

Date: 11 March 2015

Item 16: Central and Waterloo & City Lines Rolling Stock

This paper will be considered in public.

## 1 Summary

WBS KR92CPL4		92TS HOPL		
Existing Financial Authority	Estimated Final Cost (EFC)	Existing Project Authority	Additional Authority Requested	Total Authority
£123.16m	£123.16m	£ 6.08m	£117.08m	£123.16m

**Authority Approval:** The Board will be asked to grant an increase in budgeted authority of £117.08m, raising the total authority to £123.16m, to deliver the next cycle of heavy maintenance on the 1992 Tube Stock fleet (all costs are forecast within the Quarter 3 2014/15).

**Outputs and Schedule:** The request is to carry out the prescribed heavy maintenance to the 1992 Tube Stock fleet, comprising 'programme lift' and 'heavy overhaul'. The plan is to commence the maintenance in June 2015 at a rate of one unit (two cars) per week increasing to a steady-state rate of four units (one train) per week by October 2015.  
The project is scheduled to be completed by 21 July 2017. The project will ensure the continued safety of the fleet and improve reliability and availability.

- 1.1 A paper is included on Part 2 of the agenda, which contains exempt supplementary information. The information is exempt by virtue of paragraph 3 of Schedule 12A of the Local Government Act 1972 in that it contains information relating to the business affairs of TfL.

## 2 Recommendation

- 2.1 **The Committee is asked to recommend that the Board approves an increase in Project Authority of £117.08m, increasing total authority to £123.16m, to deliver heavy maintenance on the 1992 Tube Stock fleet.**

## 3 Background

- 3.1 The Train Maintenance Regime (TMR) for the 1992 Tube Stock (92TS), operated on the Central and Waterloo & City Lines, prescribes the mandatory maintenance activities required on the fleet. This covers all daily, periodic, annual and less frequent maintenance required to ensure that the fleet operates safely and reliably.
- 3.2 Included within the TMR is a requirement to undertake Programme Lift and Heavy Overhaul at a frequency of six and 12 years respectively. Programme Lift primarily addresses the maintenance of bogie mounted equipment (e.g. motors, gearboxes,

wheels and suspension), while Heavy Overhaul primarily addresses the maintenance of equipment attached to the car body (e.g. air supply and heating and ventilation systems). Every second cycle of Programme Lift (PL) coincides with a cycle of Heavy Overhaul. This combined activity is referred to as Heavy Overhaul Programme Lift (HOPL).

- 3.3 Traditionally, HO and PL have been treated as ‘business as usual’ activities, delivered by the Fleet maintenance organisation. Consequently the costs have been included in operating budgets. However, given the scope and cost of the forthcoming 92TS HOPL, it will be treated as a project and governed as such to ensure successful delivery.
- 3.4 An initial Project Authority request for £3.69m was approved in October 2014 to enable essential mobilisation activities to commence, and to ensure that the required resources will be in place at the planned commencement of the HOPL in June 2015. An additional Project Authority of £2.39m was approved in January 2015 for the procurement of long lead time materials.

## 4 Proposal

### Preferred Option

- 4.1 The scope of HOPL comprises the heavy maintenance of the majority of train systems as prescribed by the TMR and summarised below:

System	Overview of Work Content
Braking	Overhaul emergency and normal braking systems, replacing worn valves, hoses and switches.
Traction/Propulsion	Overhaul traction motors, circuit breakers, contactors and relays and replace switches.
Doors	Overhaul emergency and normal door valves and mechanisms. Overhaul all doors and door control panels.
Car body	Overhaul door tread-plates.
Bogie/Suspension	Overhaul equipment located on bogie frames, including wheels, axles, gearboxes, valves and switches. Replace suspension systems, including dampers, air bags and air suspension control units.
Couplings	Overhaul couplers. Replace bearings and air hoses.
Underframe	Replace life expired resilient mountings.
Auxiliaries	Overhaul control panels, speedometer and master control switch. Replace circuit breaker panel. Overhaul window wiper motors and whistle.
Heating and Ventilation	Overhaul saloon ventilation, control units and cab air-conditioning. Inspect hoses and temperature sensors and replace on condition.
Air Supply	Overhaul pneumatic valves and switches. Replace hoses.
Electrical Distribution	Inspect inter-car distribution and replace on condition.
Fault Recording Equipment	Overhaul fault recording computers and modules. Replace fibre optic cables.
Automatic Train Control	Inspect antenna and replace on condition.

<b>System</b>	<b>Overview of Work Content</b>
Communications	Overhaul emergency alarm switches, audio communications units and destination indicator.
Shoegear	Overhaul positive and negative shoegear and sleet brushes. Inspect arc barriers and replace on condition.
De-icing equipment	Overhaul de-icing equipment, including pumps and valves. Inspect de-ice tank and replace on condition.

- 4.2 The scope of the forthcoming HOPL includes the maintenance tasks that were omitted from the previous HOPL. These additional tasks represent 15 per cent of the total project cost and are essential if acceptable performance of the fleet is to be sustained until it is scheduled to be replaced in 2028-32 as part of the New Tube for London (NTfL) Programme.
- 4.3 The 92TS fleet has reached its nominal 'half-life' and components with a 20 year service life, such as the brake reservoirs and control panel electronics, are life expired and need to be replaced. The replacement of these components constitutes 13 per cent of the total project cost. It is cost effective to undertake this additional work in parallel with the HOPL.
- 4.4 LU has identified a number of safety or business critical modifications to improve reliability that would be most efficiently embodied whilst the train is in a disassembled state. These modifications include changes to: cab monitors, loudspeakers, passenger emergency alarms, destination displays, fibre-optic cables and coupler-carrying brackets. These modifications account for approximately four per cent of the costs.

### **Benefits**

- 4.5 The benefit of the 92TS HOPL project is ensuring the continued safety, availability and reliability of the fleet to enable the service requirements of the Central and Waterloo & City Lines to be met.
- 4.6 The TMR underpins the safety case of the rolling stock and defines the maximum permissible period between each scheduled maintenance activity. A train cannot be offered for service if any maintenance is overdue. Although additional maintenance, inspections or rectification work might be approved by the Principal Engineers as short term mitigations to maintain trains in service, these would be onerous on cost, labour and depot road capability and would not be sustainable for any significant period of time. In 2014, the cost of these short term mitigation activities was assessed, as part of the annual Asset Condition Reporting process, at £229k per annum.
- 4.7 Poor fleet reliability is contributing to the number of occasions whereby LU is unable to achieve the peak timetable service requirements. It is estimated that HOPL will improve the Mean Distance Between Failure of the stock by 1,000km (from approximately 8,000km) and reduce Lost Customer Hours (LCH) by 18,000 per period. This equates to a financial customer benefit in excess of £2m per year.
- 4.8 Completion of the 92TS HOPL as planned would maximise availability from mid 2017. This is of crucial importance due to the pressure on 92TS availability between 2018 and 2020 resulting from other planned projects including saloon door overhaul, repair of saloon floor corrosion, implementation of Rail Vehicle Accessibility Regulations modifications and conversion to an AC traction system.

## Delivery of Preferred Option

- 4.9 The HOPL will be delivered as a project by the Fleet maintenance team, supplemented with additional permanent staff employed on fixed term contracts. The project team will be provided with dedicated resources such as management, finance, procurement, quality control and planning.
- 4.10 The Central Line fleet will be lifted at Ruislip Depot and removed items, including complete bogies, will be dispatched to LU's Railway Engineering Workshops (REW) for overhaul. The REW will strip and rebuild the bogies and overhaul mechanical and electrical systems. Upon completion of the HOPL examinations and the embodiment of modifications, units will be reassembled with overhauled or replacement components and tested prior to re-entering service. The Waterloo & City Line fleet will undergo the same process, except that the trains will be lifted at Waterloo Depot.
- 4.11 Key milestones:

Milestone	Target Date
Trial Lift	15/01/2015
First unit (2 cars) enters HOPL	01/06/2015
25% of 92TS fleet complete	15/01/2016
50 % of 92TS fleet complete	13/05/2016
100% of 92TS fleet complete	01/08/2017

## 5 Financial Implications

### Costs

- 5.1 The current projected EFC of the 92TS HOPL is £123.16m, including £11.1m risk. The costs have been derived from detailed assessment of the scope of component and system overhaul and labour resources necessary to deliver all activities.
- 5.2 REW's overhaul costs are based upon previous work performed on 92TS and 96TS. Recent analysis to inform the planning of 09TS and S-Stock heavy maintenance has demonstrated conclusively that using REW to overhaul items reduces costs in comparison with third party suppliers.

## Risk

5.3 This Authority request includes a project risk of £11.1m (outturn) representing 10 per cent of the base cost. The top five risks are:

No	Risk Description	Mitigation Actions
1	De-scoping the content of the HOPL impacts fleet reliability and availability.	Engineering has assessed the minimum scope that is needed and this is reflected in the Estimated Final Cost.
2	Asset condition worse than predicted leading to an increase in component scrap rate and project cost.	Condition assessment of key components is being undertaken. Trial lift planned for January 2015 and reviews to be conducted after 10 trains have been completed.
3	Suppliers do not meet the required delivery timescales due to inadequate management control and lack of early engagement, delaying the project and increasing costs.	Supplier technical and process audits to be conducted. Key stock levels to be identified and filled. Terms and Conditions and framework agreements to be established.
4	Procurement governance (single source) and resource constraints result in material delivery timescales not being met, delaying the project and increasing costs.	Long lead time (26 weeks) items identified and mobilisation funding provided to enable orders to be placed. Trial lift planned for January 2015.
5	A shortfall in staff or skill sets could delay the project timescales and increase costs.	Engaging with Training and HR to understand the max training flow through. Mobilisation funding provided to commence depot and REW recruitment and training.

## 6 Assurance

6.1 A TfL Programme Management Office and Independent Investment Programme Advisory Group Assurance Review took place on 11 December 2014. No critical issues were identified and the recommendations made are being addressed by the project team.

### List of appendices to this report:

Exempt supplemental information is included in a paper on Part 2 of the agenda.

### List of Background Papers:

Reports from the TfL Programme Management Office and the Independent Investment Programme Advisory Group, and the management response to those reports.

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