Report on the Conservation of the Staircase at the Royal Institution

The starting date for the project was Monday the 11th of June 2007 and was estimated to take between 10-11 weeks to complete.

The team working there permanently consisted of Rupert Harris Conservation staff: Toby Morgan, Jackie Rumsey, Eva Ara Martin, Marieka Ensing and Angus Fisher.

Description:
The staircase balustrade is in the Regency style, predominantly made of wrought iron, with lead and bronze castings incorporated into its design. The balustrade has a repeating pattern of 66 sections, each with the same leaf and flower design; possibly based on sunflowers. On sections where the balustrade goes up the stairs the design stretches and slants accordingly, whilst retaining the overall pattern.

The whole balustrade was painted black with the exception of the flowers, which were painted gold. Figures 1-5 show the pattern and paint scheme of the balustrade.

![Fig.1 Paint scheme before treatment](image-url)
The four elements of the pattern:

Fig 2. Detail of linking section

Fig 3. Detail of upper section

Fig 4. Detail of the middle part of a section.

Fig 5. Detail of the lower part of a section.
**Condition:**

There was some lateral movement of the handrail on some areas of the staircase, in the main this was due to wear and loosening of the leaded settings or plugs in the stonework. There was no effective way of improving this by attempting to tighten these plugs by re-tapping, as this would risk damage to the stone stairs. It was hoped that the intended repairs to the timber handrail may decrease the movement.

The structural condition of the metal work was fair. However there were significant areas of loss to the repeated design where lead and sometimes bronze was used (Figs. 6 & 7). This loss was probably due to the soft nature of lead metal, the usage of the staircase and the position of the lead castings within the design. There was also some loss in areas of bronze, but all the iron pieces were intact.

There were many layers of paint on the balustrade rendering the detail of the metalwork indefinable (Figs. 2-5). The paint was in good condition with nothing more than some layers of dust on the surface. However it was almost certainly not painted in its original colour scheme.
Conservation Carried Out:

Paint analysis

Analysis had been carried out by Catherine Hassall and the results were used to inform the decisions regarding the redecoration scheme.

Stripping and Cleaning

A decision was made to remove all the existing paint back to the bare metal. Although it could be argued that removing the original 18th century layers was unethical, this consideration is placated by the fact that the original colour layers were well documented by the paint analysis, and that the paint to be re-applied was based upon the original colours and pigment make-up. It would have been impossible to remove all the black paint without also removing the original green and yellow layer. Similarly, painting the green and yellow on top of the black would have rendered the fine detail of the metal work even more indefinite. Both of these options would not have worked as well as stripping and repainting.

The cleaning process was divided into three stages:

1. Paint stripping
2. Wet cleaning
3. Dry cleaning

1. Cleaning tests were carried out using a caustic poultice, this proved successful and although time-consuming was both controllable and avoided significant fumes or the use of heat. Application of a poultice also meant that the paint residue could be contained and removed without the likelihood of contaminating the building. This product Peel Away1 was chosen as the stripper to remove the ten or so layers of paint from the balustrade. It was applied using spatulas to cover every surface of the metal in at least one inch of paste (Fig.11). To ensure the paste didn’t drip on to the painted stone steps, we masked up the bottom of the balustrades with duct tape and Poly Vinyl Acetate Sheeting. After a section was fully coated with paste it was covered with a thin sheet of tissue paper (Fig.12).

One problem we encountered was that as the paint dissolved over night, some of it would drip down the paper sheeting and pool on the floor below. This would either strip the paint off the steps or discolour the main floor. Neither effect was desirable, so from that point onwards we always wrapped tissue around the bottoms to catch and absorb the dripping paint.
Fig 11. *Peel Away 1* being applied.

Fig 12. Balustrade with tissue paper covering to absorb drips
Removing the Peel Away1 paste/absorbed paint proved to be trickier and dirtier than anticipated. It did technically remove all the paint layers, but lots of residue and dirty paste remained on the surface and in the tight crevices of the metalwork (Fig.13). We therefore had to resort to wet cleaning in order to wash the residues away.

Fig 13. Section after *Peel Away1* has been removed

2. We used hot water to try to wash the remaining residues and wet dirt off the balustrade. For this we used a number of cloths and brushes. This technique did clean a lot of the bulkier residue away, but did not clean the metal to a standard where it could be re-painted. There were still areas in cracks and crevices where the paint hadn’t been properly stripped off, and where the cloths and brushes couldn’t reach (Fig.14).

Fig 14. Section after wet cleaning
3. When the residues of *Peel Away* paint were completely dry we took to mechanically cleaning the metalwork with wire brushes. This abraded away the dry dirt. The wire brushes were extremely effective at cleaning the balustrades down to the bare metal. Much more care had to be taken over the lead castings as the wire brushes scratched and marked them easily. To get into the tighter, hard to reach areas sanding belts were used. Fig.15 shows a part of the balustrade after dry/mechanical cleaning and ready for repainting.

![Fig 15. Section after dry/mechanical cleaning ready for painting](image)

Where there were bits of paint still un-removed and dried residues that withstood mechanical abrasion, we used a Rothenberger (blow torch) to make them crisp and brittle so that they could easily be removed with a wire brush. Extra care was taken not to spend too long using the Rothenberger on lead parts of the staircase.
Restoring and Re-painting:

There were several areas of lost elements on the balustrade, all of which were from areas of lead casting. Lead being a soft metal in composition, the castings had broken off, sometimes by vandalism, and needed replacing. Complete, existing castings were taken from the Royal Institution site, stripped of all their paint, moulded and re-cast. All the new castings were made of bronze.

Once the castings were made, we finished the surfaces and sanded them smooth. This was done at the studios in Poplar. Fig.16 shows the castings before and after finishing.
When all the castings were sanded smooth enough they were soldered together at the studios (Fig. 17) and then re-attached to the balustrade using tin-silver and lead solder where necessary. Solder residue and flux were then removed with white spirit to prevent potential corrosion. We could now move on to the painting process.

Fig 17. A casting in the process of having the flowers soldered on.

The colour scheme was something that was debated right up until the point where we were actually already applying the primer. The original colour scheme that the paint analysis report came up with was very different to the scheme used for the later layers. We had based our time schedule and expenses on the balustrade being painted in the scheme that was already there, whereas the Royal Institution now wanted it painted in the original way. In the end it was agreed upon to paint the balustrade in the later, non-original scheme. It would have been good to follow the original pattern, but time and money didn’t allow us to take this path; the original scheme was a lot more complicated in terms of painting, concentration and detailed work (Fig.18).
Fig 18. Showing the two opposing colour schemes.
Left: Original colour scheme
Right: Alternative scheme proposed
The colours used were matched as closely as possible to those that the paint analyst described. The primer layer was pale grey like the original, and was a zinc phosphate based paint, suitable for covering metals. The green and yellow colours were made by Papers and Paints Ltd. London, and both took a couple of trials to match exactly to what the Royal Institution architect wanted. All the painting was done by hand by our team.

The primer required two full layers and a third quicker layer of “touching up” to fully cover all the metal (Fig 19).

Fig 18.5. Original black and gold before stripping

Fig 19. Grey primer layer
The green layer was applied next as it was the most dominant colour out of the two. It needed two layers to fully cover the primer and special care was needed not to overlap the flowers too much; they were to be painted yellow and needed to be as bright as possible, not dulled by darker layers underneath (Fig 20).

The yellow layers were confined specifically to the flowers. Despite being a smaller area to paint, the flowers took the longest time to do. This was because the team had to paint round the edge of each flower in detail first, so as to cleanly separate the yellow from the green. The outlining needed to be done three times before we could fill in the rest of the flower. Three layers were enough to fully cover the underneath layers and produce a bright, clean yellow finish (Fig 21).

Fig 20. Green layer added excluding the flowers  
Fig 21. Yellow layer added
Photographs of the Completed Balustrade:
Detail photographs of the completed balustrade:

Complete section linking detail

Complete upper section detail

Complete middle section detail

Complete lower section detail
Materials and Equipment

Protection Equipment:
1. Acid free paper
2. PVA sheeting
3. Tissue Roll

Cleaning Equipment:
1. Peel Away
2. Plastic and wire brushes
3. Rothernberger
4. Bucket and water
5. Metal picks and scrapers

Bronze Cast Preparation Equipment:
1. Air pen grinder
2. Belt sand paper
3. Files
4. Soldering iron
5. Soft solder

Painting Equipment:
1. Zinc phosphate primer (Dulux)
2. Green and Yellow topcoat paints. supplied by Papers and Paints.
3. Paint brushes

General Equipment:
1. Portable scaffold tower
2. Step Ladder x 2

Staircase protected with PVA sheeting
Wire and plastic brushes and metal scraper
Air pen grinder
Scaffold tower which allowed us to reach the outside of the balustrade
Health and Safety

At the Royal Institution site the Rupert Harris Conservation team adhered to our own health and safety rules as well as those set by ISG InteriorExterior. Because the building was a construction site, we were at first required to wear hard hats and high visibility jackets at all times. Wearing the hard hats would have been cumbersome and prohibitive to our work at times, so we came to an agreement with the main contractors whereby we only needed to wear the high visibility jackets when working. This exception was made because there was no-one else working in the same room as us, so the risks of a building site were only present outside the room we were in. Hard hats and high visibility jackets were worn when walking round other parts of the site. The Royal Institution had powder, water and C02 fire extinguishers present on site.

Using the Rothenburger wearing heat proof gloves, mask and other PPE.

Applying Peel Away1 whilst wearing rubber gloves, coverall, hard hat and high visibility jacket.

During the process of using the Rothenberger to burn dirt off the staircase, we had to obtain a hot works permit for every day that we wished to use it. Other safety equipment that was provided by RHC included white plastic coveralls and latex gloves in order to protect the team of conservators from the harmful chemicals in Peel Away1 and to protect them from the messiness of the job in general.

Report compiled by Angus Fisher, Rupert Harris Conservation

October 2008