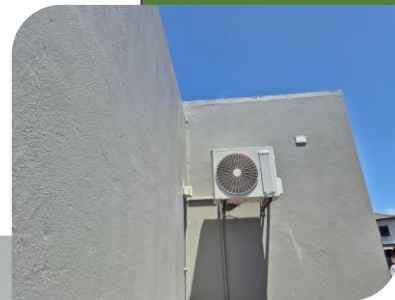


📍 Office Corner
Block C, 184 Lancaster Road,
Gordon's Bay,
7140

☎ 066 105 1226
✉ techq.development@outlook.com
📞 086 474 1937

🌐 www.techq-development.com



NATIONAL HOME BUILDERS
NHBRC
REGISTRATION COUNCIL

Professional Engineering Services

Investigation and Structural Engineering Remedial
Concepts to Erf 208, Sagewood, Parklands North
House Gosai

Report – Rev 0

13 January 2025

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

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Prepared By: TechQ Development (Pty) Ltd OFFICE CORNER – Block C 184 Lancaster Road Gordon's Bay 7140		
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Annexures

- A - Investigation (January 2025): Drawings
 - Drawing No. House Gosai – Struct 01: Investigation and remedial concepts
- B - Architect drawings (Chameleon Architects)
- C - Bending Schedules

EXECUTIVE SUMMARY

This **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 208, Sagewood, Parklands North (House Gosai)*, Western Cape Province. A design review discussion session was held with the NHBRC on 10 January 2025, with relevant comments incorporated in this report.

The original RFQ relates to water ingress in the property at different locations, however, at the site briefing held on 19 November 2024 and during the site inspection on 5 December 2024 the Home Owner (Mrs D Gosai) reported that all water ingress areas as reported previously, were self-attended but structural cracks needs to be investigated at two (2) locations of the building.

Details on the investigation and structural engineering remedial concepts are provided on the drawing attached as **Annexure A** to this report.

Documentation made available to **TechQ** included the municipal approved Architect's drawing and Geotechnical investigation, all noted in **Section 1.3**.

The concepts outlined in **Section 3** of this report are based on site inspections and the assessment done towards the complaints recorded by the Home Owner.

In summary, the following engineering concept options are presented.

Investigative Activity Area	Concept Remedial Actions
1. <u>Ground Floor</u> Crack in wall below "RI concrete beam over" in Bedroom 2	<u>Concept A – Underpinning</u> Underpinning to the GROUND FLOOR section of the exterior walls of Bedroom 2 in accordance with dwg No. HGosai – Struct 01
	<u>Concept B - Stormwater: Concrete apron</u> Improve stormwater management with construction of a concrete apron above the underpinned section as in Concept A above.
	<u>Concept C - Crack repair</u> <ul style="list-style-type: none">• <i>Option 1:</i> Expanded metal lath application repairs to low- and high-level cracks as detailed on dwg No. HGosai – Struct 01.• <i>Option 2:</i> Remove existing damaged bricks under "RI beam over" and repair as per Engineer's instruction, post exposure of cracked area.
2. <u>1st Floor</u> Crack in eastern elevation wall	<u>Crack repair</u> Expanded metal lath application repairs to low- and high-level cracks as detailed on dwg No. HGosai – Struct 01
3. <u>Roof</u> Flashing and waterproofing repairs	<u>Replace damaged roof flashing and waterproofing</u> Remove existing roof wall flashing, reinstall with new flashing and waterproofing to supplier's specification.

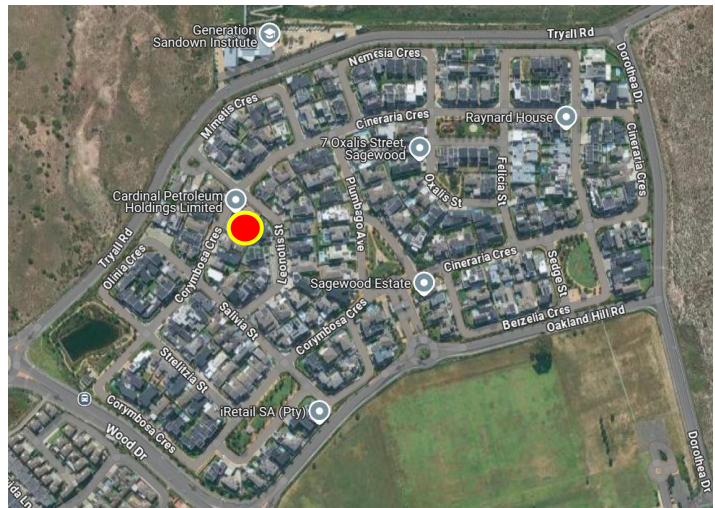
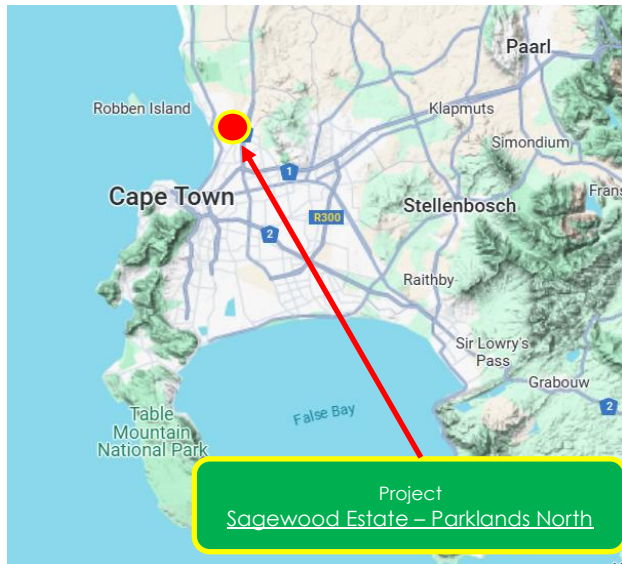
---- End of Executive Summary ---

1 PROJECT LOCALITY, SCOPE AND INFORMATION

1.1 Project Locality

Erf 208, Sagewood, Parklands North (House Gosai) is located at No.3, Leonotis Street, Sagewood Estate, Parklands North within the boundaries of the **City of Cape Town** as show on the Figures below.

Site coordinates are **South:** 33° 47' 37" **East:** 18° 30' 02"



House Gosai – Sagewood Estate, Parklands North, Cape Town

1.2 Scope of Work

TechQ Development (Pty) Ltd was appointed by the **NHBCRC** to conduct a **Structural Investigation** towards the defects reported at the property (House Gosai) 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 NHBCRC Technical Requirements.
- Determine the root causes of defects, report on the deformation of the existing structure and provide remedial solutions and specifications including drawings where necessary, towards the following areas as per previous reports filed by the **NHBCRC**:
 - Water ingress at several location of the building (self-attended by the Home Owner)
 - Structural cracks on 2 x wall locations of the house (instructed at site brief and inspection stages)

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”.

1.3 Information Provided (Summary)

Information provided by the NHBCRC, Home Owner and design Architect provided background to the site development and an understanding to analyse the structural system of the building in question and to present concept structural proposals.

1.3.1 Architectural drawings – Annexure B

Sandown Design Review Committee approved architect drawings dated 31 July 218 (**Chameleon Architects**) provided information on the layout of the property and building elements.

1.3.2 Engineering drawings and Specifications

No structural engineering drawings providing details on the external or internal walls and associated stormwater or sub-soil drainage were made available during the investigation.

1.3.3 Geotechnical Investigation

No geotechnical investigation was requested to support any engineering concept proposals.

2 INVESTIGATION APPROACH AND NOTES

2.1 Condition Assessment of the building

The building presents to be in fairly good condition, except for the 2 x cracks recorded and investigated in this report.

2.2 Areas of Investigation

2.2.1 Ground Floor – Crack in wall below “RI concrete beam over” in Bedroom 2

A noticeable vertical crack is recorded at the corner of two external walls in Bedroom 2, which is supporting the “RI Concrete Beam” as indicated on the architect’s drawings. The cornice above the crack is also showing some degree of separation from the wall which indicates continuous development of the crack in question.

Concern is raised that this specific location of the building is supporting a reinforced concrete beam which supports the roof section over the internal play area and bedroom 2. Repair and strengthening of this wall section is elaborated on in **Section 3.2** of this report.

Photo evidence of the above area is given below.



Pic 01: Vertical crack in wall

2.2.2 Roof assembly – cracks at wall plate level and separation of finishing elements

Visual inspection to the roof assembly, which is a heavy wooden architectural design, indicated cracks at wall plate level at each support point of the roof trusses and at the corners of the walls. The picture album below provides visual evidence of the complex roof design and cracks at the support areas.



Pic 02: Complex architectural roof assembly design with no ceiling



Pic 03: Crack at each support location of roof truss at wall plate level



Pic 04: Separation of roof assembly finishing elements

Noticeable is the absence of bottom cord and bracing roof elements which prevents torque, rotation and deflection of roof trusses. Remedial concepts are given in **Section 3.3** of this report.

2.2.3 1st Floor - Crack in eastern elevation wall

Possible settlement of the eastern elevation's foundation could have result in the medium to large horizontal crack on the inside of the external wall of the 1st floor and is most likely the cause of defect to this area of investigation. No noticeable crack on the same level is observed on the external wall at the same position of the 1st floor, which is unusual for such large width crack on the inside of the wall.

The crack is continuous on the same level, approximately 200mm above the upstand beam level of the 1st floor concrete slab which cause of defect is a possible weak mix of mortar between the bricks or insufficient brick force on the specific level.

The photo album below gives visual insight to the severity of this crack.



Pic 05: Horizontal crack above upstand beam level



Pic 06: Crack in corner of bedroom 3 wall and above upstand beam level



Pic 07: Crack in wall at Bedroom 3 door entrance

2.2.4 Roof - Flashing and waterproofing repairs

Inspection of the external perimeter of the building indicated some self-attended cracks on both the ground floor and 1st floor level of the building. Of interest is the defective and damaged roof flashing and water proofing detected on the northern edge of the roof covering the Study/Guest room on the ground floor.

Interesting is that this defect is a high possibility for the existence and development of the crack as elaborated on in **Section 2.2.2** above as it is on the same location and height. Repairing this to specification will attribute to a more safe and stable structure.

The picture below shows the location and status of the defective flashing and water proofing.



Pic 08: Defective roof flashing and water proofing

3 ENGINEERING REMEDIAL SOLUTIONS AND RECOMMENDATIONS

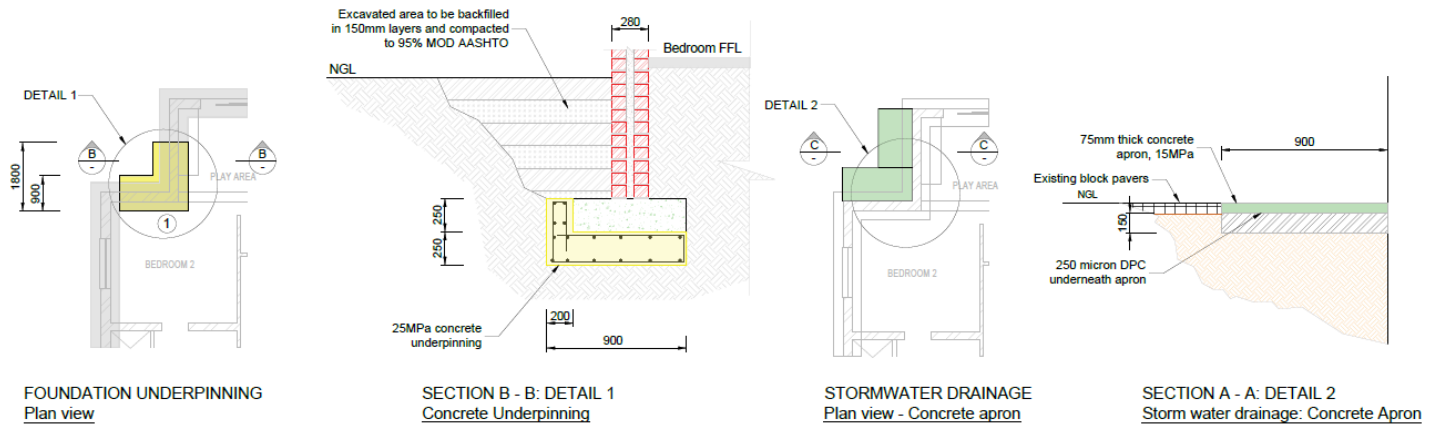
Contributing factors towards the **possible route causes** resulting in the large cracks forming at the recorded locations are elaborated on in **Section 2.2** above.

Engineering remedial concepts are categorised and described below with full details on the drawing attached as **Annexure A**.

3.1 Activity 1: Underpinning of concrete footing and Stormwater management

Concept A - Underpinning: Preventative measures to strengthen the foundation supporting the walls in question is underpinning and proper stormwater management.

Concept B – Stormwater management: To prevent possible settlement, concrete underpinning and concrete aprons are recommended to a small section of the external walls of the building at this location as indicated on the drawings in **Annexure A** with graphical images below.



Concept C - Option 1: It is proposed that approximate 500mm x 500mm of the mortar at the location of the crack be removed to investigate the brickwork supporting the “RI concrete beam over” which supports the roof at this location.

Crack repair or strengthening of the brick layers once the abovementioned area has been exposed is to be specified and finalised after inspection of the exposed area.

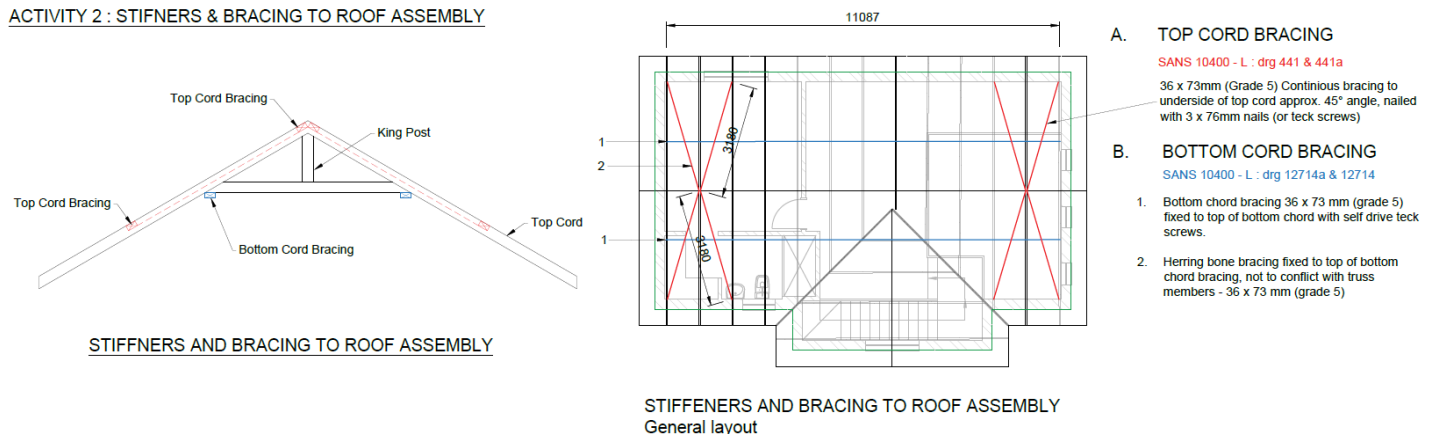
Concept C – Option 2: Application of metal latch mesh is an option to the crack repair if the brickworks are not damaged or degraded, however conditional to the inspection to be done as noted above.

Both concepts are detailed on the drawing attached as **Annexure A**.

3.2 Activity 2: Stiffeners and bracing to roof assembly

The original RFQ related to water ingress at different locations of the building, which were indicated by the Home Owner also to be on wall-plate level, especially on the 1st floor roof assembly. Evidence of this is also noted from the separation of the roof trusses, architectural finishing and pine ceiling covering which constitutes the roof assembly.

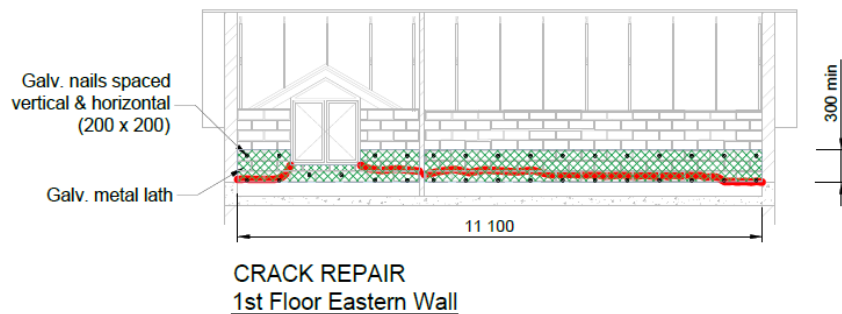
ACTIVITY 2 : STIFNERS & BRACING TO ROOF ASSEMBLY



Above activity is detailed on the drawing attached as **Annexure A**.

3.3 Activity 3: Crack repair

Photos No.2, No.3 and No.4 above illustrates the cracks located above the concrete upstand beam on the first floor, which beam forms part of the 1st floor concrete floor slab. Repair concepts to these cracks are provided in the graphics below and as detail on the drawing attached as **Annexure A** to the report.

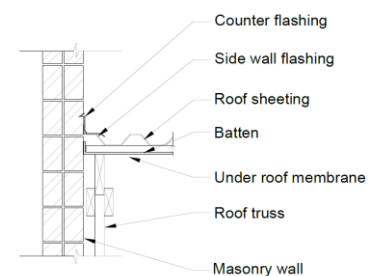


3.4 Activity 4: Repair Roof flashing and water proofing

Damaged roof flashing and waterproofing was detected on the northern edge of the roof covering the Study/Guest rooms of the building on ground floor. Repair of this section is detailed on the drawing attached as **Annexure A** with schematic image below.



EAST ELEVATION
Repair existing roof flashing and waterproofing



TYPICAL DETAIL
Side wall flashing

4 DESIGN PARAMETERS

The following section of the **Report** is towards Quality Assurance and Continuous Professional Development to ensure due diligence of **TechQ Development's** approach to engineering solutions and problem solving in following the statutory design standards, regulations and guidelines, which most are applicable to the concept repair proposals provided in this report.

4.1 Design Standards, Regulations and Guidelines

The design of structural elements, additions to, maintenance and/or repair remedial measures of affected *structural engineering elements* for this Project, is in accordance with the guidelines as set out in the latest version of the following South African design standards (SANS) and the National Building Regulations (NBR).

- | | |
|--|--|
| • SANS 10400 – Parts H, J, K, L, M & P | - Masonry building design |
| • SANS 10100 - Part 1 | - Concrete Design |
| • SANS 10144 | - Detailing of steel reinforcement for concrete |
| • SANS 0161 / SANS 10400 – Part H | - Foundation Design |
| • SANS 10130-2 | - Self-weight and imposed loads |
| • SANS 1200 | - Standardised specifications for construction works |

4.2 Design Loads

4.2.1 Dead Loads (Permanent Actions)

SANS 10160-1 read in conjunction with the requirements of **SANS 10160-2** for self-weight and imposed loads is applicable to the following elements.

Load Imposed on	Cause of Load	Load Value
Slab	Screed & tiles	1,2 kN/m ²
Slab	110mm Brick walls	19,0 kN/m ³

4.2.2 Wind Loads (Variable Actions)

The following inputs are applicable in accordance with **SANS 10160-3** to calculate the peak wind speed pressure:

- Basic wind speed : 40 m/s
- Terrain Category : C (Regular cover of buildings, sub-urban terrain)
- Site Altitude : ± 25,0 MSL

4.2.3 Soil Loads

SANS 10160-1 read in conjunction with the requirements of **SANS 10160-5** will be applied.

4.2.4 Seismic Loads

The Project Site does not fall within either **Zone I or Zone II** and no specific seismic design requirements are needed.

4.3 Design Load Combinations

4.3.1 Ultimate Limit State

Ultimate limit state relates to the safety of the people and the structure. **SANS 10160-01** with reference according to **Table 3** outlines the Partial factors for actions for the ultimate limit state.

Dominating Action	Combination Name	Combination Equation
Self-weight	STR-P	1.35D + 1L
Imposed	STR	1.2D + 1.6L
Wind down	STR	1.2D + 1.3W↓ + 1.6ψL
Wind up	STR	0.9D + 1.3W↑

4.4 Materials

4.4.1 Concrete and Reinforcement

The following key structural materials and specifications are proposed for the remedial Works.

a. Concrete

All reinforced concrete elements shall be designed in accordance with **SANS 0100-1**. The 28-day characteristic strength of all concrete elements is to be as per the table below.

Structural Elements	Concrete Grade	Stone size
Foundations, Column bases and stub-columns	30 MPa	19 mm
Surface beds	25 MPa	19 mm
Aprons and Ramps	20 MPa	13 mm

b. Reinforcement

- Mild steel or R-Bars $f_y = 250$ MPa minimum (to SANS 920)
- High yield or Y-Bars $f_y = 450$ MPa minimum (to SANS 920)
- Welded steel mesh $f_y = 485$ MPa minimum (to SANS 1024)

Bending schedules for the rebar to the concrete underpinning are detailed on the drawings and attached as **Annexure G**.

4.4.2 Masonry works

Where so detailed, specified and indicated on the drawings, typical **Type 2** (min) engineering bricks are to be used giving an **85mm** course height. All brickwork shall be set out in accordance with the relevant drawing layouts. Loadbearing brickwork should have a minimum crushing strength of **7MPa** with maximum 10% water absorption and **Class II** mortar.

4.5 Limiting Factors

Remedial and construction works as specified here within and detailed on the drawings, will require a **strategic phased decanting program** to be implemented during construction, drawn up in co-operation with the Home Owners. The safety of the Home Owners and the building need to be paramount, with construction works limiting the disruption of day-to-day and personal activities.

5 SUMMARY OF ENGINEERING CONCEPT PROPOSALS FOR REMEDIAL WORKS

The table below presents a summary to the forensic investigation and proposed concept options.

Investigative Activity Area	Concept Remedial Actions
4. <u>Ground Floor</u> Crack in wall below "RI concrete beam over" in Bedroom 2	<p><u>Concept A – Underpinning</u> Underpinning to the GROUND FLOOR section of the exterior walls of Bedroom 2 in accordance with dwg No. HGosai – Struct 01</p> <p><u>Concept B - Stormwater: Concrete apron</u> Improve stormwater management with construction of a concrete apron above the underpinned section as in Concept A above.</p> <p><u>Concept C - Crack repair</u></p> <ul style="list-style-type: none"> • <i>Option 1:</i> Expanded metal lath application repairs to low- and high-level cracks as detailed on dwg No. HGosai – Struct 01. • <i>Option 2:</i> Remove existing damaged bricks under "RI beam over" and repair as per Engineer's instruction, post exposure of cracked area.
5. <u>1st Floor</u> Crack in eastern elevation wall	<p><u>Crack repair</u> Expanded metal lath application repairs to low- and high-level cracks as detailed on dwg No. HGosai – Struct 01</p>
6. <u>Roof</u> Flashing and waterproofing repairs	<p><u>Replace damaged roof flashing and waterproofing</u> Remove existing roof wall flashing, reinstall with new flashing and waterproofing to supplier's specification.</p>

6 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 building, 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 Agreements 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 ---