

## **Case Study: Refurbishment of a Large Third-Party Cathodic Protection Installation at St. Andrews House, Edinburgh.**

### ***Introduction***

St. Andrews House, Edinburgh, is the working offices of the Scottish government for some 1400 civil servants. This six-storey stone-clad steel-framed building, was constructed between 1935 – 1939.



### **St. Andrew's House – Overlooking Waverley Railway Station and the Heart of the Old City**

Between 1999 and 2001 the building underwent complete refurbishment that included the installation of an impressed current cathodic protection (ICCP) system to minimise ongoing corrosion of the main steel frame. This work was carried out by Taywood Engineering, the CP system using 'Ferroeye' CP electronics supplied by Cyberdan, Denmark. More recently, the ICCP system's suppliers had gone out of business.

In 2011, Rowan Technologies was asked to investigate the condition of the ICCP system and found that, since commissioning, the system's monitoring and maintenance procedures had been inadequate. There were a number of technical problems that included excessive levels of cathodic protection being applied to some parts of the structure.

The system's overly-complex electronics control systems were no longer being maintained as necessary and inappropriate control of some of the CP zones had caused excessive voltages to be applied to the building's fabric. These had degraded the lime mortar between the stone slabs of the building's façade and this in turn had caused staining of the stonework.

In 2012, Rowan Technologies was successful in bidding to replace the system's control and data acquisition electronics with the company's own more-robust CP electronics hardware, recommission the system and to undertake monitoring, reporting and maintenance of the newly-refurbished system.

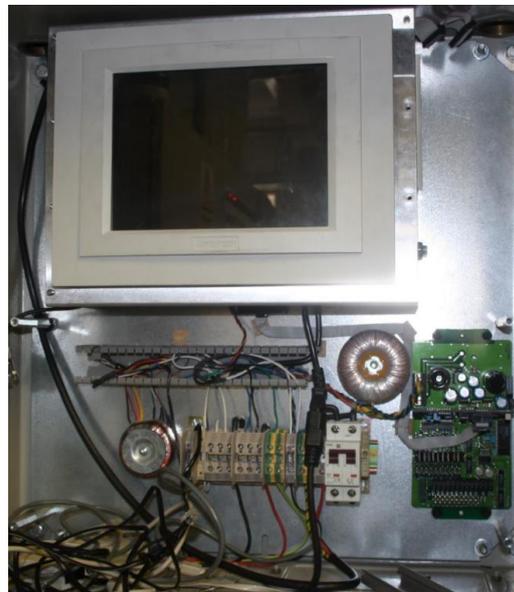
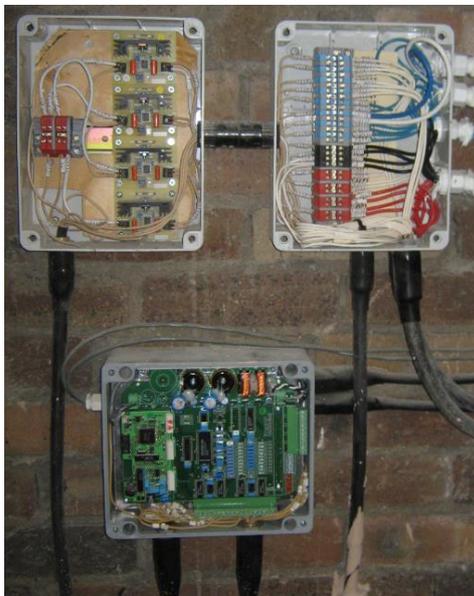
## ***Original System Overview***

The original ICCP system comprised a main control and data acquisition cabinet together with over thirty Local Rectifier Units (LRUs), distributed throughout the building, that supplied power to around 80 CP zones within the external façade. Within the façade, CP titanium ribbon anode mesh, together with both graphite and half-cell reference electrodes were installed adjacent to the building's steel frame.

The LRUs communicated with the data logger in the control cabinet via a twin-core serial communications cable that weaved its way throughout the building, connecting all LRUs in a 'daisy chain' fashion. The LRUs supplied power to the CP zones via junction boxes that interfaced external cabling from the anode mesh, steel frame and reference electrodes with the internal wiring back to the LRU electronic circuit boards.



Original LRU Electronics – a Tight Fit meant there was Little Room for Wiring



Junction Boxes were Located near to the LRUs (Left). The Original Data Logger is shown Inside the Main Cabinet (Right)

### ***System Re-Design and Refurbishment***

Rowan Technologies' approach to refurbishment of the original system was sensitive to the need to minimise disruption to the normal day-to-day work within the building's offices, many of which are open-plan in nature.

To achieve this, all existing system cabling was retained, including the communications cable between all LRU's and main cabinet. The LRU enclosures and internal DC power supplies were also retained and a plan was formulated that allowed quick and efficient in-situ removal and replacement of the original LRU electronics circuit boards. Such an approach meant that this work was completed within just two days and with little disruption to office staff, some of the work being completed out-of-hours.



New LRU Circuit Boards installed within Existing Enclosures with Adequate Room for Wiring



The Main Cabinet was also Refurbished: a New Data Logger was Installed together with an ADSL Link for Remote Communications

The refurbished ICCP system does away with the unnecessary complexity that accompanied the original installation, helping to ensure long-term reliability and making troubleshooting and maintenance simpler.

The original twin-core communications cable to the LRUs was retained, enabling the new data logger both to control the LRU output for monthly depolarisation measurements and to acquire both polarisation and depolarisation data at regular intervals.

In addition, Rowan Technologies has remote access to the data logger via the newly-installed ADSL link, allowing regular checks to be performed on system operation, data to be downloaded and reports to be prepared.

To help ensure power to the system is not interrupted, a visual alarm is fitted to the power distribution electrics: if power is removed from the system then the alarm will activate to notify relevant staff.

### ***System Expandability***

The system is designed in such a way that additional LRU circuits and CP zones can easily be added to the new system and in early 2016 the system was enlarged, including the addition of a new LRU enclosure, so that CP could be applied to some previously-unprotected areas of the steel frame. At the time of writing, further system expansion is being considered.

### ***In Summary...***

Rowan Technologies' approach to third-party CP system refurbishment, as shown by the St. Andrews House project, can equally be applied to other ICCP systems that are ageing, becoming obsolete or unreliable, or judged to be overly-complex.

Alongside the refurbishment of existing ICCP systems, the company can provide a complete 'package' that includes long-term system maintenance, reporting and possible system expansion as required.