M. NAUDE

Assessment of historic sites and buildings

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Voortrekker Monument: proposed investigation regarding the inherent presence of moist in the structure

Introduction

Soon after the Voortrekker Monument was completed in 1948, management started experiencing problems with moist ingress into the structure. The physical symptoms of the problem were not recorded at the time, but in 1955 the first contractor was appointed to address moist problems on the structure. This problem has not abated and continued until today 2020-2021.

One of the critical aspects of the moist penetration is the chemical reaction the moist may have with the cohesiveness of the large marble panels that were used to clad the various internal arches. The most serious area is the arch directly above the entrance where a falling panel may cause the death or injury to a staff member, a tour guide or a tourist.

Background to the problem area

The symptoms of moist ingress to be investigated for this project are located on the interior of the building at the highest points of the arched ceilings between the principal corner arches and walls containing the windows. Circular areas that are darker than the surrounding plastered surfaces indicate the presence of moist.

The documentation on previous investigations from the past and the visual manifestation of the problems on the structure indicate that moist ingress caused the problems.

Problems arising (symptoms of the problem)

The building is 70 years old and even during dry months, the existing moist patches enlarge or remain on the ceilings. This implies that the building contains its own water. Unfortunately the location of these reservoirs are unknown and need to be investigated to determine their location, distribution and how each manifests and contains itself.

Due to the height of these points along the ceiling, they cannot be reached by simple means such as ladders. The investigation proposed will be executed from the top down – opening up selected areas along the top pedestrian walkways.

It is feared that the moist along the top parts of the structure would alter the cohesiveness of the building materials of the ceiling, causing it to crumble and fall on staff or members of the public. It is also possible that the marble tiles (slabs) mounted onto the intrados of the internal arches may become loose and fall on staff members and members of the public. These marble tiles are not tiles in the traditional sense but panels of approximately 1m X 600mm in size and 30mm thick (see pictures below).

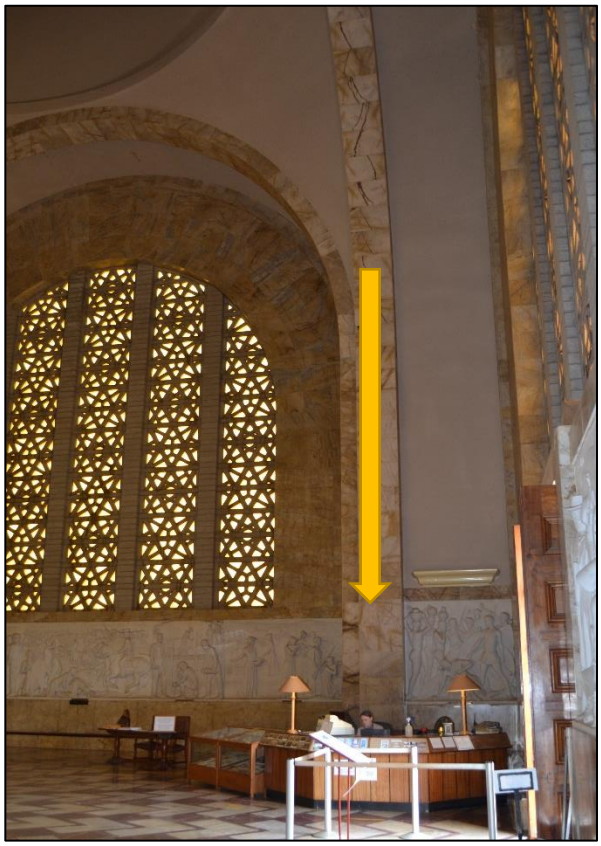

Figure 1. Location of work station of staff member in relation to arch clad with marble panels (Photograph: M. Naudé 2020)

It is unknown what the full range of remedies are that were proposed and executed in the past. It is also unknown how effective these remedies were over time.

The final objective is to determine whether the moist ingress may be due to a design error, aging building materials or due to recent (past 60 years) renovation work associated with solving the moist problems.

Intended actions at this point

The first objective of the investigation is to search for the water source(s) that has become part of the building structure and now serves as a possible reservoir feeding the symptoms of moist (dark areas along the ceiling) in the structure.

The second objective is to identify the various remedies and existing materials that were introduced to the structure to solve moist ingress into the structure.

1. One of the four walkway sections along the top of the building will be closed to the public and isolated to be used as an experimental section for the investigation.

2. The exterior floor and wall areas will be visually investigated in order to identify possible locations and ways moist would have been able to enter the structure.

3. The dome and parapet walling along the top of the structure (roof) will be visually surveyed to identify possible moist ingress points and then determine what remedies were applied in the past.

4. The current (2020-2021) flooring materials, in the isolated open pedestrian walkway area, will be removed and recorded to identify the different material types and determine their effectiveness up to 2021.

5. Once the existing materials have been removed and investigated, the results of the investigation will be compiled into a report explaining (a) where the moist is retained ('stored') inside the structure; (b) what materials and remedies were applied in the past (and were exposed during the investigation); (c) what the causes of the moist ingress were and (d) submit recommendations regarding future work including possible remedies.

Photos of the affected areas

Photographs were taken of areas that had been affected over the years and that serve as points of departure for the investigation. Spots on the arches of the ceiling could not be reached for photographing in much detail, without proper scaffolding as these locations are about 30m high from the floor.

Scale bars were used to indicate the scale of damage. A scale bar of 1 m and a small scale bar of 150mm were used.

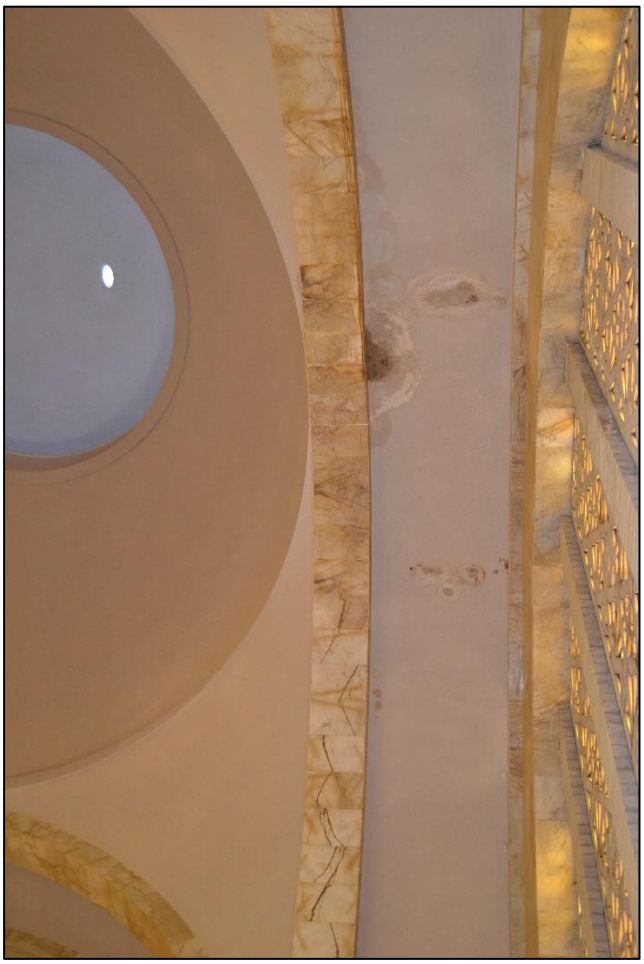

Figure 2. Areas where moist caused dark spots along the plastered ceiling inside the curve of the ceiling – southern side (Photograph: M. Naudé 2020)

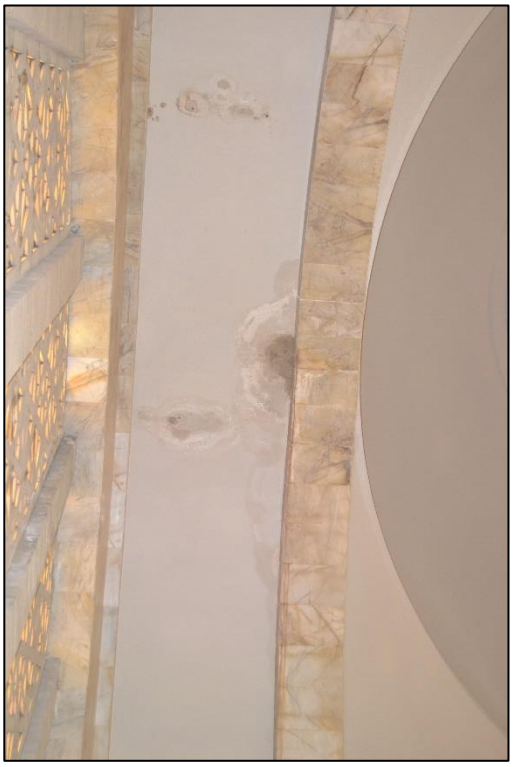

Figure 3. The same moist area but from another angle (Photograph: M. Naudé 2020)

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Figure 4. Moist has been dripping on the wooden seats along the wall of the southern side of the interior (scale bar 1 m long) (Photograph: M. Naudé 2020)

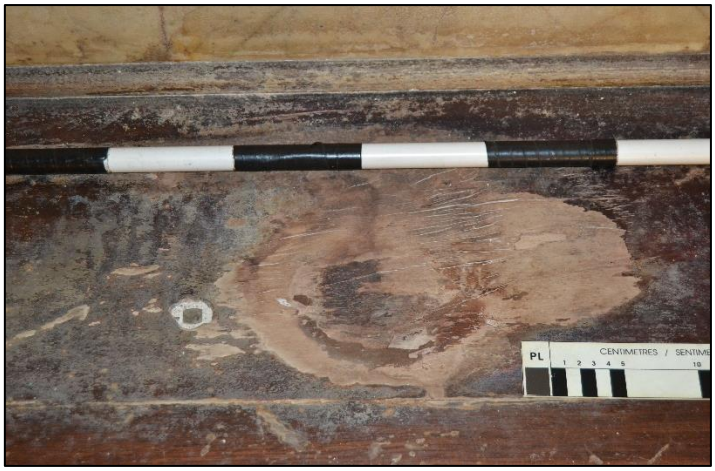

Figure 5. Dripping water has damaged the wooden seat surface (scale bar sections – 10cm long) (Photograph: M. Naudé 2020)

Figure 6. Second set of dark patches where moist degraded the plaster along the arched ceiling of the southern elevation (Photograph: M. Naudé 2020)

Figure 7. Dark patches on the floor along the southern side of the interior where dripping water caused colouration and slow disintegration of the floor tiles (scale bar – 1m long) (Photograph: M. Naudé 2020)

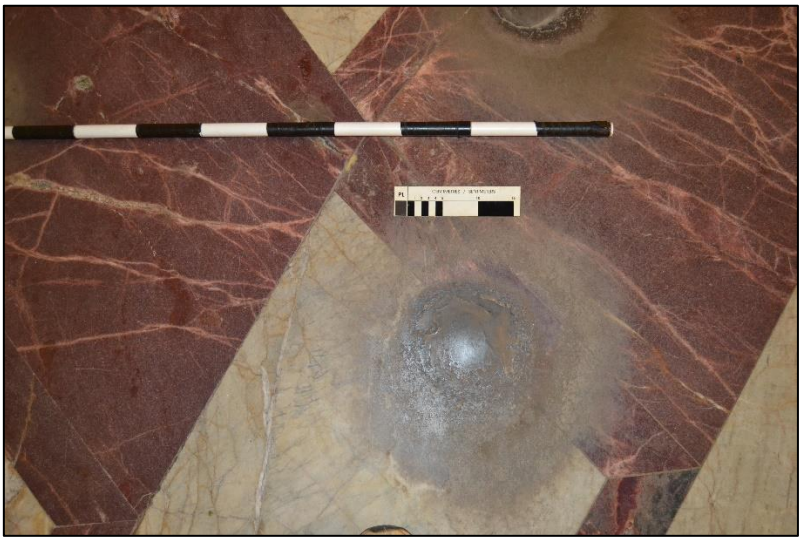

Figure 8. Extent of the water damage to the floor due to dripping from the ceiling (scale bar 1m long) (Photograph: M. Naudé 2020)

Figure 9. Colour patch on the curved ceiling along the south western corner (Photograph: M. Naudé 2020)

Figure 10. Close-up of the patch on the curved ceiling in the south western corner (Photograph: M. Naudé 2020)

Figure 11. Dark patch above the entrance to the interior of the building (Photograph: M. Naudé 2020)

Figure 12. Vertical cracked marble panels along the intrados of two corner arches (Photograph: M. Naudé 2020)

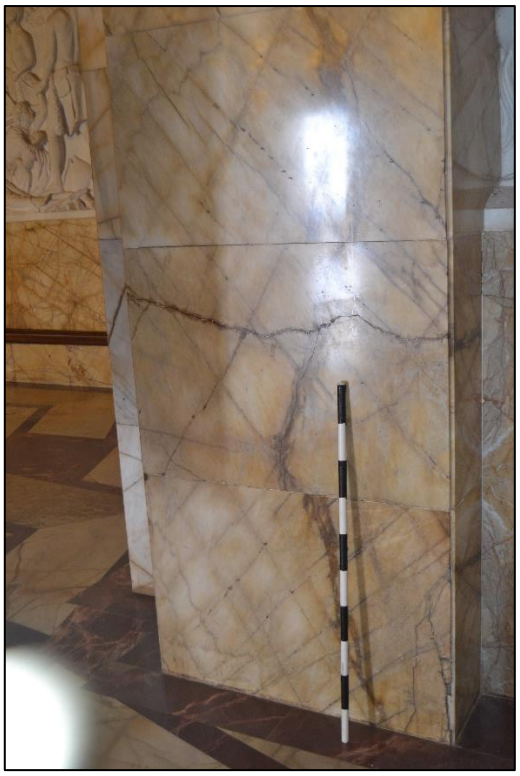

Figure 13. Horizontal crack in one of the marble panels (Photograph: M. Naudé 2020)

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