ARCHITECTURAL CONSERVATION
RED MONASTERY FALL 2016

THE TOWER

AMERICAN RESEARCH CENTER IN EGYPT

TECHNICAL REPORT

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FOREWORD

The fall season of the architectural conservation project at the Red Monastery commenced on 24 September 2016 and was completed on 10 November 2016. The project was directed by Dr. Nicholas Warner and implemented by Mahmud al-Taiyyib. Inspector Sayyid Mohamed Mahmud ‘Ali and Inspector Wafa’a Sidqi Tawfiq Mahran [conservation] from the Sohag Taftish of the Ministry of Antiquities supervised the work, with Inspector Ahmed Mitwalli assisting. Mr. ‘Ali Zaghloul [Chief Inspector], Mr. Saad Osman [Director of Islamic and Coptic Antiquities, Sohag Inspectorate], Mr. Essam Rushdi [Director of Conservation, Islamic and Coptic Antiquities, Sohag Inspectorate] and Mr. Nur ed-Din Mustafa Ahmed [Director, Foreign Missions in Sohag] provided monitoring. The work was carried out in accordance with the Permanent Committee approval of January 2016. The following report concerns the interventions that took place with respect to the Tower, that was substantially the only area worked on during the Fall campaign. The history and architecture of the Tower was described in the report on the Spring 2016 Campaign and is therefore not repeated here.

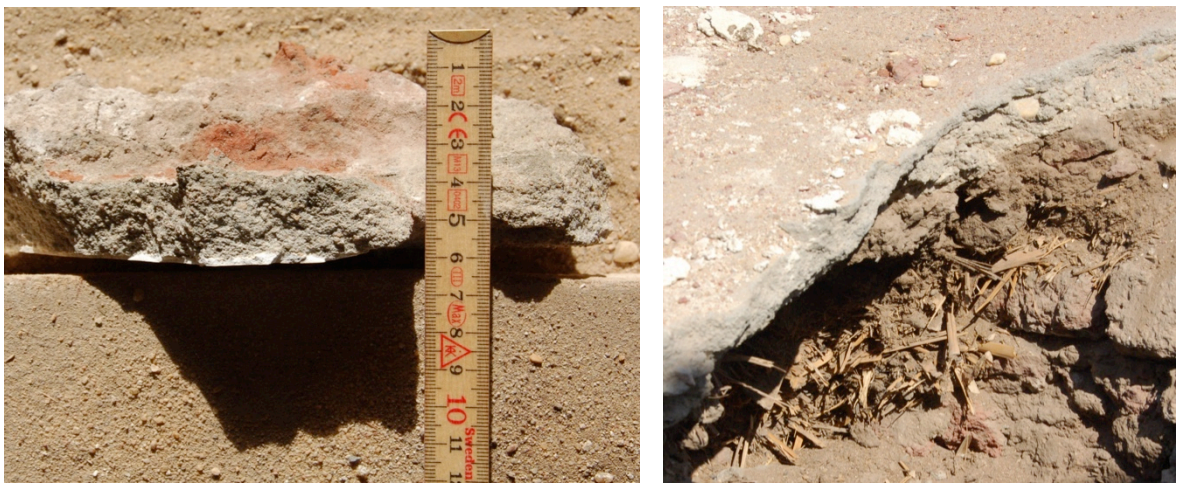
CONTENTS

1 INTERVENTIONS

1.1 Removal of accretions

The process of removing concrete slabs (ground and first floor), ceramic tiles and mud sub-floors (first floor), and the remaining organic fill (roof) was completed in this campaign. On the ground floor, the first flight of the modern limestone staircase was removed and the fill underneath partly removed in order to allow this area of the building to dry out properly (see below for more details).

One of the most significant problems relating to the conservation of the tower is that almost all internal wall surfaces were plastered during the 1980s with an exceptionally dense cement render that was subsequently covered with a layer of gypsum and emulsion paint. This inappropriate intervention led to build-ups of between 5 and 10 cm on wall faces – almost the thickness of an entire brick. The removal of this cement render results in significant damage to the original fired brick substrate and so this activity was confined to areas which had been badly affected by damp or by structural displacement.



Section of typical 5cm thick cement render from the interior of the tower (left) and cement renders over organic fill on roof (right)

1.2 Archaeological features

Objects discovered during works
In the course of unblocking the high level windows in the rooms on the south side of the ground floor of the tower, two carved limestone blocks were recovered that were originally part of the masonry of the church. The first of these was a small column capital (20 cm in diameter at its base), and the other was the central part of a stone conch hood for a niche. In the fill of the floor of one of the rooms on the first floor, a complete vessel for liquids (a type of *qulla*) was also found. This probably dates to the nineteenth century, as does a metal knife found on the roof and a number of other finds including a single leaf of a manuscript written in *naskh* script.

Limestone capital from side (left) and top (right)

Limestone conch from a niche (left) and complete pottery vessel (right)

Metal knife found on the roof of the tower (in storage at Inspectorate)

Other ceramic finds from the roof of the tower (in storage at Inspectorate)

Recto and verso of a manuscript leaf written in *naskh* from the roof of the tower (in storage at Inspectorate)

In addition to the objects found inside the tower, at the request of the local inspectorate a large 75 cm diameter x 1.2 m high ceramic storage vessel was transferred to the tower from the SCA guardhouse at the monastery. This container was found in the SCA excavations on the site in 2009. It is missing its base, and a lime mortar fill (possibly ancient) was used to consolidate the base to a depth of 30 cm. This object was put on display in the undercroft of the staircase in the tower.

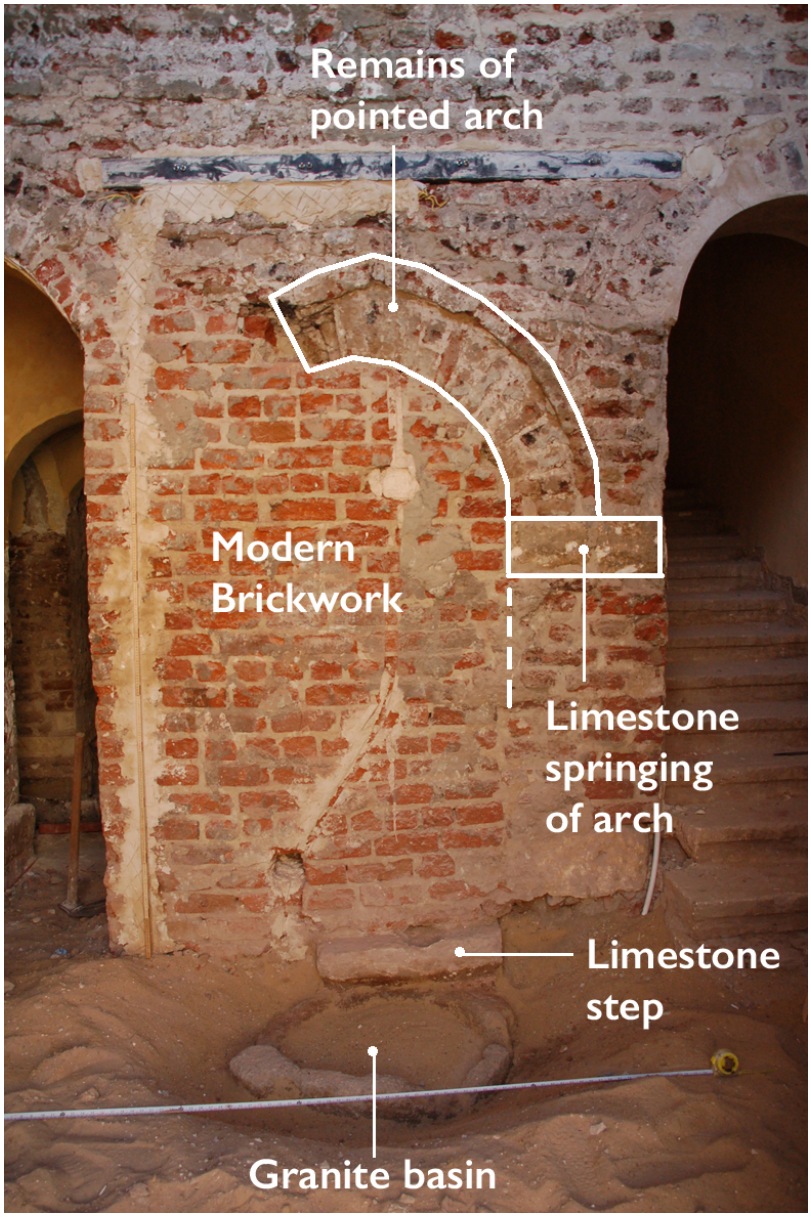
Ceramic storage bin from SCA excavations transferred to tower for display

Although no archaeological material was discovered during work around the main entrance to the tower, the presence of an inscribed hieroglyphic block on the south jamb of the door should be noted. Cleaning of this block revealed the full extent of the surviving inscription.

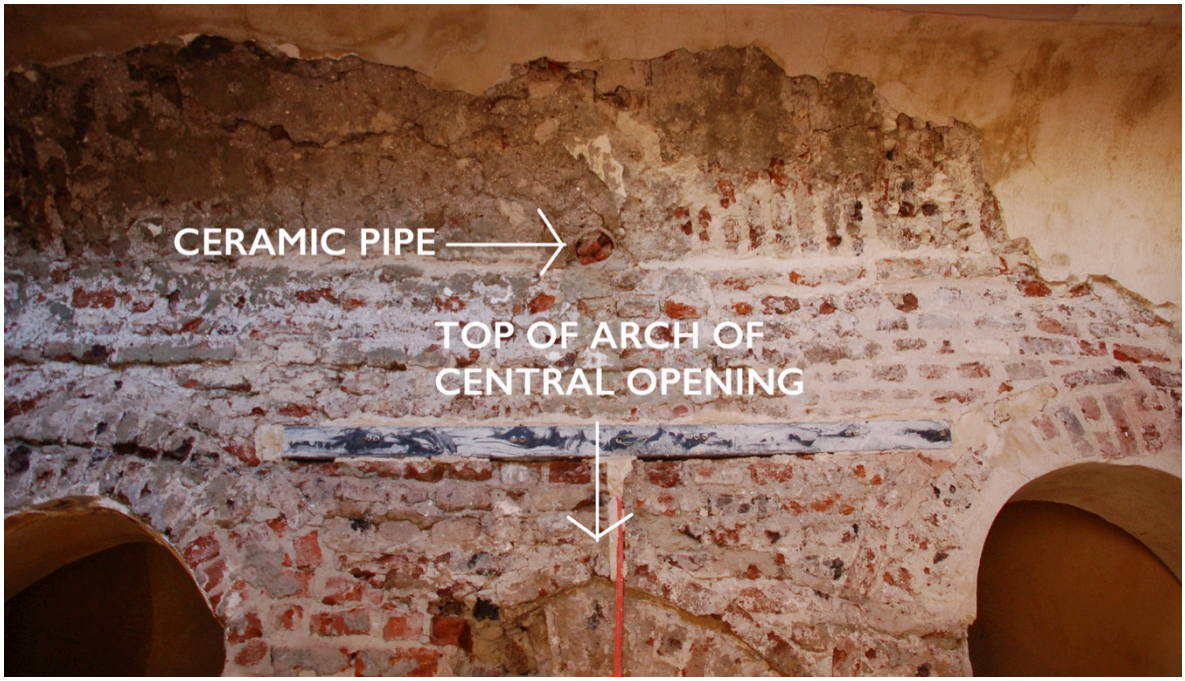
Inscribed block from south jamb of main entrance door to tower after cleaning

The hydraulic system of the tower

After removing cement render in the entrance area of the tower, the original opening for access to the well at ground floor level was discovered. This had a pointed arch, half of which had survived the rebuilding of the masonry of the well when it was converted into a toilet in the 1980s. By measurement, the width of the opening size was ascertained to be 88 cm. Remains of a white plaster survived on the underside of the arch. As noted in the report of the last campaign, a circular granite basin was uncovered in front of this opening set into the floor of the entrance area of the tower, with a limestone step up into the arched opening (see below for treatment). It is likely that this opening was not a door, but a deep window giving direct access to the well from the entrance area. An enigmatic circular ceramic pipe (20 cm in diameter) was also found embedded vertically on the central axis of the well within the remaining section of the elliptical vault over the entrance area.



View showing the relationship between the granite basin, limestone step and remains of arch above blocked opening into well



View of location of embedded ceramic pipe in elliptical arch over entrance area

Following the removal of the modern stair treads of the first flight of the staircase, other discoveries related to the hydraulic system within the tower were made under the stairs. These are partly related to the water channel cut in a limestone column drum that was discovered last season that passed through the west wall to the exterior of the building.

Limestone drainage channel in west face of tower

This channel was found to connect internally to an incomplete but distinct line of interlocking ceramic pipes that passed under the staircase, set in lime mortar within a fired brick matrix using the typical mortar (containing a high percentage of fly ash and large lime chips) of the original construction of the tower. The fall of this line of pipes was clearly seen to be from the exterior to the interior (a 10 cm fall across the 1.1 m width of the staircase). From this it can be inferred that there must have been a tank outside the west wall of the tower that fed water to the interior of the building. The route of the pipes appears not to have been directed into the well, however, but possibly ran to the granite basin inside the entrance area. A secondary line of pipes was observed connecting to the first line, with a fall feeding into it from the south. One detached but complete example of the interlocking ceramic pipes was recovered from the fill of the staircase. This is now in storage at the SCA inspectorate at the White Monastery.

View of location of interlocking lines of ceramic pipes under the tower staircase looking south

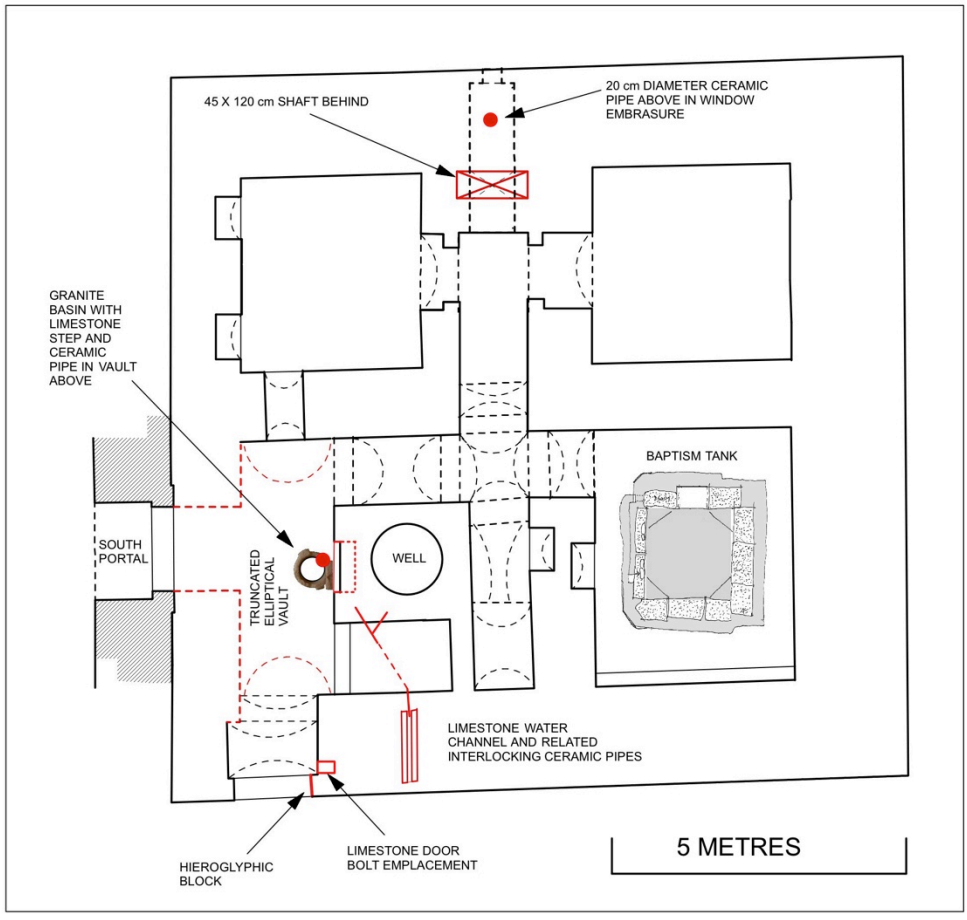
Intersection of primary and secondary feeds on east side of staircase

Interlocking section of ceramic pipe used in the hydraulic system of the tower (in storage at Inspectorate)

Brick shaft

At the east end of the east-west passage on the ground floor of the tower, a brick shaft (45 x 120 cm x circa 4 m in depth) was discovered within the embrasure of the high level window. Three limestone blocks originally covered the shaft, the central one of which is today missing. In the top of the arched window reveal, another 20 cm diameter ceramic pipe was noted, embedded vertically in the wall in a similar manner to that seen in the elliptical arch covering the entrance area. The purpose of this shaft is unknown, but its interior was clean. It may have been for the storage of wheat, transferred via the window with a small opening at ground level for extraction (not visible today).

View of the location of the brick shaft in the high-level window embrasure at the east end of the east-west ground floor corridor (note limestone slab covering).



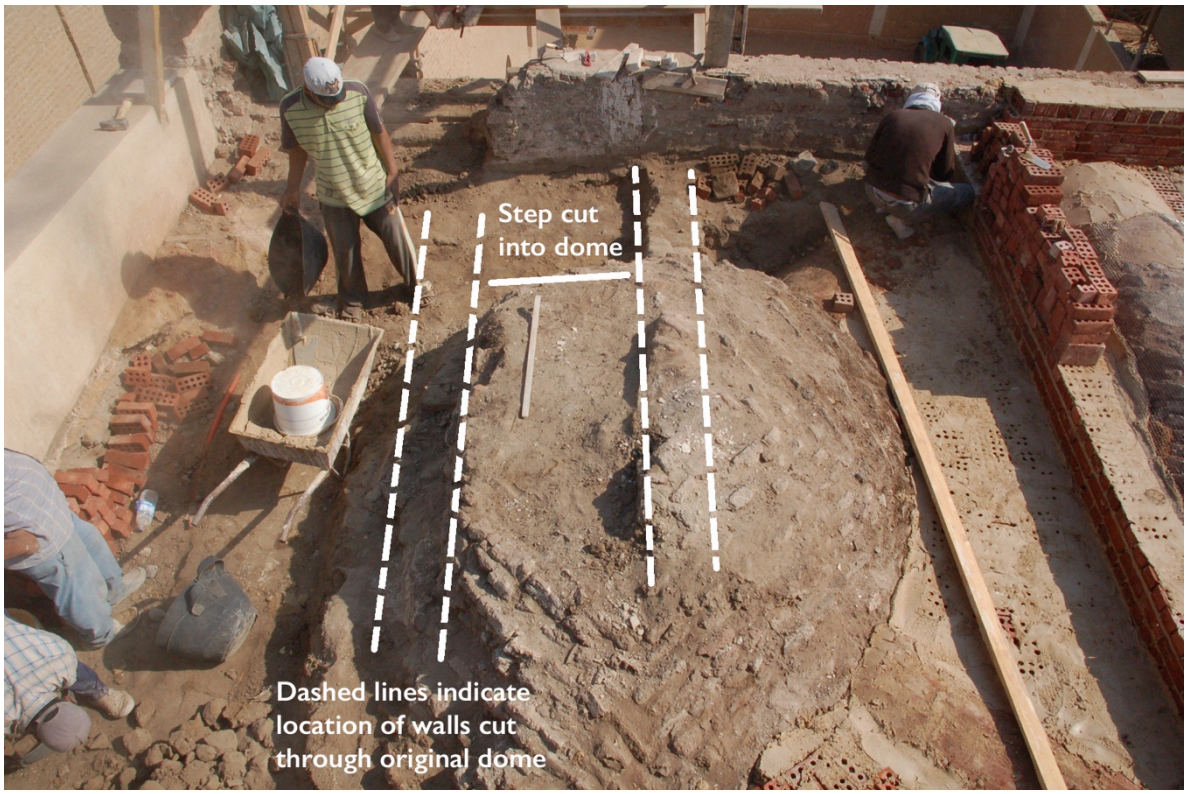
Ground floor plan of tower showing location of archaeological features

Roof domes and vaults

Following clearance, the two domes with 'sailor' vaults, located to either side of an inclined elliptical vault, were fully revealed. All were built from a mixture of fired bricks and mud bricks laid with a silt mortar that had been badly attacked by termites. The domes and vault were all in a fragile condition. It was also noted that some sections of wall supporting the south side of the northern dome were also built with mud brick, possibly indicative of earlier repairs carried out when the building was converted to domestic use. The dome to the north is slightly smaller than that to the south, and was severely damaged by later structures that cut into its structure. The elliptical vault was laid with an inclination towards the west, and had rounded ends. The character of the brickwork would suggest that these structures were all part of a single build on the roof, possibly in the late 17th century or early 18th century (by correlation with the now demolished dome over the *khurus* of the main church which has a *terminus ante quem* of 1737, the date of the visit by Richard Pococke to the Monastery).

View of domes and barrel vault from northeast after clearance

View of domes and barrel vault from above after clearance



Diagnostic view of north dome showing secondary damage

At the eastern end of the corridor at first floor level one limestone block, carved with a Maltese cross was set into the wall at high level and was partially covered by the apex of the elliptical barrel vault over this space. The piece is clearly in a secondary context, but it closely resembles other examples that were used in the decoration of the trilobe portal within the nave. The block has been damaged by an attempt to make the form of the cross more legible by scratching.

Carved limestone block in first floor corridor (left) and parallel from the trilobe portal in the nave

1.3 External works [see Appendix for detailed drawings]

The entrance door

The modern main entrance door to the tower was replaced with a new double leaf treated pitch pine (‘azizi’) timber door with heat-treated ‘baladi’ steel banding applied with hand made nails. The lintel of the door was also replaced with a new treated pitch pine lintel, set in a higher position relative to the pointed arch in front of the door so that the lintel is not visible from the exterior of the building. The door leaves are set on stainless steel pivots. At the same time, the concrete threshold to the door was removed and a new threshold made of hand-textured Aswan granite was installed in such a way as to support the granite jambs of the door. The jambs, including both granite and limestone blocks were cleaned. The hieroglyphic block on the south jamb was also cleaned using ammonium carbonate poultices in a dilute solution.

Installation of new granite threshold (top); new pitch pine doors after installation (bottom)

Conservator Hani al-Taiyyib pointing the block with hieroglyphic inscription in the entrance door to the tower after cleaning with dilute ammonium carbonate poultices

The water channel

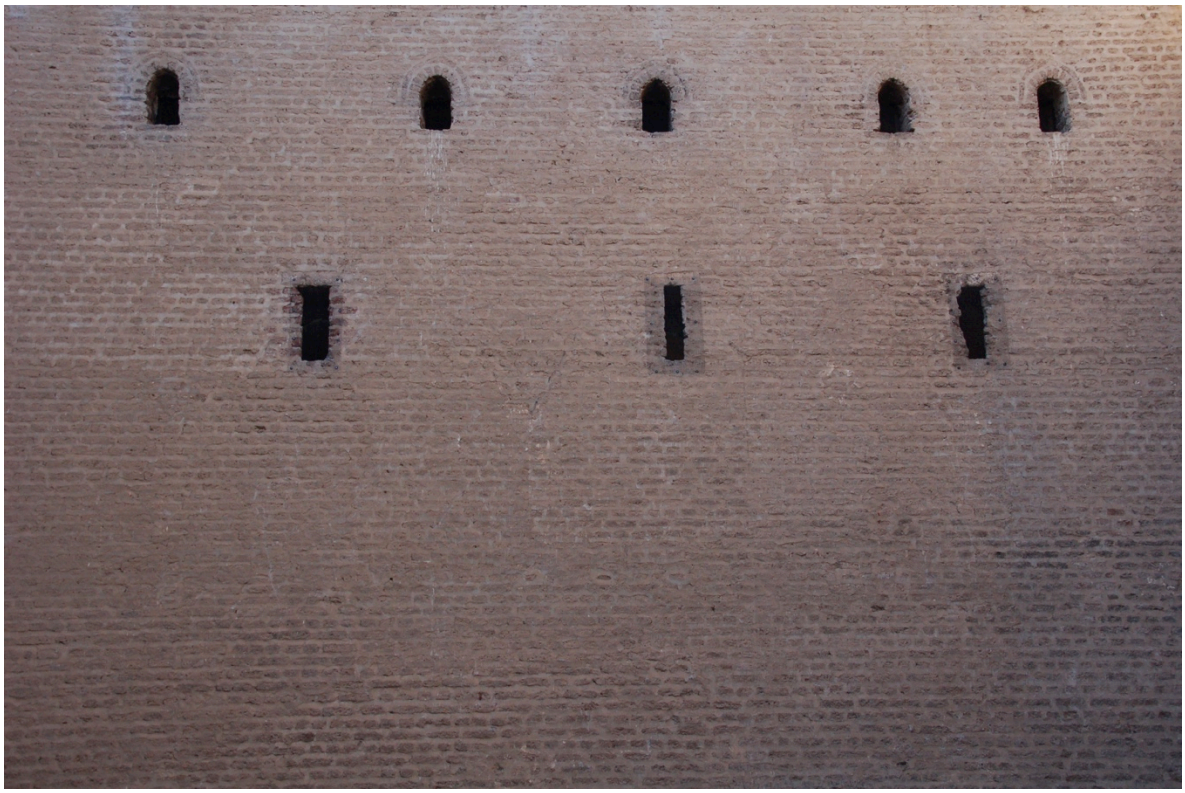
A new limestone drainage channel was installed to the right of the door indicating the line of the original limestone drainage channel set within the west wall. The new channel was inserted in such a way as to allow for natural ventilation to aerate the undercroft of the stair from the exterior.

New limestone drainage spout on line of existing water channel embedded in the west wall of the tower

Window openings

All window openings in the exterior walls of the tower below first floor level were covered with galvanised steel mesh (1cm x 1cm), sprayed black and attached with galvanised nails and washers, to prevent bird access to the interior. The first floor windows were supplied with opening glazed windows on their inner faces (see below). The windows of the upper stair enclosure were fitted with laser cut painted steel frames and bird mesh.

Typical treatment of external window with bird mesh



Fenestration of the east wall of the tower after intervention

1.4 Ground floor internal works [see Appendix for detailed drawings]

Floor treatment
The floor of the ground floor of the tower and entrance area was paved with new hand-finished 15 cm thick limestone slabs (60 x 44 cm) set on a sand bed with grouted joints. Prior to installation the ground was treated with a compound chemical solution of 'Fibronil' and oil of citronella in order to discourage further termite activity in this area.

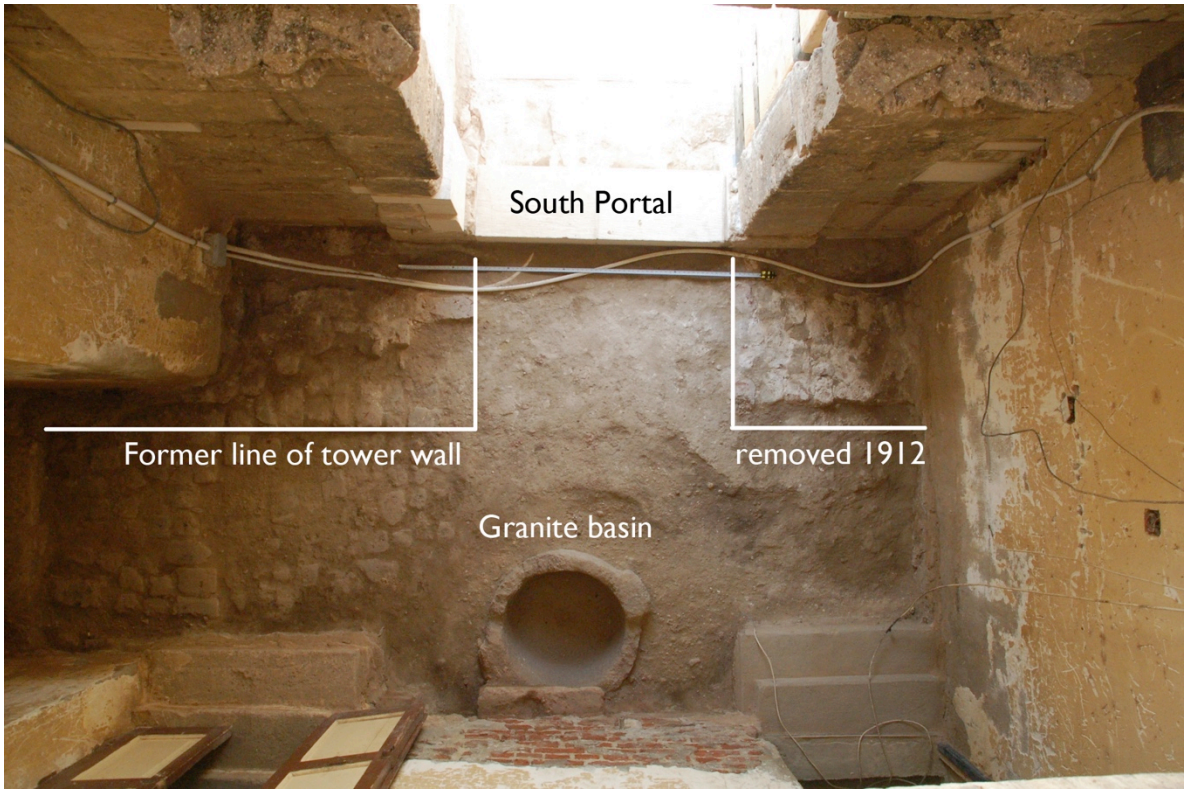
In the room containing the baptismal tank, an open grille steel deck on a 10cm deep supporting chassis with a handrail and access gate was installed on the east side of the room to allow visitors to view the tank. One new replacement limestone block was fitted in the border of the tank, supporting a steel bracket of the viewing deck. The tank was cleaned of all cement accretions and the surrounding limestone blocks repointed with a lime mortar. The gap between the tank and the surrounding walls was then filled with a thin layer of gravel to allow this area to 'breathe' in order to ease the continuing humidity problem in the ground.

Steel viewing deck in tank room

Treatment of baptismal tank

In the entrance area of the tower, the granite basin discovered in April 2016 was framed by 15 cm thick hand-finished limestone slabs and covered with an opening trap door made with stainless steel sections and pitch pine planks. To indicate the former location of the east wall of the tower that was removed by the Comité in 1912, the position of this wall was shown in the paving pattern by areas of basalt blocks.

Detail of trapdoor over basin in entrance area

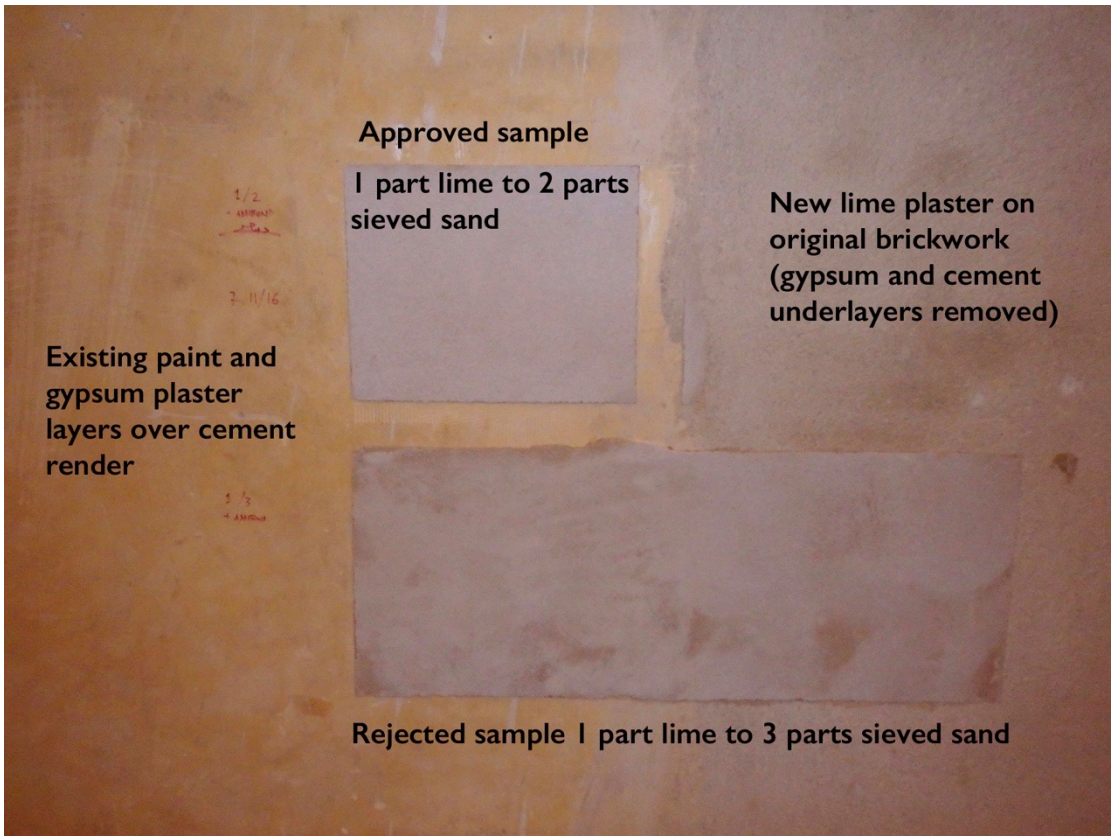


Condition of entrance area seen from above before treatment

Condition of entrance area seen from above after treatment with trapdoor over granite basin

Wall treatment
Areas of defective cement and gypsum plaster were removed back to brickwork where required, and a new render consisting of lime and sand was applied. Upper sections of walls and vaults, where emulsion paint had been applied over gypsum, were sanded down and repainted using a mixture of lime and 'Primal' consolidant. In the entrance area, the line of new lime plaster corresponds to the bottom of the handrail of the balcony. This was left unpainted to allow for drying, but a lime wash may be applied in future to the underside of the elliptical vault if desired to improve the indirect lighting of the south portal.

As far as future plaster finishes to the northeast room on the ground floor, the staircase, and the first floor rooms, both Mr. Saad Osman and Mr. Essam Rushdi are insistent that all interiors in the tower should be a single color, achieved through an integral lime plaster finish. A sample treatment, in the northeast room on the ground floor, was agreed upon with Mr. Essam. This involves the preliminary roughening of the yellow paint and gypsum plaster wall surface with a scraper, the painting of the surface with dilute 'Addibond 65' sealer, and then the application of a new render composed of 1 part of lime, 2 parts of finely sieved sand, and a small percentage of 'Addibond 65'. The sample has good adherence properties to both the existing gypsum plastered and painted surfaces and areas of new lime plaster.



Plaster samples in northeast room, ground floor

General views of entrance area after treatment

The pointed arch of the opening into the well inside the entrance area was restored with re-used old bricks springing from a new limestone impost block. The existing modern brickwork beneath the arch was only cut back in the area immediately below the arch to a depth of 25 cm to avoid further structural problems in this area while still expressing the form of the original opening. The brickwork of the arch itself (both original and restored) was left exposed.

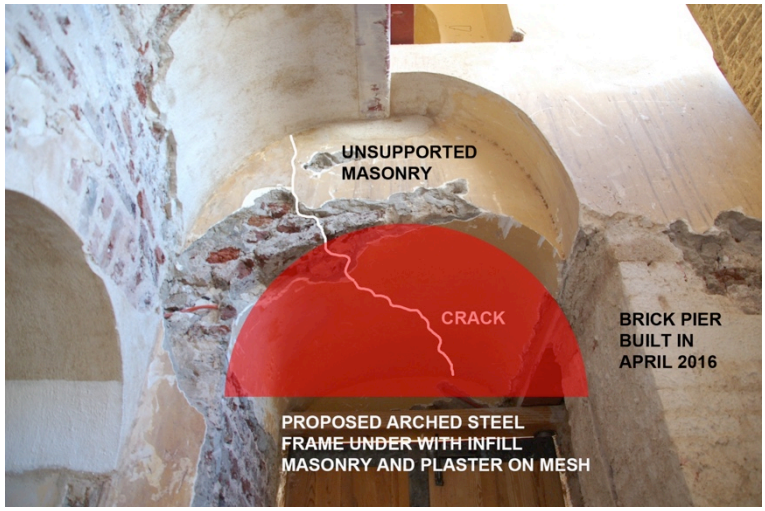
Arch over blocked opening to well during reconstruction of missing section

Arch over blocked opening to well after reconstruction of missing section

The arch over the entrance to the staircase, which had been restored incorrectly as a semicircular arch last season was rebuilt with a pointed arch following surviving traces of the original arch, and matching the style and size of the other door to the interior of the tower.

Arch over first flight of staircase before (left) and after (right) rebuilding

Upon investigation, the vault immediately inside the main entrance to the tower was found to be defective owing to the fact that its supporting arched brickwork had been removed at some point in the past, leading to structural cracking. To rectify the situation, a purpose made curved steel supporting arch made from two channel sections (10cm x 8cm) was installed under the vault to provide additional stability.



Diagnostic view of defective arch in entrance area and proposed treatment

Supporting steel frames during installation

Electrical supply to new lighting and power fixtures was provided in subsurface conduit with 35mm thermoplastic cables from a new main distribution board on the east wall of the well (marked on plan), with provision to a secondary distribution board on the first floor via a galvanised steel conduit mounted inside the well.

Doors and windows

All doors were made from treated pitch pine following a traditional design with top and bottom pivots using stainless steel fittings. A pair of wooden grille doors was installed below the arch of the first flight of the staircase to prevent unauthorized access to the upper levels of the tower. A total of three other braced and ledged doors were provided on the ground floor. The door openings leading to the eastern rooms of the tower were also fitted with painted steel box section lintels, replacing timber lintels destroyed by termites. A painted steel opening frame with bird mesh was installed in an internal opening to the well in order to provide access for periodic cleaning as well as natural ventilation to the interior. Another frame with bird mesh was fitted to an arched window below balcony level.

Wooden grille gates on staircase (left), door to inner rooms (center) and back of entrance doors (right)

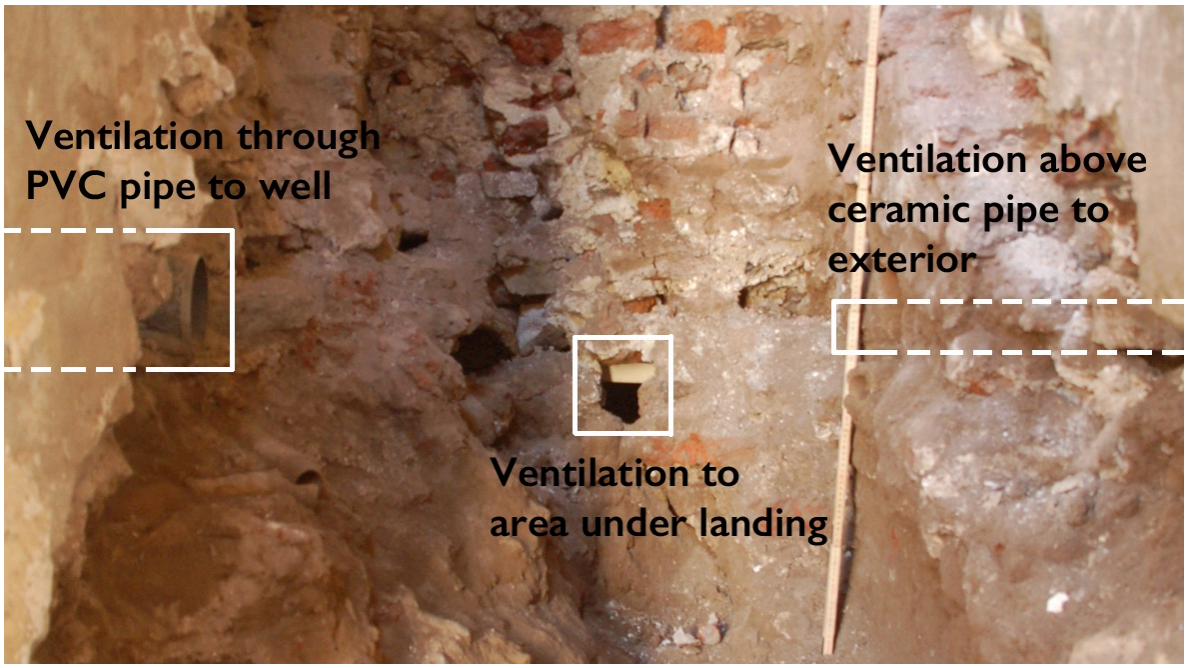
Display of archaeological material
An internally lit display case (90 cm high x 60 cm wide) made from painted steel angles, and containing archaeological finds from the tower, was installed in the passage leading to the two eastern rooms of the tower. The large ceramic storage bin from the SCA excavations on the site was displayed opposite this in the undercroft of the staircase.

View of new display case (left) and ceramic storage vessel on display under staircase (right)

1.5 Staircase works

Repair of area under first flight of staircase
To help the ventilation of the staircase undercroft, a 15 cm diameter PVC pipe was introduced between this area and the well. Additional ventilation was provided by a small opening between the void under the stair and the arched space under the landing. Finally, ventilation to the exterior west face of the tower was provided above the limestone water channel that passed through this wall (see above). The staircase was then rebuilt with new limestone treads spanning the void beneath and supported on new brick stub walls. The reinforced concrete slab on first landing of the staircase was removed and replaced with 4 cm thick limestone tiles.

First flight of staircase before (left), during (center) and after (right) reconstruction



Detail of ventilation provided to staircase undercroft

Replacements of limestone stair treads installed in the 1990s were made as follows: first flight: entire flight; fourth flight: one new tread at bottom; sixth flight and above: all new treads. Tubular steel handrails, fixed to the left side of the staircase were provided to its full height as well as lighting.

Mezzanine level (balcony)
The balcony overlooking the entrance area to the tower was created in 1912 when the original elliptical east-west vault over this space was cut in half. The remaining half vault was inadequately supported, and structural protection was provided to the edge of the balcony last season by capping the remaining masonry of the vault horizontally with a steel channel 30 cm deep supported by steel plates inserted into the walls at either end of the

vault. During the autumn campaign, the balcony was levelled with a secondary steel chassis that provided support not only for a new steel balustrade along the edge of the balcony but also a new stone pavement above the balcony. The stones (90 cm x 45 cm x 10 cm on average) were set within a subsidiary frame made of steel 'T' sections that prevented direct loading being imposed on the already weakened vault below.

The mezzanine balcony during (left) and after (right) works

Windows and doors

Windows into the east end of the balcony and into the well were protected by an anti-bird mesh, set in steel frames. A new lightweight steel door frame with mesh was placed on the landing above the balcony to prevent the access of birds to the upper level of the tower.

General view of balcony looking up (left); typical steel frame window with bird mesh deterrent (center) and steel gate on staircase with bird mesh (right)

Cracks
Cracks in the vaulting and arches of the staircase were cleaned out, packed with limestone chips set in lime mortar. Two sections of the south wall of the stair enclosure, which had previously been stitched in the 1980s with timber and re-stitched with limestone blocks in April 2016 were totally stripped back to brickwork and replastered with lime after cracks had been packed. The section on the upper wall showed traces of an arched opening that would have connected with a niche on the north side of the southwest room on the first floor. This had been blocked in the 1980s, possibly as a reaction to the extensive cracking in this part of the building that extends to the exterior of the west wall of the tower. These cracks should be monitored.

Timber and stone stitches in the south wall of the stair at lower (left) and upper (right) levels

1.6 First floor internal works

Doors and windows
The two door openings into the rooms at first floor level were returned to their original size and shape following traces discovered after the removal of the thick cement render that surrounded them. They had at some point been widened, incurring damage to their jambs and tops that originally took the form of pointed arches. Limestone thresholds were also fitted on these two doors. Treated pitch pine doors were installed here and at two other locations on the first floor, following a traditional design with top and bottom pivots.

Diagnostic view of entrances to first floor rooms from staircase after removal of cement render

The doors to the first floor after masonry consolidation following traces of the original arches

The doors to the first floor after finishing works

Eleven window openings were fitted with new treated pitch pine opening windows set within painted steel angle frames. The windows were fitted externally with a bird deterrent mesh and have been left without glazing while the building continues to dry out. The gypsum sills to the windows and niches of the rooms on the first floor were levelled with lime plaster to increase their durability.

Treatment of windows and niches on first floor

Walls and floors

Certain areas of cement and gypsum plaster on the walls were removed and the exposed brickwork re-plastered with a lime plaster. Owing to the strength of the cement render applied, however, it was not removed from all locations to avoid extreme damage to the underlying brick masonry. All the floors were re-tiled using a 4 cm thick x 30 cm square limestone floor tile. Electrical supply to new lighting and power fixtures was provided in subsurface conduit with 35mm thermoplastic cables from a new sub-distribution board on the east wall of the well beside the staircase.

Tiling in progress on first floor

General views of first floor corridor (left) and west room (right) after works

General view of staircase leading to viewing deck from first floor

1.7 Construction at roof level

The principles governing the treatment of the roof and staircase were as follows:

- To create a new enclosure to the staircase that would protect it from the elements and provide access to the different levels of the roof (viewing deck overlooking the nave, lower roof with vaults, upper terrace)
- To restrict access to the eastern half of the roof with its original vaulted structures
- To conserve the original vaulted structures in the most effective way without reconstruction
- To span the construction gap between the north wall of the tower and the south enclosure wall of the church which was filled with rubble and dust
- To use vaults and arches supported on the main masonry components of the tower transferring loads to the ground
- To incorporate the well shaft into the design as a 'wind tower' that would provide ventilation to the ground floor of the tower
- To express new construction in a distinctively modern way that still harmonised with the existing character of the tower while recalling the historical presence of structures that once occupied the area of the roof
- To provide adequate rainwater drainage to all areas of the roof
- To respect the original parapet line of the tower

Staircase and well enclosure
The bricks used for the staircase enclosure were 20 x 10 x 7 cm with holes to reduce the weight of the structure. Relieving arches and niches were used in a number of locations, also to reduce the imposed loadings, and the build up of the lower landing was made over a white foam block infill for the same reasons. One original limestone corner impost block, found in the tower, was re-used in the structure. A timber pulley emplacement, also found in the tower, was built into the well to indicate its original use.

Installation of white foam block on stair landing to reduce loading

Opening to the well with pulley block emplacement (left) and general view of upper landing with opening to well at right, and blocked access door to terrace in background (right)

An access door from the east side of the staircase to the lower level of the roof was provided for the duration of the construction work, but blocked upon its conclusion. Access to this side of the tower is via a steel gate installed at the east end of the viewing deck that is reached from the staircase.

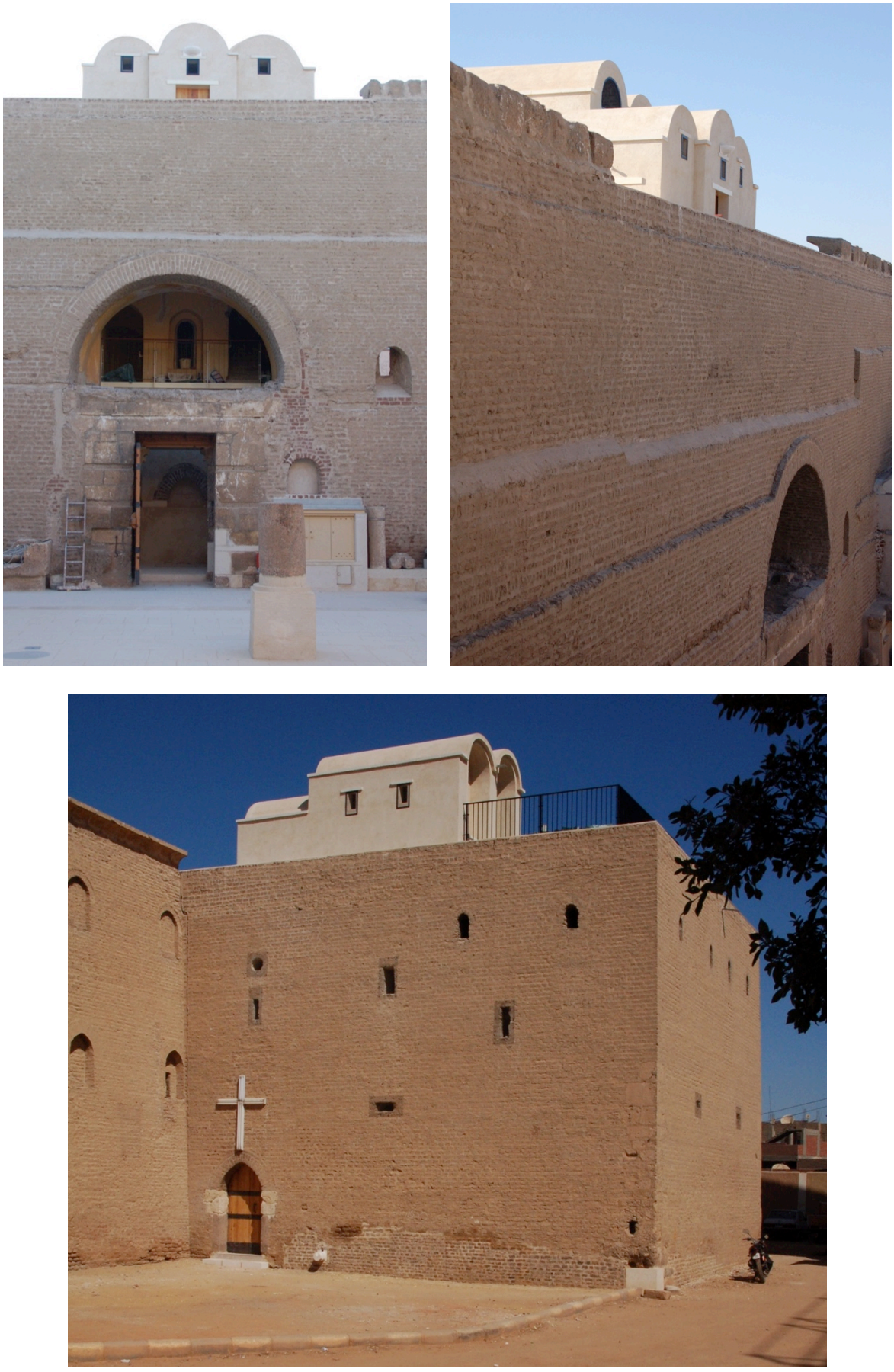
Approach to the viewing deck (left) and the steel grille viewing deck with gate to eastern side of roof (right)

Upper Terrace

Above the new brick vaults of the western room of the tower a terrace was created using 30 x 30 x 4 cm thick limestone tiles laid over a bituminous waterproof isolating membrane. The terrace was surrounded by a 1.1 m high painted steel handrail set over a 10 cm thick limestone border. Between the edge of the terrace and the external parapet of the tower, a continuous stone lined drainage channel directs water into a galvanised metal rainwater spout for external dispersal. The existing roof parapet was lined with a new brick skin to consolidate its irregular internal face and the top and sides of the parapet were then plastered with a lime render.

View of new roof terrace from the southeast

Stone lined drainage channel on west side of roof (left) and entrance to terrace from staircase (right)



Views of the new staircase structure from the north (top left), east (top right) and west (bottom)

Lower Terrace

The two domes and elliptical barrel vault on the lower terrace were seriously deteriorated, partly as a result of human activity and partly due to a high concentration of termites due to the use of a silt mortar and the presence of quantities of organic fill. The underside of the domes and vaults was covered with a very thick and dense cement render, cracked in places, which could not be removed without risking the collapse of the structures. The in situ conservation of these features was a serious challenge. A further key objective was to provide adequate falls across the roof to ensure the successful disposal of rainwater on the eastern side of the roof.

Brickwork and levels:

The corners of the domes were built up over new brick arches designed to take the stress off these important but weakened parts of the original structure. Then a series of brick courses were laid cantilevering in towards the domes' perimeter from the surrounding walls. This brickwork was constructed with a fall to external rainwater spouts on the east side of the terrace. Facing walls to the damaged interior edge of the parapet were built with new openings for four galvanised steel rainwater spouts projecting 40 cm from the outer face of the building. Three different levels were introduced onto the terrace to minimise the amount of new brickwork required to achieve the required falls across the width of the roof. The uppermost level included the south dome and elliptical vault, with a step down to a lower level around the south, east and west sides of the north dome. Two further steps down on the north side of the north dome bring the level down to a final floor finish equivalent to the viewing deck on the north side of the stair enclosure. The steps were emphasized with re-used limestone stair treads to indicate the best route to avoid treading on the domes and barrel vault.

Construction of relieving arch over corner pendentive of a dome

Structural steel reinforcement:

Steel reinforcement, in the form of 10 x 8 cm channels of 4.5 m length was installed in two locations. The first was along the north edge of the elliptical barrel vault to prevent further cracking in the wall below. There was a significant loss of original masonry in this area and the wall below was thinner (70 cm) than the corresponding wall under the southern springing of the vault (1 m).

View from northeast of elliptical vault showing location of new steel reinforcement during installation

The other location where reinforcement was introduced was along the north edge of the north dome where the original structure of the dome had been seriously compromised by the removal of a significant percentage of its masonry. It was considered that any further superimposition of masonry on this area would result in the collapse of the structure. Three channels (4.5 m x 10 cm x 8 cm) were positioned marginally above the edge of the dome spaced to provide a total width of 60 cm. 7cm thick limestone pavers were placed above these channels, and new masonry constructed above this to complete the missing profile of the dome.

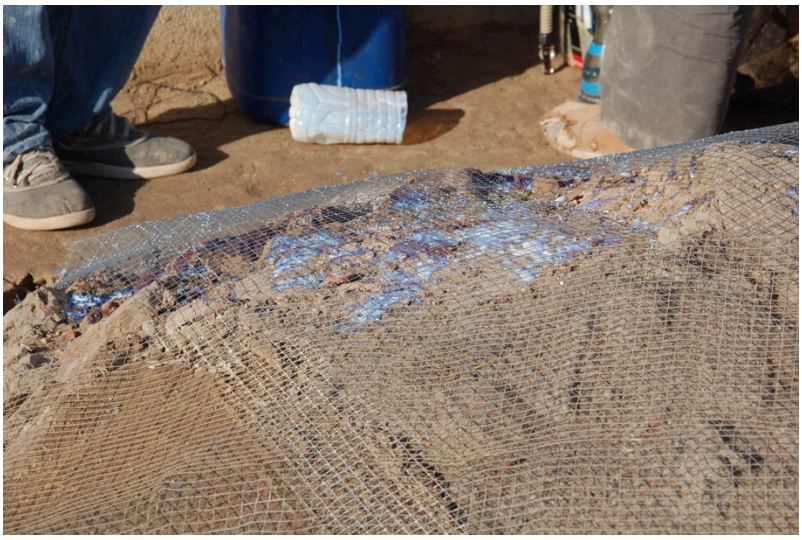
View from west of three new steel beams during installation on north side of north dome to take loading off weakened section of dome

View from west of cantilevered stone slabs and brickwork on north side of north dome

Vault surfaces:
The surfaces of the domes were first cleaned off and a treated with a dilute solution of 'Addibond 65' – a liquid Poly Vinyl Acetate [PVA] coating suitable for use as a general purpose building adhesive, tack coat for plastering / renders and for the priming of porous surfaces. Following this, the exposed upper surfaces of the vaults were covered with a 1 cm x 1 cm square galvanised steel mesh reinforcement. Then lime plaster was applied in two coats – a tack coat followed by a finishing coat.

Cleaning surfaces of the vaults

Covering the exposed areas with galvanised mesh



Application of dilute ‘Addibond’ consolidant

Plastering the domes and roof surface

View of completed intervention on lower area of roof showing vaults plastered to fall to new external rainwater spouts

View of completed intervention on roof from northeast showing lower vaults plastered to fall and new staircase structure to right

Views of the roof of the tower from the south before (top) and during (bottom) interventions

1.8 Presentation of limestone fragments

The existing modern wall on the north side of the lapidarium in the south hall of the church was built up to a height matching the horizon level of the stands for the limestone cornice blocks. Three newly discovered carved limestone fragments were then incorporated into the display supported on stainless steel mounting brackets. The wall was then plastered, and column fragments re-installed at a height where it would be more difficult for them to be damaged. Stone fragments on the south wall of the display were also secured in a more permanent manner using stainless steel fixings to prevent them becoming dislodged from their positions and falling.

New section of lapidarium under construction (left) and completed additions to lapidarium (right)

1.9 Provision of future toilet on the roof of the tower [to be omitted from MoA report submission]

Following the work carried out this campaign, it is now technically possible to construct a small toilet facility for Abuna Antonious on the roof of the tower. This would be approached from the viewing deck via the steel gate installed at its east end. The area to be occupied by the toilet has been given a treatment that will be sufficient to withstand the test of time if the toilet is not constructed. This treatment is the casting of a white cement slab reinforced with a 5 x 5 cm steel mesh over the 70 cm wide construction gap between the tower and the south wall of the church. An electrical conduit has also been provided in case the toilet is to be built. The construction of a waterproof toilet requires the following works (and it should be stressed that the Monastery will not be capable of carrying this project out on their own to the necessary level of care]:

- The removal of new 4 cm limestone paving laid to fall in this area and the sand fill below
- The casting of a new reinforced concrete beam 4 m long x 40 cm deep on the north wall of the tower with a 15 cm thick cantilevered slab extending to the south wall of the church over the new infill slab laid in November
- Waterproofing the slab and upstands with bitumen to create a waterproof 'tray' upon which the new construction can stand
- Supplying the toilet with water and a cast iron 4" diameter waste pipe to be mounted on the exterior of the east wall of the tower
- Building the toilet enclosure. This can either be constructed from brick, with a vault to match the architecture of the new stair enclosure, or as a steel frame structure with infill panels to allow for rapid assembly and disassembly.
- Providing a disposal point for waste. Upon consultation, it seems possible to run this waste pipe, with a series of inspection chambers parallel to the south wall of the church and into an existing septic tank for the old resthouse that is located close to the modern gate on the east side of the site. This work should, if possible, be combined with the construction of an anti-termite trench surrounding the resthouse

This work is predicated on Abuna Antonious discussing the proposal first with Mr. Saad. If tacit approval is received, the project should be carried out in a future season of architectural conservation at the site. Further planning and budgeting based on new drawings will be carried out upon instruction from the Project Director.

2 RECOMMENDATIONS

As the structure of the tower, as well as newly plastered areas, is still in the process of drying out, it was not possible to complete all the planned internal redecorations, and a further season is required to accomplish this task and the following additional works:

1 Repointing of the external stone quoins at the corners of the tower with lime mortar following removal of cement pointing.

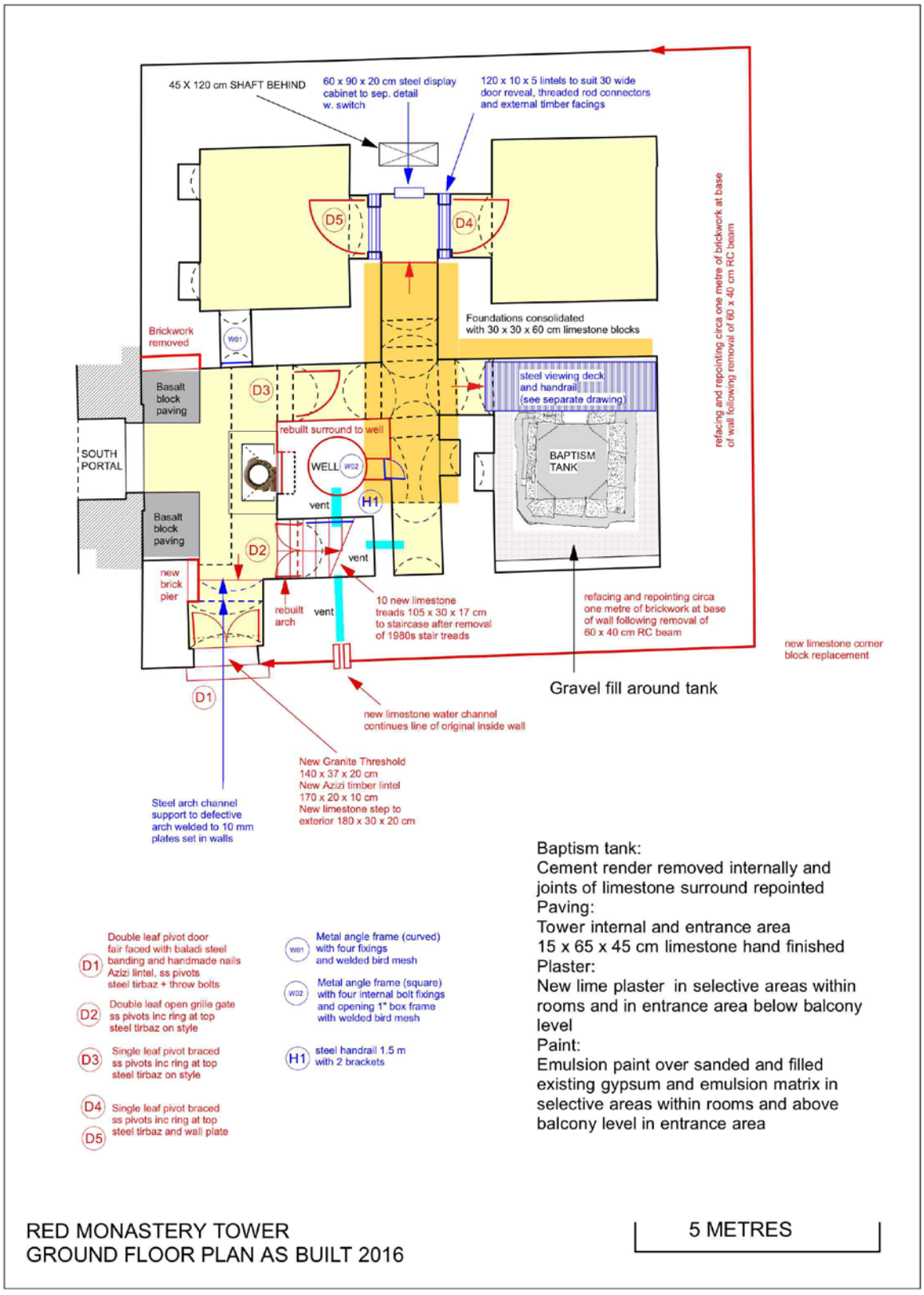
2 Removal of the remaining section of reinforced concrete beam at the base of the east wall of the tower.

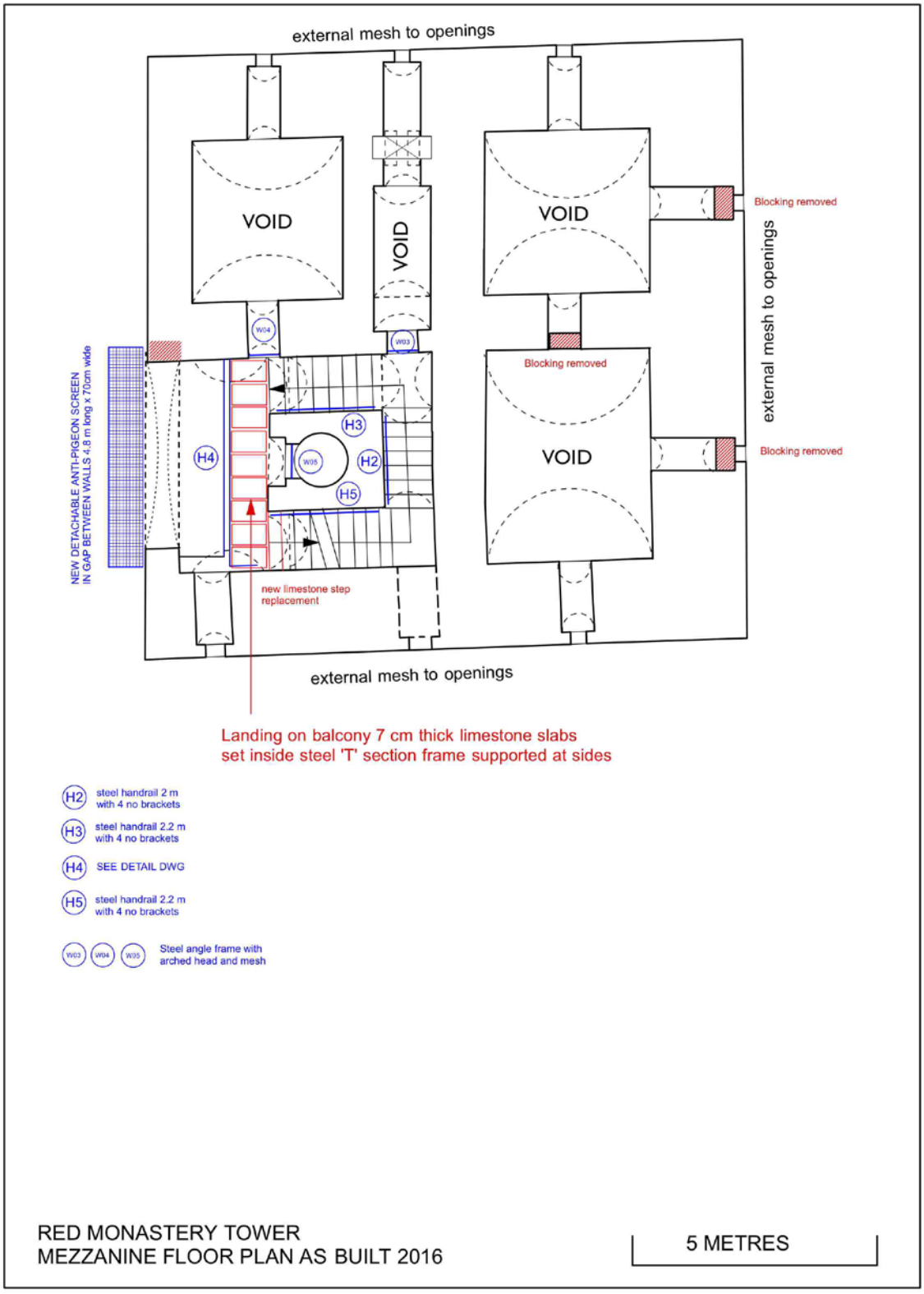
3 Additional repointing and repairs to the lower sections of the walls where water damage has occurred.

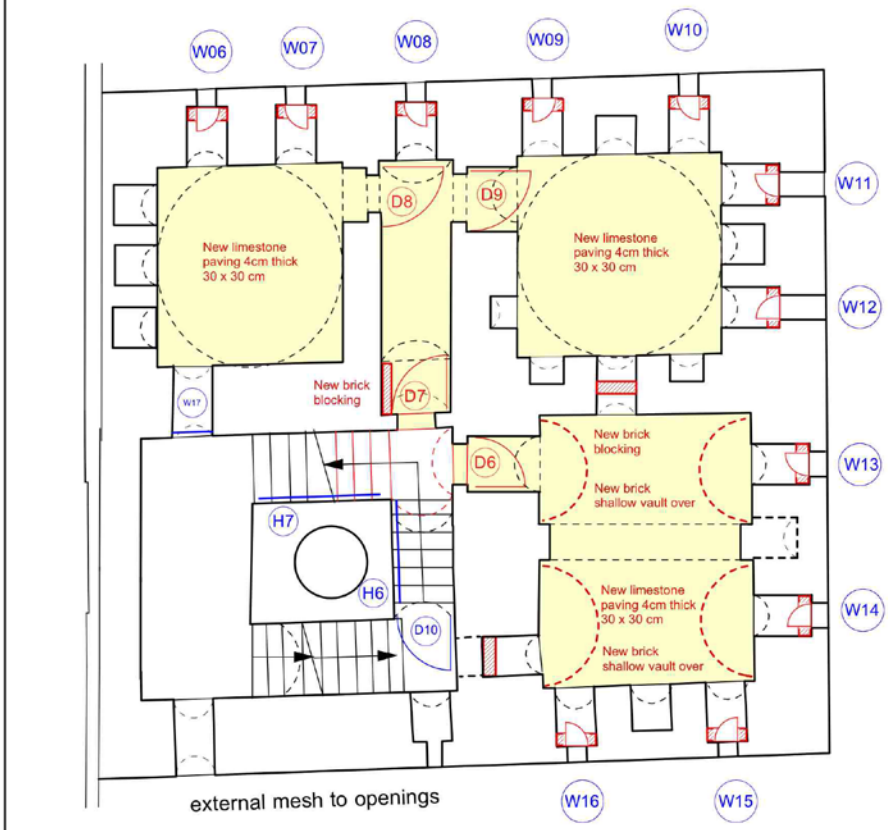
In addition, monitoring of the structure should take place to see if any other cracking occurs as a result of continuing settlement and stabilisation of the structure. Recommendations for further remedial treatment will follow upon the results of the monitoring. Monitoring should also include the level of bird infestation as it may be necessary to install an anti-bird mesh screen across the large open arch above the south portal to reduce further the area that is easily accessible to birds.

APPENDIX: AS BUILT DRAWINGS

These drawings show all interventions made during 2016




external mesh to openings
VOID
VOID
VOID
VOID
Blocking removed
Blocking removed
Blocking removed
external mesh to openings
W04
W03
H3
H4
W05
H2
H5
NEW DETACHABLE ANTI-PIGEON SCREEN
IN GAP BETWEEN WALLS 4.8 m long x 70cm wide
new limestone step
replacement
external mesh to openings
Landing on balcony 7 cm thick limestone slabs
set inside steel 'T' section frame supported at sides
H2 steel handrail 2 m with 4 no brackets
H3 steel handrail 2.2 m with 4 no brackets
H4 SEE DETAIL DWG
H5 steel handrail 2.2 m with 4 no brackets
W03 W04 W05 Steel angle frame with arched head and mesh
RED MONASTERY TOWER
MEZZANINE FLOOR PLAN AS BUILT 2016
5 METRES



H6 steel handrail 2 m with 4 no brackets

H7 steel handrail 2 m with 4 no brackets

W06 — W16 Steel angle frame with flat head and mesh with glazed inward opening azizi casemate and brass tirbaz

W17 Steel angle frame (curved) with four fixings and welded bird mesh

D6 Single leaf pivot solid ss pivots inc ring at top steel tirbaz and wall plate

D7 Single leaf pivot solid ss pivots inc ring at top steel tirbaz and wall plate

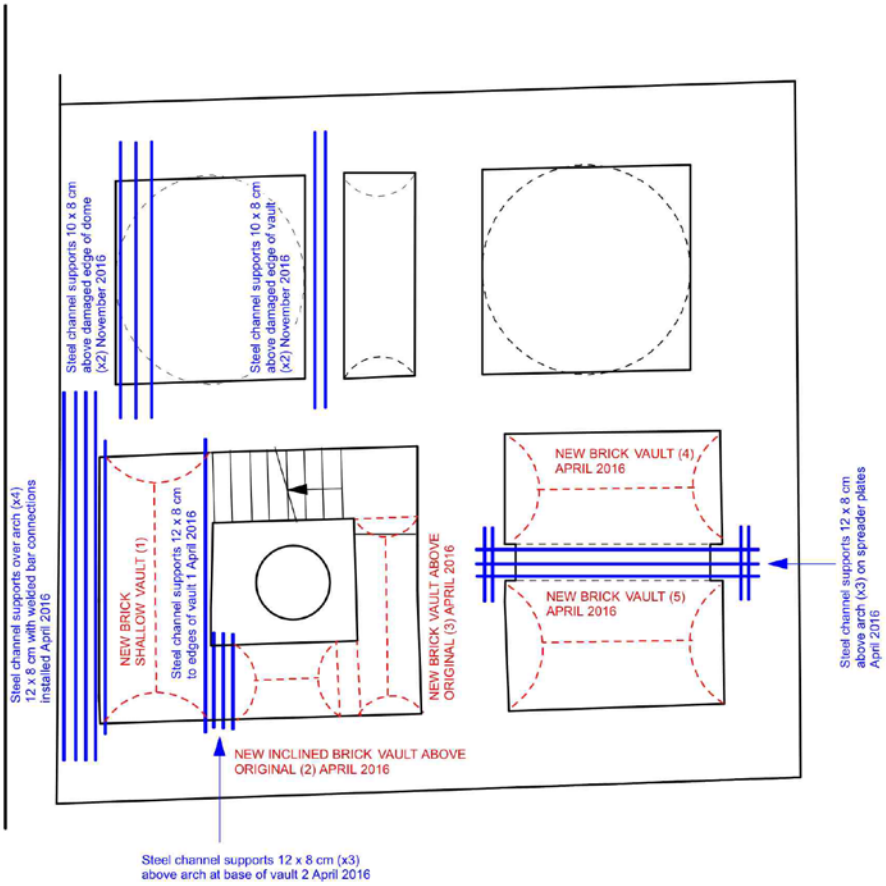
D8 Single leaf pivot solid ss pivots inc ring at top steel tirbaz and wall plate

D9 Single leaf pivot solid ss pivots inc ring at top steel tirbaz and wall plate

D10 Steel angle frame with overpanel and mesh

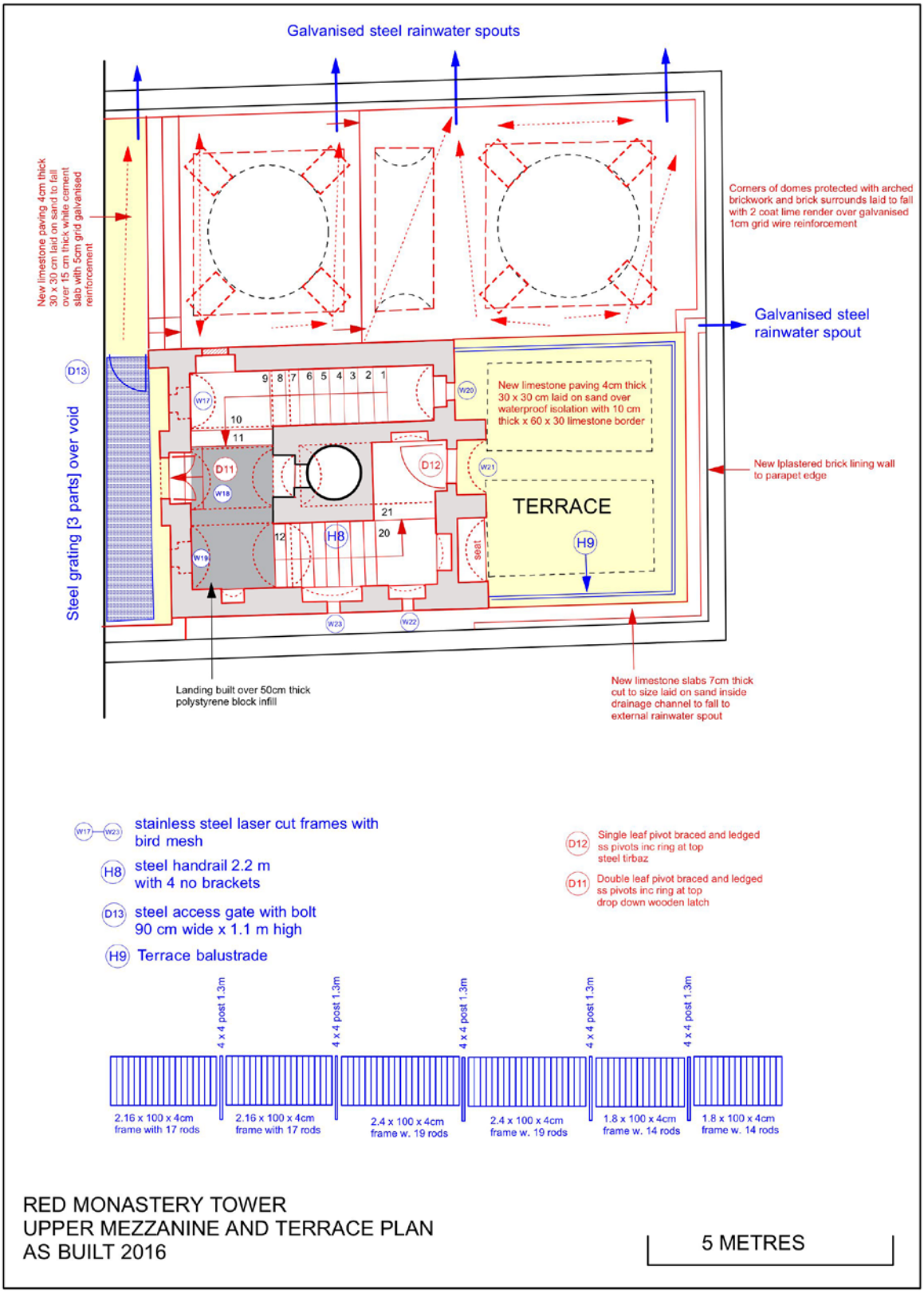
RED MONASTERY TOWER
FIRST FLOOR PLAN AS BUILT 2016

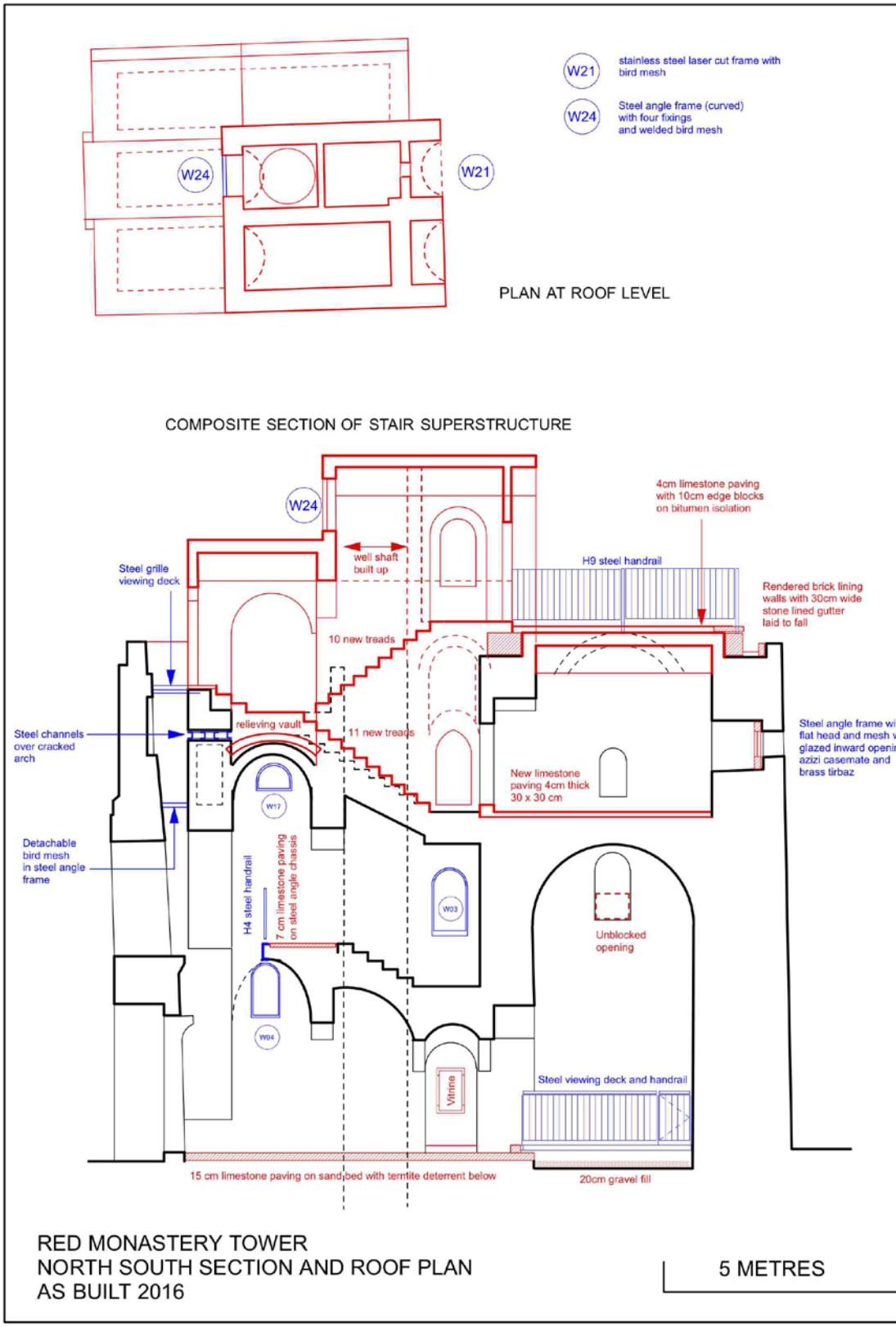
5 METRES



RED MONASTERY TOWER
STRUCTURAL INTERVENTIONS AT ROOF AND UPPER LANDING LEVEL
AS BUILT 2016

5 METRES


Galvanised steel rainwater spouts
New limestone paving 4cm thick 30 x 30 cm laid on sand to fall over 15 cm thick white cement slab with 5cm grid galvanised reinforcement
Corners of domes protected with arched brickwork and brick surrounds laid to fall with 2 coat lime render over galvanised 1cm grid wire reinforcement
Galvanised steel rainwater spout
D13
Steel grating [3 parts] over void
W17
W20
New limestone paving 4cm thick 30 x 30 cm laid on sand over waterproof isolation with 10 cm thick x 60 x 30 limestone border
D11
W18
D12
W21
New lplastered brick lining wall to parapet edge
TERRACE
H8
H9
seat
W19
W23
W22
Landing built over 50cm thick polystyrene block infill
New limestone slabs 7cm thick cut to size laid on sand inside drainage channel to fall to external rainwater spout
W17—W23 stainless steel laser cut frames with bird mesh
H8 steel handrail 2.2 m with 4 no brackets
D13 steel access gate with bolt 90 cm wide x 1.1 m high
H9 Terrace balustrade
D12 Single leaf pivot braced and ledged ss pivots inc ring at top steel tirbaz
D11 Double leaf pivot braced and ledged ss pivots inc ring at top drop down wooden latch
4 x 4 post 1.3m
2.16 x 100 x 4cm frame with 17 rods
2.16 x 100 x 4cm frame with 17 rods
2.4 x 100 x 4cm frame w. 19 rods
2.4 x 100 x 4cm frame w. 19 rods
1.8 x 100 x 4cm frame w. 14 rods
1.8 x 100 x 4cm frame w. 14 rods
RED MONASTERY TOWER
UPPER MEZZANINE AND TERRACE PLAN
AS BUILT 2016
5 METRES


W21
stainless steel laser cut frame with bird mesh
W24
Steel angle frame (curved) with four fixings and welded bird mesh
W24
W21
PLAN AT ROOF LEVEL
COMPOSITE SECTION OF STAIR SUPERSTRUCTURE
W24
well shaft built up
4cm limestone paving with 10cm edge blocks on bitumen isolation
H9 steel handrail
Rendered brick lining walls with 30cm wide stone lined gutter laid to fall
Steel grille viewing deck
10 new treads
relieving vault
11 new treads
Steel channels over cracked arch
Steel angle frame with flat head and mesh with glazed inward opening azizi casemate and brass tirbaz
New limestone paving 4cm thick 30 x 30 cm
W17
Detachable bird mesh in steel angle frame
H4 steel handrail
7 cm limestone paving on steel angle chassis
W03
Unblocked opening
W04
Vitrine
Steel viewing deck and handrail
15 cm limestone paving on sand bed with termite deterrent below
20cm gravel fill
RED MONASTERY TOWER
NORTH SOUTH SECTION AND ROOF PLAN
AS BUILT 2016
5 METRES