



NATIONAL HOME BUILDERS' REGISTRATION COUNCIL

HOUSE MNGADI

ERF 5259 BLUE VALLEY GOLF AND COUNTRY ESTATE

STRUCTURAL ASSESSMENT

KM/CIVIL/GP/028-24/05/2022

ASSESSMENT REPORT

DRAFT - Rev B



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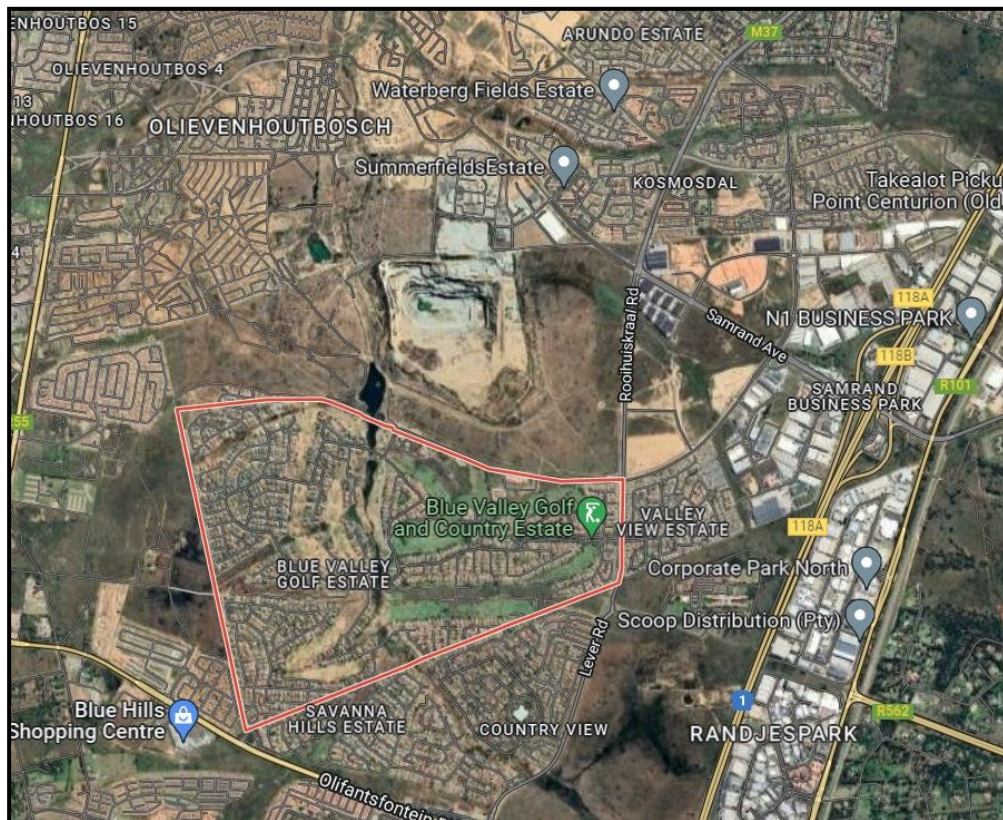
1 INTRODUCTION

The National Home Builders Registration Council appointed MJT Consulting Engineers (MJT) to carry out a structural assessment of the wall structural defects on House Mngadi ERF 5257 Blue Hills Golf Estate in Centurion. The double storey housing unit has experienced brick pops and the homeowner has subsequently reported the issue to the NHBC.

1.1 Site Location

The location of the housing unit under assessment is in the Blue Valley Golf Estate in Centurion as shown in the Figure 1-1 below.

Figure 1-1 Blue Valley Estate Location



1.2 Description of Building – ERF 5257

The housing unit is a double-storey structure–built form cement bricks, plastered and painted internally and externally. The housing unit consist of an open plan kitchen, living area, garage, and guest toilet, downstairs whilst the upstairs portion of the houses contains the main, two additional bedrooms and pyjama lounge/office.

Figure 1-2 Building Elevation – House Mngadi (view from Street Entrance)



The Client has reported to the NHBRC that they have experienced brick “pops” that led to plaster falling off the wall. This, as a result, has led to the homeowner having concerns about the safety and aesthetics of the residential unit.

1.3 AIM OF ASSESSMENT

It is the aim of this assessment to provide the following:

- To investigate the brick wall 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.
- To determine the root causes of defects and provide a rectification specification or methodology,
- To supervise the rectification works and sign-off on completion.

This report forms the first two parts of the aims listed above.

2 SCOPE OF WORK

The NHBRC issued an instruction to perform work to MJT as professional structural engineers to conduct forensic investigation of defects that have formed at Erf 5257 Blue Valley Golf Estate, Centurion Gauteng Ext 75 as per the requirements of the Housing Consumer Protection Measures Act.

The scope of the professional structural engineering services, covers the following forensic investigation activities:

- Physical and visual assessment of defects to determine the root causes and classifying the defects in accordance with HCPMA.
- Conduct necessary structural testing and analysis.
- Investigate the brick materials used on the house, strength, and material composition tests on the bricks to be conducted.
- Establish the cause of the defects in the bricks.
- Establish the extent of damages.
- To establish if the as built design / as specified is suitable to carry the applicable loads as per the SABS standards.
- Provide rectification design solution- thus specification for defects covered under the NHBRC structural.
- Provide engineering supervision services during rectification works (i.e. site briefing, implementation stage & certification on completion).
- Provide reports on inspections/ site visits conducted including completion certificate on completion of the project.
- Provide a scope of works for NHBRC quantity survey to draft a Bill of Quantities for the remedial works.

The NHBRC initial assessment of the complaint noted the following defects which requires further investigation and rectification specifications.

- Plaster popping around the house of which is it assumed to be emanating from the cement stock bricks.
- Water leaks around the house on specific areas.

3 BUILDING STANDARDS AND TECHNICAL REQUIREMENTS

3.1 Design Standards

The applicable standards for the design will include but are not limited to the following;

- SANS10160 – Basis of structural design and actions for buildings & industrial structures,
- SANS10400 – The application of the National Building Regulations – Part A to XA,
- SANS 0164 Part I –The Structural Use of Masonry Part 1,
- National Home Builders Registration Council Technical Guide and Manual.

3.2 Technical Requirements

It is expected that buildings must be designed and constructed such that they provide adequate strength and stability throughout their design life. As far as the National Building Regulations (NBR) are concerned, the design and construction of structures must;

- be able to provide the protection, health, and safety of the public;
- not be harmful to the health or well-being of inhabitants; and
- ensure that provided solutions contribute effectively to environmental sustainability.

3.3 Site Assessment Equipment

The site inspections were carried out visual using partially destructive test methods using the following visual assessment aids and equipment:

Table 1 – Site Assessment Aids and Equipment

Site Assessment Aids and Equipment	
Data input forms	To capture site information and determination of probable causes
Tape measures	To take measurements (length, depth thickness)
Cameras	For photographs
Spirit level	To measure levelness, plumpness and squareness
Metal Detectors	Rebar and Brickforce detection

Brick samples for laboratory testing were collected around the house including both bricks that have popped and bricks that have not popped. The sampled bricks were then taken to a SANAS Accredited laboratory for testing. A soundness test was carried out to determine if reactive material is present in the bricks that causes the popping. The soundness test was carried out in accordance with SANS1215:2008 Concrete Masonry Units.

4 BRICK POPPING OR LIME BURSTING

4.1 Causes of lime bursting or Brick popping

The problem is caused by the expansion of an inclusion at the base of the pop-out. As the inclusion in this case is white in colour, it is taken that it is caused by the presence of free lime (CaO) in the brick material. If inclusions of free lime occur near the surface of a brick, a chemical reaction takes place. The particles swell which may cause portions of the brick face to "pop" off, as the free lime hydrates and becomes calcium hydroxide [Ca(OH)₂]. Exposure to air, and consequently to carbon dioxide in the air, forms calcium carbonate (CaCO₃).

If there are a significant number of free lime inclusions or nodules throughout the brick unit, future hydration of the free lime to calcium hydroxide could result in further distress and deterioration of the brick unit. The pop-outs could also result in visible small white streaks if rainwater dissolves the inclusion before it carbonates.

5 SITE INSPECTIONS AND ASSESSMENT ACTIVITIES

A site kick-off meeting was carried out on the 27th of July 2022 and a site walk was carried out to familiarise MJT with the housing units and defects. The methodology for the assessment was presented to the Home-Owner and NHBC representatives and timelines for site testing proposed. A site visit for brick sampling was carried out on the 10th of August 2022.

The following images show the pops that have formed around the residential unit. Bricks samples were taken from some of the sections where pops have formed.

Figure 5-1 Brick pops – Pyjama Lounge – Image 01



Figure 5-2 Brick pops - Pyjama Lounge - Image 02



Figure 5-3 Brick pops - Image 03



Figure 5-4 Brick pops - Image 04



Figure 5-5 Brick pops - Image 05



Figure 5-6 Sampling Popped Bricks - Image 01



Figure 5-7 Sampling Popped Bricks - Image 02



6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

As the amount of lime nodules or inclusions cannot be accurately determined it cannot be accurately concluded if additional pops will occur and to what extent. It is however clear from the testing carried out that the bricks contain significant amount of reactive material beyond what is acceptable.

6.2 Recommendations

It is recommended as a primary measure to impede the process of reaction of the lime with moisture, that the residential unit be waterproofed. The waterproofing can occur by painting the interior and exterior of the housing unit with a waterproofing paint or production in accordance with the specifications of a waterproofing specialist.

The existing section where the bricks have popped and where the plaster has either spalled or completely fallen off must also be rehabilitated. This process will involve removing any loose material around the area of the pop and cleaning any residual lime material. Solid lime portion must be removed by using a drill, leaving a clean opening. The exposed opening must then be filled with non-shrink grout (with good adhesive properties) such as SikaGrout®-212 or similar approved. The grouted section must then be plastered and painted to match the existing wall colour. This process is applicable to all section that have popped or where there are visible lime nodules in the brick.

The housing unit should then be monitored for any reoccurrence the pops post application of the waterproofing product and remedial works.

It is further recommended that the defects to the building are remedied expeditiously to ensure that continued damage to the building is stopped.

7 REFERENCES

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APPENDICES

Appendix A

Appendix B