Case Study:
Managing station design changes

London Bridge station redevelopment – putting passengers first

Recommendations for improving the passenger experience on complex networks
minimising disruption during works and minimising impacts on station operations

Managing the station changes and construction feasibility

Many parties have been involved in the redevelopment of London Bridge Station (Key Output 2), from the early feasibility and optioneering stage beginning in 2008, to today, working with and supporting the contractors in the final construction stages as the platforms were released into operation and retail areas opened up to the public with Thameslink services restored and new services introduced.

Activities included system migration planning for the entire Thameslink Programme, track remodelling, station design and electrical track equipment. The complex staging solution for Key Output 2 enabled Network Rail to deliver a re-designed London Bridge station with a throughput of 18 trains per hour (and ultimately 24tph for Thameslink services through central London), within five years, with minimal disruption to passengers and railway staff.

The early feasibility and option selection during the Network Rail GRIP 2 and 3 stages was central to achieving and balancing these key objectives. The programme has been so robust that it has remained largely unchanged, with nearly all the milestones met.

Through the early collaboration of operations, constructability and systems engineering teams, Network Rail had certainty that the Thameslink Programme could be delivered while keeping London Bridge station operating for its circa 50m annual passengers. With all 15 platforms reopened on schedule to the public in January 2018, London Bridge can now serve 96m people a year.

The area covered by Thameslink Key Output 2 included some of the most constrained sections of railway infrastructure in the UK, as well as London’s fourth busiest station in London Bridge Station. To deliver a fully workable scheme design there were critical signalling and permanent-way design issues to contend with a target completion within five years while keeping London Bridge Station operational. At all times the project team was committed to putting the needs of commuting passengers first working very closely with the Train operating Companies.

Early systems integration

Ensuring ‘Industry Level’ integration, specific integration activities were managed at programme and project levels, which integrated performance targets, operational concepts and nearby infrastructure projects. Early on a clear roadmap for the programme was agreed with a comprehensive system migration plan to understand and test how the elements of the programme would align to deliver Key Output 2 outcomes.

To minimise disruption to passengers and control costs, all the elements of the programme needed to be perfectly synchronised. The system migration plan showed how the construction sequence at London Bridge, the new depots, new rolling stock and new train control equipment interacted, and identified the key states that the programme would transition through to reach the final configuration. The system migration plan produced in December 2011 was maintained – unprecedented for a project so complex.

Construction staging to minimise disruption

Working with Network Rail’s timetabling and pedestrian modelling teams and the train operating company station team representatives from a very early stage, the integrated team of track experts, systems engineers and constructability consultants explored different options of closure and their consequences, to understand how different scenarios would affect passengers. An early integrated approach to pedestrian modelling enabled
options to be explored for adjusting the operating schedule, the stopping patterns and train dwell times and to provide an optimised construction programme that features, for example, ‘non-stopping’ platforms that could remove the need to create space for passengers where work is taking place. Through strategically integrating these elements, a train operations plan was developed, including key pedestrian flows and construction sequencing for the station and the railway systems design.

The solution was a railway and station built in stages. A construction programme was created, organised into nine strategic milestones. It was not the most efficient programme from a construction perspective, but the progressive handback enabled the project team to demolish old platforms and progressively reconfigure the tracks, reducing the number of closed platforms - only three of 15 platforms were closed at any one time. This also gave certainty around timescales, enabling the number of timetable changes to be minimised – route timetables were changed just three times throughout the five years. Critically, robustly planned disruption enabled the teams to clearly communicate to passengers all service disruptions over the five-year period via social and mainstream media, this provided much needed continuity and allowed contingency planning for the millions of commuters affected.

Everyone was aligned and agreed on the programme sequencing and the need to avoid changes that would affect the passenger. The works were delivered in the tightly planned sequence of possessions and blockades - up to 70 sub-stages. If this sequence was broken it would have made significant impact on the schedule and potential disruption to passengers. The offsite construction for the platforms and canopied roofs proposed helped the construction teams meet their tight timeline. Using Virtual Design and Construction at early construction stages they integrated the station design with the development sequence and track construction to reduce costs and schedule duration and delivered a fully integrated programme on time for its passengers.

Attracting c.54m passengers a year and up to 1,000 new passengers a minute during peak hours, the London Bridge station works were Network Rail's largest to date. The challenge was to develop a programme of works that would keep London Bridge Station open and operational during the five years while the works were being delivered. The ultimate objective was to put passengers first – increasing capacity by two thirds and providing an enhanced station environment while minimising their disruption.

Reduced possessions to maximise safety

Reducing impacts to the operational railway and its customers – the design for London Bridge station maximised the use of precast and prefabricated elements, particularly for structures near the tracks, to minimise the need for possessions and the risk associated with works near the operational railway and it kept weekday commuter trains running.

The stages were very carefully planned to allow the operations at London Bridge station to be as least impacted as possible, with full consultation with the station teams at all stages.

<table>
<thead>
<tr>
<th>Construction Stage</th>
<th>Old platforms in operation</th>
<th>Old platforms out of operation</th>
<th>New platforms in operation</th>
<th>Train Service</th>
<th>Start on site</th>
<th>Completion</th>
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<tbody>
<tr>
<td>1</td>
<td>1-6, 8-13</td>
<td>14-16</td>
<td>None</td>
<td>HL as now, LL 6 platforms</td>
<td>25 May 13</td>
<td>31 Mar 2014</td>
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<td>1A</td>
<td>1-6, 8-11</td>
<td>12-16</td>
<td>P &amp; Q</td>
<td>HL as now, LL 6 platforms</td>
<td>Apr 2014</td>
<td>Sep 2014</td>
</tr>
<tr>
<td>1B</td>
<td>1-6, 8-9</td>
<td>10-16</td>
<td>M, N, P &amp; Q</td>
<td>HL as now, LL 6 platforms</td>
<td>Sep 2014</td>
<td>Jan 2015</td>
</tr>
<tr>
<td>Central Core</td>
<td>1-4 (+ Old line 7 non stopping)</td>
<td>5-16 (+the non stopping platform)</td>
<td>K,L,M,N,P and Q</td>
<td>CS as now, CHX non stopping</td>
<td>Jan 2015</td>
<td>May 2015</td>
</tr>
<tr>
<td>2</td>
<td>1-4 (+Old line 5)</td>
<td>5-16 (+ the non stopping)</td>
<td>K,L,M,N,P and Q</td>
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<td>May 2015</td>
<td>Jan 2016</td>
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<td>1-3</td>
<td>4-16</td>
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<td>CS as now, CHX non stopping</td>
<td>Jan 2016</td>
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<tr>
<td>3</td>
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<td>1-6</td>
<td>G,H,J,K,L,M,N,P,Q and through lines only E&amp;F</td>
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<td>Aug 2016</td>
<td>Apr 2017</td>
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<tr>
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<td>n/a</td>
<td>G,H,J,K,L,M,N,P,Q and through lines only A&amp;B</td>
<td>CS non stopping, CHX stopping on 3 platforms</td>
<td>Apr 2017</td>
<td>Jan 2018</td>
</tr>
<tr>
<td>4</td>
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<td>n/a</td>
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<td>CS, CHX, LL and Thameslink</td>
<td>Jan 2018</td>
<td>May 2018</td>
</tr>
</tbody>
</table>

**A station designed for passengers**

The street-level concourse, with its central load points to improve passenger flow, was designed to ease passenger congestion during peak times and simplify interchanges. The scheme involved the design of a 150m x 75m wide concourse at street level with a live railway running over the top on a viaduct, utilising existing brick arches and a new deck supported on columns located within the concourse to produce an attractive environment, allowing free passenger movement through the station from street to platform level.

To help understand the station better, operational impacts and use the knowledge of staff in the design and subsequent stages, Southeastern recruited a Project Manager, Station Change Interface to help liaise with the station teams and input subject matter expertise on station operations.

**Links with the station teams**

Having a dedicated contact at Southeastern, meant that the project team knew who to contact and involve throughout the project. As the person holding this role had previously been a Station Manager they knew what was involved and consulted and included the station team at London Bridge wherever possible. Having someone outside of the day to day operations meant that they had time to attend meetings without impacting day to day business. At the height of the changes two further resource were recruited to work alongside the Project manager to input to detailed designs and provide operational expertise and inputs to staff moves, ticket machines moves, platform train interface changes, gateline moves and other developments.

A Station Project Working Group (SPWG) was established early in the project where the station project team met with stakeholders to run through the plans, status of the programme and discuss issues. This group met once every four weeks. There were many other meetings but the key ones were the Project Review Group (PRG) and weekly station meetings. The links between the station and railway system changes were key too, so links between the Railways Systems Working Group (RSWG) and SPWG became very important.

**Future-proofed to meet passenger demand**

The proposals for London Bridge station were future-proofed to meet forecast demand for 2016 + 35%, which allows passenger growth for at least the next 60 years. Within this timescale, however, it was recognised that the station design should allow adaption and alteration; the design uses standard materials, modular components and panels in manageable unit sizes, allowing easy removal, replacement and alteration, which also provides cost efficiencies.

The five-year construction period saw the demolition and reconstruction of the station and all 15 tracks realigned over three 18-month phases (and the ongoing finishing-off phase). For passengers this led to three
more through-platforms for their onward journeys into / through central London, with capacity for 180,000 passengers. All 15 re-configured platforms were ready by January 2018.

Thameslink ran to the same programme concept originally developed in 2008 and Key Output 2 having met every milestone to minimise passenger impact. For example, the Electrical Track Equipment team were commended by Network Rail for the ‘exceptional’ quality of its work for its part in delivering critical milestones over weekend and public holiday blockade – the crossovers installed, slews removed and line signalling commissioned enabled Charing Cross services to stop at London Bridge in line with the programme.

The success of this ambitious programme, which ran to schedule, was down to the complex staging process, which involved demolishing the old platforms and the arches below and then progressively reconfiguring the tracks to construct the new station in nine stages, each of which had to come into service before the next stage could commence. Most stages were delivered in blockades of three days to limit the impact on passengers and train services.

This work enabled the main concourse, western arcade and platforms 1-5 to open to the public as planned in January 2018.

A design was created that could be built in stages and was sensitive to the way passengers moved around an operational railway.

**On completion**

On completion, the Thameslink network will handle a peak-period frequency of 24 trains per hour (equivalent to one train every 2.5 minutes) between St Pancras and Blackfriars (the ‘central core’), providing an extra 14,500 peak-period seats compared to 2008.

The Systems Integration approach was specifically highlighted in the McNulty report (Realising the Potential of GB Rail, May 2011) as best practice.

The best practice pioneered of developing construction sequencing early on has been implemented as best practice elsewhere on projects like Brighton Mainline GRIP2.

Mark Somers, Project Director, Thameslink Programme for London Bridge Electrical Track Equipment, said: "The scale and complexity of the works delivered on the railway systems and the station in such a short space of time is incredible".

1. **Key challenges**

   - Timely turnaround of document reviews and changes
   - Allowing business as usual whilst designing and implementing significant changes
   - Considering all aspects; safety, operational, passenger early on and planning changes to accommodate all these points
   - Scheduling expert resource on site during the major station changes and signing off entry into service
   - Deciding on priorities.

2. **Recommendations for future projects**

   The following recommendations, based on the direct experiences of the Network Rail and the Train Operating Companies involved, will result in a more operationally focussed delivery of infrastructure changes:

   - Work together to understand each other’s viewpoints and reach compromises
   - The system migration plan first proposed held true all the way through, acting as the glue that helped to hold the whole project together. Simon Pears, Network Rail PEM London Bridge GRIP 2-4, said: “The detail in the planning from the very early stages has been key to the overall success, the logic diagram created also remained a key comms tool to the very end - there are still copies on almost every desk.”
   - It is worth funding full time, dedicated operational resource to allow business as usual not to be impacted but provide links to this expertise
• Robust governance – regular meetings with the ‘right’ people are well worthwhile – following up actions, identifying risks and agreeing mitigations.

Author
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Further information
For more information on this Learning Legacy case study please email contact@thameslinkprogramme.co.uk