The British Museum

Repairs to West and East Residences External Stairs

Structural Method Statement

Prepared for

The British Museum

February 2023

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Structural Method Statement

1.0 1.0 Introduction

The Museum proposes to carry out some essential repair works to mitigate further deterioration and loss of building fabric to the external staircases surrounding the East and West Residence buildings. We have written this statement to record our structural engineering advice and recommendations for their repair to accompany the listed building application. This note should be read in conjunction with structural engineering drawings 1910/20/01 to 1910/20/10.

2.0 History

We obtained the original record drawings for the stairs as part of our desk study and research of the buildings. These show that the five entrance staircases (2, 4, 6, 8 & 9), shown on attached drawings 1910/20/03, 05, 08 & 10 are contemporary with the East and West Residences built in the 1840s, constructed in stone. Adjacent are four smaller stairs leading down in the lightwells surrounding the Residence buildings, as shown in drawing 1910/20/07. Three of these have been replaced with reinforced concrete (r.c.) staircases in the past, and one (stair 3) is the original 1840s stone stair. Please note, Stair 3 is covered in a separate note accompanying a separate application.

3.0 Structural Arrangement

The stairs 2, 4, 6, 8 & 9 provide access over the front lightwells to the raised ground floor level of the East and West Residences. They comprise stone treads around 3.1m long, supported on brick walls at their ends and are supported at third points by cranked cast iron stringer beams. The stringers in turn, are embedded in surrounding brick walls.

Stairs 1, 5 & 7 provide access down into the lightwells and are formed of reinforced concrete with a waist of around 95mm thick. The flights are supported on brick walls on their sides. The r.c. landings are supported on brick walls on three edges.

6.0 Observations

During our visits and structural surveys of the existing stairs, we have noted the following:

Stone staircases 2, 4, 6, 8 and 9

- A non-breathable cementitious topping has been applied to them at some point, most likely as an attempt to protect the stone.
- We noticed cementitious render repairs to the soffit within the lightwells too. Most of these are now ineffective, have fallen off, and some that remain are loose.
- The stone has weathered across the soffit where exposed, and some spalling to the stone has occurred to stairs 6 and 8 as seen on drawings 8 and 9.

- There is surface corrosion present on the cranked iron beams. Investigations show that the bearing ends of beams are in a reasonable condition considering their age and type, with only surface corrosion present.

Reinforced concrete stairs 1, 5 and 7

- We observed no visible defects to stairs 1 and 7, and we did not note any concrete spalling during our structural surveys.
- The landing to stair 5 is in poor condition, and there is significant spalling to the soffit of it.

Based on our observations, it is clear that there have been attempts to mitigate issues with the stone stairs in the past by adding cementitious render to the surfaces. We expect this has trapped moisture in the stonework and exacerbated the deterioration and spalling. The architect proposes removing this layer as part of the overall repair strategy to allow the stone to breathe. From a structural engineering point of view, there is some stone spalling in local areas to stairs 6 and 8 that needs to be addressed along with the surface corrosion to the iron beams in order to extend the useful life of these stairs for the future and mitigate further deterioration.

The spalling to the landing of stair 5 is a result of the carbonation of the concrete and water ingress in external conditions. This has caused the reinforcement within the slab to corrode. Corrosion causes the bars to expand, and large forces to build up, which results in spalling concrete. Some of the exposed reinforcement is heavily corroded, leaving little cross section remaining. If left, this will only worsen with time, and stairs 1 and 7 may follow a similar pattern.

Proposed Structural Repairs

Stone Stairs 2, 4, 6, 8 and 9

Our appraisal concludes that only minor structural repairs are needed for these stairs. We propose the following repairs to mitigate further deterioration:

- Wire brush the cast iron cranked beams back to sound metal to remove paint and surface corrosion. Apply two coats of epoxy zinc phosphate primer to protect the beams and prolong their life. Refer to drawing 1910/20/01 for details.
- Where the stone treads have spalled, we propose to insert new pieces of stone locally and anchor it into the treads above using stainless steel dowels as shown on drawings 1910/20/08 & 09.

Reinforced Concrete Stairs 1, 5 and 7

Stair 5 has significant spalling to the underside of the landing, reducing its robustness and ability to restrain the balustrade. Therefore, we propose the following repairs:

- To improve the robustness of this thin landing slab and compensate for the corroding reinforcement, we propose inserting a new steelwork beam to support the landing as shown on drawing 1910/20/07.
- We also propose to repair the spalled area by wire brushing the reinforcement and applying a concrete repair mortar as shown on drawing 1910/20/07.

- In addition, an anti-corrosion coating will be applied to the whole stair to mitigate further corrosion and spalling.

There is a risk that stairs 1 and 7 may experience similar spalling in the future. Therefore, we propose that an anticorrosion coating is also applied to these stairs to mitigate further deterioration.

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