Historic Preservation of Hoare's Bank

London, England

Submitted by C-Probe Systems, Ltd.

Aesthetic deterioration caused by the unsightliness of cracking of the stonework. Note the crack developing from a previous repair where the iron was not removed

Accessing from the street for surveying

For centuries, Hoare's Bank, situated on Fleet Street in London, has been the center of both England's legal profession and national press. As a Grade 2 listed building (in England's Historical Building rating system), it has significant historical status.

The oldest surviving independent bank in Britain, Hoare's was established in 1672 by Richard Hoare, a goldsmith who rose to become Lord Mayor of London and MP for the City. In 1704, he was knighted by Queen Anne. Today the bank is owned and run by members of the Hoare family, all of whom are direct descendants of Richard Hoare.

Fleet Street has been the bank's home since 1690, but by the late 1820s, the business had outgrown its original premises. In 1829-30, the bank was pulled down and replaced by the present building.

Problems that Prompted Repair

The building is a sandstone construction of load-bearing masonry whose blockwork was interconnected by wrought iron cramps and pins used to prevent movement of the stone during construction. These metal fixtures remain in position approximately 4 in. (100 mm) deep within the stone, but (like all iron-based components) are prone to corrosion. Deeper components have been identified that were also shielded by lead; these were, not surprisingly, in near pristine condition.

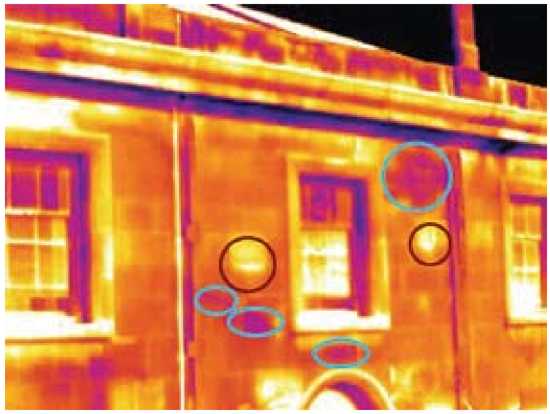
Over the past 20 years, the building has been the subject of localized repairs where the iron component is often (but not always) removed and a stone patch replaces the breakout area that was necessary to remove the ironwork.

The dilemma that the owner faced was that, given the historical significance of the structure and the unknown quantity of the iron components, how many areas were vulnerable? Also, if the policy of localized repair was to continue, what would the façade's appearance be like after all had been removed?

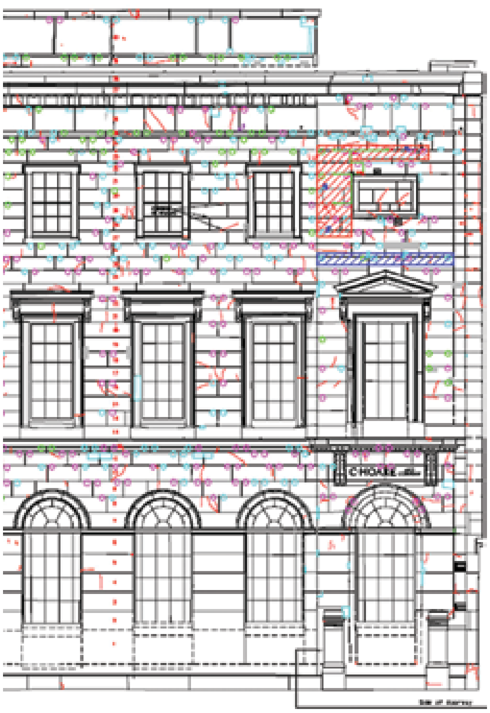
A further dilemma was the need to preserve the appearance caused by the slow historical color change to the façade.

Condition Assessment of the Iron Components within the Stonework

With such a peculiar problem, it was unlikely that conventional survey techniques would provide the depth of information necessary. Nondestructive techniques included the cross-correlative use of metal detection, magnetic mass probe, and infrared thermography surveys that could be undertaken from a street-accessed cherry-picker.



Thermography output showing areas of moisture retention within the stone and heat loss around the windows as well as locations of previous repairs



CAD representation of iron component positions including color-coding of corrosion risk assessment. Note that the red-shaded area was the location chosen for the ICCP preview study. The blue-shaded area was to test surface-applied corrosion inhibitors that did not take place

Infrared thermography was chosen to assess the retained moisture profile of the façade, as this is inextricably linked to the vulnerability pattern of the iron within the stone. Where moisture is retained, it is likely that the ironwork in that location would be prone to corrosion.

While this would provide a vulnerability pattern, it would not allow assessment of quantity, location, and current corrosion condition. To this end, a mixed use of standard metal detection and state-of-the-art magnetic mass probe techniques were adopted.

Iron components were graded as low, medium, and high risk, depending on the combined results of the survey techniques and a produced CAD drawing that showed the precise locations of all detectable iron components.

Choice of Repair System

The prospect to the owner of replacing, in a piecemeal fashion, all of the iron components was one that would cause unacceptable and continual disruption to the operation of its business. Any other solution, however, was largely untested in this type of building. The electrochemical solutions were to use either surface-applied or drilled-in capsule corrosion inhibitors or to use cathodic protection.

Inhibitors and galvanic cathodic protection systems were ruled out as they would be likely to require retreatment/replacement. This left an impressed current cathodic protection (ICCP) system as the only feasible option. There was no feasibility testing performed before, however, on this type of application; in this sense, the owner was facing an innovative development of known technology.

The iron components identified during the condition assessment numbered over 500 random, isolated, and therefore electrically discontinuous, dog-cramps and pins. The task of discretely positioning anodes was relatively simple in comparison with the intricacies of ensuring interconnection of all iron components to make a fully continuous cathode while also avoiding the risk of short-circuits by the cross-pathing of cathode interconnecting wire with the titanium wire of the anode circuits.

Moreover, any end system would require the internal routing of the cabling and positioning of power, control, and monitoring units. The internal features of the building were also covered by the Grade 2 status of the building and had recently undergone renovation; therefore, they could not be disturbed.

Facing these barriers, a preview (mockup) study of the proposed ICCP installation was developed and temporarily powered-up to ensure correct operation. This stage would also be used to convince the City's conservation specialists that a full-scale scheme could be employed.

The performance expectations were in the ability of the power systems to provide a stable and continuous supply of controllable current, and the ability of the iron over time to take advantage of the cathodic reaction of oxygen and water to produce alkalinity to induce renewed passivation. This would take time, and the first stage was to ensure adequate polarization to the immunity level for the iron-water system.

Care was the watchword and the preview installation was highly successful. Data showed that the electrochemical condition could be altered and controlled, and the end aesthetic passed the inspection by third-party conservation specialists. The project was ready to proceed to the full installation phase.

Installation of the ICCP Components

During the project installation phase, each iron component was photographed and cataloged to compare with the magnetic mass probe survey. Moreover, the contractor used a metal detector to further confirm the presence or absence of the iron component; this yielded another three positions where ironwork was present.

A discrete anode was chosen to minimally disturb the bed joints (these were only 0.04 in. [1 mm] in width, but a 0.31 in. (8 mm) anode was viewed as acceptable). The interconnecting wire was 0.05 in. (1.2 mm) in diameter and, therefore, the amount of overwidening of the joints was contained to very discrete holes.

The cathode interconnections were made using 0.05 in. (1.2 mm) steel wire and formed in joints on the opposite side (where possible) to the anode wire. Where crossover was a problem, the titanium anode wire was sleeved with a small-diameter tubing to insulate the two wires.

The final installation was controlled in three zones that were networked together internally with the cables managed within the floor space to avoid internal disruption. The performance is managed using remote access to data and Internet access to reporting.

The end product for the owner is a repaired building that has, on the face of it, remained unchanged from the first reconstruction of the building in 1827, but with a new lease of life that is protected and controlled for the foreseeable future.

The summary of the scope of the full contract is provided in the following, which had a contract value of $1.5 million (equivalent in sterling) with the ICCP element costing approximately 25% of that sum.

Full Contract Scope in Addition to ICCP Works

- Replacement of lead flashing to coping, window heads, and balconies and string courses.
- Existing windows, frames, and sills were overhauled and refurbished before repainting with traditional oil-based eggshell.
- Cement pointing to perimeter of sash window frames and stonework were repointed with traditional lime mortar.
- Balcony railings were refurbished and finished with traditional oil gloss in black.
- Undersides of balconies were coated with smooth masonry paint.
- Hardwood external double doors were refurbished before coating with matching traditional wood stain and polish.
- Replacement of two pier caps to match original features at door entrance.
- Street level railings and entrance gates were refurbished and coated as per balconies.
- Light well to basement level was recoated with masonry paint.
- Tiled wall surfaces to basement were jet washed, and related pipework, security grating, and support angles were refurbished and coated as per railings and balconies.
- Original boot scrapers at entrance were refurbished and coated to match external paintwork.
- Refurbishment of neighboring 33 Fleet Street including replacement of slate tile roof, repairs to dormers, repointing brickwork, gold and silver leaf replacement to crest and purse features, and replacement of lead flashing.
- Cleaning of entire building to comply with conservation specialist's requirement to maintain historic color.

The ICCP system is currently under a 25-year monitoring and maintenance contract through the specialist cathodic protection subcontractor directly to the owner as part of the warranty.

Special projects such as these are rarely achieved without close team effort and this project had that in abundance, from the owner and his design team to the contractor and his team.

Position showing discrete breakout for drill and tap steel connections and reference electrode monitoring installation

A view of Hoare's Bank after the work was completed

Hoare's Bank

Owner
C. Hoare & Company
London, England

Project Engineer/Designer
Tooley & Foster Partnership
London, England

Repair Contractor
Paye Stonework & Restoration
London, England

Project Partners

Special Testing/Designer
GB Geotechnics, Ltd.
London, England

Materials Supplier/Subcontractor
C-Probe Systems, Ltd.
Cheshire, England