EURA

CONSERVATION LTD.

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King Edward VII Building
British Museum

Details of Weathering Lead Alterations and New Stainless Steel Armatures

Commissioned by Arcadis

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3469 BM WEATHERING LEAD AND ARMATURE DETAILS ROB MODS.DOC www.eura.co.uk

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INTRODUCTION

The weathering lead had originally been fitted in pieces which were too large, without adequate overlaps, and improperly fixed, as detailed in our Condition Report.

The lead decoration had also been fixed inappropriately. It had been nailed, screwed, soldered and welded in place, in ways that prevented or impeded the movement on the weathering lead underneath. This caused many splits in the lead, and the failure of many of the soldered joints. Where the splits and failed solder joints have been repaired by welding, these welds have often split as well.

Together with Graham Abrey, we have worked out ways of overcoming the design and construction faults which are continuing to cause problems with the stability of both the lead decoration, and the reinforced concrete of the parapet. These problems will have to be addressed in the not too distant future, and the sooner this is done the less additional damage will occur.

WEATHERING LEAD ALTERATIONS

The alterations to the leadwork were carried out as described in Graham Abrey's report, to BSEN 12588:2006, and the current BS6915 Code of Practice.

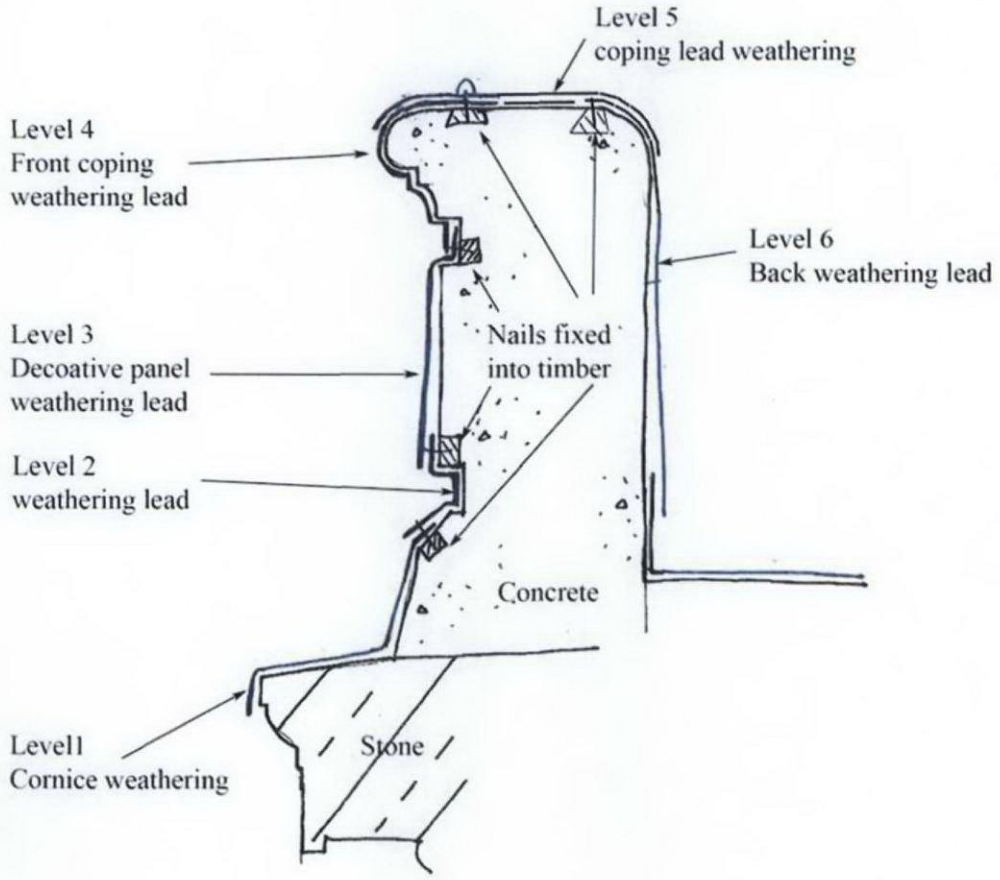

Figure 1. Section through parapet showing new lead arrangement

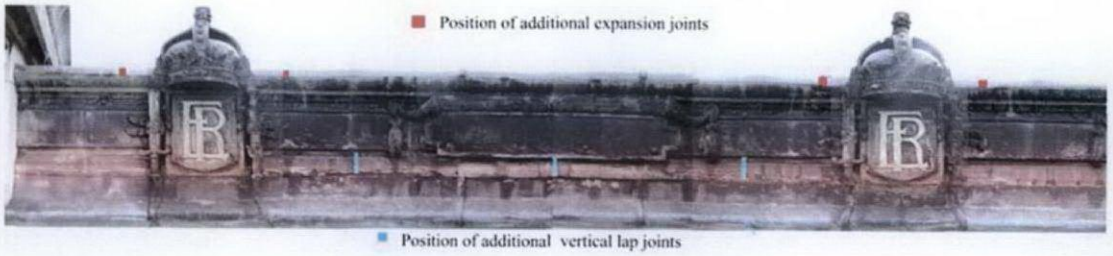

Figure 2. Position of additional welts and lap joints at front

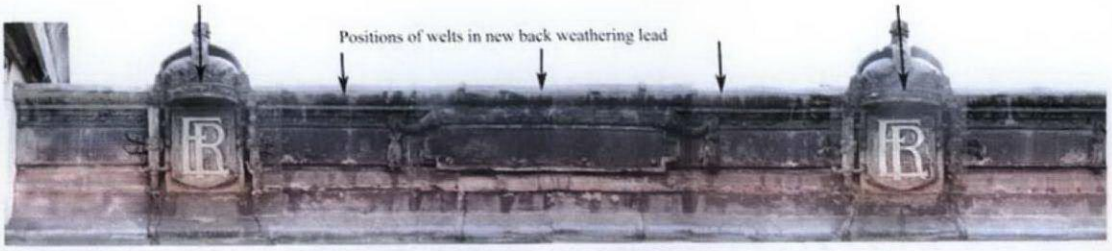

Figure 3. Position of welts in new lead at back

Fixing details

Level 1

Head fixings – 40 mm x No. 10 A2 woodscrews with 25 x 6 mm A2 washers.

Single line at 100mm centres screwed into existing timber set into parapet.

Bottom Fixings – 45 mm wide x 0.4 mm thick terne coated stainless steel clips at 400 mm centres.

Level 2

Head fixings – 40 mm x No. 10 A2 woodscrews with 25 x 6 mm A2 washers.

Single (staggered) line at 50 mm centres screwed into existing timber set into parapet.

Bottom Fixings – 45 mm wide x 0.4 mm thick terne coated stainless steel clips at 400 mm centres.

Level 3

Head fixings – 40 mm x No. 10 A2 woodscrews with 25 x 6 mm A2 washers.

The central panel has a single line at 50 mm centres screwed into plastic plugs set into the concrete parapet. Side panels have a single line at 50 mm centres screwed into existing timber set into the parapet.

Bottom Fixings

Side panels – 45 mm wide x 0.4 mm thick terne coated stainless steel clips at 400mm centres.

Central panel – 50 mm wide code 6 lead clips at 500 mm centres, fixed with welded code 6 lead straps to level 2 lead.

Level 4

Head fixings – 40 mm x No. 10 A2 woodscrews with 20 x 6 mm countersunk A2 washers.

A single line at 50 mm centres screwed into existing timber set into the parapet.

Bottom Fixings – 45 mm wide x 0.4 mm thick terne coated stainless steel clips at 400 mm centres.

Level 6

Head fixings – 40 mm x No. 10 A2 woodscrews with 20 x 6 mm countersunk A2 washers.

Two staggered lines at 75 mm centres screwed into new timber set into the parapet.

Bottom Fixings – 50 mm wide x code 6 lead clips, welded to the lead guttering at the back of the parapet.

Strips of code 6 lead were fitted on top of the parapet, between the Level 4 and Level 6 lead to prevent the formation of low areas.

Level 5

Head fixings (On top of parapet) – 40 mm x No. 10 A2 woodscrews with 25 x 6 mm countersunk A2 washers.

A single line at 300 mm centres screwed into plastic plugs set into the concrete of the parapet. These were covered, and sealed, by welding on the original lead hemi-spheres, removed during the removal of the coping lead.

Bottom Fixings – 50 mm wide x code 6 lead clips, welded to the Level 4 lead at the front and the Level 6 lead at the back of the parapet.

ARMATURE DETAILS

Shields

The Shield decoration was fixed to a bracket consisting of two brass studs braised to a strip of brass that is screwed to timber set into the parapet. The bracket is adequate, but all the weight hangs from the two lead tubes in the back of the shield. We have fitted a simple stainless steel armature to spread the load more evenly.

Figure 4. Shield during removal

Figure 5. Shield with new armature

Sword and sceptres

The swords and sceptres, either side of the shields were soldered to three or more separate sheets of lead, and the movement of these lead sheets has caused many of the solder joints and subsequent welded repairs to fail. Stainless steel armatures have been developed so that these decorations can be fixed to the concrete parapet independently of the lead sheet, with sliding joints allowing for movement where appropriate.

A loop in the bottom of the armature fits over a hook formed on the fixing strap. At the top, the armature is fixed to the fixing strap using stainless steel set screws, accessed through holes drilled in the lead. These holes are then filled with lead weld.

Figure 6. Sword armature and lower fixing straps

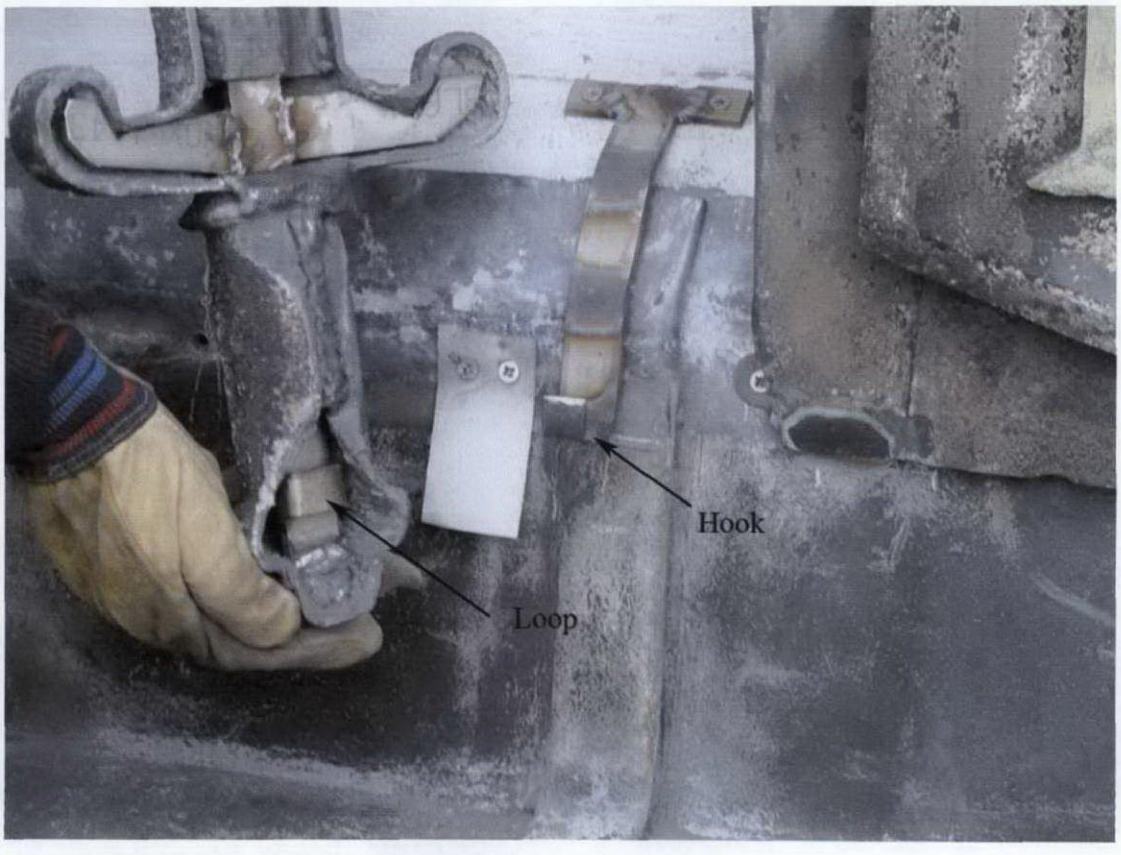

Figure 7. Close-up of bottom sword fixing

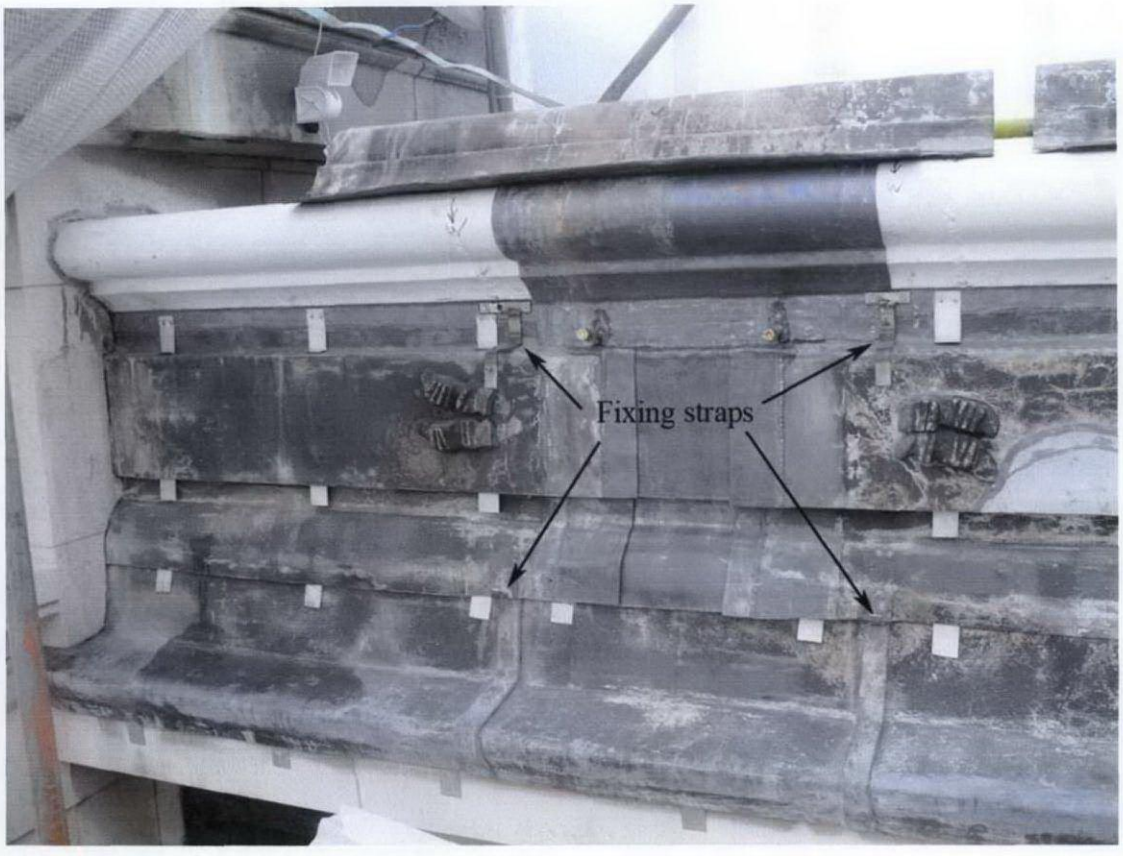

Figure 8. Fixing straps in place

Figure 9. Sword and Sceptre in position

Swags

The swags over the central decorative panel also bridged several lead sheets, with results similar to those mentioned above. Again, stainless steel armatures have been developed so that the various elements can be separately attached to the parapet, without compromising the integrity of the weathering lead. These armatures allow for movement of both the weathering lead and the lead decoration.

Figure 10. Right-hand swag with armature

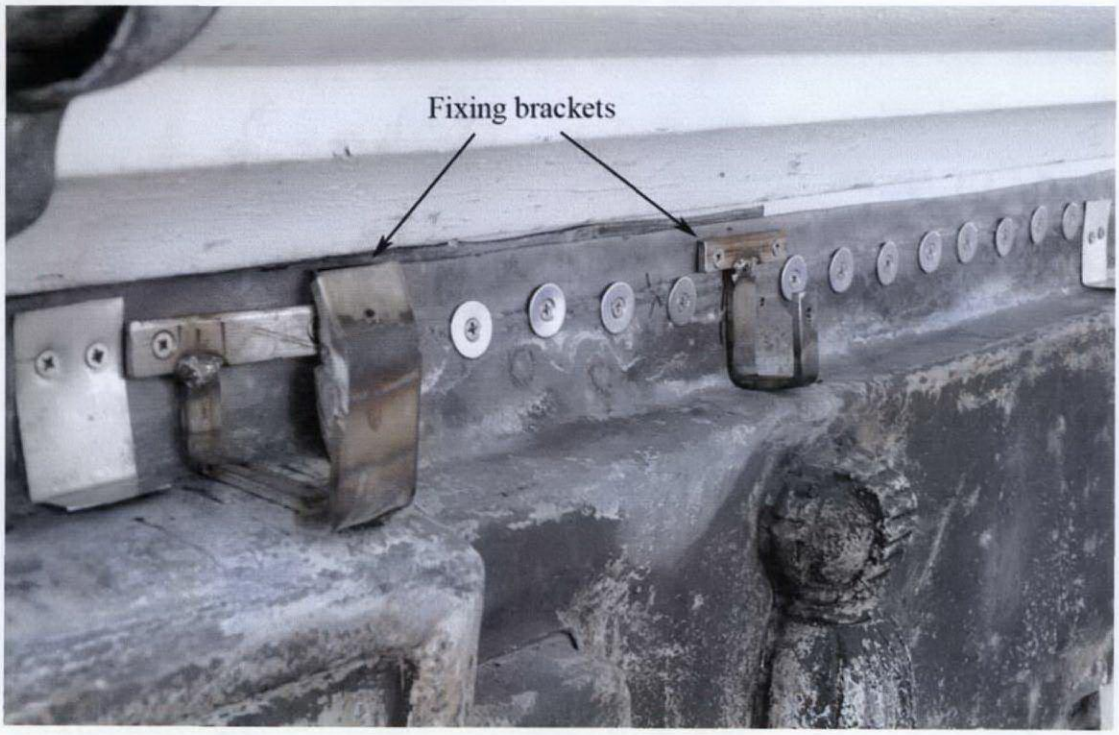

Figure 11. Right-hand swag fixing brackets

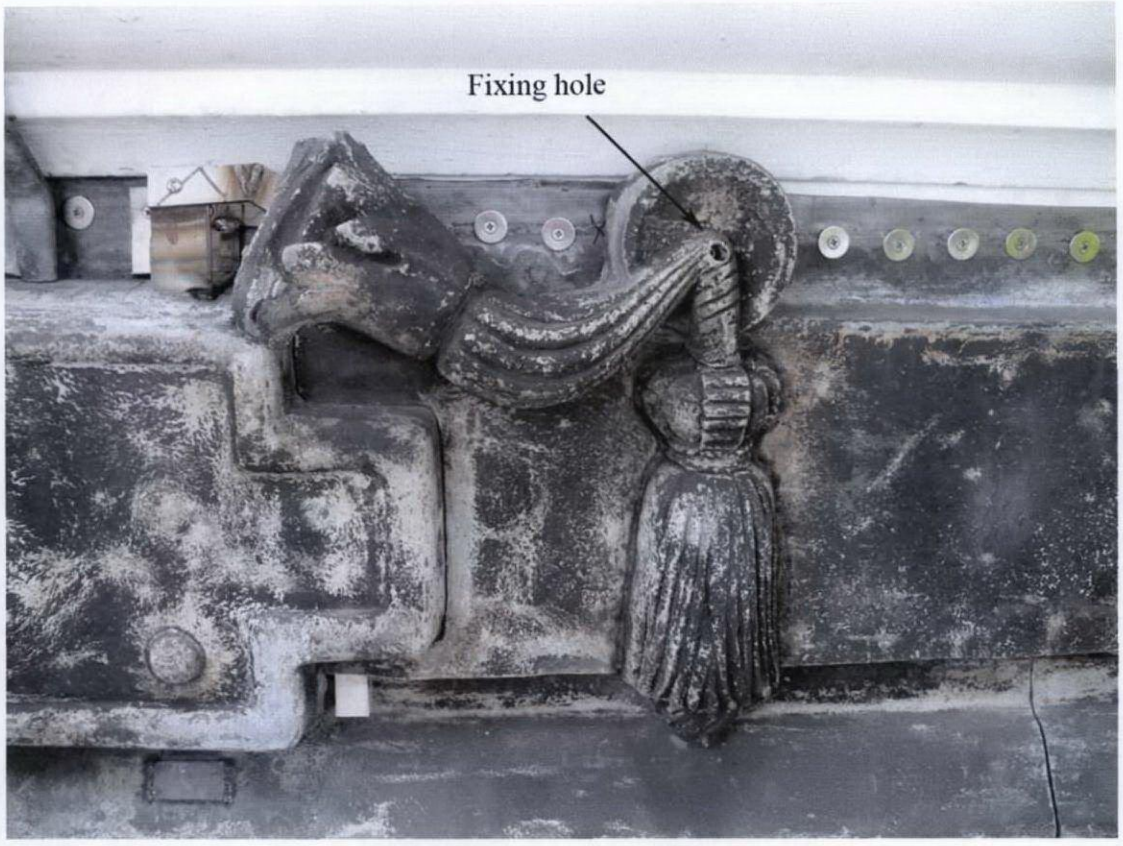

Figure 12. Right-hand swag in place

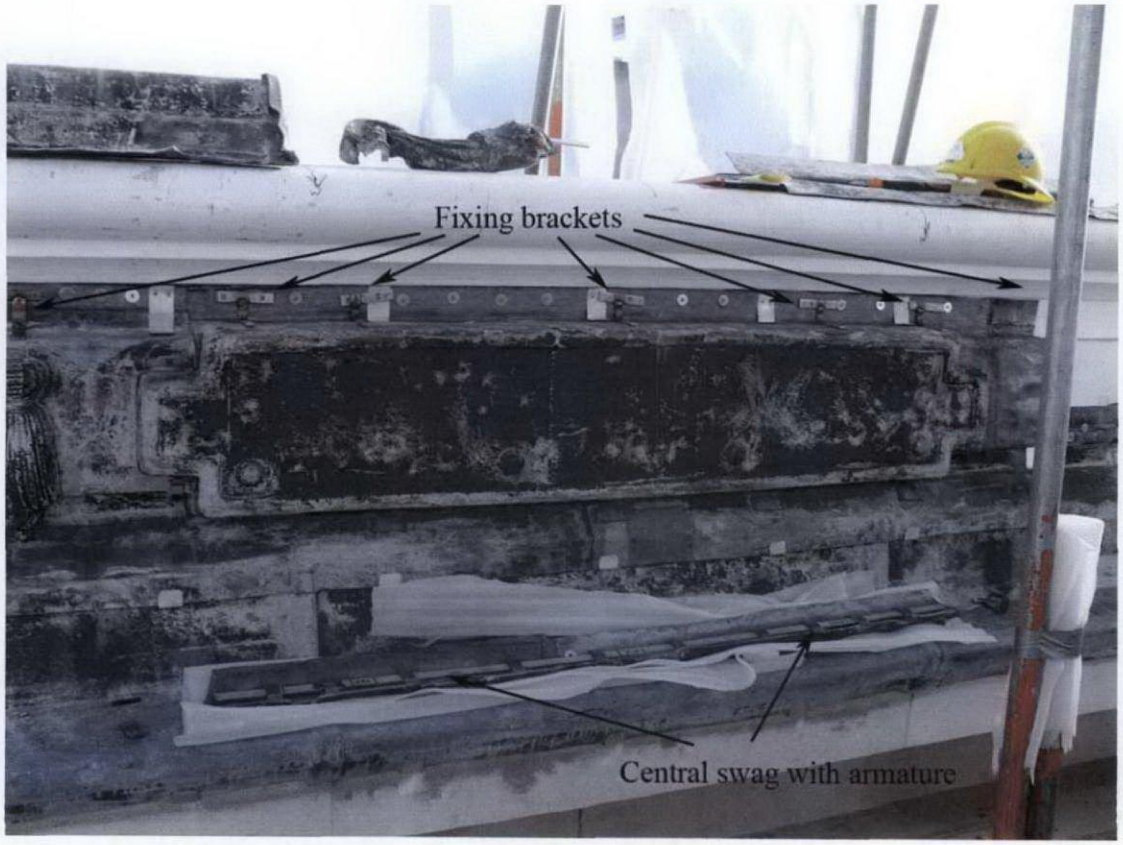

Figure 13. Central swag and fixing brackets

Figure 14. Swags in place

Crown Decoration

The crown decorations are not adequately supported, and many of them appear to have slumped down at the front as a result. A new stainless steel armature has been designed to overcome this problem.

The crown decoration had formed part of the weathering of the parapet, and had let in water as soldered joints failed. Many of these soldered joints had been welded up, these repairs have often failed. In several locations, where welding was difficult or impossible, mastic has been used with varying success.

It was decided to weather the parapet independently of the crowns, and fix the crowns over the weathering lead. Lead taken from the back of the parapet was used to cover the top of the parapet, under the Crowns. This was introduced between the new welts added either side of each Crown.

The armatures have been made to fit the shape of the nosing at the front of the parapet. They are fixed to the parapet by 12 X 250 mm long stainless steel studs, resin fixed through two straps extending from the armature at the back of the Crowns. Lead packers are welded beneath the straps to keep the entry holes above the level of the parapet lead, and they are weather with welded sheet lead covers.

Figure 15. Crown. Front view

Figure 16. Crown. Right-hand side

Figure 17. Crown. Back left

Figure 18. Cushion, back right

Figure 19. Removal of cushion

Figure 20. Removal of Crown

Figure 21. Underneath Crown in situ

Figure 22. Underneath removed Crown

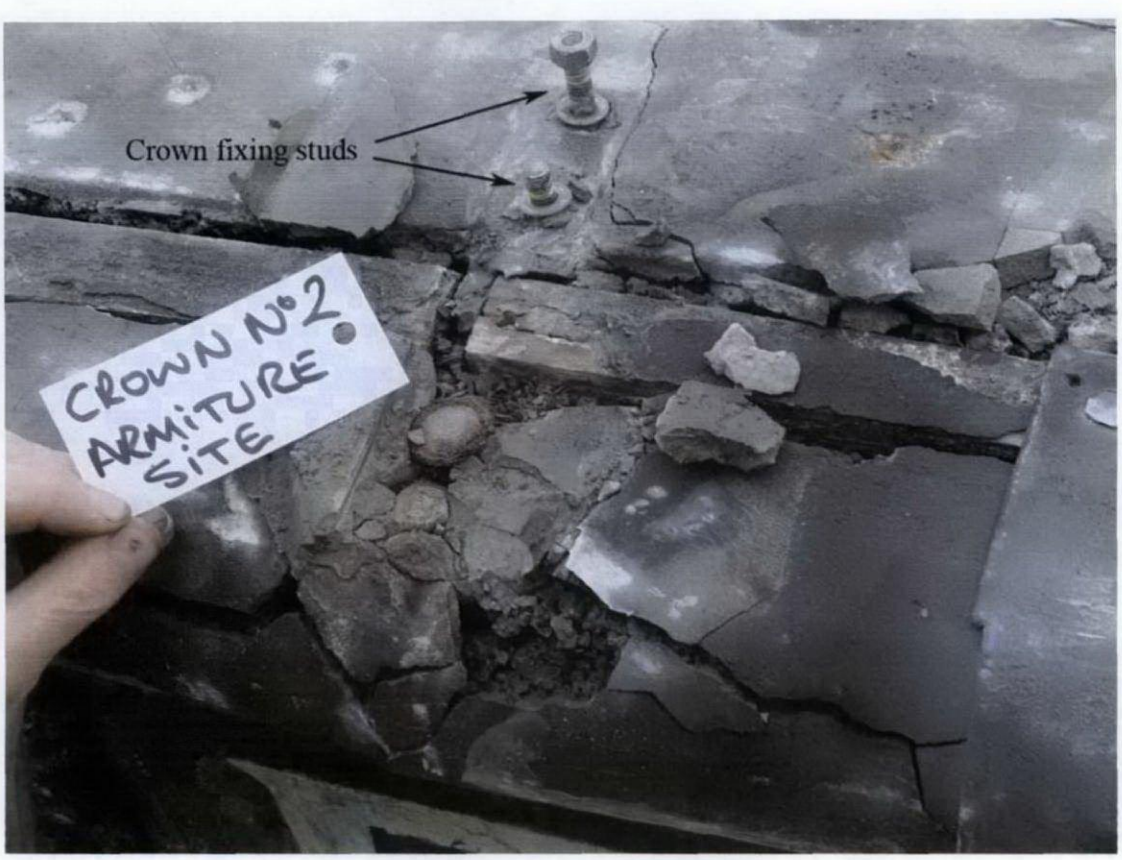

Figure 23. Top of parapet after removal

Figure 24. Crown inverted for removal of fixing bracket

Figure 25. Crown fixing bracket removed

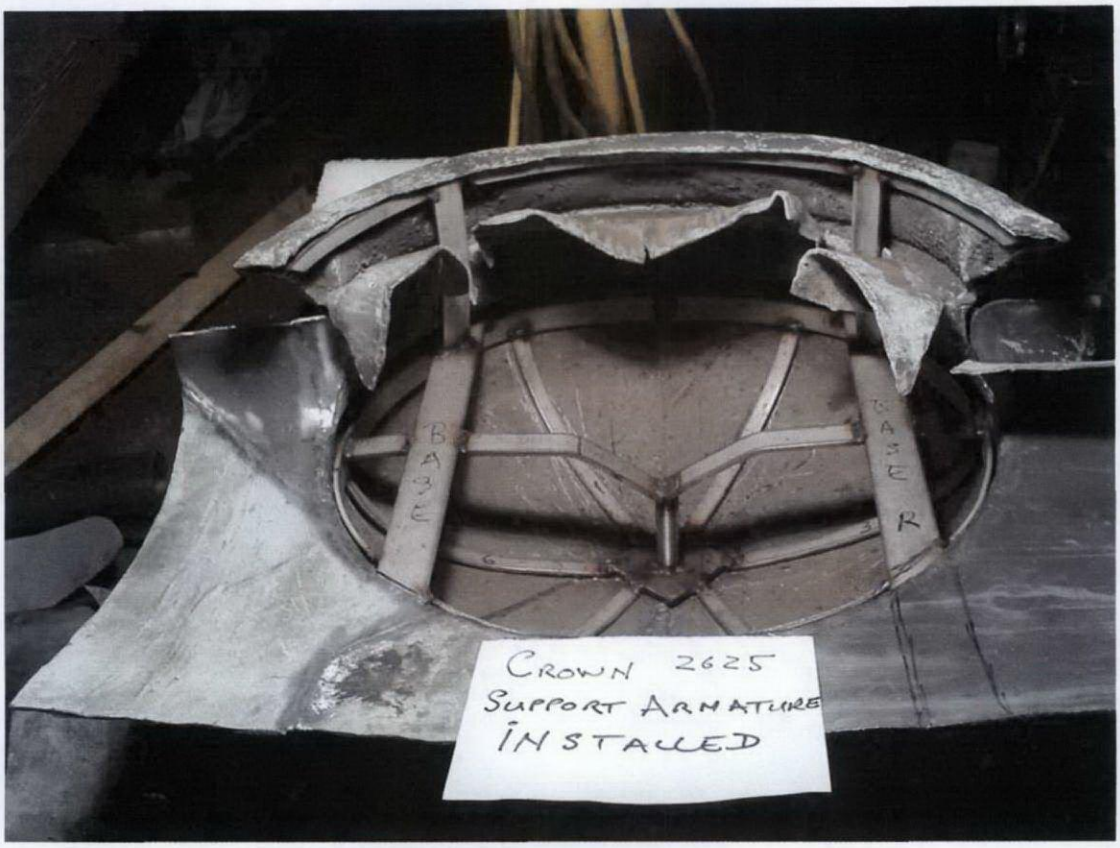

Figure 26. Installation of new support armature

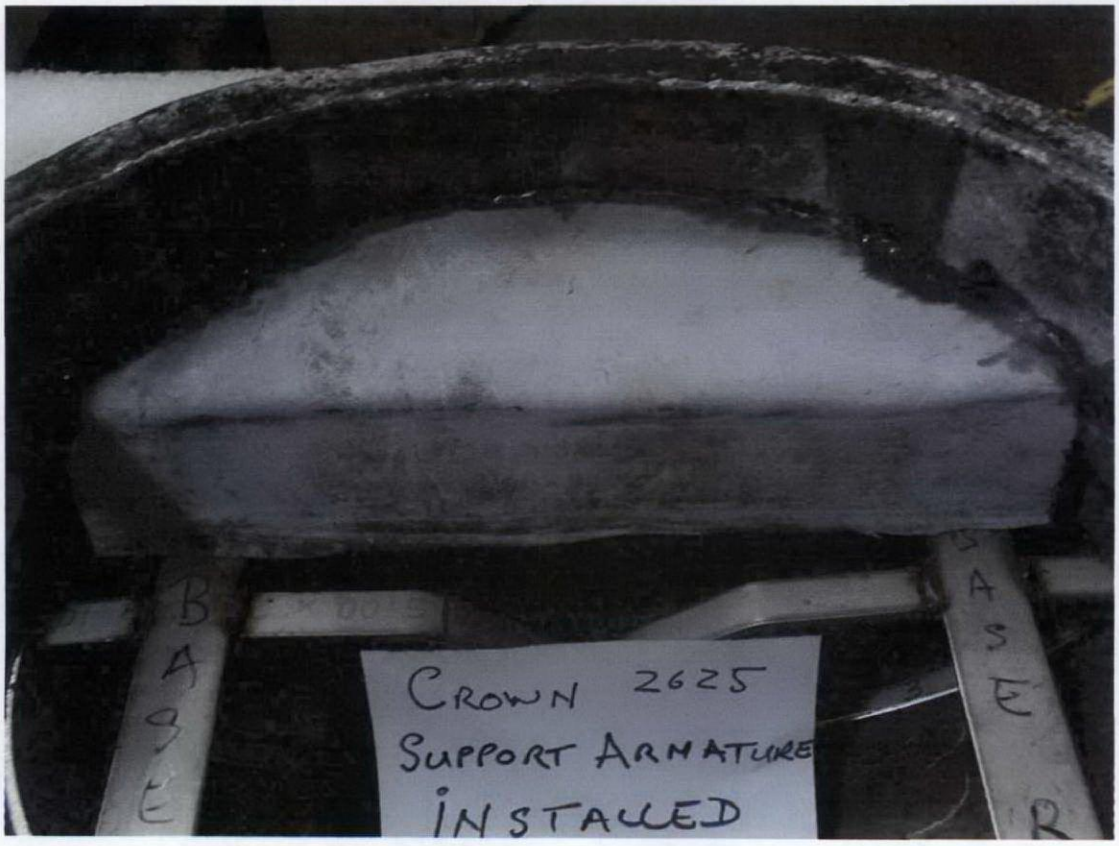

Figure 27. Armature complete

Figure 28. Crown filled with high density polyurethane foam

Figure 29. Underneath front of Crown, showing armature detail

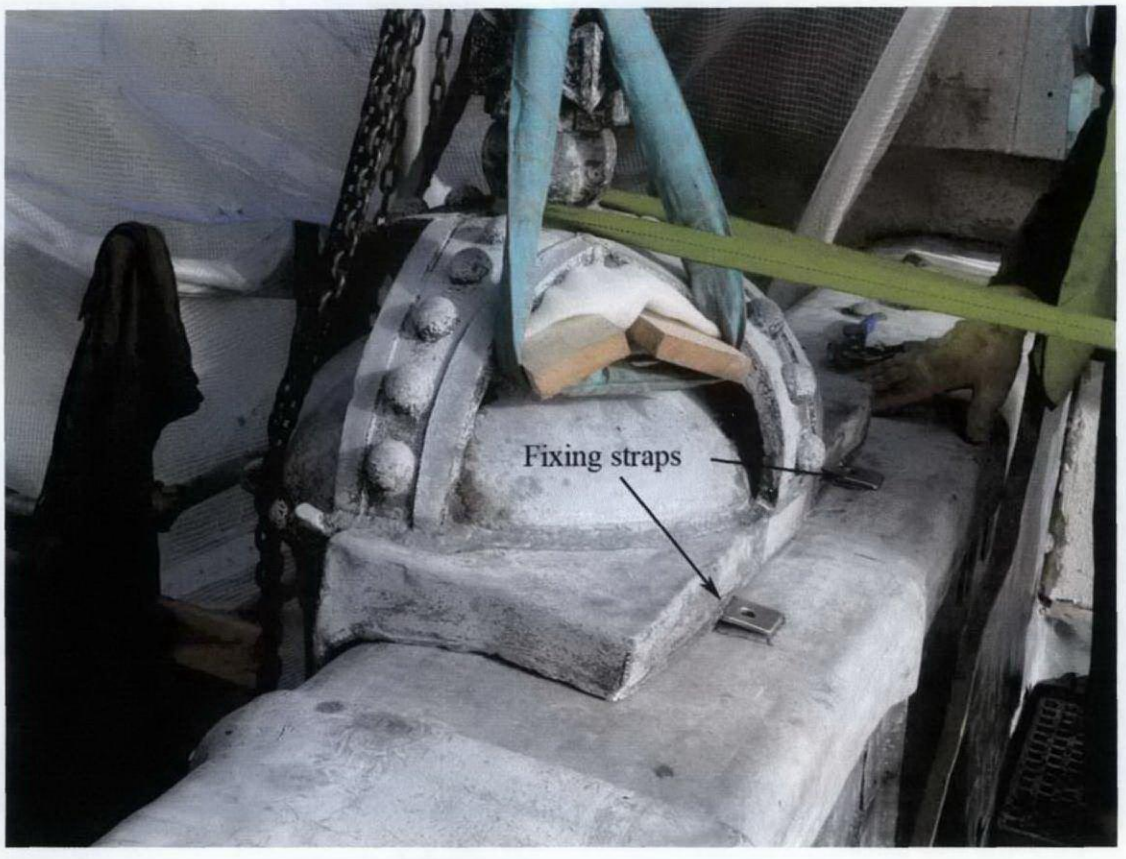

Figure 30. Crown ready for fixing

Figure 31. Completed Crown