

**NHBRC 36/2019  
NATIONAL HOME BUILDERS  
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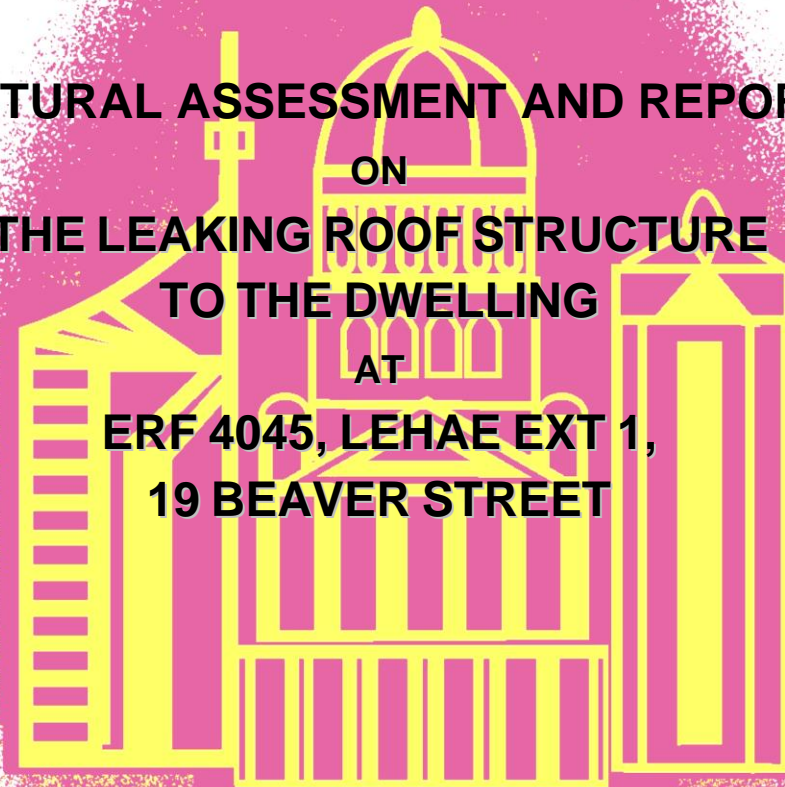
**STRUCTURAL ASSESSMENT AND REPORTING**

**ON**

**THE LEAKING ROOF STRUCTURE  
TO THE DWELLING**

**AT**

**ERF 4045, LEHAE EXT 1,  
19 BEAVER STREET**



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**TITLE** : STRUCTURAL ASSESSMENT AND REPORTING ON THE LEAKING ROOF STRUCTURE TO THE DWELLING AT ERF 4045, LEHAE EXT 1, 19 BEAVER STREET

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NATIONAL HOME BUILDERS REGISTRATION COUNCIL**

**STRUCTURAL ASSESSMENT AND REPORTING  
ON THE LEAKING ROOF STRUCTURE TO THE DWELLING  
ERF 4045, LEHAE EXT 1, 19 BEAVER STREET**

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STRUCTURAL ASSESSMENT AND REPORTING  
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ERF 4045, LEHAE EXT 1, 19 BEAVER STREET**

## **1. INTRODUCTION**

### **1.1 BACKGROUND TO THE INSPECTION**

TGC Engineers were requested by Ms. K. Modise, from NHBRC, to undertake an inspection of the property and provide a remedial solution on the water seepage through the roof structure. The property was visited on the 27 October 2021 at 14h00 followed by an inspection on the 07 March 2022, when the entire dwelling was assessed, including the external and internal walls and roof.

ERF 4045 is located in Lehae Ext 1, Johannesburg. Lehae being one of Gauteng's newest suburbs is approximately twenty minutes by road from Johannesburg and situated next to Lenasia. The single storey dwelling comprises of a kitchen, living area, bathroom and 3 bedrooms. It is constructed out of masonry brickwork and the internal walls are plastered smooth and painted. The external walls are plastered and painted with a rough textured finish. The ceiling consists of gypsum board with gypsum cornices. The hip roof structure comprises of double roman concrete roof tiles on engineered timber trusses.



*Figure 1: Front/side elevation of the house*



## **1.2 PURPOSE OF THE REPORT**

The purpose of the report is to identify all the seepage problems being experienced to the roof structure and ceilings at ERF 4045 where causes, effects and remedial measures will be outlined.

## **1.3 SCOPE OF THE REPORT**

This report covers a detailed assessment on the water seepage through the roof structure and ceilings of ERF 4045 that includes a desktop study, an analysis of structural stability and durability issues, the roof leak, remedial solutions, scope of work and proposals regarding the remedial action.

## **2. *PROCEDURE***

Mr. M. S. Moodley gathered information by:-

2.1 Consulting with Ms. K. Modise, from NHBRC during October 2021.

2.2 Inspecting the roof structure, ceilings, roof void and internal and external walls of ERF 4045 on the 27 October 2021. This involved carrying out an external and internal visual assessment of the roof, including the roof void, where materials and defects were identified. Photographs were also taken of the defects found.

2.3 Conducting a follow-up inspection of the roof structure, ceilings and internal and external walls of roof on the 07 March 2022.

2.4 Consulting with the Home Owner.

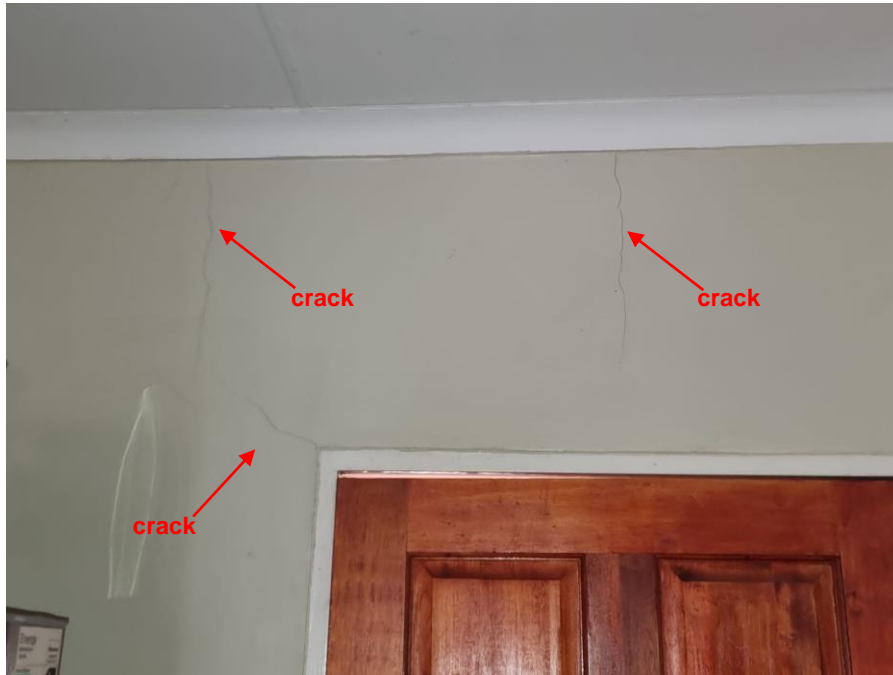
## **3. *DESKTOP STUDY***

The desktop study relates to assessing readily available site information, in this case the existing drawings of the property were obtained from Ms. Lila, the owner of ERF 4045. TGC then analysed the drawings to determine the structural stability of the property and if they adhere to SANS 10400, The Application of the National Building Regulations and the NHBRC Home Builders Manual. Thereafter TGC confirmed all information received by conducting a site inspection.

## **4. *ANALYSIS OF STRUCTURAL STABILITY & DURABILITY ISSUES***

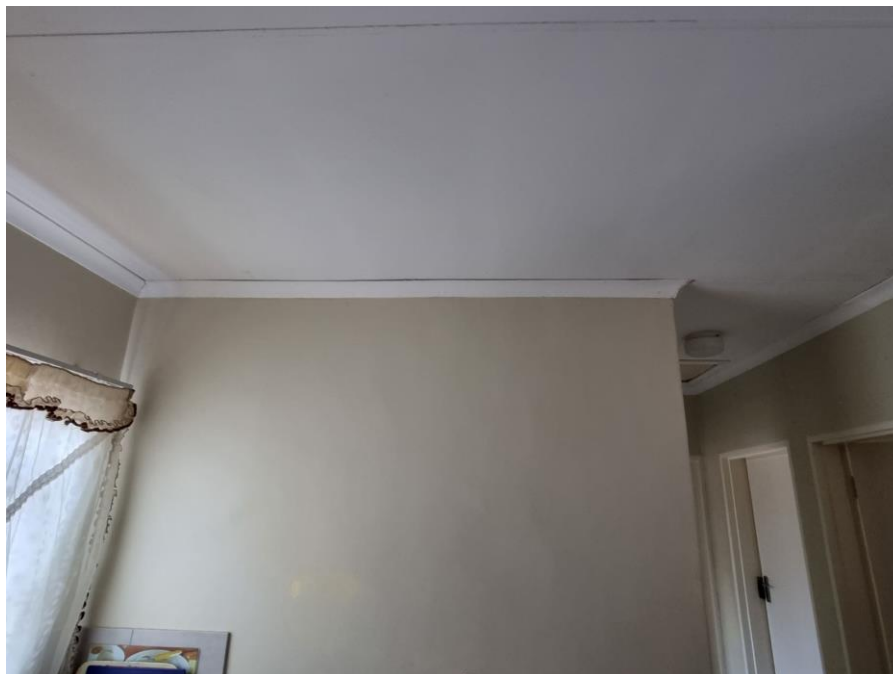
### **4.1. KITCHEN**

Observed minor to moderate vertical and diagonal cracks extending from the ceiling cornice and door frame, (figure 2).



*Figure 2: Ceiling cornice and door frame*

There is a noticeable gap between the cornice and ceiling, (figure 3).



*Figure 3: Cornice and ceiling*

Water damage to the ceiling and cornices was observed, (figure 4).



*Figure 4: Ceiling and cornices*

#### **4.2. LIVING ROOM**

Observed water damage and flaking paint to the ceiling and cornice, (figure 5).



*Figure 5: Ceiling and cornice*



Observed a dish on the living room floor to collect water from the roof leak, (figure 6).



*Figure 6: Floor*

#### **4.3. PASSAGEWAY**

Observed water damage to the cornice, (figure 7).



*Figure 7: Cornice*

The trap door frame appears to be loose around the corners, (figure 8).



*Figure 8: Trap door*

#### **4.4. BATHROOM**

The ceiling appears to be in a satisfactory condition as no water seepage was visible, (figure 9).



*Figure 9: Ceiling*

#### 4.5. BEDROOM 1

The ceiling appears to be in a satisfactory condition as no water seepage was visible, (figure 10).



*Figure 10: Ceiling*

#### 4.6. BEDROOM 2

Observed a minor to moderate vertical crack extending from the cornice to the door frame. Attempts appear to have been made to repair the gap between the ceiling and cornice and the vertical crack on the cornice, (figure 11).



*Figure 11: Ceiling and cornice*

Observed water damage to the ceiling, (figure 12).



*Figure 12: Ceiling*

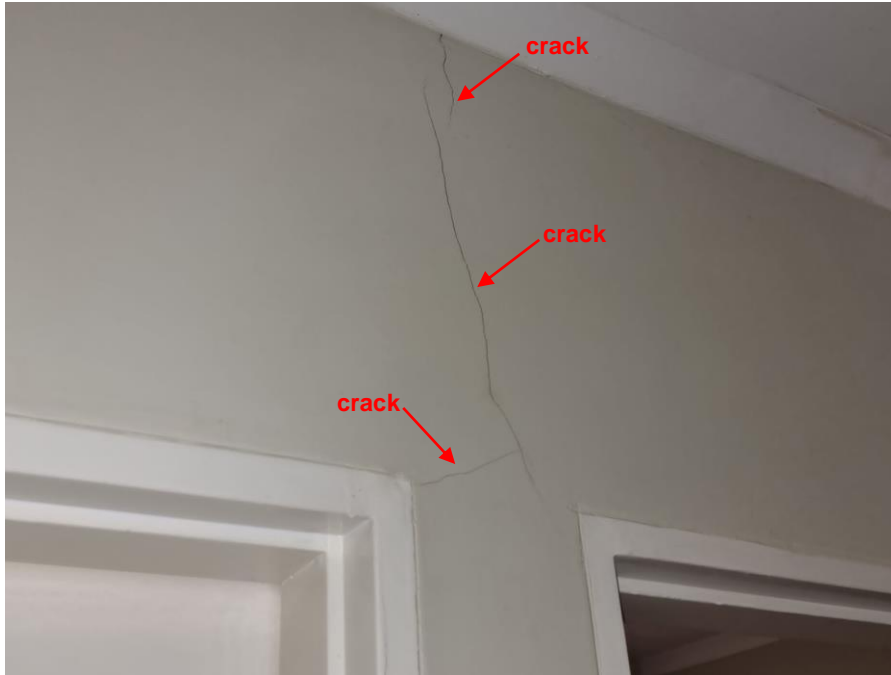
Observed water damage to the ceiling and cornice. There is also evidence of fungi growth from the cornice, (figure 13).



*Figure 13: Ceiling and cornice*

#### 4.7. BEDROOM 2 & 3

Observed minor to moderate diagonal cracks extending from the ceiling cornice and door frame, (figure 14).



*Figure 14: Ceiling cornice and door frame*

#### 4.8. BEDROOM 3

There is a noticeable gap between the ceiling and cornice, (figure 15).



*Figure 15: Ceiling and cornice*

#### 4.9. ROOF STRUCTURE

The roof structure comprises of engineered prefabricated “Cross hipped” timber trusses at approximately 760mm centres. The cross-sectional dimension of the top chord and bottom chord truss members measures 38mm x 114mm and the webs are 38mm x 76mm. The connection of the members comprises of metal gangnailed connector plates.



*Figure 16: Engineered timber roof trusses with concrete tile covering*

The trusses do not appear to be erected straight and vertically plumb as there are no nailed wedges on either side of the trusses. Some of the galvanised truss anchors are omitted and not securely fixed, (figure 17).



*Figure 17: Engineered timber roof trusses and galvanised truss anchors*

Some of the galvanised truss anchors are omitted and others are not securely fixed, (figure 18).



*Figure 18: Galvanised truss anchors*

The double roman concrete roof tiles appear to be loose as there are noticeable gaps allowing sunlight to enter through, (figure 19).



*Figure 19: Double roman concrete roof tiles*

The hip trusses and fly trusses are connected to the girder with nails and the truss hangers are missing, (figure 20).



*Figure 20: Hip trusses and fly trusses connected to girder*

#### **4.10. EXTERIOR OF DWELLING**

Observed several stormwater concrete channels, (figure 21).



*Figure 21: Front elevation of the house*



The aluminum gutters are fixed to the ends of the rafters, (figure 22).



*Figure 22: Rear/side elevation of the house*

Observed the front/left view of the house, (figure 23).



*Figure 23: Front/left elevation of the house*

Observed broken mortar joints and loose ridges, (figure 24).



*Figure 24: Rear/side elevation of the house*

Observed broken mortar joints and loose ridges, (figure 25).



*Figure 25: Side elevation of the house*

Observed broken mortar joints and loose ridges, (figure 26).



*Figure 26: Side view of ridges*

Observed a lack of mortar in the joints, (figure 27).



*Figure 27: Side view of ridges*

Observed broken mortar joints and loose ridges, (figure 28).



*Figure 28: End view of ridges*

Observed a solar geyser on the rooftop, (figure 29).



*Figure 29: Front view of solar geyser*

Observed a one tile roof overhang, (figure 30).



*Figure 30: Roof overhang*

Galvanised sheet metal valley gutter was observed, (figure 31).



*Figure 31: Valley end, viewed from outside*

## **5. CONCLUSION**

- It would appear that the cause of water damage to the ceiling and cornices in the kitchen and living room, the cornices in the passageway and ceiling and cornices in bedroom 2 is due to water seepage through the gaps in the double roman concrete tiles as well as the ridge capping. The valley on the outside of the living room could also contribute to the water damage and flaking paint to the ceiling and cornices in the living room as it appears to be leaking.
- The roof does not benefit from an underlay as a secondary water barrier therefore water leaks directly onto the ceiling thus damaging it. The water that collects on the ceiling boards also drips down onto the floor which is evident in the living room.
- It is possible that water seepage through the ceilings and roof structure is as a result of the inadequate spacing of the battens where they are too far apart from each other or the double roman concrete roof tiles are not set properly. The double roman concrete roof tiles could also be distorted or dislodged.
- Based on our observations of the structural elements of the roof erection, the roof structure appears to be unstable for the following reasons:
  - There is a lack of galvanised truss anchors in certain areas and some are not securely fixed.
  - There is a lack of galvanised truss hangers as the hip trusses and fly trusses are nailed to the girder.
  - There are missing fly rafters in the corners of the living room and bedroom 1.
  - There is no underlay waterproofing membrane present.
  - The ridge caps appear inadequate as the mortar used to bed the ridges is eroding.
  - The valleys appear inadequate.
- We can confirm that the vertical and diagonal cracking to the internal wall in the kitchen, vertical cracking to the internal wall in bedroom 2 and diagonal cracking to the internal wall outside bedroom 2 and 3 is foundation related.
- The gaps between the ceiling and cornice in the kitchen and bedroom 3 is minor as it is due to a loss of adhesion between the cornices and walls.

## **6. REMEDIAL SOLUTIONS**

On the basis of our analysis of structural stability, durability issues and the roof leak, we recommend the following:-

- The owner/occupants shall move out of the dwelling and to temporarily accommodate prior to any work being carried out.
- The solar geyser located on the rooftop shall be removed during the reconstruction of the roof structure and stored for reuse.
- The double roman concrete roof tiles and ridge caps shall be carefully removed and stored for reuse.
- The existing 38mm x 38mm battens shall be removed and stored for reuse.

*NHBRC 36/2019: Structural Assessment and Reporting on the Leaking Roof Structure  
to the Dwelling at ERF 4045, Lehae Ext 1, 19 Beaver Street*

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- The valley outside the living room shall be checked for possible leaks and replaced with a deeper profile section if necessary.
- The missing nailed wedges shall be added on either side of the trusses to ensure the truss members are erected straight and vertically plumb.
- The missing timber fly rafters shall be added to the corners of the living room and bedroom 1.
- The missing 30mm x 1.2mm galvanised hoop iron straps shall be installed at the end of each truss member.
- The existing roof anchors shall be fastened.
- The hip trusses and fly trusses must be connected to the girder with galvanised truss hangers and other missing truss hangers shall also be installed.
- An underlay waterproofing membrane shall be provided. The existing 38mm x 38mm battens must be fixed to the rafters at 345mm centres or to the technical specification of the tiles to ensure the minimum overlap.
- The existing double roman concrete roof tiles shall be carefully cleaned and re-laid over the underlay membrane.
- The ridge capping shall be cleaned and refixed with a suitable mortar.
- The contractor must have a tarpaulin readily available and it should be used to cover the roof for overnight protection and during inclement weather. The tarpaulin shall be secured to the rafter overhangs.
- The solar geyser must be reinstalled on the rooftop and the plumbing shall be reconnected.
- The damaged ceiling boards and cornices in the kitchen, living room, passageway and bedroom 2 shall be replaced where necessary, cleaned, prepared and repainted to match the existing.
- Any damages shall be repaired.
- The cracks to all walls shall be repaired with a highly flexible sealant.
- The walls shall be re-painted.
- The Contractor shall take all necessary precautions to avoid damage to other areas of the building. The building must be returned to the owner in an acceptable, approved manner.
- A photographic record must be prepared of the interior and exterior of the building and property prior to commencement of the work.

We trust that the above meets with your immediate requirements. Please contact us should you have any queries.

Yours faithfully,

**TGC ENGINEERS**

**M. S. MOODLEY** Pr. Tech. (Eng.)

Pr. No 9870131

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***APPENDIX 1***

***SCOPE OF WORK AND PROPOSALS REGARDING THE REMEDIAL ACTION***



## **1. SCOPE OF WORK**

- Remove the solar geyser located on the rooftop and store for reuse.
- Remove the double roman concrete roof tiles and ridge caps and store for reuse.
- Remove the existing 38mm x 38mm battens and store for reuse.
- Check the valley outside the living room for possible leaks.
- Add the missing nailed wedges on either side of the trusses.
- Add the missing timber rafters to the corners of the living room and bedroom 1.
- Install the missing galvanised hoop iron straps at the end of each truss member.
- Fasten the existing roof anchors.
- Connect the hip trusses and fly trusses to the girder with galvanised truss hangers. Install the missing truss hangers.
- Provide the underlay waterproofing membrane and fix the existing 38mm x 38mm battens.
- Reset the existing double roman concrete roof tiles and ridge caps with suitable mortar.
- Cover the roof with a tarpaulin for overnight protection.
- Reinstall the solar geyser on the rooftop.
- Repair the damaged ceiling boards and cornices in the kitchen, living room, passageway and bedroom 2.
- Supply and install all shortfall of material to the roof structure.

## **2. PROPOSALS REGARDING THE REMEDIAL ACTION**

### **2.1 TIMBER ROOF STRUCTURE**

- Remove the solar geyser located on the rooftop and store for reuse.
- Carefully remove the double roman concrete roof tiles, ridge caps and 38mm x 38mm battens and store for reuse.
- Check the valley outside the living room to determine if there are any possible leaks occurring.
- Nail the missing wedges on either side of the trusses to ensure the truss members are erected straight and vertically plumb.
- Add the missing timber rafters to the corners of the living room and bedroom 1. The rafters must be erected straight and plumb.
- Install the missing 30mm x 1.2mm galvanised hoop iron straps at the end of each truss member. The galvanised hoop iron straps are to be nailed to the truss member and anchored to the wall.
- Fasten the existing roof anchors to the truss member and wall.
- Connect the hip trusses and fly trusses to the girder with galvanised truss hangers. Install the missing truss hangers.

- Supply and install the under-tile membrane according to the manufacturer's specification. The under-tile membrane shall be laid horizontally over the rafters with minimum overlaps of 150 mm and secured with large head galvanised clout nails to the rafters. During installation, special care must be taken to avoid puncturing and tearing of the membrane. The membrane must be taught at the eaves to allow drainage of residual water. At closed eaves the membrane shall extend at least 20mm over the tilting batten or fascia board into the gutter. At open eaves the membrane shall extend  $\pm$  20mm over the beam filing of the exterior wall. At hips, a vertical strip of membrane not less than 600 mm wide shall be laid over the main roof membrane. At valleys a similar strip at least 600 mm wide shall be laid under the main roof membrane.
- Fix the existing 38mm x 38mm battens to each rafter that it crosses at 345mm centres or as per the Manufacturer's specification.
- Clean and relay the existing double roman concrete roof tiles over the underlay membrane making sure that they are mechanically fixed to the battens.
- Ensure that the roof structure is to an acceptable squareness and the roof trusses are to a true line and braced according to the code requirements before the laying of the tiles.
- Clean the ridge caps of the laitance mortar. A fresh mix of sand:cement mortar in the ratio of 2:1 respectively is to be used to re-lay the ridge caps in a neat manner. Excess mortar to be cleaned off before it dries.
- The contractor must provide a tarpaulin to cover the roof for overnight protection and during inclement weather. The tarpaulin shall be secured to the rafter overhangs.
- Reinstall the solar geyser on the rooftop.

## **2.2 CEILINGS**

- Repair the damaged ceiling boards and cornices by cleaning, preparing and repainting to match the existing.
- All damaged ceilings and cornices shall be replaced.

## **2.3 PAINTING**

### **2.3.1 General**

- All floors shall be swept clean, walls dusted down and surfaces not being painted (i.e. face brickwork, sills, floors and stained woodwork) covered and protected against spotting before any painting is carried out.
- No sweeping or dusting shall be done whilst painting is in progress or whilst paint is still wet.

### **2.3.2 On Plaster**

- All plastered wall, ceiling and such like surfaces being painted shall be filled, where necessary, with suitable stopping or patching plaster and the whole rubbed down ready to receive the finishings.
- Existing plastered surfaces previously painted and being redecorated shall be washed down, filled as above, where necessary, spot primed and rubbed down ready to receive the new paint.

- Existing plastered surfaces previously distempered and being redecorated shall have the old distemper completely removed by wetting and scraping the surfaces, filled as above, where necessary, and rubbed down ready to receive the new finish.
- Existing plastered surfaces previously limewashed and being redecorated shall be wirebrushed to remove loose, flaking or powdered limewash, filled as above where necessary, and left ready for new limewash. If a finish other than limewash is to be applied, the old limewash must be completely removed, the surfaces washed down, filled, where necessary, and left in a fit state to receive the new finish.

### **2.3.3 Surfaces to be Dry**

- All wall, ceiling and similar plastered surfaces shall be perfectly dry and in a fit state to receive paint finishes, before the application of any paint.
- Special care is to be taken when the plaster is specified to be finished with oil-based paints.

### **2.3.4 Paints etc.**

- All materials for paintwork for which South African Bureau of Standards Specifications have been published shall comply with the requirements of such specifications and bear the standardisation mark of the South African Bureau of Standards on the container or packing.
- Materials for paintwork for which no SABS Specification have been published shall be of brand and manufacture approved by the Representative/Agent.
- All materials for paintwork must be brought onto the site in unopened containers and no adulteration will be allowed.
- Primers and undercoats for paintwork shall be as supplied by the Manufacturer of the paint being used for the finishing coat.
- Paints etc. shall be suitable for application on the surfaces on which they are to be applied and those used externally shall be of exterior quality.
- If necessary, paints etc. shall be strained free from skins and similar impurities immediately before application.