The Government-sponsored £7bn Thameslink Programme is an ambitious 10 year programme of extensive infrastructure enhancements and new 115 trains that will bring faster, more frequent, more reliable, better connected journeys for passengers - transforming north-south travel through London.

The Programme is delivering new infrastructure, better stations, new technology and new trains on an expanded Thameslink network to deliver significant improvements that respond to the growth in passenger demand now and into the future.

As part of Network Rail’s London Railway Upgrade Plan, London Bridge Station is undergoing a stunning transformation that will deliver a better experience for users and a reduction in delays. It will also ensure greater connection between London’s home counties and increase passenger capacity by two-thirds. The station transformation includes an enlarged street level concourse underneath the tracks that is larger than the Wembley Stadium pitch, also integrated are new entrances and new platforms for more trains, with three of the nine terminating platforms converted to through platforms. The concourse is set to be one of the largest in Europe.

The rolling redevelopment programme started in 2012 and has been scheduled in such a way as to ensure the station remains open for business at all times. The final stages of the redevelopment will be completed in 2018. On 2nd January 2018 the final section of the massive new concourse and five platforms opened to the public.

Roof plan
Elegant curves are integral to the design and respond to the track geometry and curvature of the site. Steel is the natural material for the project as it allows the necessary design flexibility. It also offers sustainability benefits as it is recyclable, offers wide tolerances and less weight.

All 15 platforms have been rebuilt to be covered by a striking undulating canopy of steel and aluminium, fabricated and installed by Severfield. The eye-catching canopy roof is modularised using open sections where each module is approximately 9m deep by 3m wide. There is an astonishing 1,200 prefabricated steel cassettes with each one a bespoke unit due to the changing rooftop geometry. To save time, cassettes were pre-constructed off site and then craned into position, allowing the canopy to be built during short night-time construction hours.

The canopy structure comprises Y-shaped columns supporting a longitudinal spine beam formed from fabricated box sections that have extended webs to create service routes. Platforms and canopies sit outboard of the bridge girders, supported on transverse “elephant ear” frames, and as trains pass over the bridges any deflections cause the tips of the elephant ears to move longitudinally. The plates that connect the frames to the bridge girders are designed to balance strength and stiffness, in order to resist the applied loads while remaining flexible enough to avoid fatigue. Towards the ends of the decks, fatigue movements are higher and radial spherical bearings are used.

The centrepiece of London Bridge station is the concourse which is nearly 80m wide. There is also an expansive central space at the heart of the concourse which deals with the level changes across the site. The large span of this space was achieved by using a longitudinal V-column to support a 5m deep vierendeel truss, and this allowed for glazing between the vertical members to form the rooflights above.
Central ‘V’ shaped column supporting the roof truss (August 2016)
Platform view showing "Y" shaped structural columns
Cleveland Bridge UK Ltd has been honoured to be integral to this landmark project and has supplied steelwork for rail bridge decks spanning the new concourse. The work has including fabrication, trial erection at the company’s Darlington facility, painting, delivery and installation.

The concourse bridge decks are made up of 3 - 4 spans of simply supported decks for each rail line. Each bridge deck consists of 29 plate girder rail bridge decks, each with six main girders braced together and tied at the ends with trimmer beams delivered and erected as pairs. Following installation the beams were mass filled with concrete and fitted with platforms, rail lines and canopies. The total tonnage supplied for the project was 3,600 tonnes.

The girders were of a plate configuration, the lengths (spans) required were fabricated and painted at Darlington and no additional longitudinal splices were required. After fabrication, all components were placed in pairs together for a trial assembly to ensure perfect fit and alignment, de-risking the operation due to it occurring within a controlled environment. Upon completion of the trial erection, the deck was separated into component pairs ready for dispatch to London.

The main logistic challenge for the project was the severely restricted site access; a requirement to consider scheduling for follow-on trades; and the essential need to keep the station fully functional. The architect Grimshaw designed the station and complex staging process based on the concept of prefabrication and modular offsite construction, where components are preassembled before being delivered to site to a strict schedule and installed. This has reduced the pressure on the construction programme and again the use of steel was advantageous.

For the installation of the decks and canopy the project was split into six phases between October 2013 and May 2017. Close co-ordination between Cleveland Bridge and the main contractor Costain was essential to ensure the steelwork could be delivered efficiently to site and erected using either cranes or Self-Propelled Mobile Transport (SPMT) systems. Each stage of installation was carefully planned and exacting to ensure follow-on trades were not hampered.

The possessions for working were Rules of the route (very short window when trains are not running) synchronised with very tight and restricted short possessions for delivery vehicle road closures. The entire project takes place in a busy city centre location with narrow streets through which to move delivery vehicles, large plant and equipment.

The size of the steel structures required large bearings. However, installation of the bridge bearings was complicated by the fact there was minimal space on the pier heads to allow both longitudinal and rotational construction movement needed for installation.

This was resolved by Cleveland Bridge’s suggested use of a tapered plate between the bearing and bridge steelwork to allow the bearing rotation. This was sufficient to counterbalance the deflection caused by concrete pouring. Once the concrete was placed and cured and majority of dead load was applied, Cleveland Bridge jacked up each bearing and replaced the tapered plate with a parallel plate, thus restoring the rotational capacity of the bearing to take the imposed loads.

The lifting schemes for all steelwork installations were planned by Cleveland Bridge’s in-house project teams and included the innovative use of heavy capacity scissor lifts mounted on the top of SPMTs to solve access and installation problems.

The scope of Cleveland Bridge’s work was to maximise the level of off-site fabrication and preparation to significantly reduce the on-site programme. As the station was operational throughout the project, health and safety was paramount and the overall project was delivered within budget and ahead of schedule, exceeding the client’s expectations.

27 separate crane lifts were required, and 87 lifts using crane and SPMT. The maximum component length was 33m long and 2.7m wide and weighing 89 Tonnes.

The last two stages, Deck B and A, were extremely complicated due to the lack of space and the vast number of contractors onsite. Innovation on this project took the form of swept path analysis to study the feasibility of site access and the displacements once onsite, as well as the use of scissor lift by SPMT.
Steel bridge deck beams
Central void space at the station
2018 ENTRY FORM

PLEASE COMPLETE ALL SECTIONS BELOW IN FULL (including email addresses):

Name of building/structure: ..............................................

Location: ...........................................................

Programme of construction: ...........................................

Completion date: ....................................................... 

Total tonnage: ..........................................................

Cost of steelwork (£): ..................................................

Approximate total cost (£): ...........................................

DECLARATION OF ELIGIBILITY
As the representative of the organisation entering this structure in the Structural Steel Design Awards 2018 I declare that this steel-based structure has been fabricated by a UK or Irish steelwork contractor. It was completed during the calendar years 2016-2017. It has not been previously entered for this Awards Scheme.

Signed: ........................................................ Date: ...........

On behalf of: ..........................................................

PERSON SUBMITTING THIS ENTRY
Name: ...........................................................

Tel: ............................................................

Email: ..........................................................

SUBMISSION MATERIAL
The submission material which should be hard copies, should include:
- Completed entry form
- Description of the outstanding features of the structure (c. 1,000 words), addressing the key criteria listed overleaf, together with the relevant cost data if available
- Architectural site plan
- Not more than six unmounted drawings (eg. plans, sections, elevations, isometrics) illustrating the essential features of significance in relation to the use of steel
- Six different unmounted colour photographs which should include both construction phase and finished images
- Memory stick containing the images submitted as digital JPEG files at 300dpi A5 size minimum and an electronic copy of description text in Word (not pdf format)

Entry material should be posted to:
Gillian Mitchell MBE, BCSA, Unit 4 Hayfield Business Park, Field Lane, Auckley, Doncaster DN9 3FL to arrive by not later than 23rd Feb 2018

Sponsored by The British Constructional Steelwork Association Ltd and Trimble Solutions (UK) Ltd.
PLEASE COMPLETE ALL SECTIONS BELOW IN FULL (including email addresses):

2018 ENTRY FORM

Name:  

PERSON SUBMITTING THIS ENTRY

Cost of steelwork (£):  

Total tonnage:  

Completion date:  

Programme of construction:  

Location:  

Name of building/structure:  

Memory stick containing the images submitted as digital

Not more than six unmounted drawings (eg. plans,

Architectural site plan

Completed entry form

The submission material which should be hard copies,

SUBMISSION MATERIAL

On behalf of:  

Signed:  

Date:  

2017. It has not been previously entered for this Awards Scheme.

As the representative of the organisation entering this structure in

the Structural Steel Design Awards 2018, I declare that this steel-

described structure has been fabricated by a UK or Irish steelwork

based structure.

Description of the outstanding features of the structure

include both construction phase and finished images

features of significance in relation to the use of steel

sections, elevations, isometrics) illustrating the essential

overleaf, together with the relevant cost data if available

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Contact:  

Address:  

Email:  

Company Name:  

MAIN CONTRACTOR

Contact:  

Address:  

Email:  

Company Name:  

STEELWORK CONTRACTOR

Contact:  

Address:  

Email:  

Company Name:  

ARCHITECT

Contact:  

Address:  

Email:  

Company Name:  

LONDON BRIDGE STATION    15