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NATIONAL HOME BUILDERS NHBRC REGISTRATION COUNCIL

Ref: 2024 – WC – SE - 039

Professional Engineering Services

Structural Engineering Investigation and Remedial Concepts
to Erf 19018, Seeumeeu Park, Mossel bay
House Curtain

Report – Rev 02

27 May 2025 Contact Person: **Melt Badenhorst** (Pr.Tech.Eng)(Pr.CPM)

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Document Control Sheet

Client Project Reference	**Internal Project Number**
2024 – WC – SE - 039	TechQ – 038

Title

Professional Structural Engineering Services: Investigation and Remedial Concepts

Project Stage

Investigation and Concept Remedial Proposals

Version	Date	Comment
Rev 0	31 March 2025	Report submitted as Information
Rev 1	1 April 2025	Additional information in Section 2.1
Rev 2	27 May 2025	Elaborate on Options for Remedial Works

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EXECUTIVE SUMMARY

This ***Structural Investigation and Engineering Remedial Concept Report*** is presented by **TechQ Development (Pty) Ltd** based on the *Request for Proposals (RFP)* called by the ***National Home Builders Registration Council (NHBRC)*** in terms of the *Housing Consumer Protection Measures Act (Act 95 of 1998) and Regulations (HCPMA), and the NHBRC Technical Requirements* **at *Erf 19018, Seemeeu Park, Mossel Bay (House Curtain)***, Western Cape Province. This property forms part of the **"Gull Heights Estate"** development and is referred to as **House Curtain** in this report.

This revised report (Revision 02) presents two (2) remedial Options to be costed. Note also to be taken of the additional activity outlined in **Section 3.3** of this report.

A concept design review discussion session was held with the NHBRC on 14 March 2025, with relevant comments incorporated in this report.

The original RFQ dated 30 January 2025 recorded structural defects manifested at the building on Erf 19018, Hartenbos. Recent Structural engineering investigation report (URBAN Engineering - August 2024 to December 2024) and Geotechnical report (Terra Geotechnical - October 2024) conducted under the auspices of the Homeowner, were reviewed and is attached as **Annexure E** and **Annexure F** respectively. Details on the investigation and structural engineering remedial concepts are provided on the drawings in **Annexure A.**

Other documentation made available to **TechQ** is listed in **Section 1.3** of this report.

Section 2 of the report outlines the affected areas with notes taken during the investigation.

The concepts outlined in **Section 3** of this report are based on site inspections, review of engineering and geotechnical reports, approved municipal architect drawings, structural engineering design drawings and the assessment done towards the complaints raised by the Homeowner as recorded in the RFQ.

Two remedial action options are detailed within this report. Due to the incomplete information from the Design Structural Engineer, Option 2 is the worst-case scenario to reconstruct 60% of the surface bed and related internal walls, however **Option 1 is recommended** which will be adequate in ensuring a safe structure and prevent any further settlement of the surface bed, cracks and movement of internal walls.

In summary, the following options are presented.

Option	Concept Remedial Actions – Drawing attached as Annexure A
• **Option 1**	• Activity 1: Concrete underpinning • Activity 2 : Strengthening of walls • Activity 3 : Stormwater Management – Concrete Apron • Activity 4 : Structural crack repair - internally
• **Option 2**	• Activity 1: Concrete underpinning • Activity 2 : Strengthening of walls • Activity 3 : Stormwater Management – Concrete Apron • Activity 4 : Demolish section of the surface bed (**255mm concrete slab**) and associated internal walls and re-construct on selected engineering fill as per **Detail 2 and Detail 3** of the attached drawing.

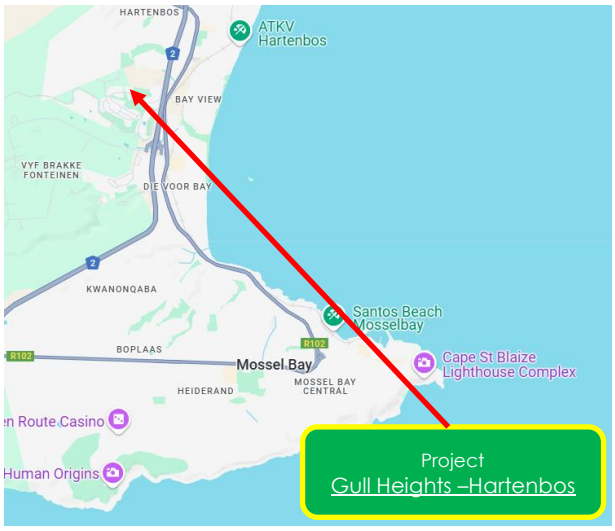
---- End of Executive Summary ---

1 PROJECT LOCALITY, SCOPE AND INFORMATION

1.1 Project Locality

Erf 19018, Seemeeu Park, Hartenbos (House Curtain) is located at No.21 *Gull Heights Estate, Hartenbos* within the boundaries of the ***Mossel Bay Municipality*** as show on the Figures below.

Site coordinates are **South:** 34° 08' 07" **East:** 22° 05' 29"



Project Location: House Curtain, 21 Gull Heights, Hartenbos

1.2 Scope of Work

1.2.1 Original RFQ scope of works

TechQ Development (Pty) Ltd was appointed by the **NHBRC** to conduct an ***Investigation*** towards water ingress at several location of the building and associated structural defects of the property with the following specific deliverables.

- Investigate defects that have manifested at the above-mentioned home and classify them in terms of the Housing Consumer Protection Measures Act (Act 95 of 1998) and Regulations (HCPMA) and the NHBRC Technical Requirements.
- Review and confirm the contents of the existing structural engineering investigation report on the property.
- Review the Geotechnical investigation report of the site.
- Determine the root causes of defects, report on the defects of the existing structure and provide remedial solutions and specifications including drawings where necessary.

Throughout the investigation and considerations of remedial works, special attention is drawn to **Chapter III** of the Act, clause 13(1)(b) – (i) "rectify major structural defects" and (ii) "deviation from plans or any deficiency related to design, workmanship or materials".

1.2.2 Additional scope following site brief and site inspection

No variation to the original scope is registered.

1.3 Information Provided (Summary)

Information provided by the NHBRC, Homeowner, design Architect and Structural Engineer involved in the planning and construction of the building, provided background to the site development and an understanding to analyse the structural system of the building in and present concept structural proposals.

1.3.1 Annexure C – Municipal approved Architect drawings

Architect drawings produced by **ARC nett Architectural / Draughting** are attached, which drawings were reviewed to ascertain the intended design approach of the building. Numerous telephone calls were made to the author **Mr Denvil May** in the attempt to discuss details of the drawings, however, no calls were answered.

Comments on the detail provided on the drawings with notes related to contradictions with **SANS codes** and general architectural detail are elaborated on in **Section 2.1** below.

1.3.2 Annexure D – Structural Engineering drawings

Structural engineering drawings drafted by **JOSHCON Structural Engineers** for Erf 19029 were received. After several telecom and e-mail communication with the design engineer, **Mr Colin Belter,** no drawings with direct specification to Erf 19018 were received.

Comments on the detail provided on the drawings with notes related to contradictions with **ESCA code of conduct** and general structural engineering detail related to buildings are elaborated on in **Section 2.1** below.

1.3.3 Annexure E – Structural Engineering Investigation (URBAN Engineering – 2024)

The Homeowner, Mr J Curtain, appointed **URBAN Engineering** in 2024 to conduct an independent investigation towards the settlement and cracks observed on the building structure soon after purchase of the property.

Valuable information was obtained from this report, which must be read in conjunction with the Geotechnical Investigation report compiled by **Terra Geotechnical – Annexure F.** Summative notes/recommendations from the report are given below.

- Concerning high foundation walls measured above natural ground level to finished floor level (>1,3m)
- Category 1 to 3 cracks (1mm to 15mm) observed on internal and external walls
- Outwards rotation movement (>10mm) of the high southern foundation walls (undersailing)
- Movement cracks/gaps between cornice and ceilings on eastern walls
- Settlement of the surface bed (>5mm) in the bedrooms located on the southern end of the building
- Horizontal cracks on DPC level possibly due to absence of V-joint and DPC in the external walls
- Finish floor level of northern facade and north-west facade is less than the permissible 150mm above NGL

1.3.4 Annexure F – Geotechnical Investigation (Terra Geotechnical – 2024)

The structural design engineer, Mr Colin Belter, stated during conversation that no geotechnical investigation was conducted during the planning or design stages. Soils were evaluated from trench excavations for which no results were received to review.

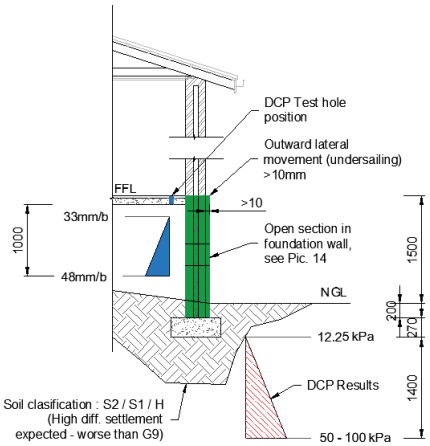
Supplement to the Structural Engineering Investigation by URBAN Engineering, the Homeowner appointed **Terra Geotechnical** to conduct a geotechnical investigation with the following deliverables.

- Soil classification below external foundation walls and strip footings
- DCP and CBR characteristics of the soils below the surface bed
- Concrete strength (Core drill) of the external strip foundation

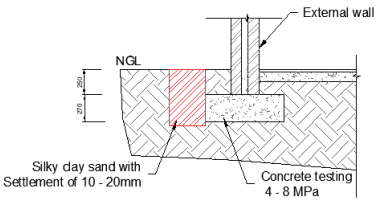
The following concerning notes/comments are highlighted, mostly not compliant with National Building Regulations (SANS 10400)

- Soil classification is S2/S1/H1 with potential settlement between 10mm to 20mm
- CBR indicators of fill under surface beds range from 12 to 25 kPa
- Average concrete strength of external strip foundations is 8,1 MPa
- Fill below surface beds has inconsistent compaction (DCP's - 35 mm per blow to more than 80mm per blow)
- Sufficient soil bearing capacity is approximately 1,0m below existing strip foundations.

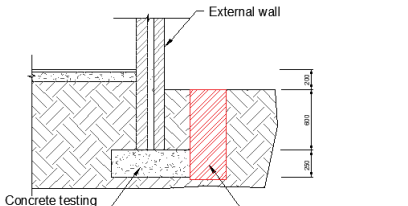
The images below is a summary of the geotechnical investigation test results and engineering interpretation of the DCP and CBR results, with graphical illustrations for clarity.



SECTION A - A : SOUTH EAST CORNER
Position of DCP and Geotech Test Pit



TEST PIT (NW)



TEST PIT (NE)

LABORATORY TESTS
Soil classification and concrete strength

2 INVESTIGATION: DISCREPANCIES, NON-CONFORMANCES AND POSSIBLE ROOT CAUSES

Structural engineering investigation of the status of the building structure together with reports of previous investigations pictured a dismal view of the structure and what possible future damage to the structure may occur if not attended too soon.

Evident during the investigation, no proof of any Quality Assurance / Quality Control was tabled or coordination between design and construction activities, which are important processes contributing to the success of a project.

2.1 Negligeable due diligence, Discrepancies and Non-conformances

Of great concern is the discrepancies and non-conformant detail on the architect and structural engineering drawings, which in itself, might be possible root causes for defects as elaborated on below.

a) Negligeable due diligence

- SANS 10400-H: clause 4.3.1.1 not exercised. No geotechnical investigation was conducted during the planning stage, however, the 2024 geotech report concluded the site soil classification to be S2/S1/H which would have triggered different foundation design and proper engineering fill specifications. Settlement of up to 20mm and more are expected.
- No test results for soil compaction density or concrete works were provided, however, the **Terra report** reported that the strip footings tests results varied between 4 MPa and 11Mpa, compared the minimum of 15 MPa (SANS 10-400-H: clause 4.3.2.2.3 – Note 3).
- Unsuitable soil infill and compaction below the surface beds as the Terra report outlines DCP results of 33mm to 80mm per blow. Suitable CBR readings were also established 1,0m below current strip footing.
- Inconsistent compaction and density results towards soils under the surface beds resulting in differential settlement and movement of slab and walls.

b) Architect drawings (ARC nett) – **Annexure G**

- Sewer services not installed within the service ducts indicated on the drawings
- SANS 10400 – H, clause 4.3.2.1.1 (f) : Foundation walls not to exceed 1,5m
- SANS 10400 – H, clause 4.3.2.1.1(g) : Fill underneath surface beds not to exceed 1,0m
- Incomplete detail towards RC Strip foundations, DPC provision and width of cavity walls
- SANS 10400 – H, Minimum depth of strip foundations is 400mm
- Numerous spelling mistakes

c) Structural Engineer drawings (JOSHCON) – **Annexure H**

- Details for Erf 19029 received (2 x types of surface beds) and none for Erf 19018
- No indication of Competent person – ECSA code: Gaz 44333, paragraph 8.3
- No improvement to the soils under the surface beds or engineering earthworks indicated on drawings or specifications towards application and compaction.
- SANS 10400-J:Clause 4.4.5 (d) and (e) pertaining to class of import material allowed.
- Concrete strength not specified on drawings for footings or surface bed
- No detail towards foundations for internal walls (strip footings or on thickened surface bed portions)
- No details for stiffening of foundation brickwork, especially if in excess of 500mm above NGL.

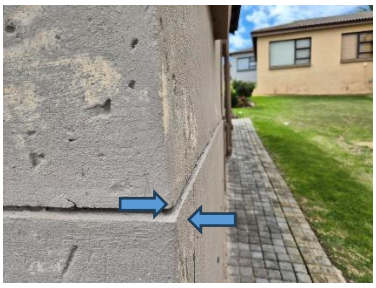
2.2 External façade of structure

Most obvious observation is the level difference in the slope of the site and the high foundation walls on the southern façade of the structure. Concern is also the finished floor levels of the north and north-east elevations of the building in comparison the naturel ground level, which should be a minimum of 150mm.

The pictures below show the extend of the defect posing possible root causes to the defects of cracks in walls and settlement of foundation and surface beds.

Pic 01: Paving level same as Garage FFL with no weepholes in walls.

Pic 02: Settlement cracks above and below V-joint



Pic 03: Outwards movement of foundation walls with cracks

It is clear from the geotechnical test pit investigation and observations towards the structural cracks and defects that the root cause of structural cracks and settlement can be related to the existing underlain soil substructure which requires improved foundation conditions and suitable engineering fill.

2.3 Internal walls and surface beds

The main focus of the investigation was to establish possible root causes to the settlement of the surface beds, structural cracks on the building walls and any related structural defects.

The photos below give evidence of large cracks (>5mm) in the internal walls and settlement of the surface beds (>10mm), all due to poor foundation design and construction and unsuitable fill material below the surface beds, as outlined in the independent reports attached as **Annexures E and F.**

Pic 04: Settlement of internal wall and detach from cupboard.

Pic 05: Large differential crack above window

Pic 06: Diagonal crack in wall from settlement of surface bed.

Pic 07: Settlement (>10mm) of surface bed and crack in wall.

3 ENGINEERING REMEDIAL SOLUTIONS AND RECOMMENDATIONS

Contributing factors towards the **possible route causes** resulting in large structural cracks, settlement of the surface beds and sideways movement of the southern foundation wall can be summarised as incorrect engineering detail towards the foundation design, engineering soil precautions, methodology of the strip footings to the building walls and proper stormwater management.

Investigation areas and possible route causes for the defects are elaborated on in **Section 2** above with proposed concept remedial measures given below.

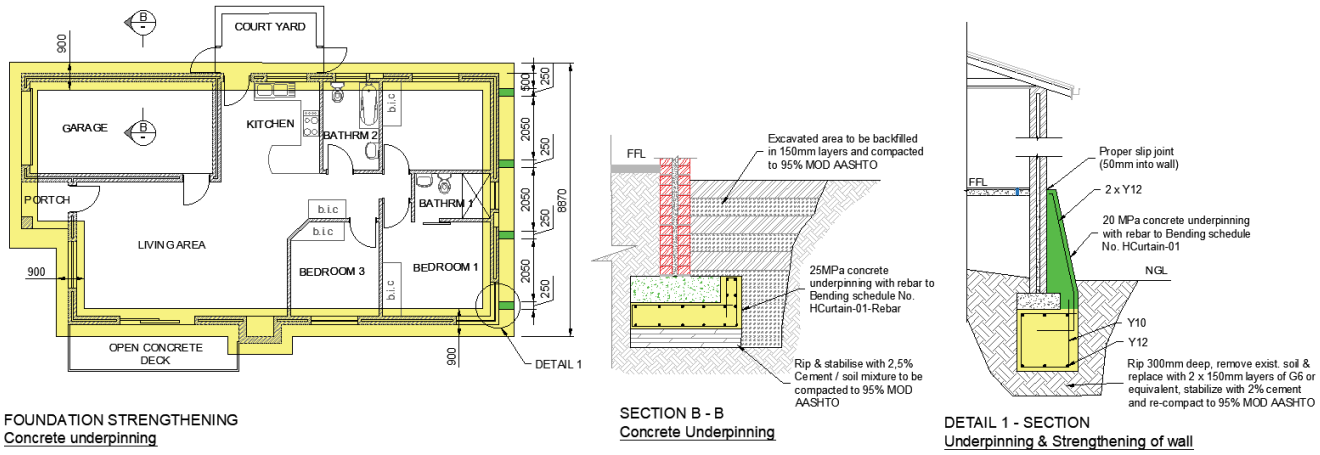
3.1 Activity 1 & 2: Foundation - Concrete underpinning and Strengthening off walls

The geotechnical investigation conducted by **Terra Geotechnical (October 2024)** as per the report attached as **Annexure F**, revealed unsuitable soil conditions for erection of a structure with **classification S2/S1/H**. Poor concrete strength results of the external strip footings is an alarming factor to possible future severe structural defects and failure.

Concrete underpinning to the existing poor quality strip foundations on the exterior of the structure, with stabilisation of the sub-strata earthworks are recommended, however, the internal wall foundation pose to be problematic in the future where settlement and cracks will occur.

Lateral support and strengthening of the eastern foundation walls are recommended as per **Detail 1** of the drawing attached in **Annexure A**.

Detailed concept remedial methodologies are provided on the drawing attached as **Annexure A** with graphic images given below.



FOUNDATION STRENGTHENING
Concrete underpinning

SECTION B - B
Concrete Underpinning

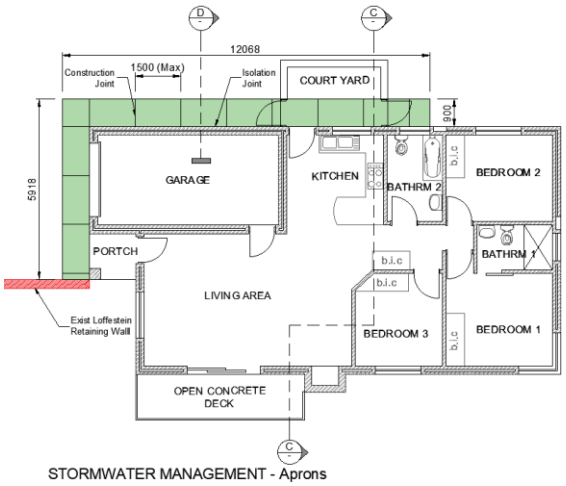
DETAIL 1 - SECTION
Underpinning & Strengthening of wall

3.2 Activity 3: Stormwater Management – Concrete Aprons

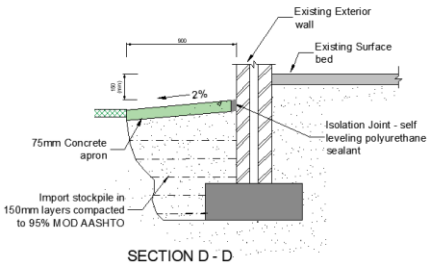
The property site slopes naturally from north to south adequately so to ensure good run-off of stormwater from the structure walls and prevent standing of rain water. However, SANS 10400 – K, clause 4.5.3.7 requires that at least 150mm be maintained between NGL and FFL of a structure, which is not evident on the north and north-east facades of the structure.

Concrete aprons, min 75mm thick of Class 15/19 concrete is recommended to the above-mentioned sections of the building to be the finishing works to the concrete underpinning.

The images below provide information towards the above methodology with full details on the drawing attached as **Annexure A**.



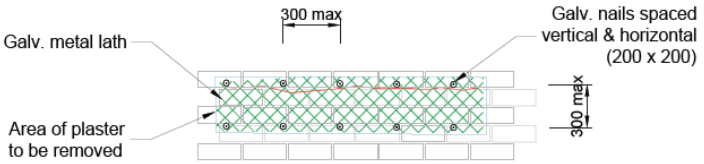
STORMWATER MANAGEMENT - Aprons



SECTION D - D
Concrete apron

3.3 Activity 4 (Option 1): Crack repair

Repair structural cracks on all walls according to Detail 4 (Expanded metal lath) as per the image below.



DETAIL 4
Crack repair : expanded metal lath

NOTE: Provision to be made to attend to all ceiling skirtings so damaged due to the movement of the walls following the settlement of the surface beds, eminent from the structural cracks on the walls.

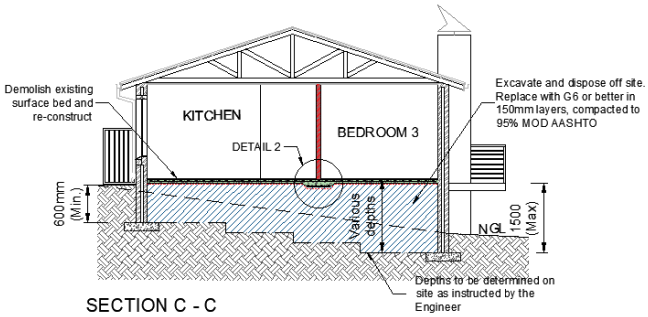
3.4 Activity 4 (Option 2): Demolish and re-construct surface beds and internal walls

No definite detail exists if the internal walls were constructed on strip foundations or thickened sections of the surface bed – see Section 2.1 (b) above. Large settlement (>10mm) of the surface bed in the eastern side of the building will continue if the supporting earthworks are not improved.

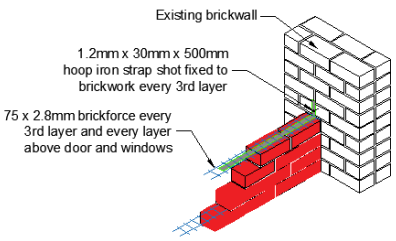
We concur with the recommendation as per **Item 3 of the URBAN Engineering report** (22 October 2024) to demolish the existing surface beds of the eastern side of the building including removal of unsuitable filling material up to a minimum depth of 1,0m, or as deep as instructed by the Engineer on site.

The above will result in the associated internal walls to be demolished and re-constructed to proper engineering design and specifications on suitable fill material, adequate thick surface beds and correct masonry wall construction.

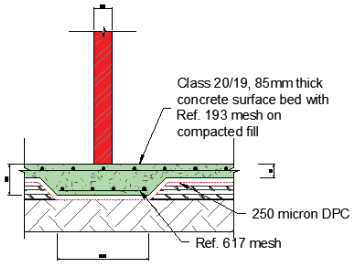
The graphic images below provide description to the above methodology with details on the drawing attached in **Annexure A.**



SECTION C - C
Bulk Earthworks and Import



DETAIL 3 - 3D
115 mm Wall : Fixing To Brick wall



DETAIL 2
Surface Bed Thickening

3.5 Summary: Engineering Solutions

Two remedial action options are detailed within this report. Due to the incomplete information from the Design Structural Engineer, Option 2 is the worst-case scenario to reconstruct 60% of the surface bed and related internal walls, however **Option 1 is recommended** which will be adequate in ensuring a safe structure and prevent any further settlement of the surface bed, cracks and movement of internal walls.

In summary, the following options are presented.

Option	Concept Remedial Actions – Drawing attached as Annexure A
• **Option 1**	• Activity 1: Concrete underpinning • Activity 2 : Strengthening of walls • Activity 3 : Stormwater Management – Concrete Apron • Activity 4 : Structural crack repair - internally
• **Option 2**	• Activity 1: Concrete underpinning • Activity 2 : Strengthening of walls • Activity 3 : Stormwater Management – Concrete Apron • Activity 4 : Demolish section of the surface bed (**255mm concrete slab**) and associated internal walls and re-construct on selected engineering fill as per **Detail 2 and Detail 3** of the attached drawing.

4 RISKS & MITIGATION MEASURES

Qualifications, risks and possible sensitivity issues needs to be considered in performing the proposed remedial Works during the construction stage. The main objective of the Project is repair works to the structural deformation of the garage wall, however, the following aspects with mitigation proposals, need to be taken into consideration in the Risk Register of the Project.

Risks and mitigation measures

Nature of Risk	Risk	Mitigation
Site and Construction Risks	Abnormal rainfall and restricted working space	Proper scheduling of Works, being aware of the "critical path" items and implementing effective construction methodologies, Quality Assurance and Controls.
Limiting Factors	Decanting plan	Phased implementation of Works in accordance with proper planned decanting program.
Health and Safety	Delays and Fatal	Detailed OH&S plan compiled.
Quality Assurance	Construction Management	QA and QC Inspection procedures in place and approved
	Sub-standard materials	Quality tests and Agrements in place
OH&S and Environmental	Disturbance to environment, community and workers	Focus on the environment, building rubble disposals, air and noise pollution and disruption of day-to-day operations

--- End of Report ---