Design Procurement & Management

THAMESLINK PROGRAMME
LEARNING LEGACY

London Bridge Station Redevelopment

Throughout the Thameslink programme delivery of detailed engineering designs at GRIP (Governance for Railway Investment Projects) 5 have proved challenging in terms of cost, programme and quality. Different approaches to procurement and management of the design were adopted at Key Output 1 and Key Output 2 stations. This case study provides some commentary on how detailed design for London Bridge was procured and managed building on the experience from Key Output 1. It highlights the main lessons learnt from London Bridge Station Redevelopment (LBSR). It also provides the location of more detailed information.

Background

The Thameslink Programme included major station redevelopment projects for Farringdon and Blackfriars (Key Output 1) and London Bridge (Key Output 2). For Key Output 1 Blackfriars Station the main construction works were procured as a 'build only' contract. Detailed design was managed by Network Rail (NR) with the build contractor taking no or limited design liability. The responsibility for the accuracy and adequacy of the design information, the timeliness of its provision and the resolution of queries on it remained the responsibility of Network Rail. This proved to be of limited success and NR's management teams struggled to cope with the volume of queries raised, the fact that the assumed construction sequences often departed from the contractor's proposals, and at the interfaces between different designers. Constructability advice informed the design but the ECI (Early Contractor Involvement) contractor was not subsequently employed for the main construction works and the appointed contractor had very different ideas on how the works should be designed and constructed.

For the Key Output 2 station at London Bridge the construction contract was a 'design and build' model let to Costain. Network Rail provided a design developed to GRIP 4 stage and the contractor then had responsibility for developing the design to satisfy all scope required by the Technical Workscope, the PDS (Project Design Specification) NR Standards and so on. The contract included for ECI in the form of a formal review of the GRIP4 design documentation, constructability review and rework of that design where required.

For the Key Output 2 station at London Bridge the construction contract was a 'design and build' model let to Costain. Network Rail provided a design developed to GRIP 4 stage and the contractor then had responsibility for developing the design to satisfy all scope required by the Technical Workscope, the PDS (Project Design Specification) NR Standards and so on. The contract included for ECI in the form of a formal review of the GRIP4 design documentation, constructability review and rework of that design where required.

Costain appointed a joint venture for the GRIP5 design, incorporating the same company as had developed the GRIP 4 design. The design contract encompassed all disciplines except for telecom design which was provided by the specialist installer under separate sub-contract arrangement with Costain. The design contract included 'Lead Designer' duties of managing and resolving design interfaces with other Key Output 2 projects eg for track and signalling. The design contract included design for several interim station configurations. Network Rails Engineering team took a reasonably 'light touch' assurance role as well as offering general guidance on NRs requirements.

While the 'design and build' approach successfully resolved some of the difficulties experienced at Blackfriars station, the final cost for the detailed design exceeded the original price by a factor of more than 3. The time to completion exceeded initial expectation by a similar factor. While it is not the purpose of this paper to critique the management decisions that lead to this, it is worth recording that the complexity of the design task was underestimated and the original price and programme unachievable, there were too many scope changes instigated by Network Rail, there was an insufficient pool of skilled MEP (Mechanical, Electrical, Public Health) designers to deliver the design, and attempts to incentivise the designer to deliver in some cases did not work or drove unintended behaviours. Notwithstanding that, there are many useful lessons learnt from the design experience and these are summarised below.

The size and complexity of the design task can be appreciated by the fact that some 12 800 design drawings were generated, 130 designers were working full time on the design at its peak and circa 1.3 million man hours were spent to deliver the GRIP5 design to substantial completion.

Top Lessons Learnt: Detailed Design

1. GRIP 4

a. Take the time to challenge and develop GRIP 4 sufficiently. Design out uncertainties and assumptions. MEP systems design to be developed as much as building and civils – risk that contractors (and NR) tend to be civils focused.

b. Establish relationships at GRIP 3/4 (Contractor for ECI, Lead Designer/MEP designer/Architect) with a view to these continuing through GRIP 5.

2. MEP Design

a. At London Bridge (LBSR) the MEP installer had no design responsibility. They were contracted to the main contractor entirely separate from the lead designer. Reliance was based on MEP Contractors Responsible Engineers reviewing designs at Inter-Disciplinary Checks (IDCs) and Form 3 stage for suitability and buildability. Behavioural and contractual issues limited the effectiveness and timeliness of this. There was no sense that the MEP installer had any 'ownership' of the design.

b. In the proposed Gatwick Station redevelopment contract model the MEP installer is also contracted separately by the main contractor but with both installation *and* MEP design responsibilities. They operate under the lead designer. This aligns objectives.

c. The MEP installer is then ideally placed to take ownership of the MEP installation drawings – this is not an activity that suits consulting engineers.

d. The industry has a severely constrained quality MEP design resource – engaging the MEP installer early and with design responsibility may help to assist as traditional consultants may not have the depth of resource required.

4. Staged Construction

a. This needs to be addressed at GRIP 3 /4 ie the station configuration at these stages is as important as the final configuration – little work was done at LBSR on this.

b. The configuration of each of the MEP systems (existing amended/new) at each stage also needs to be defined at GRIP 3 /4 as well as 5.

c. Stage design is resource hungry – the level of resource required was underestimated at LBSR.

5. Design of sitewide MEP systems

a. The design teams for LBSR were split into defined geographical areas ie concourse/station east/station west/platforms. This suited the civil/building design but not the design of MEP systems which are site wide.

b. There is no easy solution but geographical design boundaries need to be flexible to suit MEP.

6. Design Contract Incentivisation

a. Incentivisation that did work:
   i. Quality incentive (measured by % of CAT3 comments on Document Review Notices (DRNs), NOT Cat 3 DRNs)
   ii. Cost incentive related to overall construction contract performance compared to target cost.
   iii. Incentive based around the overall project success in achieving construction/stage milestones.

b. Incentivisation that did not work:
   i. Design cost – drives too much management effort in justifying increases to target cost for the work.
   ii. Delivery dates for specific deliverables or completion of GRIP5 design. Leads the designer to sacrifice other deliverables for incentivised ones, and promise delivery when it's not really feasible. Also the ability to identify the critical deliverables early on is limited – by the time the delivery date comes round priorities have often changed. Also leads to too much management effort being used to justify extensions of time for the dates caused by change etc

7. Design Control Points and IDCs

a. Design Control Point (DCP) 1 and 2 were introduced to the GRIP 5 design stage at notionally 25% and 75% completion of the design to Form 3. These additional control points supported by as many Detailed Design Reviews (DDRs) as needed worked well

b. Construction CREs must attend DCP and IDC reviews.

c. Designs must be sufficiently advanced at IDC stage for co-ordination to be demonstrated.

8. Supplier Design

a. Supplier design responsibilities (eg for cladding systems, flooring, ceilings etc) to be carefully defined at the outset of GRIP 5 design (LBSR generally has worked ok, Blackfriars did not)

b. Suppliers need to be contracted not just to deliver designs but also to resolve all trade to trade interfaces before their design is completed (Subcontractor Technical Interface Reviews used).

c. Contractual arrangements with suppliers need to include for full NR assurance processes.

8. CAD Arrangements

a. If designing in Microstation recognise that Microstation capable 3D CAD resource, especially in MEP, is severely constrained. If the project is big enough it should consider training operators (eg via apprenticeships) or retraining Autocad operators – some structures CAD operators were retrained in MEP 3D CAD at LBSR.

b. Train the CREs, NR Engineers etc so they can fully use the 3D CAD functionalities.

c. Careful set up of Projectwise eg file structure. This should be bottom up – the designing organisation should set out the desired file structure – at LBSR this was dictated by NR at programme level. Designing organisation should define other functionality eg if auto QA check is to be used.

d. Over specify the capacity and performance of local IT systems and the Projectwise or other 'filing' system.

e. Consider a bespoke license and enhanced service levels for Projectwise support. NR companywide service levels were perceived as insufficiently responsive – at the peak of GRIP5 design each full day's loss of design production cost circa £100k.

f. Employ a specialist client/contractor CAD resource to ensure that suppliers' use of CAD is optimal in efficiency eg clash detection arrangements, data cleanliness and provide software support.

About the author

Case Study produced by Martin Brandon - Infrastructure Projects Senior Programme Commercial Manager at Network Rail, October 2018

Further information

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