

Martello Tower No.24 – Conservation Repairs 2019

Introduction

Martello Tower No.24 has always had significant problem with water ingress, ever since the opening of the building for visitors. Water paths formed across the vaulted ceiling causing the formation of stalagmites, mould and staining to walls; rotting internal woodwork and constant dripping. The 2019 project was instigated as a first phase in addressing these issues.

Previous Works

The tower has been the subject of many projects over the years, often involving attempts at addressing water ingress issues internally.

The Ministry of Works removed a layer of asphalt which covered the paved surfaces of the roof and renewed the external render in the 1960s. According to drawings there was also an intention at this time to insert a waterproof membrane underneath the paving, although subsequent opening up has shown that this was not completed in accordance with the original design and is unlikely to have been complete and effective.

In 2003, localised repointing was carried out, using mastics to tamp joints in conjunction with mortars, to address ongoing water ingress issues. This was unsuccessful and so a further package of works to address continuing water ingress was carried out in 2010. After several options were considered, due to complexity & budgetary constraints and in order to cause a the minimal loss of historic fabric, the first phase of a scheme was implemented that involved inserting a membrane over the lower gun step paving, which was seen as the most likely cause of ingress issues, before covering with an identical paving layout. It did not attempt to address any other potential areas of ingress and ultimately did not result in any discernible improvement internally, indicating that the source of water ingress was elsewhere. However the second phase, continuing the membrane under the gun site paving, was never carried out.

Project Brief

The project began with a feasibility study to explore and understand the water ingress the tower had been suffering from. This was intended to establish the areas of failure and the subsequent approach to rectify the issues. The initial brief stated that “a scheme for waterproofing will need to be designed”. The feasibility study outlined several options for work packages, ranging from a conservation based approach to a more invasive and robust approach.

After discussion with EH surveyors and curators it was decided to initially pursue a conservation based package addressing the fundamental issues alongside traditional repair works to establish whether they can bring the water ingress issues down to a manageable level and therefore avoid having to carry out a more intrusive scheme.

Investigations

A specialist drainage contractor was employed directly by EH to clean the internal drainage pipes and carry out a dye test, a camera survey and bung tests to identify any issues. The tests found that although the horizontal sections from the outlets to the internal, vertical pipe were in good order (having previously been lined) the gully pots and a section of the vertical pipe, at approximately the midway point, were leaking.

The drainage contractor proposed lining techniques which they eventually carried out as a subcontractor to the principal contractor of the main package of work.

Tests

A series of tests were arranged in order to further understanding of the water ingress issues. Ground Penetrating Radar and thermography readings were taken but provided inconclusive results which were difficult to draw any conclusions, or even clues, from. A series of water tests were carried out by the maintenance contractor. These tests isolated areas of potential failure on the roof and applied a concentrated amount of water whilst recording observations below. The four locations chosen were on the coping stones, the firing step, the gun pivot and the parapet brickwork.

Although the tests were unable to be conclusively scientific they did indicate that each area is letting water enter the structure to some degree, with the exception of the central gun pivot and the lower roof area which 2011 works have essentially tanked.

External Render

The report suggested that whilst the render is cracked and may be letting some water into the structure it is unlikely to be the cause of the observed ingress. It is however likely to be holding water within the structure following its penetration from above and so intensifying the problem internally.

Monitoring

In conjunction with English Heritage's conservation scientist a strategy was put in place for monitoring the amount of moisture in the walls. This started months before the work to establish a baseline before being started to ascertain whether the project was achieving tangible results. A series of locations were identified throughout the building, at staged heights, to be read by a moisture reader. The readings continue to be carried out and recorded by a member of the Friends of Martello²⁴. The readings will also be compared to weather data to establish whether there is a correlation. At the time of writing there has not been enough data collected to draw any conclusions.

Masonry Joints

A hot lime mix was specified for both historic integrity but also the long-term performance of this particularly vulnerable element of the building. This decision was made in collaboration with the EH team, in particular the Historic Building Surveyor. After reviewing a range of samples using different combinations of aggregates the final mix instructed for repointing in all areas was a 1:3 Aggregate; 'Borough Green Sand' Binder; Microlime. The repointing trials allowed an accurate extent of depointing to be estimated. The coping stone joints would be repointed 100% after removing the shrunk and cracked cement top layer and the sealant tamping below. The coping stone joints had been widened by 10-15mm at the top due to the use of grinders in a previously undocumented package of works. The bricks meanwhile contained large sections of cement which were sound and would damage the bricks if removal was attempted. A balance was therefore found, removing all loose pointing and as much as possible of the remainder. This resulted in a repoint of approximately 40%.

In order to maintain the integrity of the parapets once repointing was complete the scope also included brick replacements for those which had eroded, fractured or lost their face.

The scope of work also included timber window repairs and internal redecoration. Framed mesh window guards were designed to slot into the sash linings to allow the windows to be left slightly open for ventilation, whilst preventing wildlife entering. A new eyelet for the rope handrail was also introduced to eliminate the dangerous slack in the rope which had proved an H&S issue on the steep stairs.

The Works

The works consisted of the following tasks:

- Depointing and repointing of the coping stones, internal brick parapets, gun step and lower paving, including removal of previous phases of failed mastic pointing.
- Brick replacements to internal parapets.
- Redecoration of iron gun runners and rings.
- Significant timber repairs to first floor modern sash windows.
- Cleaning and redecoration of internal limewashed masonry walls on the ground floor, first floor and within the stairs.
- Internal redecoration of timber wall dividers.
- New rope handrail and eyelet at lower curved section of the stairs.
- Specialist drainage repairs to reline the gully pots and the upper section of the vertical internal pipe.

- Specialist repair and redecoration of timber flagpole.
- Render repairs to failed areas of lime render at gun step upstand.

The programme lasted 15 weeks, starting in September 2019.

Specialist Drainage Package

The 2010 works to replicate the lower paving over the existing paving had the effect of making the outlets deeper. Combined with the narrow diameter this made routine maintenance difficult. This was addressed by widening the outlets within the modern Purbeck stone gully blocks to the maximum they could be under the existing grilles to prevent changing the aesthetics, in line with SMC consent guidance. Drainage work also consisted of the relining of the gully pots and the upper section of the internal rain water pipe which were both shown to lose water during tests. The insertion of a new epoxy resin lining (GRP) on the vertical internal pipe did not go to plan as there were unseen bends which prevented the liner adhering to the pipe when it was inflated. The failed liner was removed and a modern rodding eye had to be opened up and replaced to enable the liner to be inserted from both ends.

Post Project Review

At completion there was still evidence of water ingress with water paths once again beginning to form along the brick vaulting. This was not a surprise as the building is known to be saturated and water will continue to inevitably find its way in, particularly as the cement render remains in place. The hot mixed mortar will also take a significant amount of time to harden, perhaps into the spring or early summer, until which time it will not be performing at its optimum. Monitoring should continue and in time may be able to quantify how successful this phase of works has been, and if the more invasive second phase of works are needed.

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