

Date: 15 December 2021

Title: London Underground Fleet Heavy Overhaul, Fleet and Engineering Vehicles Programmes

This paper will be considered in public

1 Summary

Programme	Existing Financial Authority (£m)	EFC (£m)	Existing Programme and Project Authority (£m)	Additional Authority Requested (£m)	Total Authority (£m)
FHO	600.44	602.21	346.23	14.72	360.95
APCD Fleet	751.62	748.41	625.87	8.72	634.59
Engineering Vehicles	355.41	351.84	75.65	11.11	86.76
Total	1,707.47	1,702.46	1,047.75	34.55	1,082.30

Table 1: Programme and Project Authority requests up to and including FY2027/28.

Authority Approval: The Committee is asked to approve additional Programme and Project Authority of £34.6m across the FHO, APCD Fleet and Engineering Vehicles Programmes, bringing the total authority to £1,082.3m* up to and including FY2027/28.

Outputs: Compliance of London Underground's passenger trains and engineering vehicles with safety standards and legislation, securing expected reliability and availability levels, and the capability to cater for future forecast demands of the network.

*Figures subject to change as this is based on P08 Forecasts and Budget agreed in July 2021

1.1 This paper covers three train related programmes in London Underground (LU):

- (a) Fleet Heavy Overhauls (FHO) – delivers essential, large scale maintenance of the passenger train fleets and rail adherence trains as part of the train maintenance regime, to preserve a safe and reliable service;
- (b) Asset Performance & Capital Delivery (APCD) Fleet – deliver projects that renew life expired or degraded components on passenger trains beyond the scope of FHO, or reconfigure trains to comply with legislation; for example, installing passenger accessibility and information systems,

installing LED lighting, replacing obsolete and unsupportable traction units and addressing train underframe fatigue failures; and

- (c) Engineering Vehicles (EV) – deliver projects related to the EV fleet that serve and support the track renewal programme.
- 1.2 Noting that FHO has previously been a separate submission to Fleet and EV (previously referred to as the ‘Access’ Programme), this paper provides an update on progress since the last submissions to the Committee and requests an additional £34.6m Programme and Project Authority across the three programmes. The request brings the collective total Programme and Project Authority to £1,082.3m and enables continuation of delivery consistent with Asset Strategy and **do minimum scenarios** in the **Long Term Capital Plan (LTCP)** to FY2027/28.
- 1.3 The Integrated Asset Strategy for passenger trains is to ensure compliance with legislation (e.g. accessibility regulations), manage obsolescence of ageing systems such as CCTV and train management systems, ensure the safety of passengers, and provide a reliable train fleet via a considered and optimised heavy maintenance schedule. For EVs, the vision is to mechanise historically labour intensive, lineside track work by introducing new, modern vehicles, plant and equipment to increase productivity whilst simultaneously improving the safety of our workforce.
- 1.4 The paper outlines the programmes that support these strategies, on a project by project basis and is a combined update to the December 2020 submission for FHO and March 2021 for Fleet and EV. Key outputs for these Programmes include (but are not limited to):
- (a) modified Central and Bakerloo line trains that permit accessible travel for mobility impaired passengers;
 - (b) improved reliability on the Central line fleet, by replacing the aging and obsolete DC traction package with a modern AC equivalent (noting some limited overhaul scope prior to replacement), and on the Jubilee line by progressing a long-term solution to the fatigue cracking issue that faced the fleet in late 2019;
 - (c) overhaul of major components and systems on the fleets that serve the Piccadilly, Bakerloo, Jubilee, Victoria and Metropolitan lines;
 - (d) two new vehicles to replace our sole, aged vehicle used to measure track geometry, informing track maintenance priority. The second vehicle will help LU meet the highest inspection frequency standards;
 - (e) commissioning of recently received new vehicles that improve Points and Crossing renewals, and development of a vehicle to improve safety and productivity of deep tube track and concrete renewal; and
 - (f) procurement of a replacement fleet of support wagons to replace the near life-expired wagon fleet, and progress early stages of replacement of the aged locomotives fleet used to haul plant and equipment through the LU network.

2 Recommendations

2.1 The Committee is asked to note the paper and:

- (a) **approve additional Programme and Project Authority of £14.72m (outturn including risk) to progress mandatory overhaul works within the Fleet Heavy Overhaul Programme. This is the minimum additional authority required to continue this multi-year, in-flight essential maintenance programme and brings the total FHO Programme and Project Authority to £360.95m;**
- (b) **approve additional Programme and Project Authority of £8.72m (outturn including risk) for Central line train improvements and progress rectification of the underframe fatigue cracking issue on the Jubilee line fleet within the Fleet Programme, bringing the total Programme and Project Authority to £634.59m; and**
- (c) **approve additional Programme and Project Authority of £11.11m (outturn including risk) to design a replacement fleet of locomotives, enhance the Mechanical Renewals Vehicle prototype into an on-track machine, and continue the EV overhauls within the Engineering Vehicles Programme, bringing the total Programme and Project Authority to £86.76m.**

3 Background

- 3.1 The LU passenger fleet is comprised of 619 trains, across eleven lines, made up from nine fleets, ranging in age from eight year to nearly 50 years old. There is a broad relationship between fleet age, current performance and the works defined in this paper (and longer term strategy). The on-going FHO programme is essential for maintaining minimum acceptable levels of safety and reliability, while the Fleet programme is addressing more severe issues, for example, the poor performing fleet on the Bakerloo and Central lines as detailed in Appendix 1.
- 3.2 The Long Term Capital Plan (LTCP) and fleet asset strategy lay out the roadmap for fleet management, renewals and full replacements in a controlled manner accounting for such factors as market capabilities, financial constraints, existing fleet condition and the needs of network growth. Relatively recently, S7 and S8 trains have been introduced on the Metropolitan, District, and Hammersmith and Circle lines. Piccadilly line trains are due to be replaced from 2025. These trains have and will address age related asset concerns.
- 3.3 Various scenarios have been considered to evaluate how long each fleet might be required to remain in operation. Given the timescales to replace a fleet can stretch to 10 years and to mitigate against the current long-term funding uncertainty, programmes of interventions have been scheduled accordingly to maintain fleet safety and operability, and to ensure compliance with legislation.
- 3.4 Similar to passenger trains, the EV asset strategy sets out the steps to replace and enhance existing capabilities. LU has 275 Engineering Vehicles (EVs), including one specialist track recording vehicle, tampers, cranes, wagons and haulage locomotives. This is a specialised fleet, critical to the upkeep and

management of the railway. Some of the locomotives are already 50 to 60 years old, with 100 years old components in some instances.

- 3.5 A record high of more than 200 vehicles were classified as being in a 'very poor' State of Good Repair, until investment in an EV overhaul programme was made to curtail such deteriorating condition. Recent replacement of vehicles aims to recover this backlog and introduce modern efficient vehicles to undertake track condition inspection and support various track interventions, and the works described in this paper will continue this.
- 3.6 The Programmes support the Mayor's Transport Strategy (MTS) objective of 'providing a good public transport experience' and contribute to the aim within the MTS for 80 per cent of trips in London to be made on foot, by cycle or using public transport by 2041. The Programmes also support LU's priorities for 'Safety and Reliability', 'Customer', 'People' and 'Affordability'.

4 Delivery Progress since last submission

- 4.1 Since the last submissions, the Programmes have begun to recover from the impact of the coronavirus pandemic. Challenges of resourcing in early stages of design to prototyping have impeded the delivery progress to enter full production. A LU Fleet Capital Delivery resource management strategy is being developed with professional service business leaders to control and address these issues.
- 4.2 A snapshot of deliverables against those committed in the last submissions to the Committee and EFC changes is provided in Appendix B, while key highlights for selected projects are detailed in the sections below.

Fleet Heavy Overhaul Programme

- 4.3 The **FHO** Programme delivers heavy maintenance activities on passenger fleets and Rail Adhesion Trains (RATs). These activities are part of the routine maintenance of any fleet which necessitate the removal of trains from service to undergo:
- (a) **Programme Lift**, which predominately overhauls the suspension, wheelsets, motors and brake systems;
 - (b) **Heavy Overhaul**, which includes the programme lift activities but also encompasses overhaul of auxiliary and heating and ventilation systems;
 - (c) **Door Overhaul**, which services the door system; and
 - (d) Other activities, which have been deemed more efficient and cost effective to undertake when the train is out of service.

4.4 **Victoria line:** Programme lift was successfully completed on the whole fleet at the end of the FY2020/21 and through commercial activity, realised a £2.1m efficiency saving. At the end of the programme, 6 trains were returned for completion of work relating to parking brakes and bogie-motor harnesses; this 90 per cent complete with expected completion by the end of the financial year. Figure 1 below shows installation trials of a new pressurised ventilation system to

reduce ingress of tunnel dust (and reduce whole life costs) has been completed on 7 trains.



Figure 1: Installation trials of a new pressurised ventilation system

- 4.5 **Bakerloo line:** Being the oldest on the network, the fleet is subject to an ongoing overhaul programme to safeguard continued operation. Programme lift and heavy overhaul has been completed on 11 and three trains respectively. Engineering activities have commenced on door overhaul. The process of disposing of a non-service Bakerloo line train previously assigned for filming purposes has commenced as this has been evaluated as better value compared to refurbishment costs.
- 4.6 **Piccadilly line:** Life extension has been completed on 11 trains, door overhauls and new flooring laid on 25 trains, traction equipment overhauled on five trains and new seating installed on 40 trains. The existing fleet is required to remain operational until 2027 when they will be replaced. To support this continued operation, a programme lift cycle has commenced and 10 of the 59 units are complete including fitment of new axles as shown in figure 2 below.



Figure 2: Fitment of new axles

- 4.7 **Metropolitan line:** The first four trains have completed Programme lift and returned to service with newly overhauled bogies. Procurement activities (materials and tooling) and training of depot and engineering workshop resources is in progress to prepare for full production and overhaul at a rate of one train per week in 2022.
- 4.8 **Jubilee line:** Enabling works in preparation for Programme lift commencing in 2022 are in progress, e.g. material procurement, recruitment of resources and installation of plant and equipment in the existing Temporary Fit Out Shed (TFOS). Figure 3 below shows new jacks installed in the TFOS. The project completed condition assessment of doors and developed an indicative overhaul scope.



Figure 3: New Jacks installed in the TFOS

- 4.9 **District, Circle and Hammersmith & City lines:** With trains similar to those of the Metropolitan line fleet, data and experience gained from the programme lift is being used to inform optimisation of scope and programme of District, Circle and Hammersmith & City lines. Door condition assessments are in progress as is a final review of coupler overhaul scope for which suppliers have been engaged.
- 4.10 **Rail Adhesion Trains (RATs):** Overhaul of the second Central line RAT was successfully completed in advance of and hence ready for start of the Autumn 2021 leaf fall season.

Fleet Programme

- 4.11 The **Fleet** Programme delivers targeted interventions that fall outside of the routine maintenance regime to safeguard regulatory compliance (e.g. Bakerloo line Rail Vehicle Accessibility Regulations) safety levels, reliability or work requiring redesigns (e.g. Central Line Improvement Programme – CLIP).
- 4.12 The **Central Line Improvement Programme (CLIP)** provides accessibility, reliability and safety improvements, as well as the addition of CCTV, ensuring trains on the Central and Waterloo & City lines¹ remain safe and fit for purpose

¹ The Central line consists of 85 eight-car trains. The Waterloo and City line consists of five four-car trains.

until replacement as per the Fleet Asset Strategy and LTCP. A new AC traction propulsion system has been successfully tested and the outputs of this stage are informing the production process planned for the rest of the fleet, as shown in figure 4 below. Static testing of the integrated, new data transmission system, CCTV, Passenger Information System (PIS) and LED lighting has also completed. CLIP has also installed the wheelchair bay componentry on the first Waterloo and City line train ahead of programme. The programme will refurbish and repair saloon seats while the train is taken out for CLIP, as shown in figure 5 below.



Figure 4: AC Traction dynamic testing at an off-site test track



Figure 5: Saloon Car Installation

- 4.13 In July 2021 the newly commissioned **train modification workshop** at Acton Works began work on the first CLIP pre-production train (see 4.12 and figures 6 and 7 below) moving into the AC Traction phase.



Figure 6: First CLIP pre-production train being shunted to TMU, Acton



Figure 7: First CLIP pre-production train being lifted at TMU, Acton

- 4.14 The **Jubilee line Underframe Modification Project (JUMP)** is the result of routine inspection in Oct 2019 where fatigue cracks were discovered under several Jubilee line trains. At the time, this led to swift withdrawal of 74 per cent of trains from passenger service. Although a temporary repair was quick to return the fleet to service, associated disruption was significant. The project is accelerating into design development of a long-term solution, with early stage commercial activities also progressing. The delivery approach will aim to minimise

impact on the passenger train service and seek out available synergies to reduce costs by collaborating with FHO Programme.

- 4.15 On the **Bakerloo line** trains, work began to install LED lighting and a Passenger Information System (PIS) to comply with Rail Vehicle Accessibility Regulations (RVAR). Only one out of the planned eight trains has completed fitment of wheelchair bays and new colour contrasted grab poles. Competing demands from other fleet projects with limited engineering resource pool has unfortunately impacted project progress, meaning timelines agreed with the Department of Transport (DfT) for RVAR compliance are at risk.
- 4.16 The **Train Cab J-Door Security Improvement** project will prevent unauthorised access through the internal 'J' door that connects the train operator's cab and the train saloon across all LU passenger train fleets. This project has experienced prolongation due to the similar engineering resource issues. As such, this has seen the original planned mobilisation in Spring 2021 deferred to Winter 2021. Our operators have been engaged throughout the process.

EV Programme

- 4.17 The **EV Programme** includes engineering vehicle and specialist train projects. They comprise of battery locomotives (for haulage capability), various wagons for different activities, plant and equipment such as cranes and tampers. LU also rely upon specialist rail vehicles such as the Track (geometry) Recording Vehicle (TRV) for mandatory condition and safety assurance duties.
- 4.18 The Programme is also delivering a number of complex specialist vehicles bespoke to the constraints of LU's infrastructure. These replace and/or enhance existing capabilities and assets. Meantime, this programme ensures legacy vehicles continue safe operations often in excess of their originally intended design life.
- 4.19 The **Locomotive Capability** project completed an options development study inclusive of signalling and value management to support the LTCP on the replacement of the aged battery locomotive fleet. These trains are used to haul plant and equipment around the network predominantly in support of the track renewal programme. Increasing numbers have defects that have resulted in one being withdrawn from service.
- 4.20 The **Remote Track Monitoring (RTM)** project aims to support 'boots free' track geometry recording, replacing capability currently provided by the Track Recording Vehicle (TRV). Without the TRV, there is no alternative method to record track geometry meaning LU would need to apply temporary speed restrictions to assure railway safety, which would impact passenger service. Slow progress in procuring the replacement capability – a result of the coronavirus pandemic – meant TRV modification was needed to operate on the sub-surface lines following commissioning of the signalling upgrade (delivered by the Four Lines Modernisation (4LM) programme). This work is now complete and a new project will explore mitigations to allow the TRV to operate on the Bakerloo and Jubilee lines without a need for special operational measures.

- 4.21 The **Mechanised Renewals Vehicle (MRV)** aims to improve current labour-intensive methods employed to renew track and concrete structures in the deep tube tunnel environment. An in-house designed and built prototype vehicle, shown in figure 8 below, successfully trialled on the Piccadilly line in May 2021 and is planned to be brought into beneficial use at Turnpike Lane in January 2022. One wagon is fitted with cement-mixers with chutes for concrete pouring, whilst two more wagons are re-purposed for material transport. The MRV efficiencies target is to triple deep tube track renewal meterage per shift by 2025/26 with efficiencies ramping up from 2023.



Figure 8: An in-house designed and built prototype vehicle

- 4.22 Rectification of quality non-conformities on the four pre-production **wagons** received from China are slow due to the coronavirus impacts on supply chain and restrictions on international travel. A fifth pre-production wagon (with lessons learned from its predecessors) is now in transit from China by ship (expected in January 2022). A sixth and seventh pre-production wagon have been built. Works on the four wagons already in the UK are still being checked before being accepted onto the Great Central Railway (a heritage rail test track) and then on a Network Rail test track for dynamic testing. The project is pursuing third party surveillance in place of being in Shandong, China to ensure quality assurance through the mass production phase. Subject to satisfactory assurance outcomes, delivery of the remaining 66 wagons, starting with bogies, will now commence in Summer 2022. Continuing delays will incur additional expenditure to life extend existing wagons to support the track programme.
- 4.23 Mechanised **Modular Points & Crossing** system comprising of two Kirow cranes and eight tilt wagons successfully completed dynamic brake testing at the South Ealing test track and are fully certified to work in Ruislip Depot. Engineering assurance is ongoing for the open sections of the Sub-Surface network (SSR) which has proved challenging due to shortfall of resources as experienced across many projects and programmes. LU aims to bring the new system into use by Easter 2022, where it is envisaged that reduced blockades will save TfL up to £0.3m per closure (2 to 3 per year) and minimise disruption to passenger service.



Figure 9: Kirow crane passing South Ealing station



Figure 10: Kirow wagon hauled by battery locomotives

- 4.24 **Ruislip EV Depot** track, by the Central line maintenance shed, has been improved by the Track Programme for long-term operational and maintenance efficiencies. This also enables temporary stabling of existing rail vehicles while reconfiguration and expansion of the depot tracks start in Spring 2022 to accommodate the new wagons arriving from China, and eventually the replacement (heavy haulage) battery locomotives.
- 4.25 **EV Overhauls** is rolling into the sixth year of the 10-year programme. This exists to progressively overhaul 108 different wagon types (hopper, general purpose and rail wagons), bespoke cranes, on-track machines, and the battery locomotive fleet. To date, the programme has fixed structural defects on the hopper wagon fleet, overhauled more than 40 per cent of wagon fleet and a 7.5 tonne crane. Asbestos removal and replacement of wheel suspension parts have also completed on all locomotives. It is prioritising key works such as fleet wide bogie and traction motor overhaul to rectify critical issues to maintain locomotives availability.

5 Key deliverables for the Programmes

- 5.1 The three Programmes are summarised in Tables 2, 3 and 4 (all figures include risk and inflation up to FY2027/28). Tables present the projects and associated financial impact to FY2027/28. A more detailed breakdown of these tables is provided in Appendix C illustrating each constituent project and associated key deliverables expected of each programme to December 2022.
- 5.2 Financial Authority is granted per the Budget, approved by TfL Board in July 2021. In some cases, project EFC's are in excess of financial authority, often for the latter years of projects. Where this is the case, provision will also need to be made in future Budgets and Business Plans in respect to commitments made.
- 5.3 The Programmes deliver value for money by sourcing commonly available components to replace obsolete electronic parts for reliability and safety. Procurement strategies adopt a category management approach and drive value through consolidation across projects, competitive tendering and negotiation, and develop strategic supplier relationships to encourage innovation and delivery.
- 5.4 Specifically, FHO achieved value for money through detailed scope development using failure data and undertaking conditional assessments. Once the production is well understood, the Programme will review opportunities to combine

procurements to leverage economies of scale and where appropriate, look for cheaper alternative sources of supply to mitigate the reliance on the original equipment manufacturers.

Fleet Heavy Overhaul Programme

- 5.5 Table 2 below presents a summary of the FHO Programme. The work delivered by projects within this programme are standard heavy maintenance activities and driven by the size of the fleets. Majority of the £14.7m new authority request will complete the Bakerloo (£4.5m) and Piccadilly line (£3.9m) Programme Lift and heavy overhaul of 24 trains, as well as implementing door overhauls for these lines. A further £4.3m is allocated to the overhaul of Central line fleet DC traction motors due to delays in the CLIP full production phase, where these motors will be replaced by more reliable AC equivalents.
- 5.6 An additional £1.0m new authority will finish overhaul of the two Central line RATs and kick-start a scoping exercise for the Metropolitan line RATs. Also, £0.9m is requested for Jubilee line Programme Lift, whilst £0.1m supports condition assessment of doors overhaul of the Metropolitan line fleet.
- 5.7 A more detailed breakdown of this request is provided in the Appendix 3 along with key deliverables to December 2022.

	Financial Authority (£m)	Estimated Final Cost (EFC) (£m)	Existing P&PA (£m)	This Authority Request (£m)	Future Authority Requests (£m)
Continuing Projects Sub-Totals	591.44	597.91	346.23	10.42	249.42
New Projects Sub-Totals	9.00	4.30	-	4.30	-
Closed Projects Sub-Totals	-	-	-	-	-
Totals	600.44	602.21	346.23	14.72	249.42

Financial Authority is granted by the Budget approved in July 2021 by TfL Board.

* Financial Authority will be aligned to the overall EFC as part of the next budgeting cycle before the next submission to the Committee.

Table 2: Summary of the FHO Programme to 2027/28

- 5.8 The request for an additional £14.7m Programme and Project Authority will bring the total to £360.9m.

Fleet Programme

- 5.9 The Programme works closely with the FHO Programme and fleet maintenance to maximise efficiencies when trains are taken out of service for works. For on-going projects, the Fleet Programme requests £4.7m new authority to progress seat refurbishment and repairs within CLIP scope. This will enhance the customer travel experience by providing new seat cushions and seat suspension pans where required. It will also introduce the moquette indicating priority seating as already proving successful on the Jubilee line fleet.

- 5.10 Separately, £3.9m new authority is sought for JUMP to develop the concept design and move into the procurement stage, providing the long-term fatigue cracking solution. A further, nominal £0.1m authority request is also made to enable critical new projects on Victoria and Jubilee line trains. Such new projects intend to address pending obsolescence issues with CCTV, Train Management Systems (TMS), Customer Information Systems (CIS) as well as progressing residual life assessments for Central, Bakerloo and Jubilee lines.
- 5.11 Some projects have also completed. Closing projects relate to the Jubilee mid-life refurbishment, which included installation of wheelchair bays and other RVAR related scope, Bakerloo life extension which improved the structural integrity of this aged fleet, and conversion of an redundant Metropolitan line train (the fleet has since been replaced) for rail adhesion purposes.

	Financial Authority (£m)	Estimated Final Cost (EFC) (£m)	Existing P&PA (£m)	This Authority Request (£m)	Future Authority Requests (£m)
Continuing Projects Sub-Totals	576.76	581.85	533.78	4.69	62.93
New Projects Sub-Totals	86.40	78.07	1.09	4.03	73.91
Closed Projects Sub-Totals	88.46	88.49	91.00	-	-
Totals	751.62	748.41	625.87	8.72	136.84

* Financial Authority is granted by the Budget approved in July 2021 by TfL Board.

* Financial Authority will be aligned to the overall EFC as part of the next budgeting cycle before the next submission to the Committee.

Table 3: Summary of the Fleet Programme to 2027/28

- 5.12 The request for an additional £8.7m Programme and Project Authority will bring the total to £634.6m. The EFC increase across the Fleet Programme is largely attributed to the material costs and TfL labour rates. This is expected to stabilise as production ramps up to a steady beat rate.

Engineering Vehicles Programme

- 5.13 The minimum investment requested for the EV Programme is summarised in Table 4 and will bring in new vehicles to address the aging asset base, return to a steady state of planned heavy overhauls, and to support major track works. The programme seeks value for money by working with asset operators to deliver fit for purpose EVs with common spares to reduce the whole life costs.
- 5.14 With the critical repairs on the locomotives underway, EV is requesting additional £9.0m authority to overhaul six locomotives, cranes and tampers, as well as catch back work on 24 wagons over the next two years. £1.0m authority is requested to enable the replacement locomotive project develop technical requirements, assisted by signalling experts (to enable the new fleet to operate across the various signalling systems LU employ). Additionally, £0.8m authority is sought to

investigate a new deep tube tamper, EV braking solutions; and TRV mitigations to unplanned outages until it is replaced by the med term RTM project. Finally, £0.3m is requested to progress the MRV beyond the prototype stage, bring the Kirow system into full beneficial use, and to start concept design on a coupler modification.

	Financial Authority (£m)	Estimated Final Cost (EFC) (£m)	Existing P&PA (£m)	This Authority Request (£m)	Future Authority Requests (£m)
Continuing Projects Sub-Totals	320.24	316.98	75.45	10.36	231.19
New Projects Sub-Totals	35.17	34.86	0.20	0.75	34.12
Closed Projects Sub-Totals	-	-	-	-	-
Totals	355.41	351.84	75.65	11.11	265.31

* Financial Authority is granted by the Budget approved in July 2021 by TfL Board.

* Financial Authority will be aligned to the overall EFC as part of the next budgeting cycle before the next submission to the Committee.

Table 4: Summary of the EV Programme to 2027/28

6 Equalities Implications

- 6.1 These programmes will be delivered in accordance with the Equality Act 2010. As projects progress through feasibility and design, consideration will be given to the need for an Equality Impact Assessment (EqIA).
- 6.2 The FHO and EV Programmes constitute maintenance activities which do not impact on people and ways of working and therefore in consultation with Diversity and Inclusion, EqIAs are not required.

7 Financial Implications

- 7.1 Table 5 summarises the financial impact of the three Programmes combined, by year. All cost figures include risk and inflation and illustrate plans up to and including 2027/28. This is considered as the minimum authority required to continue these multi-year, predominantly in-flight projects across all Programmes.
- 7.2 Total Financial Authority of £1,707.5m is based on the Budget approved in July 2021, which didn't include allowances for LTCP workbank scope. This will be addressed as part of the most recent budgeting cycle (based on the EFC's in this paper) to be presented to Board on 8 December, TfL Business Plan will also align the Financial Authority with the LTCP prior to the next submission to the Committee.

Costs and Funding (£m)	Prior Years	2021/22	2022/23	2023/24 to 2027/28	Total
Cost (Outturn)					
Existing Programme and Project Authority	306.94	110.35	195.60	434.86	1,047.75
This Authority Request	-	0.45	22.01	12.09	34.55
Future Authority Requests	-	-	17.34	634.22	651.56
Financial Authority*	304.34	113.39	238.58	1051.16	1,707.47
Programme EFC	304.59	89.96	217.64	1090.27	1,702.46

* Financial Authority is based on the Budget approved in July 2021 and the EFC is reflected in the proposed budget to be submitted as part of the GLA Budget.

Table 5: Summary of All Programmes to 2027/28

- 7.3 Authority granted by the Committee which relate to both the current funding period to 11 December 2021 and commitments outside of this period, may need to be revised as part of future budgets to be considered by the Board. Provision will also need to be made in future Budgets and Business Plans in respect to commitments made. If additional funding is not available, a prioritisation of the TfL Investment Programme will be required, and some programmes and projects will not be taken forward and revised authority will be sought as appropriate.
- 7.4 All financial commitments related to this request will be overseen in accordance with TfL Business controls in respect of draw down.

8 Challenges, Opportunities and Lessons Learnt

- 8.1 **Challenges:** The scarcity of resources in engineering and support functions across TfL combined with the production phase of the LU sub-programme is a huge challenge to the UK labour market, depot facilities and logistics. TfL has also seen supplier prices and lead times of materials increased globally whilst working with suppliers to hold stock of raw materials/finished goods. This in turn challenged the programmes to adapt their schedules and allow catch back on outstanding work due to material delays.
- 8.2 **Challenges:** Our passenger fleets, being unique to London Underground, can restrict the opportunity to competitively tender. The Fleet and FHO Programmes are therefore actively looking for opportunities with Alternative Equipment Manufacturers both in and outside the Train Builder Supply to seek value for money from a wider supply chain.
- 8.3 **Opportunity:** The Programme has taken the opportunity to combine material procurement across the fleets to reduce unit rates and drive added value from the supply chain, achieving £30m of efficiencies to date. These are tracked in conjunction with Finance. Recent significant procurements in line with the procurement approach delivered £6.27m of efficiencies on their own (Victoria line (09TS) train fleet Doors and wheelsets for the Piccadilly (73TS) and Jubilee (96TS) fleets).

8.4 **Lessons Learnt:** Following delivery of heavy overhauls to date, it was identified that such refurbishments required three years of project works before delivery of the first train due to the condition assessments, governance and procurement of long lead items. Planning for this period also allowed enough time for any reverse engineering activity to support future competitive tendering/alternatives sources of supply. These lessons are being applied to the rest of the programme.

9 Assurance

9.1 TfL Project Assurance and the Independent Investment Programme Advisory Group (IIPAG) completed an assurance review of the Programme in November 2021. No critical issues were identified.

List of appendices to this report:

Appendix 1: Fleet Reliability and EV State of Good Repair

Appendix 2: EFC Movements and Planned vs Forecast Scope

Appendix 3: Project by Project Details

List of Background Papers:

Independent Investment Advisory Group (IIPAG) Report

TfL Project Assurance Report

Management response to TfL Project Assurance and IIPAG reports

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