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31st December 2018

A handwritten signature in blue ink, appearing to read 'G. Couchman', with a long horizontal flourish extending to the right.

Dr Graham Couchman, CEO, SCI

1st January 2018

_____ Date

London Bridge station

a contractor's view



COLLIN
GARR

Regular readers of Rail Engineer will have enjoyed reading the many articles about Network Rail's £7 billion Thameslink programme. Arguably, the most challenging element of the project is the construction of a new London Bridge station whilst the existing London Bridge station remains operational.

London Bridge is, in fact, the oldest terminus station in London, first opened in 1836. Today the station serves over 50 million people every year and is the fourth busiest station in the UK. London Bridge station was originally two stations and the memory of the original configuration of through and terminal platforms was the underlying problem that needed to be addressed if the Thameslink project was to work effectively and efficiently.

The old station had six through platforms that lay on the Kent and southeast London routes into Charing Cross and Cannon Street. The remaining nine platforms formed the final stop for routes from Sussex and south London.

Removing old memories

The aim of the £1bn station design and construct project has been to fully remodel the station and transform the track and platform layout from nine terminus and six through platforms to six terminus and nine through platforms.

London Bridge station - the Charing Cross platforms.



In conjunction with the construction of the new platforms, a vast new concourse, designed to provide a significant improvement to the passenger experience, is being constructed below the platforms. The end result is an emerging new station capable of coping with passenger numbers of up to 75 million per annum.

Alongside the construction of new platforms and a concourse, a substantial amount of work has been underway to improve the interchange between the Network Rail and London Underground stations.

In 2012, Network Rail appointed Costain as the main contractor for the detailed design and delivery of this £1 billion infrastructure project. As a result, Costain is both the principal designer and principal contractor. The project is now in its sixth year and is due for completion in May 2018.

Overarching objectives

Mark Howard is Costain's programme director at London Bridge. So Rail Engineer met with him to understand the contractor's role in this significant engineering undertaking, and to find out how he managed this challenge, one that must rival any railway station development anywhere in the world in its complexity.

Mark started by explaining the three guiding principles that have driven the programme's strategy, work plan and the sequence required to manoeuvre effectively the different stages of work throughout the station complex.

The overarching objectives are to maintain the safe operation of the station and its surrounds, and of the train services, and to ensure a continuing positive passenger and public experience within and around the station complex.

Incentivised partnering milestones

Costain fully understood that the station redevelopment would only be achieved if there was a successful integration of what was referred to as "The Railway Systems". These were the main packages of work that were let by Network Rail, mainly the station development itself (Costain), associated track work (Balfour Beatty) and signalling and telecommunications (Siemens Rail Automation).

There are no direct contractual links between the three parties, but the London Bridge Area Partnership (LBAP), a collaborative relationship established using BS11000, was established in 2012.

For the Thameslink programme and the individual contracts to be successfully delivered, it was and continues to be recognised that interface work is an essential element for successful delivery.

The intent of the LBAP arrangement from the outset was to ensure that the following interfaces between the parties were effective. These were the technical interfaces through the design development and approval process, programme interfaces so that 'give/get' dates could be devised, agreed and achieved, and the coordination and control of safety, health and the environment.

In addition, the relationship supports the sharing of best practice and innovation and also risk mitigation.

Network Rail ensured that the give/get milestones would be incentivised within each of the respective contracts to encourage focus and commitment. In total, there were 35 'give and get' dates agreed and, to date, all of these milestones have been achieved.



Transforming the station complex

Costain identified four main project objectives:

- » Complete remodelling of the track and platform layout. The starting layout was nine terminus platforms and six through-running. The project will change this to six terminus platforms and nine through-running, including dedicated platforms for the Thameslink service, a critical factor.
- » Creation of a new street level concourse measuring 75 metres by 200 metres, approximately the size of Wembley stadium.
- » New interchange route (Western arcade) between London Underground and the new concourse.
- » Full transformation and re-development of the station buildings.

Mark explained that Costain's early involvement in the design was crucial for adding value and de-risking the project. He gave two examples of key initiatives that had been introduced during the planning phase.

The first was to develop an effective safety case for using four tower cranes instead of mobile cranes, which are considered the norm for such work. The effort put into producing the necessary safety case was rewarded with a marked improvement in productivity.

The second was to design 1,100 prefabricated canopy units that would form the complex roof geometry. These were assembled off site and delivered 'just in time', enabling complex construction work to be undertaken in a much shorter time. With the assistance of cladding specialist Prater, subcontractor Severfield designed and constructed the bespoke cassette canopies.

Highlights of the work included:

- » The demolition of the Victorian shed roof.
- » Demolition of existing platforms and Victorian arches by Keltbray, plus complex ground engineering and the construction of more than 1,000 piles by Bachy Piling UK. The work programme was not linear but had to be carried out at different stages of the project, whilst maintaining a common high standard.
- » Civils works involving placing 85,000 cubic metres of reinforced concrete, drainage, sub and superstructure, bridge and track-bed construction.
- » Mechanical, electrical, communications, fire, station and building management systems. 11 new lifts and 24 new



escalators and the construction of 15 new platforms and associated floors, finishes, cladding, glazing and canopies.

- » Integrated testing and commissioning, in interim state with legacy systems and in end state. Planned and reactive maintenance of all assets entered into service before substantial completion date in May 2018.

The station construction staging had to be fully aligned to the track and signalling staging and underpinned by partnering milestones. Thousands of possessions and ten major blockades have been, and continue to be, successfully delivered whilst, and this is the key part, the station has been kept fully operational as the stages have progressed from the south side to the north.

Progress milestones

Work started in late 2012 and, by May 2013, three platforms had been taken out of operation. By September 2013, pile cap and drainage construction was well underway and, by January 2015, all the six reconstructed terminal Platforms 10 to 15 were in operation. This then enabled Costain to move into the heart of the station and demolish the Victorian archways below the platforms in preparation for the new expansive and spacious concourse.

At the western end of the station is the newly constructed SAVEX Weststructure cast in-situ with a precast beam decking. This structure, plus an additional 40-metre steel-decked west approach viaduct structure built by Costain, is designed to link the existing network with the new and so far unused, 350-metre pathway which includes Borough Market viaduct.

Mark explained that the west approach viaduct was probably the most challenging aspect of the project. Partly because it



Network Rail CEO Mark Carne at London Bridge with architect Andrew Byrne of Grimshaw

impacted on London Underground, the bus station and the railway activities, but also because of the restricted site access, loading restrictions and adjacent structures.

All operational activities had to be suspended so that 90-tonne girders could be positioned using bespoke lifting gantries and self-propelled modular transporters (SPMTs). Working in this restricted environment, and controlled by skilled operators, the SPMTs manoeuvred the girders onto the bearings of the previously constructed in-situ columns. The work was completed in 2015, creating a pathway designed eventually to carry an additional two dedicated Charing Cross tracks in 2018.

By July 2015, St Thomas Street façade was completed. Thorp Precast installed 22-tonne pre-finished brick and stone-faced units which look very effective alongside the existing arch structures.

Wow factor

On 29 August 2016, the southern two-thirds of the concourse opened, along with the through-running Platforms 7, 8 and 9 - described by Mark as a genuine 'Wow!' factor for the public and travelling passengers.

So as stated before, all 35 give/get targets have been met. All tracks have been handed back to operations except those alongside Platforms 3, 4 and 5, which will be handed back after the completion of work planned for the Christmas blockade.

Alongside this outstanding work is the development of the in-situ concrete Quadrapartite Arcade arches, designed to recreate the original Victorian form. One bay is already open to the public and provides direct interchange to the London Underground station. The two parallel bays will be completed by Christmas.

There are more than 200 suppliers supporting Costain in this venture. The relationship and interface management with Balfour Beatty and Siemens, overseen by Network Rail, has and continues to be absolutely critical in ensuring that the project is a success.

Passengers can now walk through large parts of the new station, and it is truly amazing to see how it has been totally transformed. It is hard to think of a more complex undertaking and one of which Mark and his team must feel very proud. It is an outstanding contribution to the Thameslink project and even has that Wow! factor.

What more can I say?

