

Programmes and Investment Committee

Date: 16 May 2018

**Item: London Underground Signalling and Control Programme
Authority Submission**

This paper will be considered in public

1 Summary

LU Signalling and Control Programme				
Existing Financial Authority	Estimated Final Cost (EFC)	Existing Programme and Project Authority	Additional Authority Requested	Total Programme and Project Authority
£181.99m	£182.43m	£68.34m	£74.19m	£142.53m

2 Recommendation

- 2.1 The Committee is asked to note the paper and approve additional Programme and Project Authority of £74.19m for the London Underground Signalling and Control Programme, increasing total authority to £142.53m.**

3 Renewals and Enhancements Programme Overview

Introduction

- 3.1 The London Underground (LU) Signalling and Control (Renewals and Enhancements) Programme has been established to:
- (a) extend the life of ageing assets to ensure safety and improve reliability, whilst reducing maintenance costs; and
 - (b) upgrade the performance of the existing legacy signalling and control systems, where viable, to enable line capacity to be increased.
- 3.2 This supports the Mayor's strategic objective of 'providing a good public transport experience' and over time leads through to the 'improving public transport services' measure on the TfL Scorecard.
- 3.3 The individual projects in the programme deliver essential asset stabilisation, obsolescence management or renewal to ensure the safety of customers and improve asset performance. The authority being requested in this submission is – for the most part – to ensure the continued safe operation of the Piccadilly, Central and Bakerloo lines pending the replacement of these lines' respective signalling and control systems under the Deep Tube Upgrade Programme (DTUP).

Background

- 3.4 Signalling and control systems are essential for the safe and efficient operation of train services. Advances in technology have enabled traditional track based systems to be replaced with train based signalling systems. Track based systems include lineside assets such as colour light signals and track circuits for train detection which inform drivers whether it is safe to proceed. Train based systems receive instructions transmitted by the signaling control system and enable trains to run more consistently and closer together whilst maintaining safety. This significantly increases capacity. LU's strategy is to implement train based signalling systems across its network.
- 3.5 LU currently operates legacy and modern signalling and control systems across its 11 lines. The oldest legacy systems are based on technology that dates from the early 1960s and the newest from the mid-1990s. A modern radio system is in operation on the Victoria line and Communication Based Train Control (CBTC) systems are in operation on the Jubilee and Northern lines having been installed within the last decade. Figure 1 - *Signalling systems and strategy* shows the decade of installation and the strategy which relates to each line.

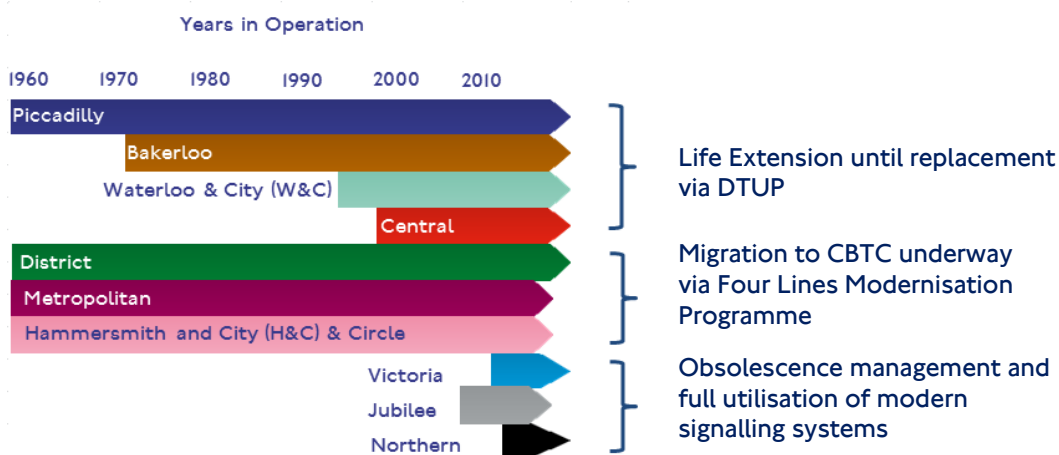


Figure 1 - Signalling systems and strategy

- 3.6 The Four Lines Modernisation (4LM) Programme is currently replacing the oldest signalling and control systems on the Sub-Surface lines (the District, Circle, Metropolitan and Hammersmith and City lines) with CBTC systems. During the upgrade, the existing systems are being maintained but not enhanced unless required to interface with new equipment.
- 3.7 New CBTC signalling will be progressively commissioned across the Sub-Surface lines from 2020 to 2023 supporting incremental service improvement up to 32 trains per hour in Central London and an increased frequency across the Sub-Surface lines once complete. LU's remaining legacy systems on the Piccadilly, Bakerloo, Central and Waterloo & City lines, will be replaced by DTUP from the late 2020's to mid 2030's (dates subject to contract award).
- 3.8 Signalling equipment on the lines being upgraded by 4LM account for 44 per cent of all signalling related customer affecting incidents. A further 35 per cent are on those lines that fall under the DTUP. Lines which have been upgraded account for only 21 per cent of signalling related failures.

3.9 As the assets age their reliability degrades leading to an increase in the number of customer affecting failures. It is essential that the signalling systems planned to be upgraded by DTUP continue to be safe, reliable and operationally cost-effective until they are replaced. These lines account for two thirds of this Signalling and Control programme capital budget.

This Submission

3.10 This submission seeks a further £74.19m of Project and Programme Authority, thus bringing the total granted for this programme to £142.53m. The components of the additional authority requested are:

- (a) £58.76m for Central line systems life extension;
- (b) £3.56m for Piccadilly line signalling life extension; and
- (c) £11.87m for depot signalling and control updates.

3.11 Further details on each of these elements are provided in Section 4. The authority requested in this submission is fully funded within the TfL Business Plan.

4 Proposal

- 4.1 The LU Signalling and Control Programme currently comprises of the following projects (all figures include risk and inflation). Those projects for which authority is being sought in this submission are highlighted in bold, with further details of these being provided in Section 5.

Project description	Financial Authority (£m)	Estimated Final Cost (EFC) (£m)	Existing Programme and Project Authority (£m)	This Authority Request (£m)	Total Authority (£m)	Future Authority Requests (£m)
<u>Central line signalling and control life extension</u> Replacement of obsolete and failing components with modern equivalents.	59.93	60.01*	1.17	58.76	59.93	Nil
<u>Bakerloo line signalling and control life extension</u> Replacement of obsolete and high risk equipment including transferring software to an up-to-date programming language and replacement of depot control panel.	19.66	19.69	9.84	-	9.84	9.82
<u>Piccadilly line signalling and control life extension</u> Delivery of a new control system in a secure building, asset stabilisation of signalling equipment.	53.91	54.36*	46.56	3.56	50.12	3.79
<u>Depot signalling and control upgrades</u> New signalling and control system for Northumberland Park depot	14.15	14.21*	0.66	11.87	12.53	1.62
<u>Northern and Jubilee lines signalling and control obsolescence</u> Audit of components and production of an obsolescence management plan. The implementation of this plan will be the subject of a future authority request.	20.85	20.67	0.85	-	0.85	20.00
<u>Point machine conversion</u> Replacement of equipment to replace pneumatic with electrical drives and standardise machines used across the network.	13.49	13.49	9.26	-	9.26	4.23
Totals (£m)	181.99	182.43	68.34	74.19	142.53	39.46

*On current best estimate, projects are working to align EFC to financial authority.

5 Programme Scope

5.1 Central line signalling and control life extension

Introduction

5.1.1 The existing Central line signalling and signalling control system was installed in the late 1990s and many sub-assets and components are now obsolete. This is mainly due to the age of the electronic components. Repairs to existing components are becoming increasingly difficult due to the availability of compatible spares and the assets present an increasing risk of major service affecting failures. The life extension projects have a financially positive business case.

Scope

5.1.2 The life extension scope has been divided into nine work packages and currently the projects are completing activities prior to contract award. The contract will have two phases; the first to deliver concept design (including re-verification of current condition/priority), provide a fixed price for the full delivery and to implement some early works. The second phase will carry out delivery which extends the life of the systems. Siemens Rail Automation (the Original Equipment Manufacturer) will carry out the works, on the basis that they are the only supplier who can modify and assure the system the installed.

Milestones

Milestone	Target Date
Indicative cost proposals for first phase	July 2018
First phase complete	March 2019
Signalling project complete	2025
Control system project complete	2025

Funding

Costs and Funding (£m)	Prior Years	2018/19	2019/20	2020/21	2021/22	Future Years	Total
Existing Programme and Project Authority	1.17	–	–	–	–	–	1.17
This Authority Request	–	5.24	6.84	13.56	11.65	21.47	58.76
Total Authority	1.17	5.24	6.84	13.56	11.65	21.47	59.93
Financial Authority	1.17	5.24	6.84	13.56	11.65	21.47	59.93
Estimated Final Cost	1.17	5.32	6.84	13.56	11.65	21.47	60.01

5.2 Piccadilly line signalling and control life extension

Introduction

- 5.2.1 The existing Piccadilly line signalling and control system is vulnerable to failure. The frequency and impact of failure is predicted to increase rapidly as asset degradation and obsolescence are exacerbated by diminishing spares and technical expertise. Assets and building conditions at the service control centre, LU's oldest serving, date from the 1950s and offer sub-standard working conditions.
- 5.2.2 A full upgrade of the Piccadilly line's signalling and control systems is due to be delivered under DTUP, which will provide automatic train operation and CBTC signalling. The existing legacy signalling and control assets are required to provide a safe and reliable service until then.
- 5.2.3 Full Programme and Project Authority is already in place for the design and implementation of a new control system. This project, the Piccadilly Line Interim Control Upgrade (PICU) project is now fairly advanced, with fit out of a new service control building taking place and the control system nearing go-live for the first section. The project appraisal delivered a benefits cost ratio of 11.5:1.
- 5.2.4 This authority request is for the scoping of signalling life extension to ensure that the condition and performance of these assets is stabilised until DTUP delivers.

Milestones

Milestone	Target Date
First section of railway controlled using PICU	June 2018
All Piccadilly line control areas migrated and commissioned	August 2019
All PICU deliverables complete	October 2019

Funding

Costs and Funding (£m)	Prior Years	2018/19	2019/20	2020/21	2021/22	Future Years	Total
Existing Programme and Project Authority	39.86	5.46	1.24	–	–	–	46.56
This Authority Request	–	0.22	1.55	1.79	–	–	3.56
Total Authority	39.86	5.68	2.79	1.79	–	–	50.12
Future Authority Requests	–	–	–	–	–	3.79	3.79
Financial Authority	39.86	5.68	2.79	1.79	–	3.79	53.91
Estimated Final Cost	39.86	6.01	2.91	1.79	–	3.79	54.36

5.3 Depot signalling and control upgrades

Introduction

5.3.1 Although the Victoria line has recently been upgraded, the signalling system at the line's Northumberland Park Depot dates from the 1960s is life expired and obsolete. The system limits the number of train moves that can take place simultaneously within the depot. Replacement of the system will reduce maintenance costs, improve train service reliability and improve safety in the depot. The project has a cost benefit ratio of 8.5:1 when appraised over 30 years.

Scope

5.3.2 The proposal is to replace the existing signalling system at the depot with a modern programmable system with a visual display unit replacing the existing shunter's panel and modern train detection (replacing existing track circuits). The project will also co-locate control of the depot signalling with the Victoria line's signalling and service control centre.

5.3.3 To date, Programme and Project Authority has been approved for the feasibility stage of the project and tendering for an external contractor to undertake the work. The authority request is to complete design and implementation.

Milestones

Milestone	Target Date
Contract award	March 2019
Design complete	January 2020*
Installation & commissioning complete	June 2021*

*subject to timing of contract award

Funding

Costs and Funding (£m)	Prior Years	2018/19	2019/20	2020/21	2021/22	Future Years	Total
Existing Programme and Project Authority	0.44	0.16	0.06	–	–	–	0.66
This Authority Request	–	1.15	1.96	3.00	5.76	–	11.87
Total Authority	0.44	1.31	2.02	3.00	5.76	–	12.53
Future Authority Requests	–	–	–	–	–	1.62	1.62
Financial Authority	0.44	1.31	2.02	3.00	5.76	1.62	14.15
Estimated Final Cost	0.44	1.43	1.96	3.00	5.76	1.62	14.21

6 Financial implications

6.1 The table below provides a summary of the costs and funding for the Signalling and Controls Renewals and Enhancements programme, which is fully funded in the TfL Business Plan.

Costs and Funding (£m)	Prior Years	2018/19	2019/20	2020/21	2021/22	Future Years	Total
Existing Programme and Project Authority	51.82	9.29	4.80	1.66	0.77	–	68.34
This Authority Request	–	6.61	10.35	18.35	17.41	21.47	74.19
Total Authority	51.82	15.90	15.15	20.01	18.18	21.47	142.53
Future Authority Requests	–	–	–	–	4.74	34.72	39.46
Financial Authority	51.82	15.90	15.15	20.01	22.92	56.19	181.99
Estimated Final Cost	51.82	16.30	15.22	19.97	22.93	56.19	182.43

7 Equality Impact Assessment

- 7.1 The Programme will be delivered in accordance with the Equality Act 2010. Equality Impact Assessments are considered on all strategies, policies, business plans, change programmes or projects, with regard to our obligations under the public sector equality duty in section 149 throughout the delivery of the Programme.
- 7.2 As projects progress through feasibility and design, consideration will be given to the need for an Equality Impact Assessment.

8 Assurance

- 8.1 A TfL Project Assurance (PA) and Independent Investment Programme Advisory Group (IIPAG) Assurance Review of the Programme took place in April 2018. No critical issues were raised and the recommendations have been accepted as detailed in their management response.
- 8.2 An Integrated Assurance Plan for the Programme has been agreed with TfL PA and this plan details the project-level reviews that will take place over the course of the year.

List of appendices to this paper:

None

List of background papers:

IIPAG and PA Reports

Management response to IIPAG and PA Reports

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