FRANKHAM GROUP

CP6 Footbridge Refurbishment Framework

Frankham Consultancy Group provided civil engineering design assurance services for the implementation of over 20 refurbishment and strengthening projects of footbridges in the Sussex and Kent regions over a 5-year period.

Client:
BAM Nuttall

Services:
Infrastructure Engineering

Start and End Dates:
2019 - 2024

Overview

The footbridge strengthening projects involved optioneering, structural assessment reviews, development of practical strengthening solutions that align with the original structural design while aiding constructability within possessions, the design of new decking and handrails, and upgrading staircases to meet the requirements of the Equality Act.

Frankham undertook the following services on these schemes:

- Structural and measured surveys
- Survey specifications
- Topographical surveys
- Feasibility studies and optioneering
- Structural assessment
- Detailed design of repairs and strengthening
- Temporary works design
- CAT1 and CAT2 check
- Design assurance: Form A/B/C/G
- Engineering assurance: CRE competency for Permanent Design and Temporary Works.

Several schemes undertaken on this framework have been provided to highlight our experience.

Methodology, Delivery & Communication

At the framework inception, Frankham developed a Project Execution Plan and Project Directory, which outlined the lines of communication, roles and responsibilities and a Communication Management Plan (CMP) with the contractor and Network Rail. This clearly set defined engagement and communication processes, with a focus on collaborative working and stakeholder communication throughout all stages of the project. The CMP included:

- The project brief with all key stakeholders
- Agreed lines of communication and reporting structure
- The defined problem-solving hierarchy
- Key milestones for delivery
- Schedule of regular project reviews and team meetings

We utilised a number of tools to ensure effective communication, which included:

- Regular design team meetings and reviews
- A Design Risk Register per scheme
- Issue of design review meeting minutes to all relevant teams
- A Project Change Control was utilised any time significant changes were made to a scheme and issued to both the design teams and the client

Open lines of communication with the client were maintained throughout the framework using project trackers, which were updated and circulated prior to any meeting taking place. Our project tracker reduced miscommunication by displaying the information in a clear and easy to understand manner for all stakeholders.

We also developed and prepared a design programme for the aspects of work that we were instructed to do using Microsoft Project. It had a clear and broken-down activity list, identified all stages, and showed milestones and activities including design reviews, co-ordination meetings and IDC/IDR. We ensured that our programmes were aligned with project objectives and that they were managed in co-ordination with other key stakeholders. We used an overall resource planning tool to ensure staff availability was managed and the programme was fully resourced for the duration of the project. If influences on the programme occurred, we reviewed the programme and our resourcing tools to ensure we continued to deliver the quality needed, on budget and to time in our designs.

All changes were reviewed regularly, and early warning notices were raised in the event of an uncontrolled occurrence emerging. We mitigated these and attended risk reduction meetings to ensure change was proactively managed for the duration of the activity. On this framework we were well known for delivering to agreed timescales and ensuring projects were effectively managed so that we hit our commitments and provided dedicated resources to manage the framework activities.

Quality Assurance

Frankham are accredited to ISO 9001 and RISQS. Our Business Management System Work Procedure is our Quality and Assurance Procedure for design deliverables. It sets out a 3-level process for checking deliverables. The purpose of this document is to ensure that a project's deliverables comply with the client project brief, project specification; accuracy of information; required information level of detail, professional standards/duty of care and our internal document/information control procedures and policies: naming conventions; filing location and the templating of documents so that the final deliverable structuring of the text follows basic rules and is easier for managers, colleagues and auditors to interrogate and approve.

Most importantly, this document also asserts that any document which is released as a direct client deliverable or contributes to a client deliverable (Internal or External) must be checked and signed off by a senior designer or lead professional responsible, such as CRE(D). On this framework, along with design team meetings and workshops, we applied our quality management processes and standards throughout the project lifecycle. This approach ensured alignment and coordination, reduction in errors and a high certainty of achieving a high-quality build, with a whole life cost and sustainability focus.

Woolwich Dockyard Station Footbridge –
Refurbishment & Strengthening

Woolwich Dockyard railway station is in Woolwich in the Royal Borough of Greenwich and has been servicing passengers since 1849. The scheme was to strengthen and refurbish the undercapacity and dilapidated footbridge and associated staircases to provide a maintenance free design life of a minimum 15 years.

The in-house activities undertaken by Frankham comprised:

- A structural condition survey of the footbridge and associated staircases
- A targeted structural assessment, using the information collected from the survey to inform the detailed design
- Development of strengthening options, taking into consideration buildability
- The preparation of Form A and B assurance forms, which included detailed design drawings, designer's risk assessment and in-house CRE(D) sign off

Challenges & Innovation

During the structural inspection, we used an ultrasonic thickness gauge to determine the condition and residual thickness of metal, which helped to inform the structural assessment capacity and the elements requiring strengthening.

The footbridge required strengthening of the main span truss top and bottom chords. The client initially proposed strengthening by using additional steel plates, which would have required excessive amounts of material. However, due to the logistics of installing these during possessions, it became a complicated and uneconomical proposal.

Based upon our experience of these types of structures, we recommended a more efficient option would be to reanalyse the footbridge, taking into consideration additional and strengthened u-frame restraints.

Using a structural analysis programme, Autodesk Robot, we modelled the entire footbridge and were able to design the optimal size and number of u-frame elements, without significantly increasing the overall weight of the footbridge or altering the overall appearance of the structure.

Sustainability

The refurbishment of this structure formed a vital part of asset management of the footbridge. The inspection and subsequent condition report highlighted defects and recommended repairs to the footbridge that would help extend its design life.

Extending the design life is a solution for a more sustainable approach to asset management. Since it prolongs the need for a more extensive refurbishment or demolition of the footbridge, we actively helped to prevent material waste and provide a positive contribution to the climate crisis.

East Croydon Station Link Footbridge –
Dilapidation Survey & Feasibility Study

East Croydon Station is one of the busiest non-terminal stations in London and in the United Kingdom as a whole. It can suffer from overcrowding and queuing at peak times. For trains coming up from Brighton, East Croydon is the final station before the route diverges to Victoria and London Bridge. It is effectively the station where everything from all the branch lines to the south comes together. Historically, to make interchange between the three island platforms there was a subway with ramps to/ from platforms.

The subways at East Croydon station have been superseded by the new Link Bridge that was installed and commissioned for use circa 2013, helping to improve the station's capacity. It was proposed in the original design optioning that the footbridge would provide secondary access and egress to East Croydon Railway Station for paying customers. There was provision in the design to provide a non-paying side to enhance pedestrian access from the East to the West side.

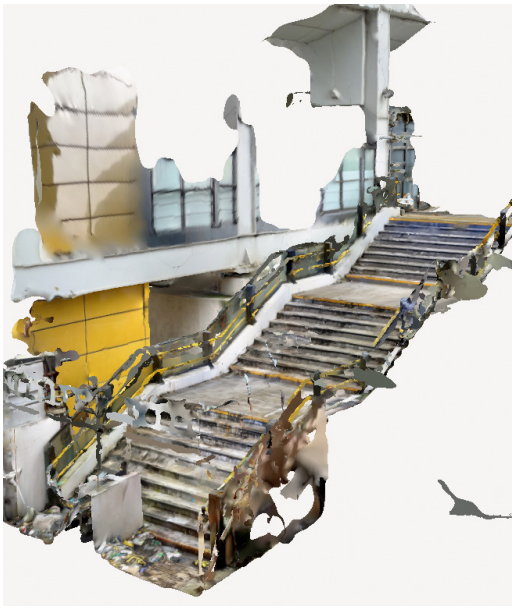
At the time of concept, East Croydon was in the midst of a large re-development programme to provide modern housing in the form of high-rise accommodation & local regeneration of the town centre.

However, due to national economic issues, the area regeneration was delayed, and some aspects deferred, meaning that the non-paying pedestrian access side of the footbridge remained closed since construction.
The scope for this scheme was to undertake a dilapidation survey and feasibility study for opening the non-paying side of the link footbridge at East Croydon Station to provide pedestrian access from the East to West Side, which included:

- Dilapidation survey
- M&E survey
- Diversity impact assessment
- Compliance check to DfT design standards for accessible railway station

With the information gathered from the surveys, the feasibility study provided recommendations for remedial works of defects identified and alterations required to ensure the non-paying side complies with the design standard for providing accessible railway stations.

To complete the DIA, research was undertaken on the community demographics, reviewing the impact the new works would have on people of different ages, race, gender, religion and disability.



M&E Survey

The M&E survey was undertaken in-house. The scope was to review the existing lighting services and assess the current lighting for compliance to Network Rail Lux level requirements. We also reviewed the existing wiring and lighting design on current systems that form the non-operational side, and to identify the circuit origins and installation.

An understanding of current distribution board power supply and isolation points was required as the non-operational side of the link bridge required sub metering for 3rd party payment of electrical usage.

To achieve the above requirements, it was agreed to attend site out of hours to enable the visual part of the survey to be completed during the hours of daylight, and then once the sun had set to complete the lux measurements and survey.

Cont

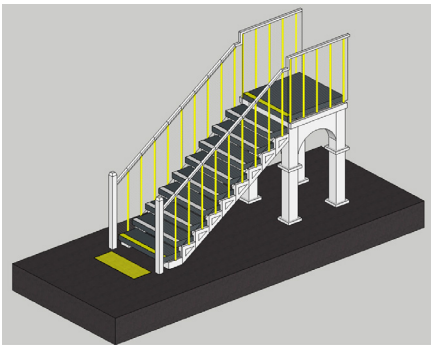
East Croydon Station Link Footbridge –
Dilapidation Survey & Feasibility Study *Cont.*

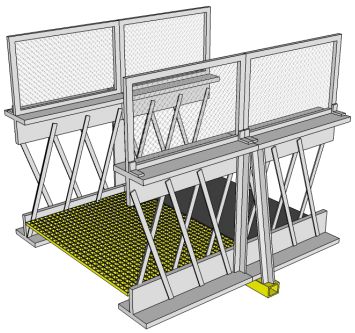
Innovation

To collect the data required for the feasibility report, a survey was conducted by professionally qualified engineers populating a schedule of defects via use of a form filler application. Utilisation of a form filler application for the site work to record data enabled us to provide faster results to the client, empowering them to make critical and informed decisions expeditiously and to benefit from huge cost savings due to the time savings.

During the surveys, a 3D LiDAR scan was also undertaken to add further value to the dilapidation survey and feasibility study by obtaining a 3D model of the footbridge. Use of LiDAR scanning surpassed the limitations of a 2D photograph, providing valuable data on the structure and wider rail environment. Three-dimensional data was used to revisit the condition of existing access at any point throughout the development of the feasibility report and to assist the observations from the photographic survey and site notes. It could also easily be shared to stakeholders, to allow them a more immersive experience of viewing their structure, as well as being used during project meetings for more constructive discussions.

Kearsney Station Footbridge Feasibility Study





Frankham were commissioned to review the viability of refurbishing Kearsney Station footbridge to extend its remaining design life, rather than replace.

The footbridge is a single span structure; the main span is formed of wrought iron lattice main girders with transverse cross girders and outriggers with a timber deck, and the staircases comprise cast iron stringers supporting timber treads, and landings supported by cast iron angle column trestles.

The project scope was to design and specify low maintenance elements to refurbish the structure whilst increasing the overall load carrying capacity of the footbridge. As part of the works, we also undertook an inspection for assessment and a targeted structural assessment, to inform the feasibility study and provide our client with the current status of their asset.

Innovation & Stakeholder Management

Optioneering was undertaken at an early stage to ensure the existing appearance of the structure was maintained, without altering or detracting significantly. The team used 3D design software to model the different feasible options, allowing the Client to make an informed decision on their preferences.

For our presentation of the proposals, augmented reality software was used to share with the asset owner the proposed refurbishment and strengthening alterations to the footbridge, illustrating how the appearance would change to help facilitate their approval.

Use of this technology enhanced the value of project by providing the stakeholders with real-time, 3D visualisation of new design proposals. We were able to present immersive visualisations of full-scale models projected into their contextual environments.

Integrating this technology with traditional drawings on our projects allows for designs to become better integrated with the actual landscape, whilst providing clearer communication of concepts to stakeholders.