Committees: Corporate Projects Board - for information Bridge House Estates Board- for decision	**Dates:** 09 March 2022 27 April 2022
Subject: Tower Bridge - Replacement of Defective Bridge Driving Machinery Hydraulic Components **Unique Project Identifier: 12222**	**Gateway 6: Outcome Report** Regular
Report of: Managing Director of Bridge House Estates **Report Author:** Jamie Bottono, Operations Manager, Tower Bridge	**For Decision**
PUBLIC	

Summary

1. Status update	**Project Description:** To replace defective hydraulic pipework, components and upgrade hydraulic power units associated with the bridge lifting machinery at Tower Bridge. **RAG Status:** Green **Risk Status:** Low **Costed Risk Provision Utilised:** £72,076 (of which £0.00 amount was drawn down at the last report to Committee) **Final Outturn Cost:** £1,223,641 *Total project expenditure (including CRP)*
2. Next steps and requested decisions	**Requested Decisions:** • Note contents of the report, lessons learned and approve closure of the project.

3. Key conclusions	Delivering an engineering maintenance project of this nature on a 'live' operational bridge has proved extremely challenging, especially where we have a statutory duty to provide bridge lifts 24/7, 365 days a year. The project was delivered as planned and within budget, taking into consideration all other operations and business needs, which required close working and co-operation with the contractor and staff on site. At G1-5 the works were initially estimated to be 10 months. Following approval of the report, a detailed review of the programme was undertaken and revised to 15 months to accommodate design, pavement closure negotiations/ agreement with TfL, and procurement/ supply issues. The project was completed within the agreed programme and the primary objective to maintain bridge lifting was achieved. The delivery of the new installations, one machinery room at a time, was an opportunity to further test our resilience by running one bascule (moving structural parts of the Bridge) on one machinery room, whereas it is normally two. The upgrade and modernisation of the components, as well as improving pipework layout and access, should provide a reduction in revenue costs for maintenance and repairs. Bosch Rexroth have advised that the new installation is also expected to be more efficient and environmentally friendly delivering between 5-15% higher efficiency across the components in the system. The project was managed in-house by the Tower Bridge Operations Manager and Technical Team, due to City Surveyors having no resources for this type of project, which impacted on day-to-day operations. It is therefore recommended that dedicated project management by an external consultant is provided for future 'specialist' projects of this type.

Main Report

Design & Delivery Review

4. Design into delivery	The design and delivery of the project was undertaken in collaboration with Bosch Rexroth and worked well. Challenges were presented around access to the machinery rooms, located beneath a public pavement, and engagement with TfL was necessary to introduce planned pavement closures for 3 weeks per machinery room.
5. Options appraisal	There were options to 'Do Nothing', which would leave the risk of a major failure, and for a complete renewal, which would require extensive investigations and planning, as well as years to deliver at anticipated costs of between £14M - £20M. The option approved represented a lower project cost, could be delivered relatively quickly, and was considered low risk as it replaced existing components. It met the project objectives and should provide another 30 years of hydraulic performance, as well as being more efficient and environmentally friendly.
6. Procurement route	Tower Bridge has historic and specialist machinery and therefore the works were procured via the use of a sole waiver to appoint the original manufacturer, supplier, installer, and current maintainer of the hydraulics, Bosch Rexroth Limited. This was recommended by Tower Bridge Officers and agreed in consultation with City Procurement. Tendering this project would have resulted in Bosch Rexroth having to be appointed as a sub-contractor as this project was for the modernisation/ upgrade of their system, rather than a complete replacement.
7. Skills base	The project was managed in-house by the Tower Bridge Operations Manager and Technical Team who worked closely with Bosch Rexroth. This presented challenges as there were no dedicated in-house resources and this impacted on the operational works of the team on site.

8. Stakeholders	Internal stakeholders were engaged, managed, and kept informed through presentations to the Tower Bridge Management Group, all staff annual Business Planning sessions, staff daily briefings and communication via the all-staff daily report, prior to and during the delivery of the project.

Variation Review

9. Assessment of project against key milestones	The project's programme was designed around the operations of the Bridge as well as the need for pavement closures to allow for safe entry to 3 of the 4 machinery rooms via access hatches in the public pavement (NW access is within the Ticket Office which required relocation of this facility during works). Physical installations were completed within the 3-week window for each pavement closure followed by cold/ hot commissioning which required maintenance bridge lifts. Within the G1-5 report the programme for the works was initially estimated to be 10 months and following signing of contracts in October 2020 and further review, it was revised to 15 months.
10. Assessment of project against Scope	The project delivered against the original scope and assisted with identifying improvements and further works due to access being gained to inaccessible areas as pipework and plant was removed. Elements of this were covered by the Costed Risk Provision and undertaken whilst Bosch Rexroth were on site. The remainder will be fed into future works covered by the 50-year maintenance plan.
11. Risks and issues	The Costed Risk Provision (CRP) for the project was £114,000. CRP R1 - Ensure our statutory obligation to carry out Bridge lifts can be maintained throughout the project, and CRP R2 - Failure to meet our statutory duty would reflect poorly on the City of London and Tower Bridge. • Bridge lifts were maintained throughout, although during the project there were two occasions where issues were experienced;

	○ **9th August 2021** – Following the 13:45hrs bridge lift there was an issue with the bridge driving controls which prevented the Bridge from being lowered. This was investigated by the Bridge Driver and on-site team who eventually resolved the issue in conjunction with our on-call contractor who attended site. The Bridge was eventually lowered and locked into position at 01:00hrs. ○ **4th November** – during the 15:30hrs commissioning maintenance lift the Bridge Driver could not lower the Bridge. Indications were a loss of hydraulic pressure from the south side machinery rooms and following investigations an oil leak was found in the southeast machinery room. This was resolved by the on-site team and Bosch Rexroth and the Bridge was lowered and locked into position at 17:35hrs. CRP R3 – Asbestos Survey, and CRP R5 - Asbestos may be discovered in inaccessible areas once static machinery/ components are stripped out. • Costs were realised for a sample survey due to the contractor identifying a fibrous material within a partition wall which was not captured within the Asbestos Management Survey – Total spend against CRP £150. CRP R4 – The project does not include for any other associated bridge driving operational components. • Costs were realised against this provision for additional electrical works and opportunities to install new components where issues were identified - Total spend against CRP £71,926.
12. Transition to BAU	Tower Bridge has a statutory duty to provide bridge lifts 24/7, 365 days a year. There are two machinery rooms per bascule (4 in total) and only one machinery room was isolated at any time, which allowed for bridge lifts to be undertaken, and therefore BAU was maintained throughout. The Bridge also remained open to users and paying visitors, although west or east pavement closures were required when necessary to access the machinery room hatches to remove/ lower equipment.

Value Review

13. Budget

Estimated Outturn Cost (G1-5)	Estimated cost (including risk): £1,265,565 Estimated cost (excluding risk): £1,151,565

	At Authority to Start work (G5)	*Final Outturn Cost*
Fees	*£0*	*£0*
Staff Costs	*£0*	*£0*
Works	*£1,151,565*	*£1,151,565*
Purchases	*£0*	*£0*
Other Capital Expend	*£0*	*£0*
Costed Risk Provision	*£114,000*	*£72,076*
Recharges	*£0*	*£0*
*Other**	*£0*	*£0*
Total	*£1,265,565*	£1,223,641

The Chamberlain has been consulted and a verification check has been undertaken by the Director of Tower Bridge.

14. Investment

This is a maintenance project which was necessary due to the age and condition of the existing installation. It is anticipated that we will achieve another 30 years of hydraulic performance through the upgrades/ modernisation works undertaken.

15. Assessment of project against SMART objectives

- *The ability to continue providing bridge lifts during the works, for which we have a statutory duty to undertake, and conduct "business as usual"* - was achieved, however, there were some issues experienced as detailed in paragraph 11,

	• *To reduce the risk of failure of aged and deteriorating components which will result in long term downtime and commissioning* - this is part of a programme of upgrade/ modernisation/ renewal to bridge driving components and performance will be monitored through reactive works, • *To reduce the amount of future reactive works and high costs to replace plant which can be measured through monitoring associated budgets* - 50-year maintenance plan is reviewed 6 monthly and efficiencies will be identified at this time.
16. Key benefits realised	• Reduced the risk of an issue with hydraulic pipework before or during a bridge lift, • The system is more efficient and environmentally friendly delivering between 5-15% higher efficiency across the upgraded components in the system, • Significant savings, time, and money, to upgrade/ modernise as opposed to completely replace (£1.2M as opposed to £14M - £20M), • Anticipated expectation of another 30 plus years of hydraulic performance, • Future reduction in revenue costs for maintenance and reactive repairs of aged hydraulic components.

Lessons Learned and Recommendations

17. Positive reflections	• Good working relationships and co-operation between Tower Bridge staff and our long-standing contractor, Bosch Rexroth, whilst working on a 'live' constrictive site, • Bridge lifting is usually conducted with all four machinery rooms in operation (two per bascule) and this project has required the isolation of one machinery room at a time. This has proven our resilience, in the event of the unforeseen loss of a machinery room, that we can continue to carry out bridge lifts or isolate a room for future works, if necessary, • Agreed and enhanced procedures, including working at height and pavement closures, in place to create a safe working

	environment for the contractor to access the machinery rooms from pavement level worked well, • Project was completed as per agreed programme and therefore no impact on our next major project, HV System Replacement, which commenced on 13th December 2021.
18. Improvement reflections	• The need for dedicated project management resource for these types of 'specialist' projects, rather than manage in-house, as this impacted on day-to-day operational delivery, • Following any works to the bridge driving components, including software, a full interrogation of all systems must be undertaken via the control software which should indicate a 'healthy' system. Any alarms or abnormalities must be investigated, and once cleared, a maintenance lift should be undertaken, • The west pavement closure started on the first day of the October half term and during that week the Bridge was busy. Congestion and gathering of crowds on the east pavement were experienced during the first bridge lift. Pavement closures should therefore be avoided during school holidays and peak periods if possible.
19. Sharing best practice	There is a comprehensive programme of major projects and works over the next few years and on-site knowledge and experience, with regards to logistics and challenges associated with working on Tower Bridge, will be shared with colleagues.
20. AOB	N/A

Appendices

Appendix 1	Project Coversheet
Appendix 2	Project Photographs
Appendix 3	

Contact

Report Author	Jamie Bottono
Email Address	Jamie.bottono@cityoflondon.gov.uk
Telephone Number	020 7940 8391