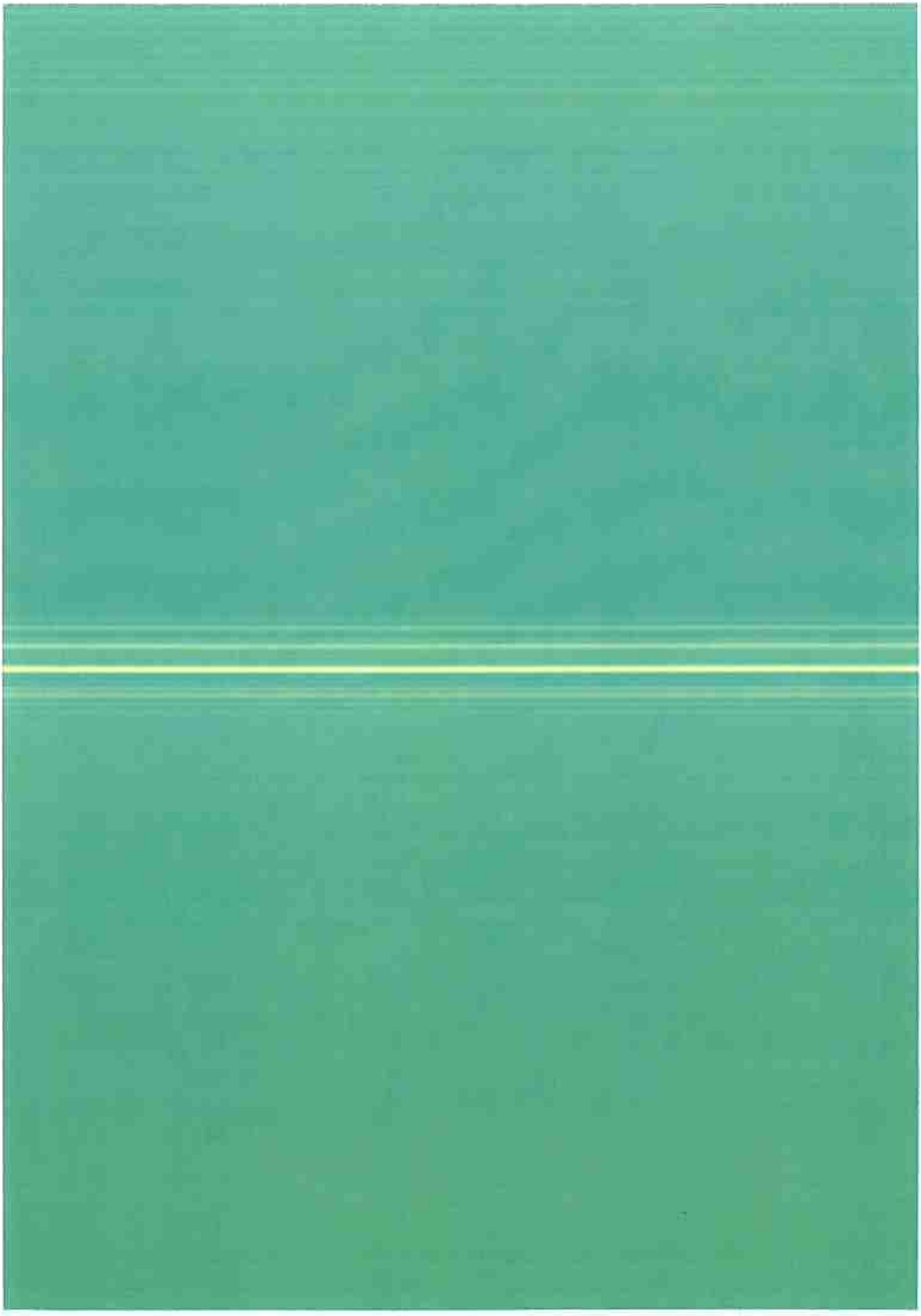
GLAZING

Glass is to comply with BS 952.

Glass for glazing is to comply with SABS CKS 55.

Safety and security materials are to comply with SABS 1263 as specified.

Laminated safety glass is to carry a written five year guarantee.



INDEX

SUPPLEMENTARY PREAMBLES

ELECTRICAL WORK

SUPPLEMENTARY PREAMBLES

1. ELECTRICAL INSTALLATION

a) The Electrical installation shall comply with all requirements of the local authority, Telkom and with SANS 10142-1"Wiring of Premises".

b) All work must be done under supervision of a registered electrician and the required installation certificate of compliance shall be issued to the Head Works: Representative by at least a registered Installation Electrician on or before first delivery.

c) All chasing shall be carried out neatly. Do not chase walls constructed of hollow blocks, locate services in the block cavities. Chase solid walls not deeper than one third of the wall thickness vertically and not more than one sixth horizontally. Avoid horizontal chasing where possible. Ensure that chases, holes and recesses are so made as not to impair the strength or stability of the wall, or reduce the fire resistance properties of the wall. Single brick walls must not be chased.

d) Only contractors registered with the Electrical Contracting Board of South Africa in accordance with the regulations of the Occupational Health and Safety Act will be accepted and permitted to do work under this contract. The requirements of Regulation 5(2) will be strictly enforced by the Head: Works. It will be compulsory for the Contractor to submit proof of registration at closing date of tenders by submitting his registration number in the space provided on the cover page of this tender document or in the Proposed Specialist Sub-Contractors together with a copy of his Registration Certificate.

2. CERTIFICATE OF COMPLIANCE (COC)

The Certificate of Compliance for Electrical Installation as per SANS 10142-1 is a mandatory requirement for all electrical installations.

Section 5 – responsibilities, requires four separate signatures indicating acceptance of responsibility for the electrical installation i.e.

5.1 Design
5.2 Material Specification/ procurement
5.3 Construction
5.4 Inspection and tests.

The CoC must be completed in full to comply with the OHS Act (85 of 1993).

3. CONCRETE CABLE MARKERS

The Contractor shall supply and install concrete cable markers to indicate positions of all cable joints and wherever a turn occurs in the run of the cable. The cable markers will be buried into the ground directly above and in line with the cable route and with the bottom of the aluminium nameplate, level with the finished ground level. Maximum separation distance between adjoining cable markers will not exceed 50m. The Contractor will further allow for the inscription to be provided by the Head Works: Representative, to be punched onto the aluminium nameplate.

Details for the manufacture of the cable markers are indicated and specified on the accompanying typical drawings.

4. CABLE MARKING TAPE

Cable marking tape must be installed above all underground cables. The cable marking tape must be of the yellow PVC marking type, 150mm wide and must be laid minimum 250mm above the entire length of the cable.

5. ELECTRICAL DISTRIBUTION KIOSKS

The required equipment shall comply with the following:

5.1 Distribution Kiosks

The kiosks shall have a weatherproof construction complete with lockable doors and shall be of the foundation mounted or root planted types. All plinth details of mini-subs, transformers and kiosks shall be approved by the Head Works: Representative prior to installation. These units shall be constructed from:

5.1.1 Pre-painted mild steel or

5.1.2 3CR12 (within 50km of the coast and in corrosive industrial atmospheres) or

5.1.3 Fibreglass (within 50km of the coast and in corrosive industrial atmospheres).

Notes: 1. Refer to accompanying typical drawings for concrete plinth details.
2. Refer to project specification for particular specification on Kiosks.

6. PRIORITY OF DOCUMENTS (IN ASCENDING ORDER)

In cases where there is a contradiction in the contract, the following order of precedence will apply:

(a) Post Tender Correspondence / minutes

(b) Conditions of Contract

(c) Project Specification and drawings

(d) General Specification

(e) Bills of Quantities.

7. LIGHT FITTING LUMINAIRES

All installed light fitting luminaires and its associated equipment shall comply fully with SABS approved equipment or materials.

7.1 Light Fitting Schedule

Light fittings supplied and installed shall be as specified or other approved to the specified equipment. The light fittings shall further comply in full with the standards and specifications applicable to all materials and components of the specified equipment.

Prior approval of alternative type of fittings must first be obtained in writing before submitting a tender offer based on the alternative types.

8. LIGHT SWITCHES

8.1 Flush Type

All flush type tumbler 16A, 220/250V light switches complete with cover plate shall be suitable for mounting inside standard type 100 x 50 x 50mm wall boxes and shall comply fully with SABS 164-1 and shall further bear the mark.

The dimmer type units shall comply with SABS 1012.

8.2 Surface Type

These units shall comply with SABS 164-1 and shall be provided with specially manufactured surface mounting type box.

8.3 Watertight Type

Watertight switches shall be of the micrograph type suitable for surface mounting and shall bear the SABS mark.

The housing shall be of galvanised cast iron or die-cast aluminium with watertight cover plate and toggle.

The switches shall have a porcelain base and a quick acting spring mechanism and further be rated at 16A, 220/250V.

8.4 All light switches on Essential Power to have red covers.

9. WALL SOCKETS

All switched and un-switched sockets shall be of the same manufacture and shall conform to SABS 164-1 and SABS 164-2 and shall bear the SABS mark for normal use under normal environmental conditions.

Switches, when installed, shall be of the tumbler operated micrograph type rated at 16A, 220/250V.

Where 13A flat pin switched socket outlets are specified, these shall comply with BS 1363.

9.1 Flush Types

These units shall be installed in standard 100 x 100 x 50mm or 100 x 50 x 50mm wall boxes and shall comply fully with SABS 1084/1085.

9.2 Surface Types

Surface mounted sockets can be standard flush types mounted on the standard 100 x 100 x 50mm or 100 x 50 x 50mm extension boxes complete with the standard cover plates. The specially designed for industrial types can also be employed.

9.3 Watertight Switched Socket

The housing of watertight switched socket shall be of galvanised cast iron or die-cast aluminium with watertight machined joints.

The switch shall have porcelain base and a quick acting spring mechanism and shall be rated at 16A, 220/250V.
The ON/OFF positions shall be clearly marked on the switch housing.
The socket openings shall be rendered watertight by means of a gasketed cover plate which is screwed onto the body of the unit. The cover plate shall be secured to the body of the unit by means of a chain.

9.4 All sockets on Essential Power to have red covers.

10. SCHEDULES

10.1 Mounting Heights of Outlets

All electrical outlets shall be installed at the heights listed below if not specified in the symbols list on the drawings:

Internal wall light:
1800mm above finished floor level

External wall light:
2400mm above finished floor level
Wall mounted examination light:
1600mm above finished floor level

Light Switches:
1300mm (to bottom of box) above finished floor level

Switched Socket Outlets
Switched socket outlets shall be mounted at a height of 300mm and 1300mm above finished floor level to bottom of draw box.

Distribution board:
1800mm to top edge of board

Stove isolator:
1400mm (to bottom of box) above finished floor level

Telephone and television outlets:
300mm above finished floor level to bottom of draw box

Electrical door bell:
At top edge of door frame level

Ablution extraction fan:
5A Double Pole Isolator at 300mm from finished ceiling height.

11. TESTING

After the installation had been completed the Contractor shall issue a certificate of compliance.

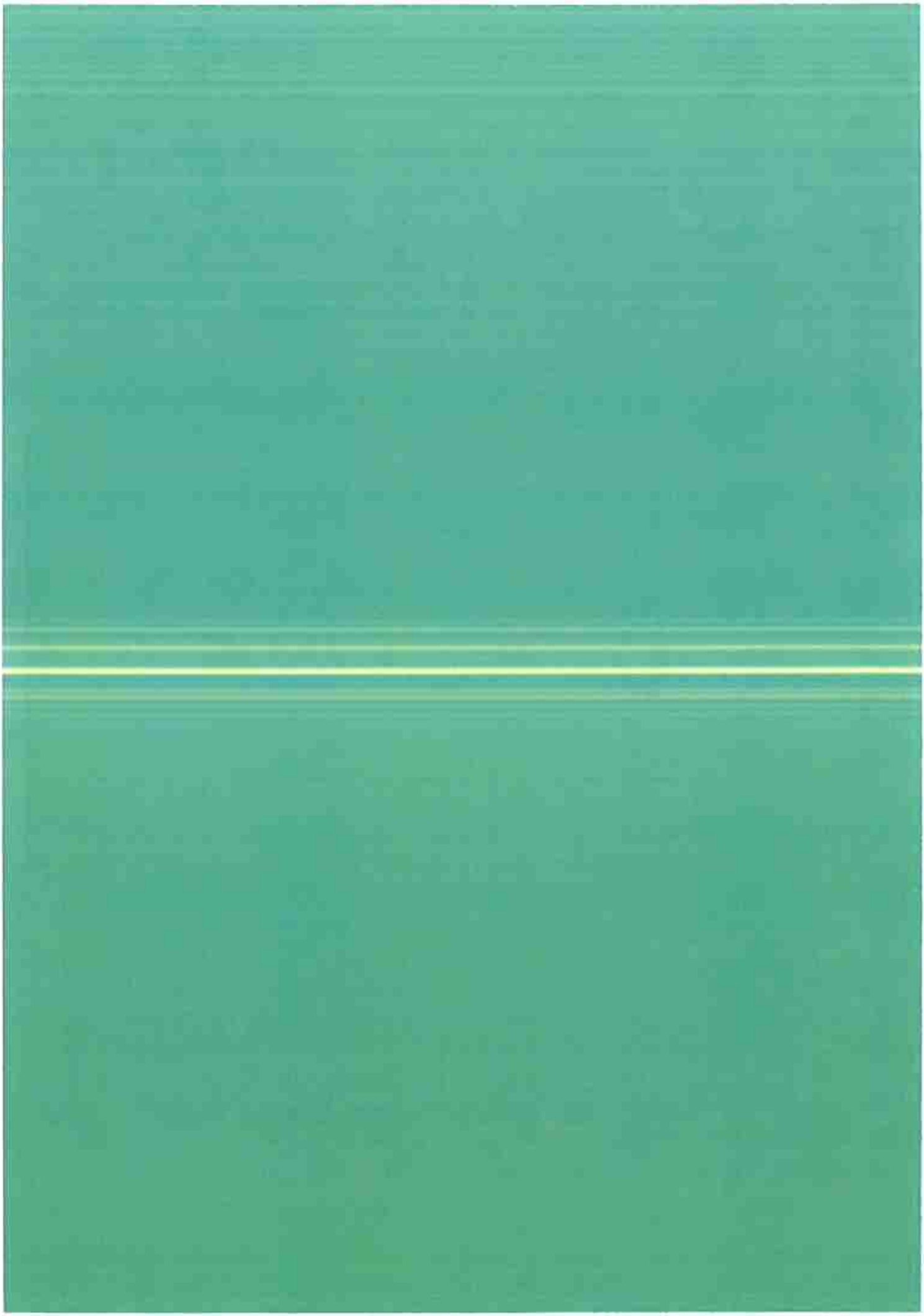
Before issuing a certificate of compliance, an accredited person shall inspect and test each new installation or extension of an existing installation for compliance with the relevant standard.

12. SABS SPECIFICATIONS

Where SABS Specifications references had been mentioned in this contract document it will deemed to be the applicable SANS Specifications and any amendments thereto.

13. AS BUILT DOCUMENTATION

On completion of the electrical installation work and the testing there of the contractor shall prepare As Built Documentation. The documentation shall be issued to the electrical engineer as follows:
A set of As Built Drawing which will indicate any changers to the positions of installation or type of material used.
The original certificates plus two copies of the Certificate of Compliance.
The original plus two copies of the Lightning Protection Certificate.
Service and Operating Manuals for all equipment installed,



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DANNHAUSER COMMUNITY HEALTH CENTRE
STRUCTURAL REPAIRS
Design Report

PROJECT NUMBER : **P1995**

PROJECT NAME : **HANNHAUSER COMMUNITY HEALTH CENTRE – STRUCTURAL REPAIRS**

DOCUMENT TITLE : **DANNHAUSER CHC – STRUCTURAL REPAIR DESIGN REPORT**

DOCUMENT NUMBER : **Rep9528**

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Revision No:	**01**
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Notes:	

This document has been prepared under the control of HSC Consulting Quality Management System.

Verification	Capacity	Name	ECSA Registration No.	Signature
Prepared by:	Project Engineer	H Scott	PrEng 810419	
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Accepted by:	Client			

CONTENTS Page

APPENDIX A - Site Plan and External Works

APPENDIX B - Photographic Survey of the building cracks

APPENDIX C - Drawings

APPENDIX D - Estimated cost

1 Introduction

HSC Consulting were appointed to report on the possible reasons for the severe damage to some of the buildings at the Dannhauser community Health Centre, propose remedial measures to stabilise the situation and to assist with the construction associated with the remedial work.

Inception and concept reports have been issued, which give our view on the reason for the damage and also the basics of what is proposed for remedial work. This document focusses on the proposed remedial work to minimise damage in the future.

2 Background

The IDT were appointed as the implementing agent for the project in about 2012. Through them, Delca Systems (Pty) Ltd were appointed to provide all professional services for the project. This included administration of the implementation under a JBCC contract. The contractor appointed was GVK (KZN) but to due to financial disputes, their contract was terminated prior to the final account and therefore didn't take liability for the defects.

Practical completion was taken in November 2014 and completion in April 2015.

Early in the life of the complex cracks started appearing, to an extent that they caused some concern. Consequently, a contract was called for a report including proposals for the repair of the buildings. Anderson Vogt were appointed for this exercise which commenced in February 2018. They presented their final report in January 2020. Some concern around this report has been expressed and this contract was awarded to take the process further.

3 Information Available

The information that we currently have available for this study includes the following items. This is unchanged from the list provided in the inception report.

- A report produced by Anderson Vogt Consultants. This includes
  - Minutes of the project briefing meeting
  - A plan of the facility showing areas of worst damage
  - Site investigation report by Geosure ref 128-11.R01 dated 13 May 2011
  - Levels of the rafts relative to what was planned and also the platform formations
  - A crack survey of the cracks in the pharmacy area.
  - Forensic Geotechnical report completed in December 2018 by Ground Africa.
  - Scans of the concrete rafts to indicate reinforcing
  - A rock engineering investigation undertaken by Geomech Consulting, dated November 2019 on the possibility that old mining works might be affecting the site
- A set of architectural "as-built" drawings of the project
- A set of structural drawings including reinforcing
- Original survey of the site giving original site levels – the survey provided was for a municipal office that was to be built on the site
- Control testing done on the bulk earthworks and concrete – this is very limited
- The final project account giving a schedule of costs approved for the project

The bulk excavation drawings were received but on closer examination, these were for a municipal office was to have been built on the site.

4 Description of the Complex

The Dannhauser Community Health Centre is a medical facility consisting of a main complex which has been divided into 4 modules and a further 17 separate buildings. These additional buildings include gate house, staff housing, mortuary, maintenance workshop and domestic building. The site is 4.8ha in extent and is situated south west of the town of Dannhauser.

All buildings are single storey and have essentially the same construction system as described below.

A plan of the site showing the various building is given in Annexure A.

4.1 Earthworks

The site has a fall of some 9.5m from north to south with the main road from Darnacol/ Dannhauser on the south east side of the site.

The site is divided by a retaining wall with the medical facilities on the south of this wall and the accommodation buildings to the north.

A series of platforms were formed in the in-situ material on which the buildings were constructed. The drawings indicate that the in-situ material was to be compacted to 93% MOD AASHTO and that there are then 3 layers of imported material placed on this, i.e. a 200mm layer of G5 to compacted 95% and two 175mm layers of G5 compacted to 96% MOD AASHTO. The beams of the rafts were excavated through these top two layers and are supported on the lower layer of G5

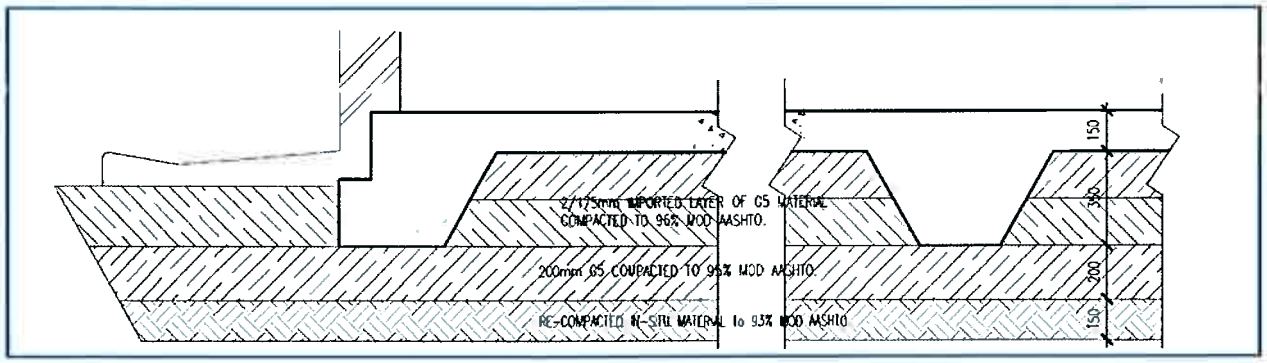


Figure 1 - Typical layerworks under floors

4.2 Foundations and Floor Slab

All buildings have reinforced concrete raft foundations similar to that shown on the drawing in Figure 1 above. The edge beams, where there is a wall, have a step to hold the external skin of brickwork and have a total depth of 500mm. There are internal beams forming a grid of beams at approximately 3m centres in both directions. The slab (surface bed) spanning between the beams is 150 or 170mm thick. The slab is underlain by a 250 micron damp proof membrane on imported material as shown in figure 1.

All walls and columns are built on these rafts.

4.3 Walls

External walls are cavity walls with a face brick for the external skin and plastered stock brick for the internal skin. There are movement joints shown on the drawings at varying centres but only on the longitudinal walls and at up to 15m apart. The joints are 10mm wide and are designed with concertina hoop iron ties every third

course. These have been shown as running through the walls but have generally only been constructed in the external skin.

The internal walls are a mix of 115 and 230 walls constructed in plastered and painted clay bricks. Except at some concrete joints, there are no joints indicated on the drawings.

4.4 Ring Beams

In the documentation that we have, the engineering drawings show ring beams along the top of the internal wall in the Additional Administration building (Module 16) only. This shows a 330x220 beam on the internal wall, behind the external wall and to span the cavity. We do not have any other details for the beam. On the drawings that we have, a ring beam is not indicated on any of the other buildings.

There is also no indication whether the beam spans across the movement joints, but based on our observations on site, there appears to be no joints in the beam.

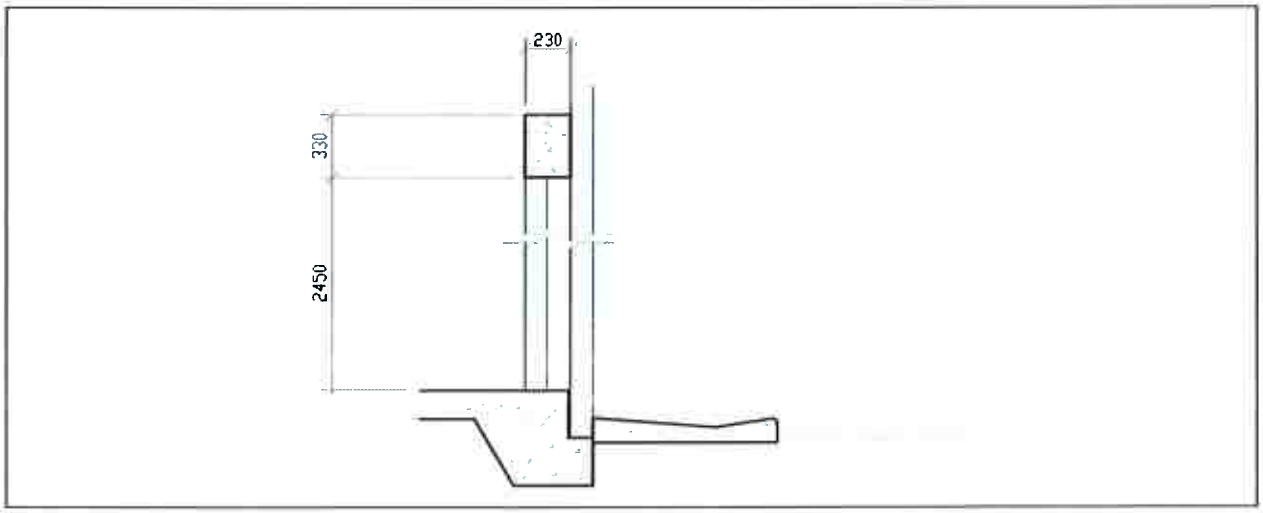


Figure 2 - Ring beam detail given for module 16 (Add administration). This detail is not shown on the drawings for other buildings.

4.5 Roof

The buildings all have conventional roofs with IBR type Chromodek profile steel sheeting supported on timber trusses and purlins.

No structural roof drawings were made available to us.

On the pharmacy building, the main pharmacy store has a concrete roof (ceiling) in addition to the timber structure and steel roof sheeting. The concrete slab is constructed using a rib and block system. Again, we do not have engineering details of this slab.

4.6 Roads

The complex has a network of roads giving access to all the buildings as well as parking and circulation. The width of the roads and parking areas varies but the surfacing comprises a 40mm asphalt wearing course supported by five engineered layers. Following the bulk cut, the in-situ material was ripped and compacted to 95% MOD AASHTO. There are two 150mm layers of G7 material on this in-situ material which were

compacted to 93% MOD AASHTO, a 125mm layer of G6to 93% and finally a 125mm base of graded crushed stone compacted to 98%.

There are precast kerbs in an in-situ concrete supports on either side of the road.

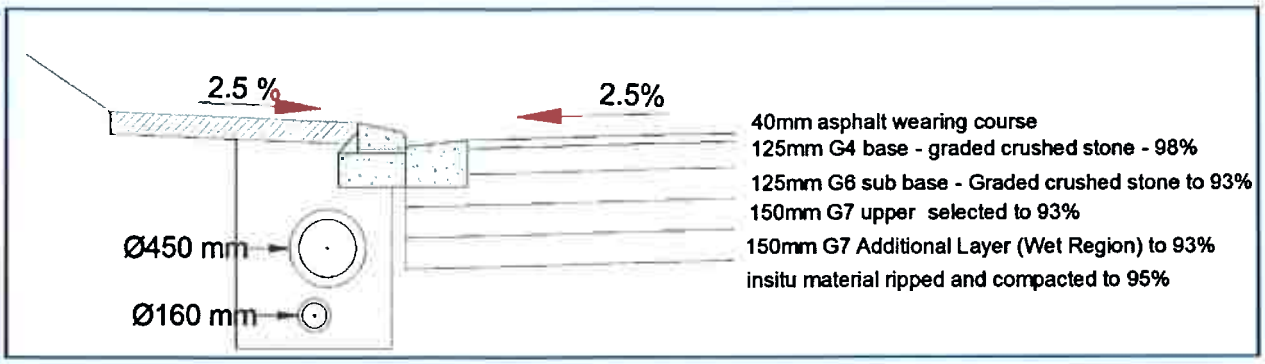


Figure 3 - Typical Road cross section showing kerbs and service positions

4.7 Road Sidewalks

The road sidewalks are indicated in figure 3. The width varies depending on location and are constructed in concrete. The drawings call for reinforcing in the concrete, but we could not confirm that this has been used. The drawings do not give the specification to be used for the material under the sidewalks.

4.8 Stormwater and Sewerage

We do not have details relating to the drainage of the site but based on our site visits, the site is drained by a network of pipes and there are a number of grid inlets visible on site. There are critical areas, however which do not appear to be properly drained. Such as around the additional administration building and east of the main complex of buildings.

4.9 Walkways

There are a number of external pedestrian walkways. The drawings indicate a reinforced concrete structure with downstand edges. There are no details of the joints between the panels.

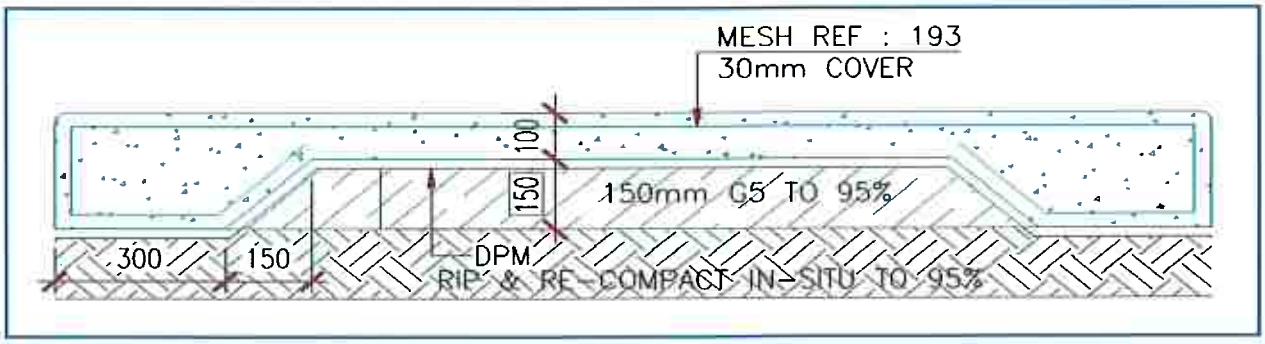


Figure 4 - Section though walkways without kerbs

It appears that there are some walkways where kerbs existed, and the concrete is placed between these using a similar specification

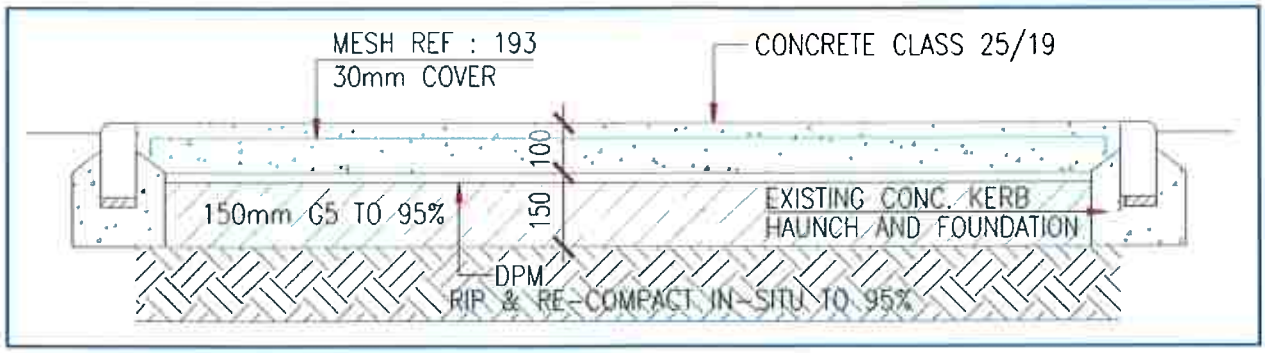


Figure 5 - Section through walkways using kerbs. Drawing implies that the kerbs existed?

4.10 Courtyards

The courtyards are mainly paved with interlocking blocks together with a combination of benches, openings for trees and flower boxes.

There is piped stormwater system in each courtyard. The downpipes from the roofs discharge into the courtyards. Some of these fall directly into the stormwater system or are guided into the stormwater, while others discharge onto the paving so that the water runs across the paving into the stormwater system or are built in such a manner that the water flows onto the paving.

5 Discussion and Recommendations

5.1 General

In this section we use our observations on site together with the information made available through the drawings, geotechnical reports and earlier forensic report, to discuss the possible causes of the damage and also recommend remedial measures. It should be noted that due to nature of the work, it is not possible to definitive in terms of the remedial work and much of the decision making will need to take place on site once areas are opened up and the full extent of damage can be assessed.

The problem, cause of the damage and proposed remedial work is laid out below and this should be read in conjunction with the attached drawings

The buildings are generally considered safe (except for very localised areas) but they are badly cracked and this is affecting their use in some areas where doors do not open properly etc. There are also problems with some of the support infrastructure such as road, walkways and paving. We do not have details of services but it has been suggested that there may be problems with them as well.

One solution would be to demolish large section of the buildings and re-build them with properly engineered foundations. This would be costly, time consuming and very disruptive to this important community facility. The other issue with this approach would be knowing where to stop as there are indications that the cracking is getting worse with time.

We are proposing an alternative pragmatic approach where we accept that the buildings are compromised but that we

- stabilise them my maintaining the moisture content of the soil under the foundation as even as possible and
- alter the structure to make them more able to cater for the seasonal movement that must be expected.

It is accepted that the facility needs to keep operating during the construction process and this is going to be challenging for both the clinic as well as the contractor. This will require careful programming of the work and communication between leadership on site. We make a proposal in this regard.

5.2 Repair Concept

In the development of a details of the repair proposal we are taking the following approach to minimise the differential movement across the buildings and to make the building more capable of accepting the movement that will occur during wet and dry seasons. This will include:

- Improving the stormwater system to keep water away from the critical buildings and to take water away from them as quickly and cleanly as possible
- Creating a vapour barrier around the building to help maintain moisture across the buildings as even as possible.
- To repair joint that exist to make them work
- To introduce new joints in the brickwork which allow the brickwork to move with the raft foundation with minimal additional stress
- To check existing services to ensure that the do not leak and where feasible introduce details that allow for movement without damage to the services

5.3 Site Visits, Photographic Survey and Observations

A detailed inspection of the buildings was undertaken on 22 and 23 September 2020. All cracks were photographed and plotted. The record is given in annexure B.

These photographs were used to study the crack positions and shape to understand the nature of the foundation and other movements responsible for the damage, as discussed below.

5.4 Cracks in Walls

The cracking is extensive. The intensity of the cracking varies across the complex with cracks being observed in the main hospital buildings, the additional administration building, the domestic building as well as the store and mortuary buildings. It is useful to note that these are all the larger building, where the length of the walls is the greatest. The smaller more compact buildings are performing well.

The most severe cracking in the walls is in the pharmacy building (section H of modules 1-4) where the cracks are very substantial, particularly on the north east side. The site investigation report puts this down to the fact that the roof of this building is concrete, making it stiffer. As the cracks are spread across the building, this is probably not the cause but may exacerbate the cracking by concentrating the movement. The reason is that there is more movement in the foundations in this area.

The shape and position of these cracks indicates differential foundation movement mainly from the interior of the building to the external faces. At the time of inspection, the main movement is settlement of the external area relative to the centre of the buildings. (Refer to the crack survey in annexure B)

There are also substantial cracks in the additional administration building, a standalone building, west of the main buildings. The cracking is most severe on the south end of the building, where there is cracking of the face brick skin in addition to the internal walls. The main movement is along to length of the building but there is also lateral movement. Most of the cracking indicates rotational movement in the walls but there are also areas of purely vertical movement.

The other area of severe movement is the west of section F of modules 1-4 (short stay ward) and east side of the administration section (G). The movement here has resulted in cracking of the external face brick skin of section F with bricks coming loose from the entrance lintel beam. There is also severe movement in the east wall of the administration block which is causing the doors to jam in addition to the cracking.

As will be seen from the photographic record, there is cracking throughout the main building as well as a couple of the ancillary buildings. The crack patterns are similar although less severe.

5.4.1 Movement Joints in Brickwork

The NHBRC in Part 1 Section 2 requires that for H3 soils where a raft foundation is used, the walls should be lightly reinforced, they should be articulated, and special attention should be given to site drainage plumbing and services.

The issue that is most concerning on all the buildings, is the almost complete lack of articulation. There are movement joints between the concrete rafts, however,

- these are not always carried through the walls
- the joints in the walls do not always line up with the joints in the concrete
- some of the finishes on the joints have not been properly constructed and are damaged
- there are instances where the walls have been built over the joint
- many joints have been badly constructed (mortar in the joint, plaster over the joint etc) and would not operate properly

In additional, the engineering drawings show joints in the external brickwork at spacing of between 10 and 15m. However, they are not consistent and are not close together enough. The drawings also indicate a 230mm wall rather than the cavity wall shown on the architect's drawing and which are built. There are no joints shown on the architect's drawings.

The position of existing joints found on site have been marked on the attached sketches. We note that although most of these joints have been constructed in the external face brick skin, they do not extend through the internal skin of bricks. This means that they are unable to allow movement in the foundations without cracking the internal walls.

Except in a few isolated cases, there is no articulation of the internal walls. Any movement in the foundations, will therefore reflect as a crack in the walls.

5.4.2 Recommended Joint Spacing and Width

Based on the two site investigation reports for the site together with our own interpretation of the results that have been presented, we have attempted to estimate the maximum spacing and width of joints that would be adequate.

The foundation movement expected on this site would be due to

- **compaction** where the fill material is not adequate. The second site investigation noted areas of fill where the material was inadequate. Much of the fill material appears to have been in-situ silty clay which would not be expected to compact well. Some compaction of the founding material and consequent foundation movement should be expected in all areas of fill. This movement will be relatively small however (fill is not deep), and will reduce with time. This is probably a factor in the two areas where they was cracking of the face brick (south side of the

additional administration building and west side of the short stay ward) , where the cracking is where fill would be expected to be greatest.

- **consolidation** (long term consolidation settlement) where, due to the pressure on the clay material, water is squeezed out of the clay, causing downward movement of the foundations. It has been calculated that, due to the low foundation pressures, this movement will not be great and will also take considerable time (up to 4 years to consolidate). In the absence of other influences, this movement would be expected to be more even across the buildings than has been observed.
- **heave and settlement** will be the dominant movements of these foundations caused by swelling and shrinkage of the clay as the moisture content changes. The two geotechnical reports have both predicted large potential heave with values of between 90 and 150mm. The magnitude of the movement will be dictated by the properties of the soil, the pressure imposed on the soil, the moisture content of the soil and thickness of the expansive clay stratum. The damage to the walls is not caused so much by the maximum movement, but by the differential movement across the building.

On these buildings, it is our view that, the main cause of the cracking is a change in moisture content between the interior of the building and the edges caused by drying out (or wetting up) out of the material under the foundations. Drying out at the edge is more has a more severe affect as the rafts are much stiffer when sagging (outside edges up) rather than when hogging (outside edges down).

This change in moisture content is quite severe on these buildings for a number of reasons

- The foundations are very shallow given the fact that a raft has been used
- The apron of 1m is very narrow and inadequate to locate the critical zone of moisture fluctuation well away from the edges of the buildings. It therefore does little to stabilise the moisture content of the soil between the centre and edges of the buildings, which reflects as 'hogging' beneath the central parts and 'edges down' around the perimeters of the buildings.
- There is a variation of permeability in material surrounding the buildings ranging from grassed areas with limited stormwater control to fully paved areas. The drying out of the soil will therefore also vary considerably
- The planting boxes adjacent to the buildings which will encourage moisture content changes rather than maintaining static conditions above the critical moisture level, i.e. above which swelling will not take place
- There is Interlocking block paving in the courtyards, which is quite permeable and would allow water into the soil and also drying out of the soil close to the buildings.

It is very difficult to predict differential moisture content in the founding stratum beneath the building and hence the differential heave that can be expected. Our rough estimate for the differential movement between the edge and the centre of buildings is 25mm (due to heave only as this could be exacerbated by other factors such as poorly compacted fill etc).

This translates to a curvature of the raft. We have done some analysis on the stiffness and shape of the raft under various conditions and considering the stiffness of the raft in a hogging situation (when the outside is frier than the internal area) across a typical building, we find that the raft is flexible enough to follow the shape of the soil, even under self-weight only. This gives a total crack width over a full length of a 2,5m high wall of 20mm. This would suggest a maximum wall length of 5m with joints capable of 10mm of movement. (The situation is less severe when outside edge is wetter than beneath the centre of the building).

Considering the ability of the walls to span over the deflected shape of the raft (the strength of the wall), this is quite complex due to the large number of variations such as shape of wall and openings etc. Making some

rough assumptions on a typical lateral wall shape (door openings etc) and brickwork bending strength, our calculations suggest a similar distance between joints.

We therefore recommend joints of 20mm at 5m centres in all walls.

5.4.3 Propose Remedial Work

5.4.3.1 Concrete Expansion Joints

For expansion joints that have been identified as being inadequate and not lining up with joints in the walls, we propose the following

- In the concrete rafts check that the joints are clean and able to work as joints
- Check the mechanism used to keep dirt from the joints and if necessary, replace this
- Where joints are not protected, insert a backing chord to a depth of 15mm
- Apply an approved flexible sealer such as polysulphide or silicon with a minimum elasticity of 50%
- Make good the finish of the joint to match what was originally proposed (or agreed alternative)

Where concrete joints do not line up with joints in the brickwork, or where there is no joint in the brickwork

- Remove brickwork to at least one brick width either side of the joint
- Re-build the brickwork leaving a 20mm clean joint using a closed cell void former
- Re-plaster the brickwork to match the existing
- If necessary, the plaster should be skimmed to eliminate plaster lines between the old and new plaster
- A joint of 20mm in the plaster to match the joint in the brickwork is to be allowed
- Remove 10mm of the closed cell foam and seal the joints on both sides with an approved flexible sealant with a minimum elasticity of 50%.
- If required, cover the joints to match the original design of the joints (or similar approved detail)

5.4.3.2 Cracks

In areas of extensive damage to the walls, we propose that the following solution be adopted

- In a limited number of areas (in pharmacy only) remove portions of the wall the wall and rebuild, elsewhere,
- Remove plaster from the walls (both sides for internal walls)
- Replace damaged cracked bricks
- fix a 50x50 1.8mm galvanised weldmesh (garden mesh) to the walls with Hilti nails, staples or similar approved. The mesh should be fixed in such a manner as to allow most of it to have a gap of approximately 5mm between the mesh and the wall
- Apply an approved bonding liquid to the walls
- Re-plaster with a high-quality mortar
- Paint and finish to match existing

For isolated cracks

- Open the cracks to a width of 5-10mm and to a similar depth
- Fill the crack with an approved paintable, flexible filler
- Sandpaper and paint and finish to match existing

5.4.3.3 Lintels

There are several lintels that are damaged, and the door have been closed and not used (mainly in administration area). For these areas, rebuild the lintels and refit the doors with flexibility to accept some movement

5.4.3.4 Doors

Due to the movement that is taking place, several doors are jamming. The proposal is

- In areas of minor movement, remove the doors, re-shape them and replace
- Where the movement is more severe, and the doors frames are to be removed and re-placed.
- Where Aluminium doors are damaged, they should be replaced with doors that have a sub-frame that allows for a certain amount of movement.

5.4.3.5 Articulation of the Building

As indicated on the plans, it is proposed that the buildings be articulated at approximately 5m centres to allow movement in the foundations without causing undue damage to the walls. The following is proposed for the joints.

5.4.3.6 External Walls

External walls are generally cavity brick walls with plastered and painted stock brick for the internal skin and face brick for the external skin. There are two scenarios, where expansion joints exist in the external skin but not in the internal skin and where no joint exists at all.

- Where external joints exist, clean all existing mastic from the joint, and clean the joint of all mortar and other foreign matter
- Where external joints are absent, cut a joint of 20mm all the way through the external skin and clean the joint thoroughly.
- Cut and grout 5 concertina hoop iron (as detailed) into the wall evenly over the full height
- Insert a backing chord to a depth of 15mm
- Seal with an approved flexible sealer with a minimum elasticity of 50%
- For the internal skins a similar joint is proposed which should be exactly lined up with the external joint
- Cut and grout 5 shaped strips of hoop iron (as detailed) into the wall over the full height
- Insert a backing chord to a depth of 15mm
- Seal with an approved flexible sealer with a minimum elasticity of 50% and that is paintable
- Finish to detail and to match existing

5.4.3.7 Internal Skins

There are currently no internal joints, except at some of the construction joints (but not all) and it is proposed that internal movement joints be added at a maximum of 5m centres throughout the buildings (as indicated on the attach plan), except for some of the smaller buildings. This is to allow some differential movement in the foundations without undue damage to the walls between joints. The proposed methodology for the construction of these joints is similar for 115 and 230 walls. There are no cavity walls for internal walls. The procedure is as follows:

- For the internal walls a 20mm wide joint is to be cut through the walls at positions as provided on the plans (The exact position can change slightly to suit construction conditions and can be agreed on site)
- Cut and grout 5 shaped strips of hoop iron (300mm each side as detailed) into the wall over the full height
- Insert a backing chord to a depth of 15mm
- Seal with an approved flexible sealer with a minimum elasticity of 50% and that is paintable
- Finish to detail and to match existing or as provided for in the details

5.5 Aprons

The aprons are an integral part of the foundation solution to the building and are installed as a vapour barrier to maintain the moisture content of the foundation material.

There are 1m wide aprons around all buildings where there is no other paving. The aprons are moving very badly and in some instances they have moved up to 40mm away from the buildings (figure 7).

The detail in figure 1 shows the apron on about 400mm of imported G5 material on a compacted in-situ material. This should be an adequate detail. The extent of the damage and movement of the aprons indicates that the design detail was not used for the construction of these aprons.

This is a serious problem as the purpose of the aprons is to provide an impermeable barrier. Currently, rather than preventing water getting out or into founding stratum, most are permeable and the water running down walls will be caught and channelled into the soil.

***Figure 6** - Gap of over 30 mm between the apron and wall and drop of 25mm in the apron*

***Figure 7** - Apron east of the main complex showing the embankment falling towards the apron without proper drainage. Also note the gap between the wall and the apron in which rainwater that is driven onto the walls infiltrates the substrate*

5.5.1 Propose Remedial Work

We propose that aprons be removed, and that the detail as provided in figure 1 be used to create a base for the aprons with the addition of waterproof membrane. The interface between the apron and the wall should be sealed with an approved sealant with a minimum elasticity of 50% . the joints between panels should be sealed in the same manner. A 193 mesh should be used in the concrete.

Where no other protection is to be provided (such as at the additional administration building) a vertical vapour barrier as shown on drawing SK02 is to be constructed over the full length of the apron.

5.6 Walkways

The walkways around the site were to have been built to the details above. In our view, this specification places the walkway foundations in the zone where the maximum movement would be expected.

There is widespread damage to the walkways with obvious vertical and horizontal movement as can be seen in figure 9. There are also other where the panels are large and have cracked such as adjacent the domestic building and south of the main complex.

***Figure 8** - Typical walkway showing vertical movement between panels and also the kerbs*

5.6.1 Propose Remedial Work

It is proposed that the walkways are lifted and that a similar detail to that used for the aprons be used to get the founding material down to a zone with less potential moisture change and movement. The detail given in figure 4 should be used.

5.7 Roads

The roads are performing relatively well relative to a number of the other elements on this project as the specification is satisfactory and they seem to have been built to that detail. There has however been some movement and there are areas of surface cracking as indicated below in figure 10.

Figure 9 - An example of some of the more severe cracks in the tarred road/ parking surfaces

5.7.1 Propose Remedial Work

The are a number of areas in the roads where there is cracking. The cracks vary across the site and there is a combination of crocodile and longitudinal cracks. Some are close together.

It is proposed that any areas that would allow water ingress, should, a minimum, be sealed.

Our preference would be to seal all roads with Slurry Seal with a conventional Slurry with anionic stable grade emulsion.

Where cracks are nominal and widely spread, a cold pour crack sealing could be used to save on budget. We propose the use of COLSEAL, a rubberised mineral filled bitumen emulsion.(Application is as per manufacturers specification)

5.8 Grassed areas

The damaged buildings have a number of grassed areas in close to the building perimeter. A number of these have very severe desiccation cracks indicating the presence of highly active clay. The attached plan indicates these areas which are not properly drained. We would at least expect an open drain which takes the water to a piped system. The areas of grass within 5m of a structure need to be sealed to prevent the ingress and loss of water. Refer to the attached plan showing the area that we propose upgrading.

Figure 10 - Desiccation cracking in soil adjacent to the additional administration building There are similar cracks on the east and south sides of the main buildings

5.8.1 Propose Remedial Work

. We propose

- These areas are re-shaped to ensure that water runs away from the buildings. . Under no circumstances should water be allowed to pond near the buildings.
- All stormwater should be captured and drained into the stormwater systems as soon as possible to avoid long runs and at least in concrete channels
- The areas should be paved with either concrete or interlocking pavers with DPC underlay to ensue an impermeable layer
- Alternatively, a trench could be dug approximately 1,0m from the foundation walls and down to where the moisture regime remains stable both during summer and winter seasons. A vertical curtain membrane is then hung in this trench, which is then backfilled on the outside, preferably with sand placed in compacted layers. An extra length of the plastic membrane is then folded over towards the foundation wall upon which a concrete apron is cast. In order to intercept and divert run-off from the apron away from the building, a dish-drain should be cast at its edge

5.9 Courtyards

The courtyards are an important component in controlling the moisture in the foundation material as they are adjacent to a large proportion of the building walls. We have a number of areas of concern, including

- Flower boxes and tree planter holes: - Flower boxes as shown in figure 12 which are against the wall of the building and therefore close to the building's foundations. We don't have details of the flower boxes but the tree planter holes are simply penetrations through the paving. This means that any water landing in the area or used to wate the plants will penetrate through to the foundation material, changing the moisture content. Evapotranspiration by the trees will also dry out the soils, which could give rise to cracking of nearby walls.
- Courtyard Paving: - The courtyards are paved with interlocking concrete pavers as can be seen in figure 12. Although they provide some protection, these are permeable and will allow water through changing the moisture content of the soil below – if somewhat delayed.
- Stormwater: There is pipes stormwater to the courtyards but there is not complete control of the water. As can be seen in figure 12, the downpipe will discharge water onto the paving. Some downpipes don't have their own gulley and water flows over the paving
- Other services: - At least in one instance as shown in figure 13, services penetrate the building below the level of the paving and a trench has been built to accommodate this. It is not drained and will seep into the soil below

Figure 11 - Courtyard flower box against the building and drain which is not working correctly

Figure 12 - Courtyard drainage showing drainage and in lower left services which penetrate the surfacing

5.9.1 Propose Remedial Work

5.9.1.1 Stormwater

All areas of the courtyards must be positively drained, and all downpipes must drain directly into the piped system. Extend the piped stormwater system, add gulleys and adjust the downpipes to ensure that no water leaks onto the paving. Ensure that all areas are drained (refer to the 4th bullet above).

5.9.1.2 Paving (Interlocking Blocks)

To ensure that the pavin is impermeable, we propose

- **Lift paving blocks and remove sand**
- **Lay a 250 micron PVC sheet over the whole area**
- **Replace sand and re-lay the blocks**

5.9.1.3 Planting boxes and tree holes

Planting boxes in the courtyards, including the boxes for trees do not seem to be sealed. We propose:

- One alternative is to remove all planting in the courtyards and pave the whole area. If this is not acceptable ,
- The planter boxes are cleaned of all soil
- A base is added, if not already there
- Add filter material and drainage to the boxes which run to the existing stormwater systems
- The boxes are fully sealed with a torch on waterproofing product such as Derbigum or equivalent approved.

Alternatively the planter boxes can be removed and replaced with paving as described elsewhere

5.10 Sewers & Water

We have not received drawings of the site services. There are some bulk service lines shown on the bulk excavation drawing but no details are provided.

One of the requirements in the NHBRC document for a raft foundation is that special precautions are taken with services. The large movement in the soil can rupture services if these are not detailed correctly, causing leaking into the soil, exacerbating the situation.

It is understood that during the excavations for the geotechnical report, some holes had water penetration. It is not clear from our inspection if any special details were provided, or built to allow for the anticipated heave in the soil. The following is proposed

- Pressure test all services (water and sewerage) to establish whether there are leaks
- Isolate these areas
- Excavate and repair these services making allowance for future expected movement with flexible details
- Investigate the details used for the services and if necessary, adjust the details to allow for the anticipated movement due to heave.

5.10.1 Stormwater Control

There are several areas where the stormwater is not properly controlled. This includes the areas surrounding the buildings such as the administration building and also in courtyards, where water from the roofs is not fed directly into stormwater drains.

- The stormwater systems should be checked throughout to ensure that there are no leaks.
- That there are no areas where water can lie.
- That all water from the roofs is drained away.

The entire stormwater systems should be checked to ensure that there are no leaks, that there are no areas where water can lie and that all water from the roofs is drained away.

All current grassed areas proposed for paving should be drained to open channels and then to the piped water system

As noted above, the piped systems should be extended in the courtyard to prevent water flowing across the paving.

5.11 Floor Coverings

Several areas have been recorded where the vinyl floor covering is damaged. It is not clear at this stage what the cause is and what the condition of the concrete slab under these areas is but we suspect that the slab is cracked and that it is due to the ingress of water that is causing the floor covering to delaminate and bubble. It is then damaged by use.

In these areas

- Remove the floor covering over the whole extent of the room
- Arrange for an inspection by the engineer
- Repair and seal any cracks
- Allow the floor to dry adequately by measuring the moisture content
- Replace the floor covering with new material and to the manufacturers specification

Figure 13 - Damage to the floor covering in a nunmber of wards

5.12 Sealant/ Mastic

All the joint sealant used that was inspected has broken down and is no longer performing its function. A product that should be flexible and well bonded, hard and still and in many instances coming loose. Most sealant will be replaced as a matter of course when the remedial work above is undertaken.

Where this is not done, we propose that the existing sealer is removed, joint is cleaned a backing chord is installed and that new sealer be installed to the manufacturer's specification. The sealer used must have an elasticity of at least 50%

5.13 External Vapour Barrier

Where there is inadequate protection provided to the foundation material by either aprons, paving, road or walkway, we propose the installation of a vertical barrier to the detail shown in SK02 in the annexures. The extent of the proposed barrier is given on the attached site plan.

6 Danger of Collapse

Previous inspections have recommended closing down certain portions of the complex as they were considered dangerous to use. In general, we do not agree with this and, except in the couple of instances

listed below, in our view, there is no danger of collapse. Although damaged and in many instance unacceptably cracked, there is no danger to the users.

The following areas do present some risk and should exclude use until urgent repairs are undertaken

The doorway into west side of the short stay ward is compromised and there is a possibility of the bricks coming loose and falling. This area should be closed until this can be repaired.

The wall running from west to east with door opening leading into Plant Room 3 on the east side of the main complex. This wall has a severe crack, no brickforce can be seen and the crack has compromised the stability of this wall. The area should be closed until the damage can be repaired or the propped.

7 Construction Methodology

The major issue for the contractor on this project will be the fact that the facility will need to remain operational during the construction process. This is going to need close liaison between the clinic management and the contractor's leadership on site. There will also be a time and cost implication and it is important that the constraints are made known at the time of tender.

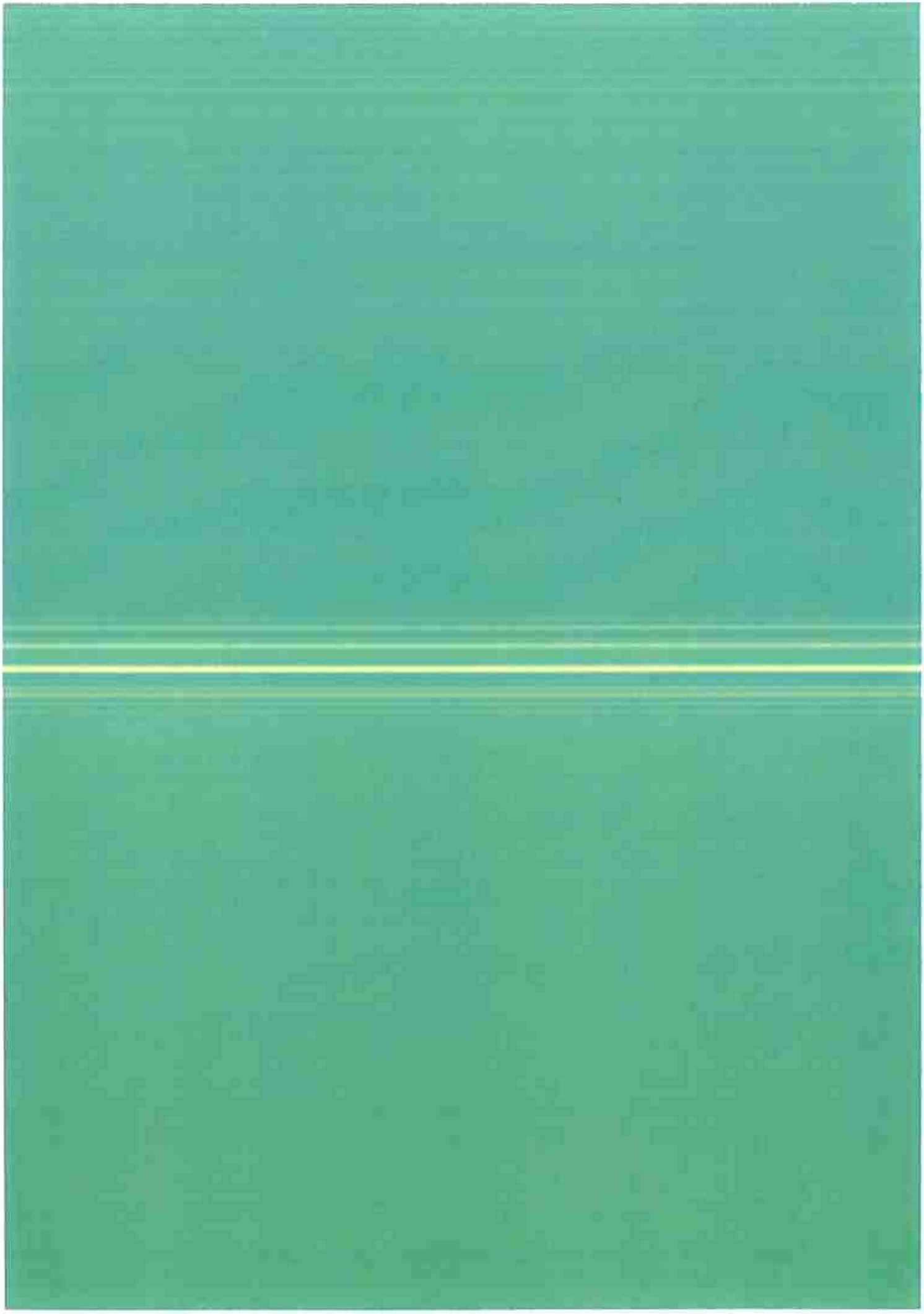
The work proposed is quite simple but will be messy and will disrupt the operations of the clinic.

The following is proposed:

- The clinic management should be in attendance at the contractors compulsory site information meeting
- They should give a detailed briefing of what will be allowed and how the work can be undertaken
- Once appointed, the contractor should set up a steering committee that will include
  - The contractor's leadership team from site
  - Management from the clinic
  - The department
  - The consulting team
- A detailed programme should be drawn up by the contractor giving details of when each task will be undertaken and the time and space requirements needed
- This will rely on working in small areas to get them complete as soon as possible. Each area in which the contractor is working will need to be completely cleared
- This will be approved by clinic management
- Prior to working in an area, it will be cleared by the clinic and fully sealed in an approved manner
- We would propose daily meetings of at least a subcommittee to discuss resolve problem and issues and plan for the next day
- The above should be made known to the contractor at the time of tender.

8 Estimated Cost

The information presented in this report was made available to the quantity surveyor, PROQS, who has prepared the attached cost estimate given in Annexure C.



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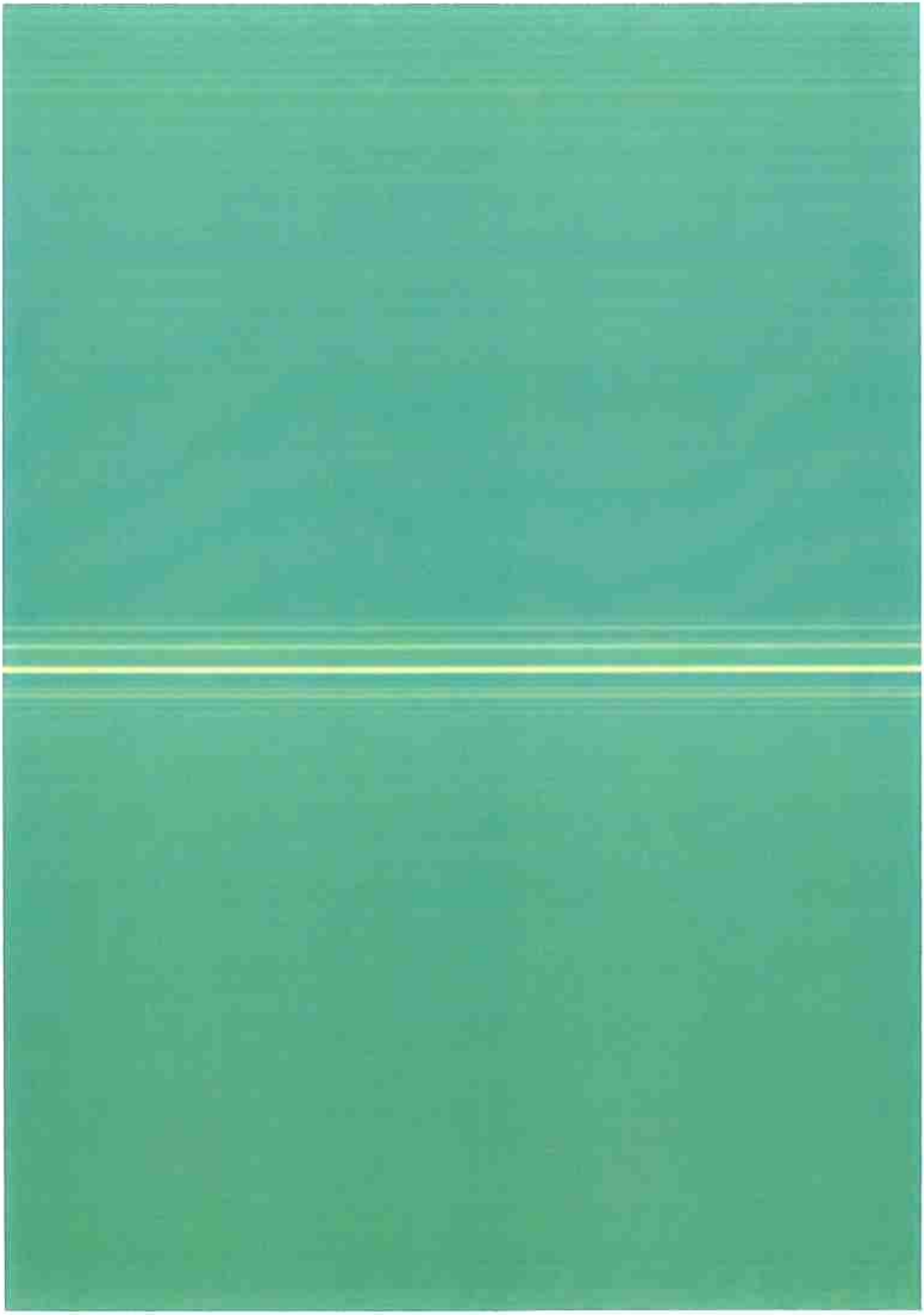
Preliminary Works Methodology

The following preliminary works methodology is proposed for the remedial works to be completed by the contractor. The contractor will start work in the first zone, while patients and staff are accommodated elsewhere in the building, and complete his work there before moving systematically from one area of the building to the next.

Work Stage	Zone	Action Required
1	(1) - Pharmacy	Zone not currently in use and no time restraint. Equipment to be stored temporarily in zone (2).
2	(1) - Pharmacy	Remedial work to commence in zone (1).
3	(1) - Pharmacy	Equipment and staff to be moved back into zone (1).
4	(2) - Pharmacy	Zone not currently in use and no time restraint. Equipment to be stored temporarily in zone (1).
5	(2) - Pharmacy	Work to commence in zone (2).
6	(2) - Pharmacy	Equipment and staff moved back into zone (2).
7	(3a) – Administration	Staff to be moved temporarily into zone (3b).
8	(3a) – Administration	Work to commence in zone (3a).
9	(3a) – Administration	Staff to be moved back into zone (3a).
10	(3b) – Administration	Staff to be moved temporarily into zone (3a).
11	(3b) – Administration	Work to commence in zone (3b).
12	(3b) – Administration	Staff to be moved back into zone (3b).
13	(4) – Short-Stay Ward	Staff and patients to be moved temporarily into zone (5).
14	(4) – Short-Stay Ward	Work to commence in zone (5).
15	(4) – Short-Stay Ward	Staff to be moved back into zone (5).
16	(5a) - Casualty	Staff and patients to be moved temporarily into zone (5b).
17	(5a) - Casualty	Work to commence in zone (5a).
18	(5a) - Casualty	Staff to be moved back into zone (5a).
19	(5b) – Casualty, Reception	Staff and patients to be moved temporarily into zone (5b).
20	(5b) – Casualty, Reception	Work to commence in zone (5a).
21	(5b) – Casualty, Reception	Staff to be moved back into zone (5a).
22	(6a) – Maternity	Staff and patients to be moved temporarily into zone (6b).
23	(6a) – Maternity	Work to commence in zone (6a).
24	(6a) – Maternity	Staff to be moved back into zone (6a).
25	(6b) – Maternity	Staff and patients to be moved temporarily into zone (6b).
26	(6b) – Maternity	Work to commence in zone (6a).
27	(6b) – Maternity	Staff to be moved back into zone (6a).

57	(13b) - HAST	Staff and patients to be moved temporarily into zone (13b).
58	(13b) - HAST	Work to commence in zone (13a).
59	(13b) - HAST	Staff to be moved back into zone (13a).
60	(14a) – Domestic Services	Staff and patients to be moved temporarily into zone (14b).
61	(14a) – Domestic Services	Work to commence in zone (14a).
62	(14a) – Domestic Services	Staff to be moved back into zone (14a).
63	(14b) – Domestic Services	Staff and patients to be moved temporarily into zone (14b).
64	(14b) – Domestic Services	Work to commence in zone (14a).
65	(14b) – Domestic Services	Staff to be moved back into zone (14a).
66	(15) – Maintenance, Mortuary	Staff and patients to be moved temporarily into zone (9).
67	(15) – Maintenance, Mortuary	Work to commence in zone (9.
68	(15) – Maintenance, Mortuary	Staff to be moved back into zone (9).
69	(16a) – Additional Administration	Staff and patients to be moved temporarily into zone (16b).
70	(16a) – Additional Administration	Work to commence in zone (16a).
71	(16a) – Additional Administration	Staff to be moved back into zone (16a).
72	(16b) – Additional Administration	Staff and patients to be moved temporarily into zone (16b).
73	(16b) – Additional Administration	Work to commence in zone (16a).
74	(16b) – Additional Administration	Staff to be moved back into zone (16a).



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Preliminary Sewer and Water Reticulation Inspection Methodology

Areas of the existing sewerage and water reticulation systems that require remedial action are to be worked on zone by zone, as proposed in the sketch below. The following methodology is proposed:

(1) For each zone: isolate water and sewerage to allow for pressure tests of each.
(2) Where damaged sections of the system are identified, break into smaller segments and pressure test again.
(3) Areas of each system that are damaged or leaking are to be replaced/repaired.
(4) In areas where movement is to be expected, flexible connections and/or sections of pipe are to be installed, to further detail.

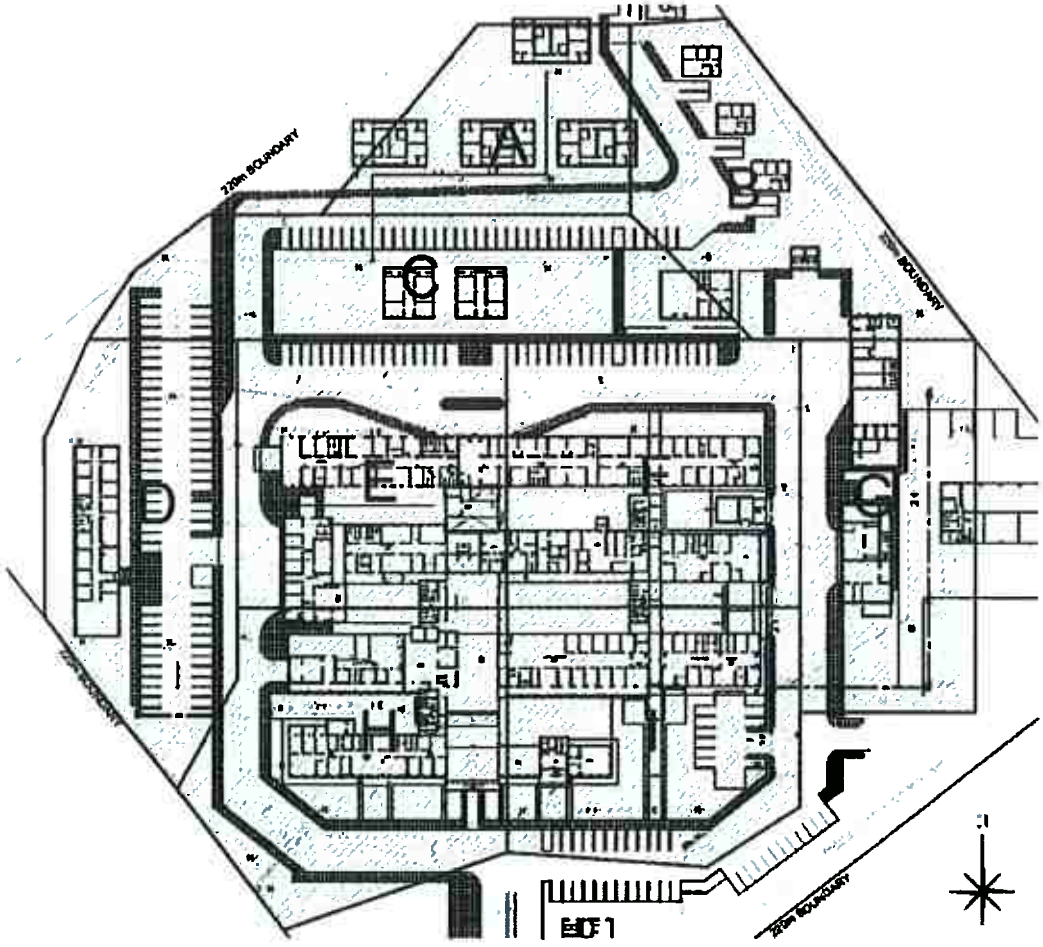
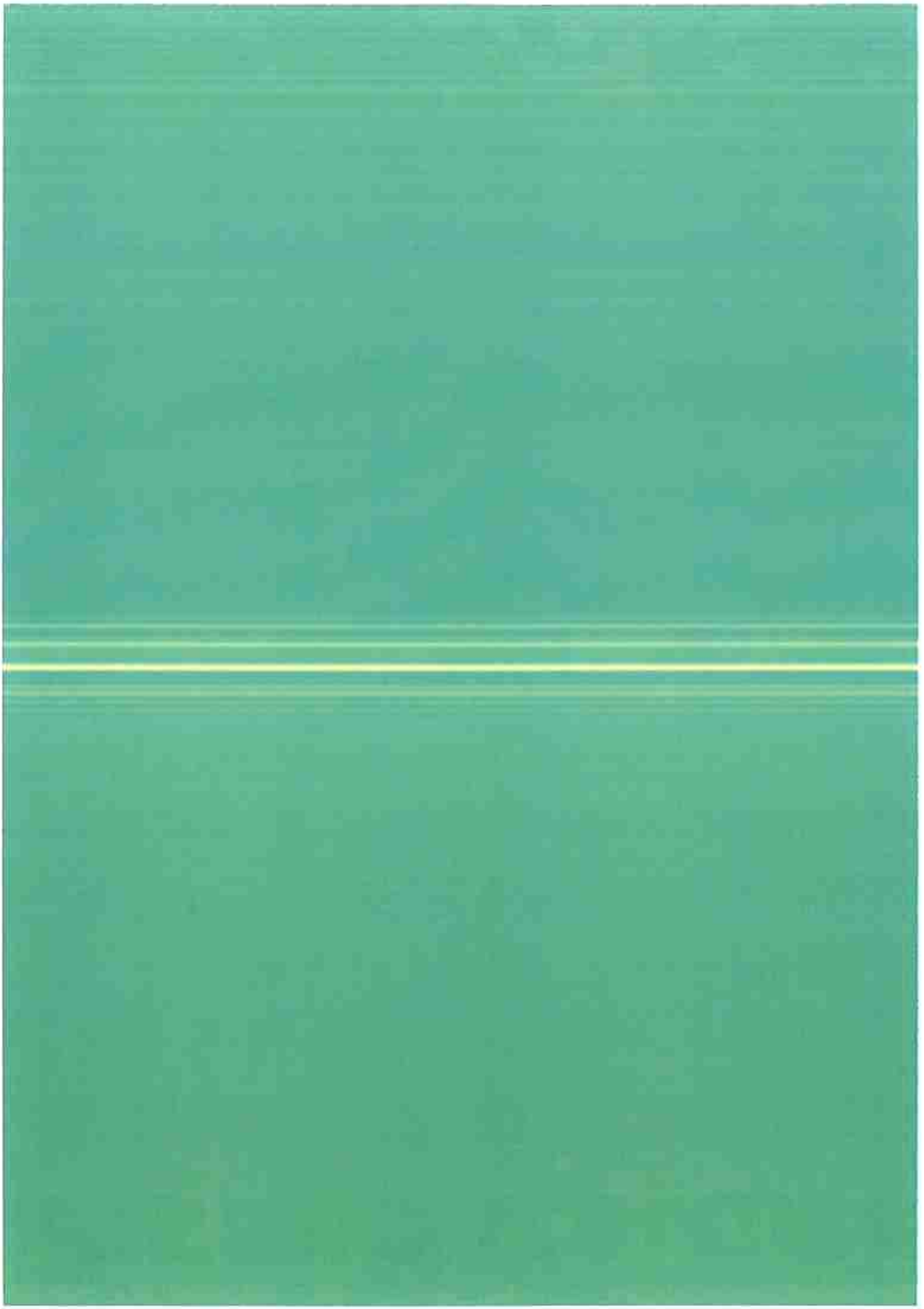


Fig. 1: Preliminary zones for the inspection of services(sewerage and water reticulation systems)



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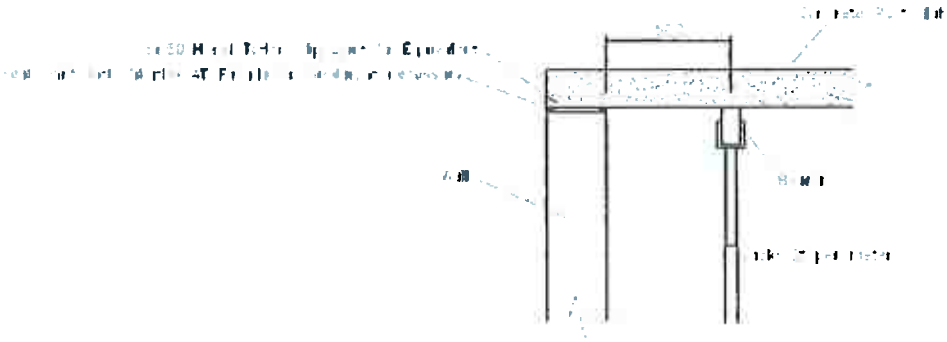
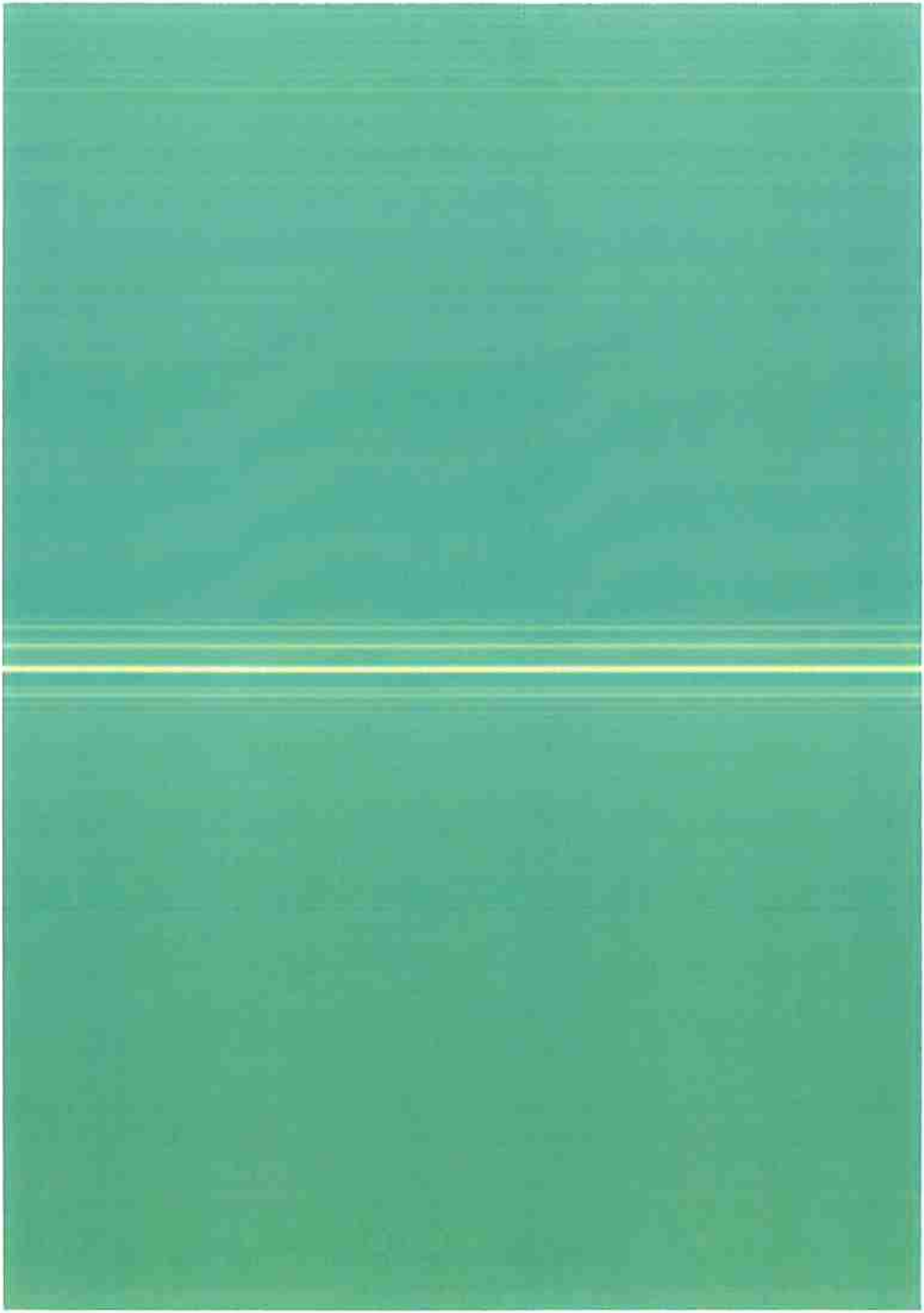
Methodology For Installation Of Bearings Below Pharmacy Roof Slab

(1) Prop slab with bearer(beam) 500mm away from wall, with a jack capable of lifting 3 tons per meter.
(2) Lift slab 15mm.
(3) Slide in Teflon slip joint (manufactured in 2-meter strips) and release slab.
(4) Release roof trusses if necessary.

Joint Specification: Honel 5N50 Teflon Slide Slip Joints or equivalent.





DEPARTMENT OF HEALTH: PIETERMARITZBURG DANNHAUSER COMMUNITY HEALTH CENTRE: STRUCTURAL REPAIRS

PROVISIONAL SECTIONAL COMPLETION PROGRAMME

Work Stage	Zone	Action Required	Months	Section
1	(1) - Pharmacy	Zone not currently in use and no time restraint. Equipment to be stored temporarily in zone (2).	4	1
2	(1) - Pharmacy	Remedial work to commence in zone (1).	4	1
3	(1) - Pharmacy	Equipment and staff to be moved back into zone (1).	4	1
4	(2) - Pharmacy	Zone not currently in use and no time restraint. Equipment to be stored temporarily in zone (1).	4	1
5	(2) - Pharmacy	Work to commence in zone (2).	4	1
6	(2) - Pharmacy	Equipment and staff moved back into zone (2).	4	1
7	(3a) – Administration	Staff to be moved temporarily into zone (3b).	4	1
8	(3a) – Administration	Work to commence in zone (3a).	4	1
9	(3a) – Administration	Staff to be moved back into zone (3a).	4	1
10	(3b) – Administration	Staff to be moved temporarily into zone (3a).	4	1
11	(3b) – Administration	Work to commence in zone (3b).	4	1
12	(3b) – Administration	Staff to be moved back into zone (3b).	4	1
13	(4) – Short-Stay Ward	Staff and patients to be moved temporarily into zone (5).	3	2
14	(4) – Short-Stay Ward	Work to commence in zone (5).	3	2
15	(4) – Short-Stay Ward	Staff to be moved back into zone (5).	3	2
16	(5a) - Casualty	Staff and patients to be moved temporarily into zone (5b).	3	2
17	(5a) - Casualty	Work to commence in zone (5a).	3	2
18	(5a) - Casualty	Staff to be moved back into zone (5a).	3	2
19	(5b) – Casualty, Reception	Staff and patients to be moved temporarily into zone (5b).	3	2
20	(5b) – Casualty, Reception	Work to commence in zone (5a).	3	2
21	(5b) – Casualty, Reception	Staff to be moved back into zone (5a).	3	2
22	(6a) – Maternity	Staff and patients to be moved temporarily into zone (6b).	4	3
23	(6a) – Maternity	Work to commence in zone (6a).	4	3
24	(6a) – Maternity	Staff to be moved back into zone (6a).	4	3
25	(6b) – Maternity	Staff and patients to be moved temporarily into zone (6b).	4	3

DEPARTMENT OF HEALTH: PIETERMARITZBURG DANNHAUSER COMMUNITY HEALTH CENTRE: STRUCTURAL REPAIRS

PROVISIONAL SECTIONAL COMPLETION PROGRAMME

Work Stage	Zone	Action Required	Months	Section
26	(6b) – Maternity	Work to commence in zone (6a).	4	3
27	(6b) – Maternity	Staff to be moved back into zone (6a).	4	3
28	(7a) – Women and Child Care	Staff and patients to be moved temporarily into zone (7b).	4	3
29	(7a) – Women and Child Care	Work to commence in zone (7a).	4	3
30	(7a) – Women and Child Care	Staff to be moved back into zone (7a).	4	3
31	(7b) – Women and Child Care	Staff and patients to be moved temporarily into zone (7b).	4	3
32	(7b) – Women and Child Care	Work to commence in zone (7a).	4	3
33	(7b) – Women and Child Care	Staff to be moved back into zone (7a).	4	3
34	(8a) - Radiology	Staff and patients to be moved temporarily into zone (8b).	4	4
35	(8a) - Radiology	Work to commence in zone (8a).	4	4
36	(8a) - Radiology	Staff to be moved back into zone (8a).	4	4
37	(8b) - Radiology	Staff and patients to be moved temporarily into zone (8b).	4	4
38	(8b) - Radiology	Work to commence in zone (8a).	4	4
39	(8b) - Radiology	Staff to be moved back into zone (8a).	4	4
40	(9) – Dentist, Rehabilitation	Staff and patients to be moved temporarily into zone (8b).	4	4
41	(9) – Dentist, Rehabilitation	Work to commence in zone (9).	4	4
42	(9) – Dentist, Rehabilitation	Staff to be moved back into zone (9).	4	4
43	(10a) – Common and Chronic Diseases	Staff and patients to be moved temporarily into zone (10b).	3	5
44	(10a) – Common and Chronic Diseases	Work to commence in zone (10a).	3	5
45	(10a) – Common and Chronic Diseases	Staff to be moved back into zone (10a).	3	5
46	(10b) – Common and Chronic Diseases	Staff and patients to be moved temporarily into zone (10b).	3	5

DEPARTMENT OF HEALTH: PIETERMARITZBURG DANNHAUSER COMMUNITY HEALTH CENTRE: STRUCTURAL REPAIRS

PROVISIONAL SECTIONAL COMPLETION PROGRAMME

Work Stage	Zone	Action Required	Months	Section
47	(10b) – Common and Chronic Diseases	Work to commence in zone (10a).	3	5
48	(10b) – Common and Chronic Diseases	Staff to be moved back into zone (10a).	3	5
49	(11) – Counselling, TB & Infectious Diseases	Staff and patients to be moved temporarily into zone (10b).	3	5
50	(11) – Counselling, TB & Infectious Diseases	Work to commence in zone (11).	3	5
51	(11) – Counselling, TB & Infectious Diseases	Staff to be moved back into zone (11).	3	5
52	(12) – Training Centre	Zone not in use. No time restraint. Work to commence in zone (11).	3	5
53	(12) – Training Centre	Area to reopen on completion of work.	3	5
54	(13a) - HAST	Staff and patients to be moved temporarily into zone (13b).	4	1
55	(13a) - HAST	Work to commence in zone (13a).	4	1
56	(13a) - HAST	Staff to be moved back into zone (13a).	4	1
57	(13b) - HAST	Staff and patients to be moved temporarily into zone (13b).	4	1
58	(13b) - HAST	Work to commence in zone (13a).	4	1
59	(13b) - HAST	Staff to be moved back into zone (13a).	4	1
60	(14a) – Domestic Services	Staff and patients to be moved temporarily into zone (14b).	4	3
61	(14a) – Domestic Services	Work to commence in zone (14a).	4	3
62	(14a) – Domestic Services	Staff to be moved back into zone (14a).	4	3
63	(14b) – Domestic Services	Staff and patients to be moved temporarily into zone (14b).	4	3
64	(14b) – Domestic Services	Work to commence in zone (14a).	4	3
65	(14b) – Domestic Services	Staff to be moved back into zone (14a).	4	3
66	(15) – Maintenance, Mortuary	Staff and patients to be moved temporarily into zone (9).	4	3

DEPARTMENT OF HEALTH: PIETERMARITZBURG DANNHAUSER COMMUNITY HEALTH CENTRE: STRUCTURAL REPAIRS

PROVISIONAL SECTIONAL COMPLETION PROGRAMME

Work Stage	Zone	Action Required	Months	Section
67	(15) – Maintenance, Mortuary	Work to commence in zone (9.	4	3
68	(15) – Maintenance, Mortuary	Staff to be moved back into zone (9).	4	3
69	(16a) – Additional Administration	Staff and patients to be moved temporarily into zone (16b).	4	4
70	(16a) – Additional Administration	Work to commence in zone (16a).	4	4
71	(16a) – Additional Administration	Staff to be moved back into zone (16a).	4	4
72	(16b) – Additional Administration	Staff and patients to be moved temporarily into zone (16b).	4	4
73	(16b) – Additional Administration	Work to commence in zone (16a).	4	4
74	(16b) – Additional Administration	Staff to be moved back into zone (16a).	4	4
75	External Works	All external works to be completed concurrent with all building work	18	6
76	Temporary Accommodation	Supply two single wide four office units, size 11.620 x 2.990m wide and one single wide male/female/disabled ablution unit, size 5.820 x 2.990m wide for the duration of the contract period	18	6
77	Contractual Obligations	All contractual obligations such as site establishments & de establishment, contract guarantees, insurances, etc. association with the day to day running of the project and described under preliminaries to be executed for the duration of the contract period	18	6