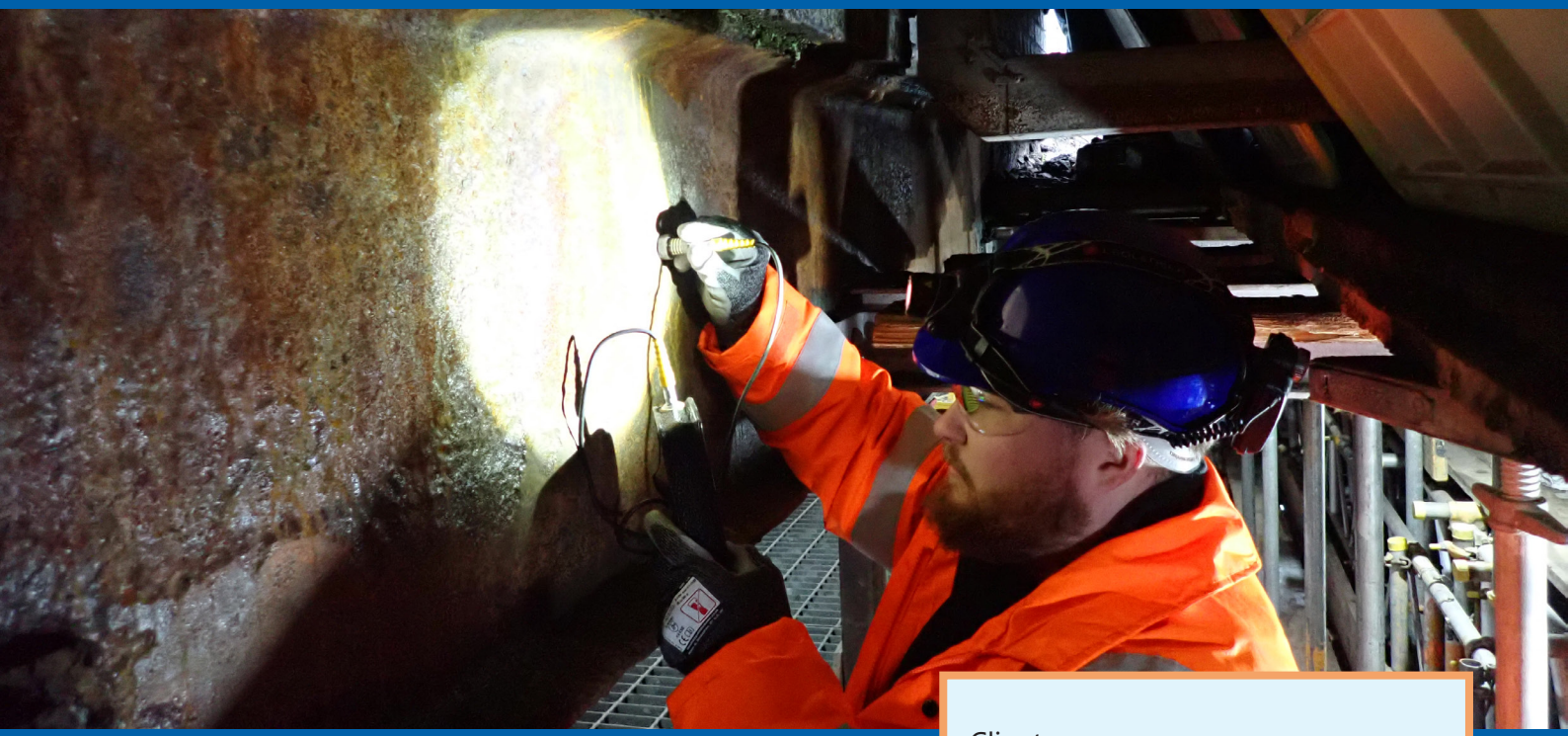
FRANKHAM GROUP



Client:
Octavius

Services:
Infrastructure Engineering

Start and End Dates:
October 2019 - March 2021

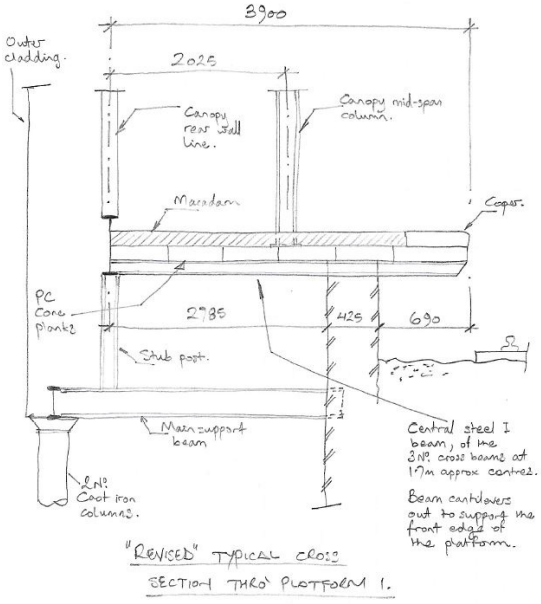
A Major London Railway Station: HCE, Propping Review, Assessment, and Refurbishment Design

Frankham were initially commissioned to undertake a Hidden Critical Element (HCE) examination for Platform 1 and associated canopy and superstructure of a major London railway station, of which is located high above ground level. In response to identifying a number of urgent defects, additional services were provided to support our client and the end client.

Overview

The in-house services undertaken by Frankham on the project included:

- Hidden Critical Element (HCE) Examination
- Contractors Responsible Engineer Design (CRE-D)
- Lead Designer – Design coordination
- Trackside coper support inspection and temporary works design
- Corrosion inspection and section loss survey using Ultrasonic Thickness Gauge (UTM) device
- Combination of inspection techniques to compile the Inspection for Assessment (IFA)
- Design of replacement support-beam
- Level 1 and 2 assessment of platform support structure
- Design Assurance Forms
- Site query support
- Designer's Risk Assessment
- Working for the contractor on this project whose client was the main asset owner



Innovation and Added Value

One of the early tasks identified was to ensure that the cantilever copers at the edge of the platform were properly supported. The beams that needed replacing passed through the ballast wall to cantilever out above the Cess, supporting the coper slabs where the adjacent slabs butted together. The beams had severe corrosion inside the ballast wall and urgent action was taken to provide additional support to the copers using a gallows angle bracket either side of the external cantilever portions of the defective beams. By thinking ahead, we provided the required support but were not in the way of the construction work to replace the beams when the design was completed.

A full survey was undertaken of the ballast wall below the copers to verify the surrounding areas were sound and would hold the fixings for the brackets. This added-value-exercise was to look beyond the task in hand and to try and foresee some of the challenges that our client would have during construction. Also, to save the end client added cost from re-work.

In order to allow for installation of the beams while trains were running, without closing the train lines in a possession, we designed the temporary support brackets to be installed quickly and easily on nights in a possession. The permanent works followed on and significantly without possessions except to replace the cantilever portions of the beam. This meant less impact on the railway and inconvenience to the travelling public.

In the absence of record drawings, a measured survey was undertaken using laser scanners, as well as hand measurements, from within a congested scaffold propping system, which was put in place as an emergency.This meant that replacing the beams was difficult and required manual handling. Each beam had varying dimensions to ensure that the end beams did not foul the gauging for trains.

In collaboration with the steelwork supplier and main contractor, we developed a design that allowed shorter manageable sections of beams. We worked with the fabricator to check bolts and fixing details with tension control bolts, ensuring the installation gun could fit in the scaffolding properly without compromising safety and quality of the connection. As the platform was curved and the structure varied, this needed tables of dimensions and items of varying sizes. We provided tabulated information and where possible grouped sizes together to have as many of the same sizes as possible.

This project became more complicated as it developed through the design stages. Due to the emergency status of the works, we needed to be agile, adapt and work with all the other suppliers working for our client. We acted as design CRE and co-ordinated with the CEM and all the other suppliers and sub-contractors with the project outcomes in mind. Even though this team was pulled together very quickly we worked in a collaborative and pragmatic way to deliver a robust solution for the issues found on a simple HCE presented us. This was all done whilst maintaining a safe and operational platform at this station.

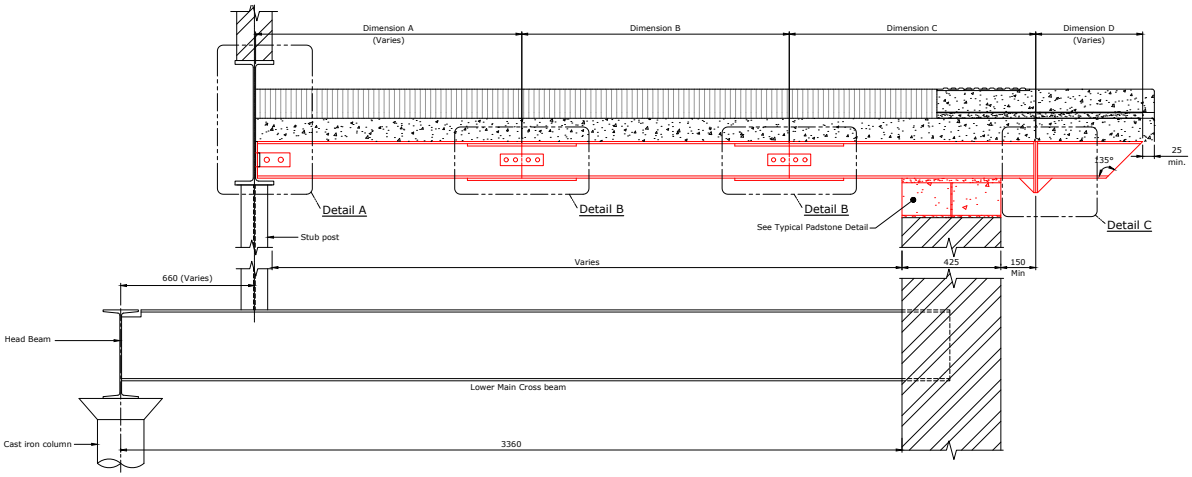
Challenges

The project was unplanned and one of the largest reactive projects we had completed at the time. The local authority was a stakeholder as traffic management had to be put in place around a temporary scaffold that was put up to make the structure safe until the work could be evaluated, designed, and constructed.

Additional defects and issues came to light as the project progressed. We overcame this promptly by providing professional and technical advice, adding resources and working closely with the supply chain and our client.

Our team delivered under pressure and handled the difficult and technical issues professionally. One of the main drivers were the stakeholders it impacted: the travelling public - both road and rail, and the tenants in the arches below.

The whole team worked together to open the structure as quickly as possible and to minimise the impact on this busy London station. It was a relatively high pressured but rewarding project to work on that has provided a safe environment for many years to come.



Sustainability

The beams that were designed and replaced were identified as being beyond the end of their serviceable life during the HCE examination. The findings showed they were in need of urgent replacement. A temporary scaffold propping system was put in place by our client as a matter of urgency to support the platform structure. The failed beams effectively provided implied horizontal restraint to the overall support structure columns as well as direct vertical support to the overlying platform deck slabs and surfacing. The remaining elements were severely corroded also. Engineering judgement identified that these could potentially be reused, therefore reducing the need to replace materials, extend the work programme and negatively impact the carbon content of the project.

As propping was in place to support the structure, undertaken immediately after the HCE identified the issue, we were able to take some short time to consider what could be conserved. In order to prove this, we undertook hand calculations to demonstrate initial viability of this proposal. This looked positive but was close to the required utilisation factor. It was also based on a number of assumptions as the corrosion was masking the true remaining section sizes as it was widespread throughout the structure.

A detailed examination and structural investigation was undertaken as an inspection for assessment. This also involved a dimensional survey on which to build the computational model for Finite Element (FE) analysis. We measured the section loss after the beams had been cleaned of corrosion products and checked element thicknesses using an Ultrasonic Thickness Gauge. The FE modelling confirmed the initial judgement and this saved replacement of a significant amount of steel members, which were cleaned and painted to extend their useful life and reduce the environmental impact of the project.