Programmes and Investment Committee

Date: **21 February 2018**

Item: **London Underground Rolling Stock Renewals Programme**

This paper will be considered in public

1 Summary

London Underground Rolling Stock Renewals Programme				
Existing Financial Authority	Estimated Final Cost (EFC)	Existing Programme and Project Authority	Additional Authority Requested	Total Programme and Project Authority
£898m	£893m	£413m	£199m	£612m

1.1 The paper seeks the annual renewal of the London Underground (LU) Rolling Stock Renewals (RSR) Programme and additional Programme and Project Authority of £199m. The authority requested is fully funded within the TfL Business Plan.

2 Recommendations

2.1 The Committee is asked to note the paper and approve additional Programme and Project Authority of £199m (outturn including risk) for the London Underground Rolling Stock Renewals Programme in order to progress a number of projects aimed at accessibility legislation compliance and improvements to safety and reliability.

3 Rolling Stock Renewals Programme Overview

3.1 The RSR Programme has been established to deliver:

(a) modifications to passenger rolling stock to improve safety, accessibility, reliability and customer satisfaction, while reducing maintenance costs; and

(b) modifications to existing engineering vehicles (supporting track maintenance) and the procurement of replacement vehicles to reduce the cost of infrastructure renewals and minimise line closures.

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.

Passenger Rolling Stock

3.3 There are eight types of passenger rolling stock in use on the LU network, comprising 619 trains made up of 4,316 cars. These vehicles operate on 11 lines and are maintained across 14 fleet depots. The assets typically account for approximately 40 per cent of LU's annual maintenance costs and 20 per cent of its

Renewals and Enhancements capital costs. They span a broad spectrum of age and technology, causing variation in reliability and performance. LU's objective is to reduce this variation and improve reliability, capacity and customer satisfaction, while reducing whole life costs.

3.4 The rolling stock operated on the Piccadilly, Bakerloo, Central and Waterloo & City lines will be replaced through the Deep Tube Upgrade Programme (DTUP). The rolling stock operated on the Central and Waterloo & City lines are LU's worst performing fleet, hence significant investment is included within this programme to ensure their continued safe operation and curtail the likelihood of further reliability degradation until replaced by DTUP in the early 2030s. The programme is also undertaking works to extend the life of the Bakerloo line trains to enable them to remain safe and fit for purpose until their planned replacement by DTUP in late 2028.

3.5 The mid-life refurbishment and modification of the Northern line trains to improve customer experience and accessibility was completed in April 2015. An equivalent project for the Jubilee line trains has commenced and is due to complete in 2019. This is no investment planned within the RSR Programme over the Business Plan horizon on the S7 or S8 stocks operated on the Metropolitan, District, Circle, and Hammersmith & City lines; however some funding has been forecast for the Victoria line fleet in the later part of the ten year asset plan for refurbishment.

3.6 The scope of the RSR Programme includes depot renewal projects to support the safe, efficient and cost-effective delivery of maintenance and renewal of passenger rolling stock and engineering vehicle. This includes the design and construction of a new workshop at Acton Works to replace life-expired facilities, which is underway.

Engineering Vehicles

3.7 Engineering vehicles are essential to the delivery of track maintenance and renewals as well as transporting materials for other asset areas. LU's fleet of engineering vehicles operate across the full LU network and comprises locomotives, wagons, plant equipment (e.g. cranes) and the track recording vehicle.

3.8 Until the development of the current engineering vehicle work-stream in 2012, minimal investment had been provided to ensure availability and reliability of the engineering vehicle fleet. The last significant investment took place in the early 1980s. Many of the vehicles (particularly the wagons) come from Network Rail (and its predecessors) and are therefore not designed for the LU network.

3.9 The RSR Programme includes engineering vehicle work-streams with the following specific goals:

(a) reduction in the cost of track maintenance and renewals by enabling more activities to be mechanised e.g. mechanised renewal vehicles (MRV), mechanisation of points and crossings renewal;

(b) life extension of the existing battery-powered locomotives until new heavy haulage capability is provided in the late 2020s;

(c) life extension of wagons; and

(d) provision of Remote Track Monitoring (RTM) capability to provide a 'predict and prevent' capability, enabling track maintenance efficiencies.

Previous Committee Submission

3.10 In March 2017, the Committee approved additional Project and Programme Authority of £199m, bringing total Programme and Project Authority for the RSR Programme to £413m. The additional authority granted in March 2017 comprised:

(a) £172m for the Central line Improvement Programme (CLIP);

(b) £4.8m to extend the life of LU's existing track recording vehicle and determine the future remote track monitoring solution and deliver the design stage of the mechanised renewals vehicle; and

(c) £22m for the Trains Modification Unit Workshop project.

This Submission

3.11 This submission seeks a further £199m of Project and Programme Authority, thus bringing the total granted for this programme to £612m. The key components of the additional authority requested are:

(a) £151m for the final tranche of funding for CLIP;

(b) £35m continuation of funding for the Bakerloo line Life Extension and RVAR (Rail Vehicle Accessibility Regulations) compliance programme; and

(c) £12m continuation of funding for engineering vehicle projects.

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

4 Proposal

4.1 The LU RSR Programme comprises the following projects (all cost figures include risk and inflation, these figures show the plan up to 2026/27). Rows highlighted in bold are the subject of this authority request.

Description	Financial Authority (£m)	Estimated Final Cost (EFC) (£m)	Existing Programme and Project Authority (£m)	This Authority Request (£m)	Future Requests (£m)
Central line Improvement Programme. Established to bring together the planned rolling stock investments to ensure that the trains operated on the Central and Waterloo & City lines remain safe and fit for purpose until they are replaced through the DTUP in the 2030s.	**357**	**356**	**205**	**151**	**Nil**
Bakerloo line Life Extension and RVAR. Essential structural repairs, accessibility modifications and reliability improvement works to extend the life of the Bakerloo line trains until they are replaced through the DTUP in the late 2020s.	**108**	**113**	**67**	**35**	**11**
Jubilee line Mid-life Refurbishment. Refurbishment of the Jubilee line saloon cars and modifications to comply with accessibility regulations.	25	26	26	0	Nil
Rail Adhesion Trains (RAT). Renewal of the Metropolitan line's RAT and delivery of RATs on the Piccadilly line through temporarily converted 73TS, which mitigate the effect of leaf-fall on the rail-head. Additional funding has been included in the Business Plan for 2022 to support life extension of the Central line RAT.	10	10	8	0	2
Remote Track Monitoring. A series of work packages to deliver LU's track condition monitoring requirements	**39**	**39**	**18**	**1**	**20**
Mechanisation of Points & Crossings (P&C) Renewal. The design and manufacture of specialised vehicles to mechanise the renewal of P&C.	**11**	**10**	**7**	**1**	**2**
Mechanise Renewals Vehicle (MRV) The design and manufacture of specialised vehicles to mechanise (automate) the renewal of deep tube track.	**18**	**25**	**3**	**1**	**18**
Mechanisation of Ballast Track Renewal (BTR): Mechanisation of the BTR to allow greater productivity for overnight renewals. This work is planned to begin in 2019/20 and will be covered in later submissions.	51	51	0	0	51

Description	Financial Authority (£m)	Estimated Final Cost (EFC) (£m)	Existing Programme and Project Authority (£m)	This Authority Request (£m)	Future Requests (£m)
Engineering Vehicle Life Extension and Overhaul. Life extension and overhaul of engineering vehicles to enable them to remain in service until their planned replacement date. Procurement of 71 general purpose wagons to support track renewal and maintenance activities. Design and manufacture of a replacement to the battery-powered locomotive fleet.	**245**	**228**	**49**	**9**	**174**
Trains Modification Unit Workshop. The design and construction of a new facility at Acton Works for the delivery of rolling stock and engineering vehicle projects and heavy maintenance.	22	21	23	0	Nil
Victoria line Projects. These work streams include works to improve door reliability and flooring as well as reducing dust inside the saloon. In addition a level road has been provided at Northumberland Park depot to support major overhauls and a trial is being conducted to extend the duration of the door close tone warning tone.	6	6	6	0	Nil
Future Projects. Funding has been budgeted outside of the five year Business Plan horizon for future work streams including remote condition monitoring on the Jubilee line fleet, rolling stock underframe scanning system to improve maintenance capability as well as Northern, Jubilee and Victoria line life extension and obsolescence?.	34	36	0	0	36
Totals	928	922	413	199	315
Efficiency Target. A value engineering efficiency has been included up to 2023/24. This will be subject to ongoing review and where efficiencies are identified and adopted, the EFC will be updated. This is already included within the overall Financial Authority.	(30)	(29)			
Net Totals	898	893			

Central line Improvement Programme

4.2 The 1992 Tube Stock (92TS) trains operating on the Central (85 trains) and Waterloo & City (five trains) lines are just over halfway through their 40 year nominal design life. The fleet performs worse than any other fleet on the network and is a significant and persistent underlying cause of poor reliability. It also scores consistently lowest in customer satisfaction surveys. These issues have their origins in poor design and poor manufacture, in addition to which this fleet also contains technology that was innovative at the time but is now superseded and difficult to maintain. They are the last trains procured by LU to use 'direct current' (DC) motors and the first to use electronic rather than electro-mechanical control systems. Approximately £8m per year is spent repairing and overhauling the motors to contain the frequency of motor damage, known as 'flashovers', to below 200 per year.

4.3 CLIP was established to deliver essential works to ensure the fleet remains safe and fit for purpose - including modification to become RVAR compliant - until they are replaced through the DTUP in the early 2030s.

4.4 The scope of CLIP is to:

(a) Replace the DC propulsion system with a modern 'alternating current' (AC) propulsion system;

(b) Replace the unreliable and obsolete on-board train computer, known as the Data Transmission System (DTS);

(c) Replace the flooring with a modern RVAR compliant system and resolve known issues with the saloon body integrity, specifically door pillar cracking and water ingress;

(d) Achieve RVAR compliance, including wheelchair access and a visual and audible passenger information system (PIS);

(e) Install CCTV and LED lighting in the carriages; and

(f) Overhaul of the door system.

4.5 At its March 2017 meeting, the Committee increased CLIP's Programme and Project Authority from £32.4m to £205.3m. This authority funded primarily the procurement of the DTS for the Central line fleet, as well as the design and prototyping of the other main modifications and repairs.

4.6 The additional CLIP authority of £151m being sought in this submission represents the final tranche of funding required for full programme implementation.

4.7 The CLIP programme remains on schedule and within funding. Key milestones and a cost summary are summarised in the tables below:

Milestone	Target Date
Critical Design Review (CDR) for AC Traction Project	October 2018
CDR for DTS Project	May 2018
Train works commence (prototype)	February 2019
Train works complete	February 2023

Costs and Funding (£m)	Prior Years	2017/18	2018/19	2019/20	2020/21	Future Years	Total
Cost (Outturn)							
Current Authority	5.1	10.8	12.6	29.2	43.0	104.6	205.3
Authority Requested	0.0	0.0	8.0	15.9	51.6	75.3	150.8
Future Authority	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Business Plan	5.1	7.9	17.5	68.8	87.9	169.5	356.7
EFC	5.1	10.8	20.6	45.2	94.6	179.9	356.1

Bakerloo line Life Extension and RVAR Compliance

4.8 The Bakerloo line fleet comprises 36 seven car trains of 1972 Tube Stock (72TS). It is the 'next worst' performing fleet on the network (after the Central line), and is substantially out-performed by the Piccadilly line 73TS which is of a similar age and design.

4.9 The fleet was originally planned to be replaced in 2018 as part of the Deep Tube Upgrade Programme (DTUP), but is now expected to remain in service until the end of 2027. The fleet suffers from age related failures and some structural integrity issues. The Bakerloo line life extension project has been developed to address these issues, such that the fleet can be retained in safe and reliable operation until its replacement under DTUP. The project will also address a number of RVAR requirements.

4.10 The existing £67m of Programme and Project Authority has primarily funded works to address the structural integrity issues. These works will be complete in 2019.

4.11 The additional £35.5m authority requested in this submission comprises:

(a) £29m to deliver RVAR compliance works on the Bakerloo line including new wheelchair bays, additional hand rails, a new passenger information system, and manual boarding ramps/humps (where applicable); and

(b) £6.5m to deliver further reliability improvement works to doors, propulsion systems, suspension systems and brake systems.

4.12 The programme remains on schedule and within funding. Key milestones and a cost summary are summarised in the tables below.

Milestone		Target Date
72TS Life Extension	Start on Train 24	June 2018
	Project Completed	April 2019
RVAR Compliance	Detailed design – wheelchair bay area and grab handles	May 2019
	Detailed design – Passenger Information Service	January 2020
	Last train – wheelchair bay area and grab handles	November 2020
	Last train – PIS	May 2021

Costs and Funding (£m)	Prior Years	2017/18	2018/19	2019/20	2020/21	Future Years	Total
Cost (Outturn)							
Current Authority	23.7	14.8	20.4	7.8	0.1	0.0	66.8
Authority Requested	0.0	0.0	4.1	11.4	16.3	3.7	35.5
Future Authority	0.0	0.0	0.0	2.0	3.1	5.5	10.6

Business Plan	23.7	15.2	21.9	31.7	9.8	5.6	108.0
EFC	23.7	14.8	24.1	21.2	19.6	9.2	112.7

Engineering Vehicle Projects

4.13 The third element of the £199m Programme and Project Authority sought under this submission comprises a total of £12.6m to support four separate projects relating to the engineering vehicle fleet. These projects are summarised below:

(a) Remote Track Monitoring: An additional £1.4m to support delivery of LU's track condition monitoring requirements – specifically to fund the completion of feasibility and design phase for a replacement track recording vehicle;

(b) Points and Crossing (P&C) Mechanisation: An additional £1.3m to progress the design and manufacture of specialised vehicles to mechanise the delivery of P&C renewals;

(c) Mechanised Renewal Vehicles: An additional £0.9m to progress the design of specialised vehicles to increase mechanisation and automation of deep tube track renewals; and

(d) Engineering Vehicle Life Extension and Overhaul: An additional £9m to progress the overhaul of the engineering fleet (locomotives, wagons and plant equipment) to enable them to remain in service until their planned replacement date in the early 2020s.

5 Financial implications

5.1 The table below provides a summary of costs and funding for the RSR Programme through to 31 March 2029:

Costs and Funding (£m)	Prior Years	2017/18	2018/19	2019/20	2020/21	2021/22 to 2028/29	Total
Cost (Outturn)							
Current Authority	89.2	55.2	64.8	53.4	44.6	105.7	413
Authority Requested	0.0	0.2	19.7	32.1	68.0	79.0	199
Future Authority	0.0	0.0	0.0	10.1	14.5	290.0	315

Business Plan	84.4	52.8	73.1	115.7	103.4	468.5	898
Programme EFC	84.4	54.0	78.5	87.5	119.2	469.5	893

6 Equalities Impact Assessment

6.1 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.

6.2 As projects progress through feasibility and design, consideration will be given to the need for an Equality.

7 Assurance

7.1 A TfL Project Assurance (PA) and Independent Investment Programme Advisory Group (IIPAG) Assurance Review of the Programme took place in January 2018. Separate project level Assurance Reviews were also completed for CLIP and Bakerloo line RVAR works in January 2018. There were no critical issues identified.

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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