Programmes and Investment Committee

Date: **5 October 2023**

Item: **London Underground Renewals**

This paper will be considered in public

1 Summary

	Existing Financial Authority	Existing Programme and Project Authority	Additional Authority Requested	Total Authority	Prior Years Spend	Forecast 24/25 to 25/26
LU Renewals	£4,032m	£3,162m	£559m	£3,721m	£1,766m	£1,463m

Table 1: Summary of Programme and Project Authority (see Table 9 for further detail)

1.1 This paper updates the Committee on the progress of the London Underground (LU) Renewals Programme (the Programme). The Programme maintains the safety, operability and reliability of LU and Elizabeth line (EL) assets through a prioritised programme of renewals. Details of the assets which this Programme covers are listed in paragraph 3.4.

1.2 This submission brings sub-programmes into a single Programme and Authorities request for the first time following the approval of the new Programme structure by the Committee in May 2023. Table 1, above, shows that £559m Programme and Project Authority is requested, bringing the total to £3,721m to deliver the Programme through to the end of financial year 2025/26.

1.3 The focus of this paper is to:

(a) present the achievements of the Programme since the previous submissions;

(b) provide assurance to the Committee on the progress of the Programme and the future plans; and

(c) set out the existing Programme and Project Authority alignment to the current forecasts through to the end of the 2025/26 financial year.

2 Recommendations

2.1 The Committee is asked to note the paper and:

(a) approve increased Programme and Project Authority of £559m for the London Underground Renewals Programme, bringing the total Programme and Project Authority to £3,721m; and

(b) note that matters for which authorities are sought above include commitments that extend beyond the period of the 2023/24 Budget and provision will, therefore, need to be made for those commitments in future Budgets.

3 Background

Strategic Context

3.1 The Mayor's Transport Strategy (MTS) has three key themes: healthy streets and healthy people; a good public transport experience; and new homes and jobs. Maintaining a State of Good Repair (SoGR) of LU and EL assets through renewals is key to delivering all these plans. All LU and EL assets and their SoGR are directly related to a good public transport experience, which itself supports healthy streets and a mode shift to sustainable public transport, cycling or walking, and delivers growth in locations with high public transport capacity.

3.2 Budget constraints during and after the coronavirus pandemic have reduced investment in all our renewals and we are beginning to see service impacts of the resultant degrading asset base. Specific examples of declining asset reliability and availability are described later in this section and Appendix 1. In headline terms, our reliability incident count has increased significantly since 2018 with 2022/23 showing a worse position to prior years. Overall, asset condition has deteriorated and the need to defer projects has led to a backlog of works which continues to build. We anticipate this position will challenge future maintenance budgets.

3.3 The Programme includes a number of major renewals to address high priority asset risks; for example, the Central line signalling incremental upgrade programme (CSIP); the Central Line Improvement Project (CLIP) (fleet renewal); and the Aldgate points and crossings renewal. The required funding to address all of these in addition to the rolling renewal programmes for track, fleet, signals and other systems is significant and not all planned activity will be affordable. Decisions may therefore be required during 2023/24 business planning to defer some major renewal projects. Should this be the case, an update will be made to the Committee to set out any proposed changes to the Programme.

3.4 The total value of the Programme from April 2024 to April 2026 (the period of this request for Programme and Project Authority excluding long term contractual commitments) is £1,463m. The phasing of this is set out in Table 8.

3.5 This submission builds upon previous papers to the Committee in July 2022 for Infrastructure Renewals and in October 2022 for Train Systems Renewals. EL Renewals are now also being incorporated into the Programme.

LU and EL Renewals

3.6 The assets covered by this paper include both LU and EL assets. LU assets are grouped by asset type and include track; signals and control systems; fleet (both passenger and engineering vehicles); buildings and supporting civils infrastructure (including station buildings, depots and other LU buildings, as well as civils infrastructure such as embankments, bridges, tunnels and lighting); lifts and escalators; and systems (including power, electrical, mechanical, fire and communication systems). The EL Asset Renewal Programme (ELARP) was launched in October 2022, and EL assets are currently managed as a single programme rather than being grouped by type.

3.7 Functions carried out by the Programme include both heavy maintenance and overhaul, and full replacement of life-expired assets. The Programme does not cover enhancement works, though in some cases improvements are delivered as part of the Programme; for example, when upgrading to more modern technology.

Environmental Objectives

3.8 The Programme contributes to our environmental and carbon reduction objectives by maintaining existing LU and EL assets in a SoGR, supporting mode shift to public transport, which is a low-carbon form of travel. In addition, the Programme includes many projects which will improve energy efficiency, helping to reduce the energy demand of LU as a whole and contributing to the Mayor's ambition for London to become carbon neutral by 2030.

3.9 Examples of energy efficiency and environmental projects within the Renewals Programme include:

(a) all planned lighting renewals are now LED and deliver significant energy savings. For example:
   (i) LED fitment on 20 of 36 Bakerloo line trains reduced carbon emissions by 0.16t CO_2 in 2023/24 (55 per cent reduction);
   (ii) the rolling replacement of station lighting replaces fluorescent lights at 20 stations per year with LEDs, reducing emissions by 2254t CO_2 per year (50 per cent reduction). As of 1 September, 14 stations have been converted; and
   (iii) replacing lights at Oxford Circus with LEDs will save 63t CO_2 per year (62 per cent reduction) once completed later this financial year, with King's Cross the next station to be re-lamped in the Programme

(b) CLIP includes the introduction of new motors on the trains that will reduce energy consumption by 7 per cent, leading to a cumulative saving of 6000t of CO_2 across the Programme; and

(c) by utilising lighter die cast aluminium steps instead of traditional steel steps, our renewed escalators will offer a 34 per cent reduction in energy consumption. In addition, trials are being carried out to look at whether escalator speed reductions could safely be implemented at certain times to further save energy.

3.10 The Programme seeks to deliver renewal activity in a way which reduces emissions, and we regularly review our ways of working to identify and enact more sustainable practices. For example, track renewal deliveries of track, ballast and sleepers all now take place by rail rather than road, and recyclable composite sleepers are used rather than concrete in areas which are above ground where they are suitable to install. We now complete carbon modelling for all building renewals.

Asset Duties and Responsibilities

3.11 The Office of Rail and Road (ORR) regulates health and safety on all mainline railways in the UK, including LU and the Elizabeth line. We are required to meet ORR safety requirements to obtain the certification and authorisation required to operate trains, stations and infrastructure. The need to meet the Health and Safety standards set by the ORR, as well as other relevant Health and Safety legislation, drives many renewals projects.

Maintaining Assets in a State of Good Repair

3.12 We seek to maintain assets in a SoGR to provide a safe and reliable network that meets customer expectations while minimising whole life costs. An Asset Condition Report (ACR) is produced for each asset area on an annual basis, and where possible, records SoGR based on industry standard condition measures. This uses a five-point physical condition summary (Very Good, Good, Fair, Poor, Very Poor). Where the SoGR is below the preferred range, it reflects the need for renewals investment to deliver a safe and reliable network and reduce the risk of injuries, restrictions and closures arising from critical failure.

3.13 Details of how SoGR is measured and calculated are provided in Appendix 1, with details of the current SoGR of assets within the LU Renewals portfolio. For some asset areas, SoGR data remains poor for historic reasons. We are investing in a data collection programme to ensure we have reliable condition data for every asset area to support our investment decisions. In areas with poor data, other metrics have been used to prioritise works, but a common metric is the target to inform decision making.

Impact of Budget Constraints on Asset Condition

3.14 From 2019/20 to 2022/23 the level of funding allocated has been insufficient to maintain the SoGR of the network at pre-pandemic levels. This will lead to an increased impact on customer service and continue to build a backlog of works to be completed in future. Where continued safe operation of assets is not possible, closures or removal from service will take place.

3.15 Asset Strategy has modelled the degradation of asset condition, and Table 2 shows the investment required to achieve ‘steady state’ within these asset groups across the next nine years, where ‘steady state’ means achieving a Level of Service rated as ‘Average’ against our quantified Asset Management Objectives.

Table 2: Actual spend compared to modelled average spend required to maintain Steady State

Sub-programme - Asset Group	Annual investment required to achieve steady state (2023 estimate)	Actual / Forecast levels of investment by year					
		18/19	19/20	20/21	21/22	22/23	23/24 (fore-cast)
Track	185	114.3	121.7	76.3	131.8	85.7	121.1
Fleet - Passenger	150 to 300*	51.9	66.3	50.9	70.4	120.8	149.5
Fleet - Engineering Vehicles	39**	4.2	22.8	3.8	7.2	4.2	7.2
Signals and control	60	14.3	15.3	6.6	12.1	26.2	37.0
Systems – Lifts and Escalators	44	26.0	25.3	13.8	27.8	25.9	37.4
Systems – Power and Electrical, Mechanical, Fire and Comms	119	12.1	24.8	13.7	27.0	37.3	63.7
Built Environment and Civils	95	6.3	11.7	7.4	11.0	18.6	25.9
Programme Total	**692 - 842**	**229.1**	**287.9**	**172.5**	**287.3**	**318.7**	**441.8**

Note: Investment levels appear different to other tables as some programme elements are not included: ELARP: initiated in September 2022; Safe track access: a programme not an asset; Railway Systems Enhancements: a programme not an asset
*** Fleet – Passenger** - based on Average steady state range (peak-driven by overhaul programmes)
**** Fleet – EVs** - based on Average steady state annualised average 2024/25 to 32/33 forecasts which includes replacement programme for Battery Locomotives

3.16 Due to constrained investment, it has been necessary to defer projects to remain within the budget envelope, resulting in a backlog of renewals. This has left the network with an overall deterioration in asset condition across all LU asset areas since 2019. Table 3 shows the estimated extent of the investment backlog by asset area. The biggest backlogs are in Track and Passenger Fleet. The backlog in works started to be realised in 2015/16 and has been building since. This grew significantly due to funding constraints from 2019 onwards.

3.17 The increasing renewals backlog will place additional pressure on future years' budgets as the assets deteriorate further and require more extensive, and therefore more expensive, interventions. If renewals are not undertaken in a

timely manner, it will impact the ability to run a service for our customers at present levels.

Table 3: Estimated backlogs developed using historical analysis

Asset Type	Renewal backlog since 2015/16 (£m)	% of total LU backlog
Track	1,462	42%
Fleet - Passenger	663	19%
Fleet - Engineering Vehicles	161	5%
Signalling and Control	100	3%
Systems - Lifts and Escalators	60	2%
Systems – Mech, Fire and Comms	439	12%
Systems – Power and Electrical	8	0.2%
Built Environment	5	0.2%
Civils	602	17%

3.18 The overall service operated percentage across LU in Periods 1-4 in 2023/24 was 92.1 per cent, against a target of 91 per cent. However, the declining condition of assets has begun to manifest itself in reductions in performance in some areas. For example:

(a) on the Jubilee line, deferred overhaul of the fleet has meant availability regularly drops to around 80 per cent, when 90 per cent of fleet is required to operate the full timetable; and

(b) the operational impact of track speed restrictions in Lost Customer Hours (LCH) has risen by nearly 200 per cent in the last five years.

3.19 These impacts will become more apparent if we must take further interim measures to maintain safety, such as speed restrictions or trains, lifts and escalators being taken out of service. A table showing service impacts felt across LU since 2018 is provided in Appendix 2, along with a table showing incidents resulting in LCH which are linked to asset condition decline.

3.20 Overall, there was a 284 per cent increase in LCH from incidents believed to relate to asset condition decline between 2018/19 and 2022/23.

Prioritisation and Efficiency

3.21 Beyond meeting our statutory and regulatory obligations and ensuring that critical assets are maintained, a prioritisation framework for all our capital renewals investment has been used to determine the Programme's budget, comparing the priorities against those in other programmes and networks. The framework uses six Asset Management Objectives (AMOs) aligned to business objectives. The AMOs are Safety, Service, Customer and Staff, Environment, Capacity and Growth, and Finance. Current levels of service against the AMOs are established and future forecasts are modelled against a series of different budget scenarios. Details of the budget scenarios modelled are provided in Appendix 3.

3.22 The projected budget constraints in 2024/25 and 2025/26 mean that we may not be able to fund all our high-priority projects. We are in the process of assessing which projects to defer to future years and what impact this will have on the network. The most significant business and customer impacts of asset condition decline are listed in Appendix 4, along with the actions we are taking to minimise these risks. These are considered in terms of safety, customer experience, costs, revenue loss arising from journey time increases and reputational damage.

3.23 To ensure allocated funding is spent in year, projects are progressed at the start the financial year with a total forecast expenditure which is in excess of the budget. They are then considered on a periodic basis to assess what changes may be required (for example, to slow down works) to ensure the total renewals spend remains within the budget. While this can impact delivery efficiency, it is preferable to underspending which adds further pressure to the renewals backlog.

3.24 To minimise the impact of reduced investment we have worked hard to improve efficiency, drive value for money and increase delivery through innovation. Projects which will enable us to work more efficiently in future have been prioritised for delivery. These include:

(a) the Modular Points and Crossings project, which will enable us to transport prefabricated points and crossings to site, reducing track possession and increasing the rate of delivery;

(b) the Mechanised Renewals Vehicle project, which will enable essential works equipment to be conveyed to site by rail, and reduce workforce requirements on track renewal projects;

(c) the Asset Data Information project, which will significantly improve the condition data we hold about complex asset areas such as buildings fabric, enabling us to better target investment and generate more robust value for money assessments;

(d) the In-House Wagon Overhaul project, which will enable us to carry out full overhaul of engineering wagons at Acton depot. We expect this to enable our retention of the existing wagons in service for a longer period, indefinitely delaying procurement of replacement wagons; and

(e) the use of our LU Renewals delivery teams to deliver works to other TfL areas, such as track works on the Trams network.

4 Programme Delivery in 2022/23

4.1 Delivery in 2022/23 and for the period up to July 2023 has been strong across the Renewals Programme against the original budget approved by the Board in March 2022. The total investment in 2022/23 was £326.3m, an increase of £44.6m against the original budget of £281.7m. The increased level of investment allowed the Programme to increase outputs. This was achieved through the flexibility which enabled funding to be moved between projects within the LU

Train Systems and LU Infrastructure Programmes, enabling accelerated delivery of high priority areas where appropriate. For example, Track was able to deliver 1,827m of deep Tube renewal, 356m more than the planned target of 1,471m (24 per cent increase) and 5,546m bullhead rail to flat-bottom conversion, 1,970m more than the target of 3,360m (58 per cent increase).

Table 4 – Base budget compared to actual spend 2022/23

Sub-programme - Asset Group / £m	22/23 budget	22/23 actual	Difference
Track	66.0	85.7	19.7
Fleet – Passenger	93.0	120.8	27.8
Fleet - Engineering Vehicles	12.0	4.2	-7.8
Signals and control	34.0	26.2	-7.8
Rail System Enhancements	5.8	6.0	0.2
Systems – L&E, P&E, Mech, Fire & Comms	55.0	63.2	8.2
Built Environment and Civils	13.0	18.6	5.6
Safe Track Access	1.2	1.2	0.0
Elizabeth line	1.6	0.5	-1.1
Programme Total	281.7	326.3	44.6

4.2 Some key outputs for 2022/23 were:

(a) renewal of four sets of points in Parsons Green and installation of a new set of points at Tower Hill, increasing our reliability in a complex area. In delivering these sites we met our 2022/23 target for points and crossings;

(b) full design sign-off for all nine sub-systems on the CLIP rolling stock overhaul, allowing the programme to move into full production, in line with the plan presented to the Committee in October 2022. This will enable the trains to be more accessible through the installation of wheelchair bays and upgraded customer information systems; increase energy efficiency through the replacement of motors; and bring reliability benefits to the fleet;

(c) installed driver cab door security system on the Waterloo and City line fleet, improving staff safety on all five trains according to plan;

(d) 5,546m of bullhead rail converted to flat bottom rail, 1,970m more than the target of 3,360m (58 per cent increase) across the network, improving reliability;

(e) 1,827m deep Tube renewal delivered against a target of 1,471m (24 per cent more);

(f) signalling control interface equipment installed in lineside rooms at nine sites (in line with the plan) on the Bakerloo line as an enabler to replacing the control system with one designed and delivered in-house which has proven to be reliable on the Piccadilly line;

(g) trials for the prototype mechanised renewal vehicle completed, with modifications now being implemented to improve safety prior to the next phase of trials;

(h) works to replace the life-expired and asbestos-containing roof on Plaistow sub-station were completed in five months, ahead of plan and with a £200k saving realised;

(i) delivery of eight escalator refurbishments, which improve reliability and availability for our customers to access the network;

(j) 12 sets of fire doors at Liverpool Street station brought into use to protect escalator landing areas in the event of a fire;

(k) replacement of 22 life-expired uninterruptable power-supply units (UPS) to ensure a continuous power supply to critical signalling assets on the railway; and

(l) completion of work to replace 11 non-compliant traction isolation switches (as planned) at Ruislip depot. These allow sections of the depot to be switched off to support maintenance activities.

4.3 Elizabeth line Renewals have progressed slower than anticipated since the Programme was launched in October 2022, with only £0.47m investment in 2022/23 against a budget of £4.9m. The main reason for this underspend were a focus on completing the EL into service, which took precedence over the establishment of BAU renewals, resources being shared with the Residual Works Programme and industrial action, which affected works in key possessions. The EL Renewals sub-programme is maturing and lessons learnt are being implemented. For example, dedicated commercial resource is now available, increasing delivery confidence for the remainder of the year and into 2024/25.

4.4 This investment has maintained the current service levels and reliability of the network but has not made significant improvements in the short-term. We have a number of major renewal projects underway, such as CLIP, which will bring benefits of reduced energy usage, improved reliability and reduced maintenance once completed. However, budget constraints mean we may have to take the decision to defer other large projects such as the Heavy Haulage Battery Loco Replacement going forward.

Table 5: Actual spend by year

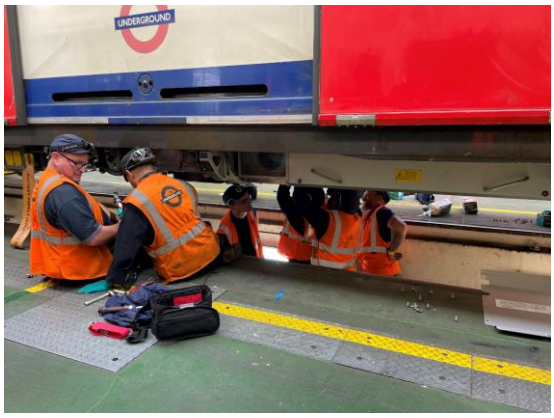
Sub-programme - Asset Group / £m	18/19	19/20	20/21	21/22	22/23	23/24 YTD*
Track	114.3	121.7	76.3	131.8	85.7	39.3
Fleet – Passenger	51.9	66.3	50.9	70.4	120.8	49.6
Fleet - Engineering Vehicles	4.2	22.8	3.8	7.2	4.2	2.6
Signals and control	14.3	15.3	6.6	12.1	26.2	13.5
Rail System Enhancements	15.4	15.5	10.2	4.9	6.0	1.1
Systems – Lifts and Escalators	26.0	25.3	13.8	27.8	25.9	8.8
Systems – P&E, Mech, Fire and Comms	12.1	24.8	13.7	27.0	37.3	18.8
Built Environment and Civils	6.3	11.7	7.4	11	18.6	8.2
Safe Track Access	-	-	-	1.6	1.2	0.6
Elizabeth line	-	-	-	-	0.5	2.5
Programme Total	244.5	303.4	182.7	293.8	326.4	145.0

*To period 5 of 13 in the year

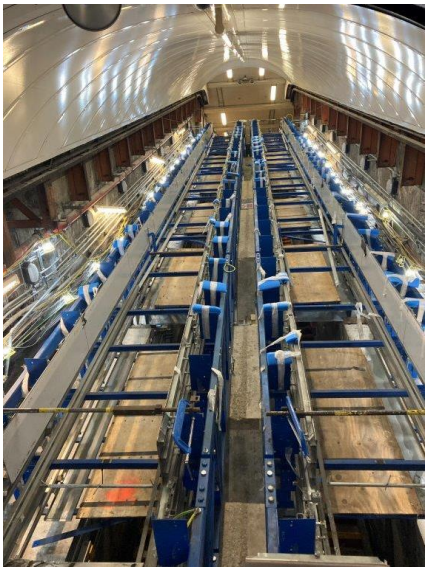
4.5 Appendix 5 contains a breakdown of delivery by sub-programme since the last submission.

Figure 1 – Examples of our 2022/23 deliverables

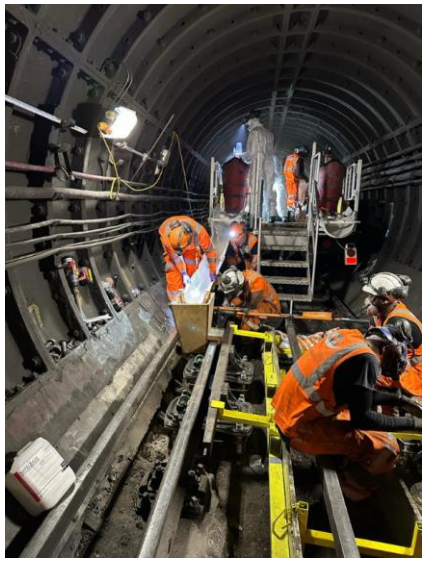
The new roof on Plaistow station



Work on Central line trains as part of CLIP



Installation of new escalator trusses at South Kensington



Sub-surface track renewal taking place using the new Mechanised Renewal Vehicle

5 Programme delivery for 2023/24, 2024/25 and 2025/26

Scheme Prioritisation and Option Assessment

5.1 Several budget scenarios were considered during business planning, details of which are provided in Appendix 3. The renewals funding envelope for 2023/24 to 2026/27 places us in the ‘budget constrained’ scenario, in which available funding is insufficient to deliver all high priority projects.

5.2 Projects were scored according to their impact on our six key AMOs. Under the ‘guiding mind’ principle, key stakeholders from Asset Strategy, Maintenance and Engineering teams came together to assess the scored options against risk and deliverability. This work resulted in a ranked list of schemes for delivery. At present, more high priority schemes have been identified for delivery than can be

funded from the allocated budget. This gap will be closed during business planning as we identify where schemes need to be deferred.

5.3 Periodic reviews will be used to assess the level of delivery achieved, risks, and whether additional commitments can be made through change control should additional funding become available or if there is slippage within the Programme or wider TfL. This approach gives maximum flexibility to target funds to deliverable priorities.

Delivery in 2023/24

5.4 To date in 2023/24 the Programme is on schedule to deliver the remainder of the planned outputs which were set out in the papers to the Committee for LU Infrastructure (July 2022) and LU Train Systems (October 2022). Appendix 5 summarises progress so far and outstanding work for these projects by sub-programme. Key projects we expect to finish in the remainder of 2023/24 include:

(a) upgrade of Jubilee line communications systems at six stations, replacing an obsolete system, scheduled for completion in Quarter (Q)4 2023/24;

(b) completion of escalator refurbishment at Marylebone station to increase station capacity, scheduled for completion in Q3 2023/24;

(c) rollout of Modular Points and Crossings (MPAC) unit enabling points and crossings to be prefabricated and installed on-site as single units. This will leverage our recently procured Kirow tandem lifting cranes, leading to efficiency and improved safety for our staff, scheduled for completion in Q4 2023/24;

(d) stabilisation of the cutting between Grange Hill and Chigwell stations on the Central line will ensure the continued safe running of the railway, scheduled to complete in Q4 2023/24; and

(e) re-railing a 550m section of Connaught Tunnel, one of the older EL assets which runs under the Royal Docks and is subject to water ingress. A protective coating will be added to the new rail to prevent water damage scheduled to complete Q3 2023/24.

5.5 There is a high confidence that the 2023/24 programme of planned works will be delivered. Close management of resources, contracts and programme risks will be required and, should further funding become available, a workbank of opportunities for acceleration of priority schemes is in place.

Scope in 2024/25 and 2025/26

5.6 Looking forward beyond the end of the current financial year, many activities will continue into the following years as they are significant projects with lifecycles beyond one year. We continue to review delivery challenges and lessons learnt which ensures that we improve our efficiency. Projects we expect to finish in 2024/25 and 2025/26 include:

(a) refurbishment of life-expired components that form part of smoke and heat exhaust ventilation systems located in the roofs of Bermondsey station and Stratford Market depot, scheduled for completion in Q2 2025/26;

(b) overhaul of the Metropolitan line (S8) fleet doors and couplers is due to start in Q4 2023/24. Bogie overhauls of the full fleet are ongoing and scheduled to complete in Q2 2024/25. These activities increase reliability of the fleet;

(c) overhaul of the S7 fleet (District, Circle and Hammersmith & City lines) is planned to commence after the completion of the Metropolitan line project in Q2 2024/25;

(d) Piccadilly line fleet life extension project, maintaining reliability until replacement with new fleet, which is currently undergoing testing, scheduled for completion by Q2 2024/25;

(e) ‘quick-win’ feasibility work for platform remedial works on 94 platforms will start in January 2024, scheduled for completion in Q1 2025/26. This will enable the project to deliver the main works more efficiently and improve safety to our customers;

(f) work to upgrade obsolete tunnel ventilation control panels and refurbish the fans in the staircase pressurisation system on Jubilee line extension stations and intermediate shafts will continue, scheduled for completion in Q2 2026/27; and

(g) surveys and design leading to the commencement of a rolling programme of works for the renewal of Great Eastern stations on EL (transferred from Network Rail). Works schedule to be determined, likely to be over three to five years.

5.7 A full list of projects in scope for 2025/26 is provided in Appendix 6.

Forecast spend by sub-programme

5.8 No additional Programme and Project Authority in 2023/24 and 2024/25 is requested to that previously approved. Additional authority is requested for work planned to take place in 2025/26 and to ensure our longer-term commitments can continue. This timeframe allows for certainty in forward planning and will allow efficiency in procurement activities expected to take place in 2024/25.

5.9 The forecast in Table 6 below shows financial years to 2027/28 inclusive. This recognises that the existing budget constraints are forecast to continue for the foreseeable future. Refinement of the forecast for the coming financial years will take place through the business planning process and be presented in future annual submissions to the Committee. This will be prioritised in accordance with our Asset Strategies. A proportion of future years spend is already contractually committed. There are also longer-term contractual commitments that will need to be made in 2024/25 and these will be refined through business planning.

Table 6: Forecast spend (£m) by sub-programme

Sub-programme - Asset Group	2323/24*	2024/25	2025/26	2026/27	2027/28
Track	121.1	133.7	151.7	153.6	184.4
Fleet – Passenger	149.5	259.2	336.6	271.2	242.6
Fleet - Engineering Vehicles	7.2	19.8	66.7	14.4	34.0
Signals and control	37.0	43.8	53.3	34.7	52.5
Rail System Enhancements	6.3	7.7	6.9	-	-
Systems – Lifts and Escalators	37.4	44.7	37.2	25.7	25.1
Systems – P&E, Mech, Fire and Comms	63.7	99.1	77.3	47.6	10.8
Built Environment and Civils	25.9	34.7	52.2	52.0	60.2
Safe Track Access	2.0	6.7	9.1	-	-
Elizabeth line	9.0	10.4	11.8	20.1	25.1
Programme Total	**459.0**	**659.8**	**802.8**	**619.3**	**634.7**

*Forecast at period 5 of 13 in the year

Outcome Forecast from our Investment

5.10 Investing in renewals is essential to the continued operation of LU and EL services. Tables 2 and 3 (Section 3) show that current and forecast levels of investment are below what is required to maintain a steady state in terms of SoGR, and asset modelling shows that current investment proposals are resulting in a backlog of renewals. In a 'budget constrained' scenario where investment is delayed, more must be spent on maintenance and when interventions occur, they may be more extensive, and therefore more costly. For example, in track a new category of works has been introduced to the capital budget to fund urgent Life Extension works for the sites of highest concern. While keeping the railway operable these works account for a growing proportion of the track budget, £25.8m (19 per cent of the total) in the 2024/25 forecast. Whole life costs and best value for money are harder to achieve in these circumstances. This is being mitigated by:

(a) the use of asset condition modelling to understand where interventions are most needed and to find the best balance between maintenance and renewal;

(b) a detailed prioritisation process which ensures investment is targeted towards areas where risk is highest;

(c) our £18m Asset Data Improvement sub-programme which will greatly improve the quality of asset data in key areas;

(d) the prioritisation of projects which will improve efficiency (for example, through mechanisation) over the long term; and

(e) stronger and more regular analysis of condition and performance data to inform any operations mitigations and ensure we draw clear links between renewal investment and performance / customer service.

5.11 The 2024/25 Budget and business planning process will consider the current forecast levels of investment and the projections of SoGR for LU and all other TfL assets to inform whether any changes from the current 'budget constrained' scenario are appropriate.

6 Programme Risks and Milestones

6.1 Table 7 shows top risks associated with delivery of the Programme to address asset resilience and a decline in the SoGR.

Table 7: Top risks for the Programme

Risk No	Risk Description	Mitigation Actions
1	Constrained funding and increasing materials and labour costs due to supply chain resilience and inflation impact delivery against objectives. Declining SoGR increases risk of asset failure. Increased risk of asset failures result in the programme needing to be re-prioritised in year	Prioritise projects on whole life cost and risk to ensure best value. Strengthen regular reviews. Develop greater asset health awareness through data collection to prioritise critical assets in line with our Asset Strategies and life extend where possible. Ensure that maintenance and operations can react to asset condition changes. Regular engagement with the supply chain regarding any supply challenges. Projects are reviewing options with suppliers, such as bulk-buying and storage where feasible, to mitigate against increasing materials costs
2	Lack of attractiveness to supply chain due to smaller contracts let on a case-by-case basis	Review commercial strategy within the duration of available funding. Reviewing available frameworks to assess if they continue to be fit for purpose
3	Resource levels in planning, delivery and supporting teams (e.g. Commercial) and long lead times to replace resources impact delivery	Larger combinations to consolidate work may reduce supply chain uncertainty and make more efficient use of commercial resource. Regular deliverability reviews, and escalation to senior management in cases where resource shortages may directly impact delivery timescales
4	Access to the network for delivery of works	Early engagement and continuing coordination and communication through delivery with relevant stakeholders. Aggregate work in delivery to reduce overall disruption and cost
5	Maturity of Asset Strategies is variable. Data may be unreliable or incomplete	Ongoing development of our Asset Strategies to identify data gaps and address these. Use tacit knowledge, while asset data matures

6.2 Risk allowances are applied at the project level. The Programme does not include a programme-wide risk allowance so increases in costs beyond known and planned project risk need to be balanced by reductions or deferrals into future years. This reflects the fact the Programme is comprised of hundreds of schemes that, experience has shown, enable risk to be effectively managed across the Programme using the workbank approach.

7 Commercial Strategy

7.1 The Programme is predominantly delivered by our internal Direct Labour Organisation, contractors via existing frameworks and individual tenders for rolling renewal interventions.

8 Financial Implications

8.1 The 2022 TfL Budget provides the Financial Authority needed to deliver the scope of the works set out in this request. The Programme's Financial Authority and the Programme and Project Authority is shown in Table 8.

Table 8: Summary of the costs and funding

LU Renewals								
Rounded to £m		Prior Years	23/24	24/25	25/26	26/27	27/28	Total
Financial Authority*		£1766	£374	£429	£456	£477	£530	£4032
Programme Forecast		£1766	£459	£660	£803	£619	£635	£4941
Programme and Project Authority	Existing authority	£1766	£459	£660	£244	£30	£3	£3162
	Authority requested	-	-	-	£559	-	-	£559
Total Authority		**£1766**	£459	£660	£803	£30	£3	£3721

* Budget is for 2023/24 only, 2022 business plan thereafter

Note: all future costs exclude inflation

9 Equality and inclusion

9.1 TfL has an obligation under the Equality Act 2010 to:

(a) eliminate discrimination, harassment, victimisation, and any other conduct that is prohibited by or under the Equality Act 2010;

(b) advance equality of opportunity between persons who share a relevant protected characteristic and persons who do not share it; and

(c) foster good relations between persons who share a relevant protected characteristic and persons who do not share it.

9.2 Most of the Programme is like-for-like renewals that maintain existing provision. However, we seek opportunities to improve access where possible in all projects. For example, fleet life extension projects include bringing the vehicles up to an agreed level of compliance with the Rail Vehicle Accessibility Regulations 2010 and lift refurbishments and replacements contribute to maintaining availability of step-free access to our stations. There are temporary impacts for customers during the delivery of works. Equality Impact Assessments will be completed on projects as required. Deteriorating asset condition, particularly in lifts and escalators, has a higher adverse impact on older and disabled customers, and a

lower level of investment in Fleet means it will take longer to meet our RVAR obligations.

10 Assurance

10.1 TfL Project Assurance conducted an Integrated Assurance Review (IAR) on the Programme in August 2023. This covered the programmes which will comprise the unified LU Renewals Programme: LU Infrastructure, LU Train Systems and Elizabeth line Renewals. Overall there were 15 recommendations by Project Assurance and eight by IIPAG. There was one critical issue raised which is related to track. This has both been accepted and an action plan put in place to address the issues. These observations and recommendations are all in line with our view of the Programme and we are grateful for the support from the additional assurance. Details of these recommendations and our Management Response have been shared with the Committee.

10.2 An agreed Integrated Assurance Plan (IAP) for the Programme, covering the next 12 months, has been produced that sets out those projects that are expected to be reviewed. The IAP will be reviewed and updated quarterly.

List of appendices to this paper:
Appendix 1: State of Good Repair
Appendix 2: Impacts of reduced investment in assets
Appendix 3: Budget Scenarios
Appendix 4: Business and customer impact of reduced investment in assets and mitigation actions taken
Appendix 5: Delivery since last Committee submission and plan to next submission
Appendix 6: 2023/24 planned scope

List of Background papers:

TfL Project Assurance Reports
Management response to TfL Project Assurance Reports

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Appendix 1: State of Good Repair (SoGR)

SoGR, where available, is based on industry standard condition measures. SoGR helps inform prioritisation of interventions, although not in isolation (other factors, such as asset criticality, risk, safety, and service are considered alongside SoGR). We have mapped these industry measures to a consistent five category scale of asset condition – the condition categories are Very Good, Good, Fair, Poor and Very Poor. The percentage of assets in these categories is used to calculate SoGR, namely:

SoGR – the sum of the percentages in the Very Good, Good and Fair categories. These assets, in general, do not require planned asset renewal in the next one to three years, although in some instances it does reduce whole life costs to intervene when an asset is in the Fair category.

Not in a SoGR – the sum of the percentages in the Poor and Very Poor categories. Typically, these assets have a higher probability of failure and should be considered for a renewal within the next one to three year period (subject to assessment through prioritisation processes).

SoGR in LU is calculated using a range of methodologies, primarily using data from Asset Condition Reporting. However, there are some gaps across LU's asset base limiting our ability to calculate a total SoGR for LU. In these cases, other condition and asset health metrics are used to support prioritisation.

Asset Management is in the process of developing a new metric for asset condition which will give a broader view of asset health. For example, by also considering regulatory compliance, maintainability and reliability. This will be rolled out across the programme in 2024 and will give better consistency of reporting across different asset groups.

Table A1: SoGR of LU Renewals Assets

Sub-programme - Asset Group	SoGR (latest available data)	Notes and comments
Track	48%	35.7 per cent track is classed as life expired, with a further 16 per cent classed as Poor. However, significant progress has been made in improving the SoGR of deep Tube track in particular. Project close out and more accurate asset condition data, track life extension projects (which offer a short-term improvement), and work completed has seen an increase in the amount of deep tube track classed as 'Good or Very Good' to 31.1 per cent in 2023, from 17.7 per cent in 2021. The percentage of life expired deep Tube running line has also reduced from from 54.5 per cent in 2021 to 36.1 per cent in 2023.
Fleet Passenger	39%	The overall SoGR of the passenger fleet has declined from 46 per cent in 2020 to 39 per cent in 2022. Fleet condition is largely based on residual life; this 7 per cent drop is slightly

Sub-programme - Asset Group	SoGR (latest available data)	Notes and comments
		more than the 5 per cent that would be expected from a purely linear decline in line with asset age (passenger rolling stock has a nominal life of 40 years). This reflects the reduced investment in overhauls. However, the Piccadilly line Upgrade (PLU) will bring in new rolling stock from 2026, so condition of this fleet is being wound down.
Fleet - Engineering Vehicles	19%	The condition of the Engineering Vehicles fleet is particularly poor due to historic under-investment. Due to the complexity of the vehicles and the need for many of them to be operable on all lines, requiring them to be compatible with multiple signal types, many vehicles are 40+ years old. It has often been judged more cost-effective to repair existing vehicles than to replace them. A project to procure a new fleet of general-purpose wagons has been significantly delayed, contributing to the overall poor SoGR of the fleet. As of 2023/24 there is renewed focus on this asset area with several significant projects planned to improve the condition and reliability of these essential vehicles.
Signals and control	85%	Signals SoGR is 85 per cent; however, it should be noted that this metric does not capture the problem of obsolescence of component parts, meaning that faults which develop cannot easily be rectified.
Systems – Lifts	71%	State of repair of lifts and escalators was previously based on age of asset but is now assessed according to performance. This means that well performing assets may remain in operation for longer.
Systems - Escalators	82%	
Systems – Power and Electrical, Mechanical, Fire and Comms	no SoGR available	The SoGR data for these systems remains weak for historic reasons. However, asset concerns are tracked as part of the annual Asset Condition Report. This data shows that between 2020 and 2023 there was a 7 per cent decrease in Code 1 (Legal Compliance) concerns across Mechanical, Fire and Comms systems but a 13 per cent increase in the number of Code 2 (Safety) concerns in the same time period. The £18m Asset Data Improvement project (which has just completed Gate A) includes a budget to improve data collection for this asset area.
Built Environment and Civils	no SoGR available	The SoGR data for buildings and civils remains weak for historic reasons. However, the £18m Asset Data Improvement project (which has just completed Gate A) includes a budget to improve data collection for this asset area.

Sub-programme - Asset Group	SoGR (latest available data)	Notes and comments
Elizabeth line	no SoGR available	SoGR data is not yet available for the Elizabeth line as this is a new programme; some assets have been taken over from third parties (for example, Network Rail stations). A key part of work to set up the programme will involve putting in place systems to ensure accurate asset condition data is regularly recorded, and work on this is already underway. At present the focus of EL Renewals is on assets known to present a safety risk.

Appendix 2 – Impact of reduced investment in Assets

Table A2 – Incidents on the LU network relating to Asset Condition decline

Asset area	Number of incidents per asset area						% change 2018-2023
	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	
Track	382	390	333	333	671	253	76%
Fleet (passenger)	1619	2116	3151	2936	6399	1871	295%
Fleet (Engineering Vehicles)	30	24	15	28	32	11	7%
Signals	1701	1543	1082	1147	1426	439	-16%
Lifts and escalators	220	0	22	158	1092	315	396%
Power and electrical	117	87	92	66	127	29	9%
Mechanical, fire and Comms	117	144	111	152	164	46	40%
Built Environment & Civils	9	14	6	16	38	18	322%
TOTAL	**4195**	**4318**	**4812**	**4836**	**9949**	**2982**	**141% (average)**

Note: the table uses NACHS 5G data and shows a count of incidents with cause factors which are considered to relate to asset condition decline for the asset areas shown. The exception is Fleet, for which the cause factor 'No OK Stock' was used as a proxy for all cause factors to avoid double counting incidents where a rolling stock fault recorded one day was recorded as 'No OK Stock' the following day. Cause factors which are not relevant to asset condition (e.g. factors relating to staff or customer behaviour) have been excluded from the table.

Table A3 – Service impacts felt across LU since 2018 due to renewal deferrals

Network	Performance Metric	2018 Performance	Change (%age)	2023 Performance (part year)
LU Fleet	Mean Distance Between Failure (MDBF)	18k KM	-8%	16.5k KM
	Case for Continued Safe Operation (CCSOs)	45	+84%	83
LU Track	Total Track LCH (including Speed Restrictions)	874k	+75%	1,531k
	Speed Restrictions LCH	78k	+192%	228k
LU Signals	Total Signals LCH	2.3m	+26%	2.9m
	Central line Signals Assets (Train Detection) LCH	72k (2020)	+32%	106k
LU Lifts	Availability	99%	-1%	98%

Network	Performance Metric	2018 Performance	Change (%age)	2023 Performance (part year)
	Step-free access lift availability – days per year	361	-4 days	357

Appendix 3: Budget Scenarios

The following strategic options will be considered during business planning:

(a) **Budget Constrained**: Remaining within GLA budget allocations for the next 10 years and forecasting condition and levels of service against the Asset Management Objectives. Under this scenario, asset condition will deteriorate, resulting in increased likelihood of restrictions and closures to keep the network safe. This will result in decreased reliability and increased operational expenditure. The backlog of renewals will increase in both scale and time to address it. Future renewals schemes are likely to need more extensive, and therefore costly, interventions;

(b) **Base**: Achieving the 'Base' level of service for the Asset Management Objectives. Declining State of Good Repair and increasing asset defects/faults; majority of interventions are reactive. Restrictions, closures, and service reductions will be required to manage safety. Increased pressure on operational and engineering teams to manage assets and safety, with a large renewals backlog which will take years to address and result in a prolonged period of service disruption (several years). The service remains safe but reliability is reduced. Customers frequently experience disruptions and delays during their journey and modal shift is evident. Customer satisfaction will decline and there will be frequent negative press coverage of London's transport network;

(c) **Average**: Achieving the 'Average' level of service for the Asset Management Objectives. A mix of planned and reactive renewals depending on risk exposure. In control of State of Good Repair and asset risks. Customers receive an adequate but acceptable service that is safe and generally reliable; services can be inconsistent. Customer experience of TfL services is mixed; this is reflected in customer feedback with major complaints occasionally made;

(d) **Good in 10 years**: Achieving the 'Average' level of service for the Asset Management Objectives within the next 10 years. Optimised interventions, utilising preventative interventions to reduce whole life costs. Well-planned interventions that minimise network disruption, innovating materials and processes. Customers know they will have a safe, reliable and easily accessible journey. The experience will be of a 'world-class' transport environment with trains, buses, stations and facilities which customers praise and promote to others. A good/high-quality service, with the appropriate reliability and availability, which delivers the ambition of the Mayor's Transport Strategy and caters for ongoing passenger growth/demand; and

(e) **Good in 5 years**: Achieving the 'Average' level of service for the Asset Management Objectives within the next 5 years. As for Good in 10 years but achieved within 5 years.

Appendix 4: Business and customer impact of reduced investment in assets and mitigation actions taken

Programme	Business risk	Customer impact	Actions being taken to mitigate risk
Signals	Reduced renewals leads to increased level of obsolescence of critical signal components. Likelihood of critical fail increases due to ageing parts. Ability to swiftly repair failures is decreased due to lack of market availability of obsolescent parts	Potential loss of signal functionality to operate a normal timetable, possibly leading to the unavailability of trains or areas of lines if spares are depleted before replacement can take place	Continuing to work with suppliers to secure 'last time buy' options. Where possible, share spares across TfL. Harvest components from 'beyond economical repair' units to enable in-house repairs; source second-hand components when international equivalent systems are decommissioned
Track	Reduced investment in track renewal leads to worsening of overall condition of track. Poor track condition leads to increased noise and vibration, increases wear and tear on rolling stock, leading to higher rolling stock replacement costs	Degradation of passenger service due to need for speed restrictions or section closures impacting timetable delivery	Increased frequency of track inspections. Increased spend in reactive re-railing
Fleet - passenger	If heavy overhaul of passenger trains does not take place on schedule, trains will be removed from service because they exceed mileage intervals – this is part of the safety system surrounding train operation. There is a risk of enforcement from ORR if trains are not refurbished to the agreed timelines through the RVAR derogation process	Degradation of passenger service on affected lines as fewer trains are available – trains become less frequent and hence more crowded	Risk cannot be mitigated – if fleet overhaul work does not take place, trains will be removed from service. This is a non-negotiable safety requirement

Programme	Business risk	Customer impact	Actions being taken to mitigate risk
Fleet - Engineering Vehicles (EV)	Decrease in the number of functioning EV available to carry out critical inspection, maintenance and renewal works on all lines. Delay in the delivery of planned track and signal works programmes	All track and signal maintenance, repair and renewal works will be impacted by a loss of functionality of the EV fleet. This will eventually impact service levels for passengers in the form of delays and track closures	Work is planned to better forecast upcoming works demand for engineering vehicles so that limited renewals resource can be very tightly targeted at the most essential pieces
Built Environment and Civils (including Staff Welfare)	Increased risk of a major health and safety incident if key civils infrastructure is not renewed (e.g. embankment collapse). Degradation of service levels, in particular during extreme weather events (e.g. leaks, flooding etc). Lack of capacity of poor quality / condition of facilities causes poor staff relations or the inability to accommodate required staff	Degradation of service levels where incidents cause service delays or cancellations. Impact on customer experience where buildings become run down	The Asset Data Improvement project includes funding for surveys of built environment assets, to generate missing asset data and identify assets most in need of renewal. A future pipeline for earth structure projects is being developed. For staff welfare, sites have been prioritised and the most critical sites will be delivered. A reactive delivery model is in place while a long-term strategy is being developed
Safe Track Access	Increased risk of a major health and safety incident if measures to improve track access safety are not implemented in a timely way	No expected customer impact	Existing systems are being maintained while improvements are rolled out
Systems - Lifts and Escalators	Stations may be closed due to a lack of access in certain stations. Possible limited business impact in some stations	Lifts and escalators go out of service more frequently. Passengers will be inconvenienced and step-free access may be compromised in some cases	Assets are assessed against a number of criteria to ensured that the worst performing/ highest risk are prioritised
Elizabeth line	General degradation of existing assets. Assets handed over from	Safety of passengers could be put at risk if key safety upgrades to	A risk-based prioritisation process has been used to

Programme	Business risk	Customer impact	Actions being taken to mitigate risk
	Network Rail in a poor state of repair, in particular Great Eastern station buildings, would not be improved - risks to workforce from poorly maintained buildings and degradation of staff welfare. Reputational risk to TfL of stations appearing shabby, run-down, vandalism not addressed etc.	inherited Network Rail stations are not implemented	identify where investment is most urgent; a key part of ongoing EL Renewals work involves creating an asset condition database for all EL assets to support future investment decisions

Appendix 5: Delivery since last Committee submission and plan to next submission

Note: For asset areas formerly in LU Infrastructure the update is given from July 2022. For asset areas formerly in LU Train Systems, the update is given from October 2022This table does not align to previous submissions to the committee owing to time frame differences; between submissions in contrast to financial years.

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
Track		Deliver 1750m of new LU Ballasted Track Renewal (BTR), improving reliability and reducing noise. 1510 planned Deep Tube Renewal (DTR) 3360 planned Flat-Bottom Conversion to Bullhead Rail (FBC) 7 points and crossings renewed	1760m BTR delivered (10m more than target) 1,646m DTR delivered (136m more than target) 5,330m FBC delivered (1,970m more than target) 7 points and crossings renewals delivered - on target	BTR: 23/24 Planned: 3427m against forecast: 2927m 24/25 Planned: 3600m 25/26 Planned: 3500m DTR: 23/24 Planned: 1760m against forecast: 2188m 24/25 Planned: 2400m 25/26 Planned: 2400m FBC: 23/24 Planned: 6600m; against forecast 7830m 24/25 Planned: 8500m 25/26 Planned: 8400m
Fleet - Passenger	Fleet Heavy Overhaul (FHO) and Central line Improvement	Fleet Heavy Overhaul: works continued on Waterloo & City line fleet. Capital re-prioritisation to defer works on rest of LU fleet Central line Improvement Project (CLIP): withdraw five trains for production; AC02 temporary store for	FHO: work has now been completed and delivered on the Waterloo & City line fleet. Following the capital re-prioritisation, work is being undertaken to determine a schedule for the next fleets expected to undergo the similar intervention. CLIP: design signed off for all systems	FHO: completion of Rail Adhesion Train programme lift, completion of S8 programme lifts, commencement of S7 programme lift. CLIP: by March 2024, first CLIP train return to service. Production of five trains in AC14 (TMU); accelerate Programme Lift and Heavy Overhauls

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
	Project (CLIP)	CLIP ramp up; Train Modification Unit (TMU) hand back Bakerloo line (BL) Rail Vehicle Accessibility Regulations (RVAR): return first train into service and install LEDs on 10 trains Jubilee line Vehicle Underframe Modifications (JVUM): Invitation To Tender (ITT) to deliver a permanent fix to the underframe cracking	meaning the project has achieved a strategic design milestone allowing all nine sub-systems ranging from AC Traction to RVAR to begin full production. Barriers to wider programme success include material storage certainty, supply chain and labour market BL RVAR: completed 15 trains with LED and three with wheelchair bays	scope Confirmation of temporary storage facility for CLIP; AC14 TMU handed back; contract award for seats overhaul. By March 2026, programme lift complete and doors overhauls concessions met; storage facilities maximised for full production beat rate; seats overhaul commences BL RVAR: delivered all trains with LEDs, wheelchair bays and grab poles by March 2025. PIS planned on 75% trains by March 2026 JVUM: Contract award in Oct 2023; designs complete by Oct 2024; commence modifications with 10% complete by March 2026
Fleet - Engineering Vehicles	Engineering Vehicles	Engineering Vehicles: overhaul three locomotives; commence works on one Matisa and one Plasser unit. Remote Track Monitoring (RTM): sign off concept designs for the RTM replacement. Track Recording Vehicle (TRV) Sub-Surface Lines (SSL) project and extend concession to operate on other suitable lines. Confirm assurance requirements for tunnel sections on the SSL. Re-planning of dynamic testing on the Network Rail (NR) and LU network.	Decision to pause the procurement of new wagons has delayed sign off of RTM concept designs. Designs are being reviewed to enable installation on existing general purpose wagons. TRV SSL project is underway with static testing complete and dynamic testing planned. MRV Phase 1 trials are still underway - delays caused by driver availability and difficulty getting track access. Trials so far are positive - Phase 2 will be commissioned once we can	Completion of RTM project and Ward Couplers project autumn 2025. MRV Phase 1 complete autumn 2024 - work to begin on Phase 2. MPAC project to be delivered and closed by end of FY 24/25. Ruislip depot works which contribute to delivery of MPAC also completed. New Wagon Overhaul Facility set up, enabling full wagon overhauls to be carried out internally and working to a beat rate of approximately two wagons

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
		Close out Mechanised Renewals Vehicle (MRV) Phase 1 and draft technical requirements for Phase 2. Ruislip depot: complete familiarisation for Modular Points and Crossings (MPAC). Roll out on-site trials for track renewals; install lighting for the new tracks. Commence mass production of wagon bogies only. Complete concept and detailed designs for the ward coupler modifications.	demonstrate MRV is as or more efficient than previous manual processes. MPAC: On site trials for track renewals are taking place at Gloucester Road station. Procurement of new wagons has been paused. A new programme to set up an in-house facility to overhaul existing wagons in house so they can be retained in operation for longer is being set up. Ruislip depot: track lighting has been installed. Mod P&C familiarisation has been delayed until Mod P&C open trials are complete. Contract for concept and detailed design of ward couplers has been awarded.	per month. Heavy Haulage: tender process to be underway by end of FY 25/26.
Signals and control	Signalling renewals and incremental upgrade projects	JNIP: Detailed design to be completed for train operator displays (TODs), preliminary works for Vehicle Control Centre (VCCs) complete BCUP: All site enabling works to be completed Detailed design for control centre to be completed Detailed design for back up control to be completed CSIP: Enabling works information and	JNIP: Detailed design for TODs completed. VCC replacement preliminary works completed in December 2022 BCUP: Procurement strategy complete, enabling works design completed, commenced on site CSIP: Feasibility commenced, a change in strategy resulted in less work than planned as we undertake a longer supplier engagement period to	JNIP: 2 VCCs commissioned by July 24 with 3 more during planned closures to follow. Project to complete Q4 2026/27. TODs prototype design, testing and approval completed, production and installation commenced. BCUP: Completion of signalling installation works along the line to support control system replacement Passenger information system design

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
		main works information to be completed in advance of tendering. Central line signalling and control life extension (CLSLE): completion of detailed design for two further packages of work and commencement on site installation works. Northumberland Park depot (NPD) resignalling: concept design completed and tendering commenced Removal of all Polychlorinated Biphenyls (PCBs) containing capacitors Acton Town signalling room rewire: project to be delivered by maintenance	firm up design requirements CLSLE: completion of design package and commencement of installation at 20 sites. NPD: resignalling: project paused following strategic decision to prioritise Piccadilly line upgrade and develop a technical solution. Documentation completed to allow swift recommencement of the project in future. Commencement of removal of all PCB containing capacitors. SSOW (safe system of works) has been agreed with the Unions. Familiarisation/training complete. Acton Town signalling room rewire: Project is split into three stages. 2 out of 3 stages will be complete. Completion of for Large File Transfer Project	completed, new control room fit out completed. CSIP: Early contractor engagement stage complete, contract award for first work package. Concept and detailed design will continue through March 26 and beyond. CLSLE: Design and Installation complete. NPD: Make a decision as to when to recommence project. This will be dependent on resource availability and progress of the PLU project. PCB: Completion of removal of capacitors. Acton Town signalling room rewire: Completion of project. Large file transfer project: Completion and close out of project
Rail System Enhancements		Brake system performance: commissioning new 96TS Auto-condition braking software (V9.3.0) to improve stopping accuracy on Jubilee line (JL) and completion of Alstom design compliance for similar works on Northern line (NL). Northern line Train Management Software:	Brake Glazing: completion of modifications to the Jubilee line 96TS fleet to enable increased depot entry/exit speeds. JL software delivered but 6 months late due to Alstom sub-contractor (Villeurbanne) resource constraints. Northern Line Train Management System (TMS) Software:	Brake Glazing: delivery of final software on JL and design compliance on NL prior to handing over to Fleet. Northern line Train Management System Software: software delivered and commissioned on whole NL Fleet

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
		issue of Contract to Alstom to commence modification works Neasden Depot Injection Rates: bringing into use of increased depot entry/exit speeds planned for February 2023 in support of planned 4LM timetable improvements. Power package 1: project close-out Upgrades to the High Voltage network to support service levels on the Northern line - works completed in 21/22. Power package 2: commencement of works to restore Northern line power system resilience. - Produce concept design (CDS) for Batch C scope (DC Feeders at Elephant & Castle and Leicester Square) - Issue Tender for Batch C scope - Commence Site surveys - Produce CDS for Batch D scope Jubilee line: design, build and commission VCC software to rectify Non Train Specific Reservation (NTSR) safety issue and remove associated Operational Restriction (OR) Northern line - Complete Factory Acceptance Testing (FAT) of final NLE Signalling software drop	contract issue delayed due to Villeurbanne resource constraint and subsequent delay to quote being issued from Alstom. Contract subsequently let in March 2023 Neasden Depot Injection Rates: bringing into use delayed due to anomalies with performance on some 96TS trains. Issues resolved and bringing into use subsequently achieved in June 2023. Power package 1: close out delayed due to supplier resourcing prioritisation with Piccadilly line Upgrade (PLU). Power Package 2: - CDS signed off for Batch C scope (DC Feeders at Elephant and Castle and Leicester Square) - Tender issued for Batch C scope - Site surveys undertaken - Final CDS for Batch D scope drafted Jubilee line: all NTSR works completed in September 2022 Northern line - FAT Completed The Power Package 2 works will reinstate power resilience on the Northern line to achieve compliance with LU Standard S1972	Neasden Depot Injection Rates: project close out and Gate 6. Full close out and Gate 6 of Power Package 1 Project in 23/24. Completion of Power Package 2 works on the Northern line to reinstate power system resilience to deliver a reliable service during planned or unplanned outages. This also restores compliance for the service enhancements delivered under the NLU1 WTT58 project. Jubilee line: design, build and commission VCC and SMC software to rectify Manual Route Reservation (MRR) and Fouling Point (FP) safety issues, remove associated Operational Restriction (OR) and commission Battery Loco 'B' modifications on the JL. Northern line: commission final NLE signalling software drop. Commission final WTT58 signalling software dro

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
Systems – Lifts and Escalators		Two Primary Mode of Vertical Transport (PMVT) lift replacements 14 escalator replacements (excluding maintenance renewals)	14 Escalator replacements (excluding maintenance renewals) (on target) Two PMVT lift replacements (on target)	11 Lifts will be replaced: two Primary Mode of Vertical Transport (PMVT) Nine Secondary Mode of Vertical Transport (SMTV) Lifts 73 Escalators will be renewed across TfL
Systems – P&E, Mech, Fire and Comms		Mechanical and comms workbank: Renewals of assets to maintain performance. Station communication upgrades of public address systems, help points, CCTV, station management systems. Improved surveillance for drivers of gaps at platforms for passengers boarding and alighting. Replace obsolete equipment. Renew ventilation systems, machine chambers, air control, heating and pump equipment. Fire systems workbank: Renewals of existing hydrants and detection equipment to standards, scoping work to inform future design for renewing systems Power and electrical workbank: Legislative requirement to remove hazardous chemicals used in capacitors, replace obsolete/end of life equipment, improve power distribution, renew air circuit breakers, purchase spares, depot lighting	Mechanical and comms workbank: continued design work for heating and water pumps, smoke damper works progressed into delivery, optioneering for platform air handling units completed, removal of PCBs containing equipment at Finchley Road completed, completion of comms system replacement at six sites. Fire systems workbank: tunnel ventilation designs completed, programme progressing to deliver replacement fire panels and tunnel ventilation systems. Power and electrical workbank: power control system replacement completed, online battery inverter (OLBI) replacement, contract awarded, UPS replacement, 22 sites completed, contract award for 31 further sites awarded, scoping works for power quality controllers completed, 11 traction isolation switches replaced. LED conversion in stations: 22 small stations to complete, Oxford Circus	Mechanical and Comms workbank: continued design work for heating and water pumps. PCB and Paxolin Asbestos removal works completed. Bermondsey and Stratford Market depot smoke dampers work completed. Platform air handling units designs completed and in delivery. 'OPO Gaps obscured views' tranche 1 delivered. Tranches 4 to 6 in delivery. King's Cross comms upgrade completed; St James Park comms upgrade in detailed design. Emergency voice communications in detailed design. Fire systems workbank: Jubilee line Extension Tunnel and Down Street Ventilation projects completed, Victoria line Mid Tunnel Ventilation Project in delivery. Replacement fire panels in delivery. Station Fire Hydrant Systems in delivery and Depot Fire Hydrant system in detail design. Power and electrical workbank: continuation of the workbank activities to deliver projects addressing safety and legislative concerns across the

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
		LED conversion in stations: 20 small stations to complete.	converted, additional surveys completed and contract awarded for King's Cross, depot conversion to LEDs commenced	network. Completion of LED conversion at three train depots, Completion of Holborn DC switchboard replacement, complete replacement of gas turbine controllers at Greenwich Generating Station (GGS), Replacement of gas turbine number two at GGS, contract award for power quality controllers, rolling programmes of OLBI and UPS' established and contracts awarded, delivering 31 further sites. LED conversion in stations: 40 small stations converted to LEDs, King's Cross station and a three large/major stations (based on priority) to be completed, Continuation of LED Conversion programme at Depots.
Built Environment and Civils	Built Environment	Design and build at 38 stations and other works at seven locations. Asset condition data and assessments to inform the State of Good Repair for identified assets	Feasibility stage commenced for mini-programmes (Staircase Tactiles (31 sites), Timber Canopies (76 sites), Hounslow West & Sloane Square canopies and Highgate Sidings asbestos. Feasibility stage complete for Water Ingress (Chancery Lane & St Pauls), Hounslow Central canopy and Weston Rise Headhouse demolition. Platforms Package is in design and contract will be awarded in Q3 for delivery of 20 sites. Concept design complete for Pimlico ceiling and lighting, Water Ingress (Liverpool	Continuation of key programmes: Timber Canopies, Staircase Tactiles, and Platforms Package - onsite delivery of approx. 5 to 10 stations in each programme per year Completion of ADI programme for data collection for buildings and fabric assets Completion of all existing site-specific projects (excluding Hounslow West &

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
			Street, Charing Cross & Mayor Sworder Arches). Detailed design complete for West Acton high-level glazing works. Works completed at West Acton (lighting works), Leytonstone (platform remedial works), Plaistow (Asbestos Roof Replacement) and Osterley (Tactiles). ADI2 Survey Package Completed (245 power and lineside buildings), ADI3 Survey Package awarded and has started	Central, Highgate Sidings and Sloane Square which will all be in delivery) Examples of key projects delivered are Weston Rise, Pimlico, West Acton, Fulham Broadway Progression of new projects details of which are currently unknown
	Civils	Design and build at six earthworks locations. Design and build of renewals at a further 12 earthworks structures. Design and build at one depot Complete feasibility at five stations of railway structure asset renewals. Completion and close out of Bakerloo RVAR project	Earth Structures: CTS10 (Rickmansworth) - complete CTS4 (Park Royal) - complete - snags remain. CTS4B (Chigwell to Grange Hill) - Earth Structures 90% complete, bridge works remain EM3 (Queensbury) - concept design complete, ITT due in Q3 Five other sites in development (Stage 2) Assessments programme ongoing Depot: Stonebridge Park depot - Lighting Column scope completed, 2x column heads replaced, 1x column removed	Continuation of assessments programmes for Earth Structures and Bridges and Structures Detailed designs completed for 5x earth structure remediation projects, with intrusive surveys (ground investigations) completed Canons Park to Queensbury EM3 Embankment to have commenced on site London Road tunnel project completed Barons Court canopy and column refurbishment project completed Wembley Brook project to have commenced on site

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
			Railway Structures: Barons Court (column and canopy) design complete R3 Footbridge re-commenced - design completed. Wembley Brook re-commended - feasibility ongoing London Road Tunnel Water Ingress - design completed, contract to be awarded in Q2 23/24 Bayswater: Feasibility ongoing, due for completion in Q4 RVAR completed and project closed	R3 Footbridge to have commenced on site Stonebridge Park depot lighting works to be completed Designs completed for new projects not yet initiated, prioritisation/business planning required. Examples may include HB40 bridge, 070 footbridge
	Staff Welfare	Complete renewals at 12 locations, initiate design in other locations for future year delivery	Renewals completed at four locations. Site works commenced at three further locations. Optioneering completed for works at 20 locations for future delivery.	Minimum expected outcome of eight sites complete by 5 December 2023; this is a strategic milestone target. Aim to complete three further sites before end of FY 23/24. not yet confirmed as priorities have not been agreed. Future spending drops drastically. Prioritisation is currently in place to resolve this. Additional 10 sites initiated every year. Opportunity works to be included i.e. enhancement projects as well as SFA.

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
				Colindale blockade to be considered in 24/25. Remote booking office sites to be considered supporting the change management team.
Safe Track Access		Complete installation of signage Contract award for P-CRIDs and start design. Contract award for CMS and start system modification. Safe access system paused and now being managed under technology portfolio	Install signage. Contract award for P-CRIDs complete but delayed. Design now underway. Contract award delayed but now complete and system modification underway	Completion of CMS New P-CRID product designed and accepted. Installation of P-CRID underway due to complete in 2026/27.
Elizabeth line	ELARP	Establishment of a new Renewals Programme	Programme level governance has been approved and processes implemented to enable full delivery of the programme in 23/245	By March 2024: renewal of Ilford handrail and staircase. Initiation of the re-railing programme with the first site being Connaught Tunnel. Initiation of the points rectification programme. The initiation of a programme of works to bring the former Great Eastern line stations in line with Elizabeth line stations in the central operating section. By March 2026: relocation of the Crossrail Integration Facility.

Sub-programme	Asset group	Expected outputs by March 2023	Actual outputs March 2023	Expected outputs to March 2026
				A programme of works at Custom House to rectify water ingress issues at escalators and platforms; Continuation of programmes that commenced in 23/24 including re-railing, points rectification and the major renewals of the Great Eastern line stations.

Appendix 6: 2023/24 planned scope

Notes:

1) This provides an overview of the LU Renewals portfolio from October 2023 to the end of FY 2025/26
2) This list will be subject to change as deliverability and priorities continue to be assessed
3) Includes additional scope to be progressed if funding becomes available

Sub-Programme / Asset Area	Programme / Project	FY 23/24	FY 24/25	FY 25/26	Description
Track	Hazardous Materials	0.7	0.8	0	Removal of contaminated materials (e.g. asbestos and contaminated ballast) from track assets
Track	Deet tube renewal (DTR)	19.9	37	35.5	Track renewal in section of deep tube
Track	Track Project General Legacy	33.2	13.5	13.5	Closeout of incomplete Track projects from previous business plans for closeout in previous years.
Track	Track Project Cat 4	24.5	17.1	18.1	Lesser Interventions Operations to maintain Performance such holding works (short term fixes), replacing odd sleepers, small section of re-railing and fencing,
Track	Flat-bottomed conversion (FBC)	15.9	18	23	Conversion of bull head rail to flat-bottomed rail
Track	Ballasted Track Renewal (BTR)	14.7	23.2	32.8	Renewal of sections of ballasted track in sub-surface and open rail sections
Track	Track Project Drainage	3.2	15.2	15.2	Drainage renewal projects
Track	Points and Crossings (P&C) Renewal	7.9	7.8	12.5	P&C renewals projects, for example Aldgate Junction
Track	Track Sub-Programme Miscellaneous costs	1.1	1	1	Funds to cover miscellaneous overlays, forecasting not allocated to a programme and early investigation for projects that aren't in our sub programmes and some contract overheads.
Fleet - Passenger	Central line Improvement Programme	27.5	59.4	82.6	Renewal of Central line and Waterloo & City line fleet
Fleet - Passenger	Bakerloo line	4.7	8.5	7.7	Accessibility modifications on Bakerloo line fleet
Fleet - Passenger	Jubilee Vehicle Underframe Modifications	0.8	2.2	5.6	Safety works to remove vehicle underframe cracks on Jubilee line fleet
Fleet - Passenger	Fleet Cab Security	0.2	0.7	1.6	Driver's cab door security improvement across LU Fleet
Fleet - Passenger	Jubilee line Obsolescence Management	0.4	0.5	0	Feasibility studies on managing obsolescence of electronic systems on Jubilee line trains

Fleet- Heavy Overhaul	Central line Rail Adhesion Train	0.8			Overhaul of Central line Rail Adhesion Trains
Fleet- Heavy Overhaul	S8 Programme Lift	24.4	13.9		S8 Programme Lift
Fleet- Heavy Overhaul	S8 Gangways and Couplers	0.3	3.7	10.8	Overhaul of S8 Gangways and Couplers
Fleet- Heavy Overhaul	S7 Programme Lift	1	12	25.8	S7 Programme Lift
Fleet- Heavy Overhaul	Piccadilly line Programme Lift	8.5	6	3.4	Piccadilly line Programme Lift
Fleet- Heavy Overhaul	Piccadilly line Wheels and Motors	5.4	5.3		Overhaul of Piccadilly line wheels and motors
Fleet- Heavy Overhaul	Jubilee line Programme Lift	48.1	49	13.4	Jubilee line Programme Lift
Fleet- Heavy Overhaul	Victoria line Doors and Couplers	9.9	9.7		Overhaul of Victoria line doors and couplers
Fleet- Heavy Overhaul	Bakerloo line Doors	1	5.5	6.9	Overhaul of Bakerloo line doors
Fleet- Heavy Overhaul	S8 Doors	2.4	10.1	29.8	Overhaul of S8 Doors
Fleet- Heavy Overhaul	Jubilee line Doors	1	9.4	29.4	Overhaul of Jubilee line doors
Fleet- Heavy Overhaul	Metropolitan line Rail Adhesion Train	0.7	2.4	2.4	Overhaul of Metropolitan line Rail Adhesion Train
Fleet- Heavy Overhaul	Bakerloo line Heavy Overhaul/Programme Lift	7.7	8.9	9.5	Bakerloo line Heavy Overhaul/Programme Lift
Fleet- Heavy Overhaul	Central line Motors	6.3	6.7		Overhaul of Central line motors
Fleet- Heavy Overhaul	S7 Gangways and Couplers			12.9	Overhaul of S7 gangways and couplers
Fleet- Heavy Overhaul	Victoria line (2025/26) Programme Lift	0.5	1	10	Victoria line programme lift
Fleet- Heavy Overhaul	S Stock Depot Equipment	1.4	1.3		S Stock Depot Equipment works

Fleet- Heavy Overhaul	Central line Depot	9	8.2		Central line Depot works
Fleet- Heavy Overhaul	Bakerloo line reliability			1.5	Bakerloo line reliability works
Fleet - Engineering Vehicles	Remote Track Monitoring programme	1.1	2.5	6.7	Project to replace the 40-year-old, life-expired Track Recording Vehicle (TRV) with newer technology. The TRV is used to scan track for defects
Fleet - Engineering Vehicles	Modular Points and Crossings (MPAC)	1.2	0.4	0	Enables points and crossings to be pre-fabricated and delivered to site by rail
Fleet - Engineering Vehicles	Mechanical Renewals Vehicle	0.3	3.9	4.4	Mechanises processes currently done manually, improving efficiency and safety of track renewal works
Fleet - Engineering Vehicles	Acton Works Traverser	0.2	1		Replaces one of two 40-year-old life-expired Traversers located at Acton Works. The Traversers are needed to move rolling stock between work sheds for overhaul
Fleet - Engineering Vehicles	Engineering Vehicles Overhaul Works	4.7	3.7	6.8	Routine overhaul of existing Engineering Vehicle fleet
Fleet - Engineering Vehicles	Wagon replacement	0.1	1.6	0.2	Originally procurement of new wagons, now additional overhaul of existing wagons including setting up in-house wagon overhaul workshop
Fleet - Engineering Vehicles	Ruislip Depot Development	0.4	0.1	0	Modifications to Ruislip depot to enable delivery of additional functions
Fleet - Engineering Vehicles	Heavy Haulage	0.8	2.5	2.5	Procurement of new fleet of battery locomotives
Fleet - Engineering Vehicles	Ward Couplers	0.5	0.3	0	Resolution of safety problem currently preventing the use of ward couplers; this will enable the continued use of existing Engineering Vehicles
Fleet - Engineering Vehicles	Future feasibility studies	0.1	0.5	0.3	Including desktop study of how we can ensure brakes on older Engineering Vehicles comply to modern standards
Fleet - Engineering Vehicles	Track Tube Gauge Tamper	0.2	0.6	4	Replacement of 2 Tube gauge tampers (used to settle ballast)
Signalling and Control	Jubilee & Northern Incremental Upgrade (JNIP)	5.1	12.3	12.8	YTG 23-24; Completion of detailed design and installation of the cut-over rack and equipment for central computers (Vehicle Control Centre) 4&5.

Signalling and Control	Bakerloo Control System Incremental Upgrade (BCUP)	4.5	9.4	10	YTG 23-24; Enabling works, award and start of installation of Control Room fit-out and completion of signal installation equipment at the remaining 6 sites.
Signalling and Control	Central Line Signalling Incremental Upgrade (CSIP)	0.6	1.64	2.9	YTG 23-24; Early contractor involvement with Siemens to clarify the scope for Work for Package 1 (Interlocking for the East end of the Central Line) with plans to later initiate the tendering process.
Signalling and Control	Northumberland Park Depot	0.2	0.3	13.3	Deferral of project All pathway products complete for early feasibility for the information that was available to us. Further investigations required when project recommences.
Signalling and Control	Central Line Signalling Life Extension	6.1	9.2	16.7	Design work commenced and ongoing for WP1-5 and 9. Site installation commenced and installed at 20 sites for Wp1-5 and 9. Enabling Connect work complete. WP 7 commence early concept. WP 8 commence design.
Signalling and Control	Acton Town Interlocking Machine Room	0.4	0.7	0	Stage 1 and 2 out of 3 completed. Approximately 700 wires have been replaced.
Signalling and Control	Piccadilly Line Signalling Line Life Extension	2.7	1.6	0	On-site capacitor survey complete. The removal and replacement of non-compliant capacitors has commenced.
Signalling and Control	Central Line C & I Signalling Life Extension	3.2	4.4	4	It is necessary that most hardware of the control system is replaced both within Wood Lane Signalling Equipment Room(SER) facilities and in site-based SERs and relay rooms.
Railway Systems Enhancements	Northern and Jubilee line Fleet modifications	0.8	0.8	1	Software modifications to onboard Train Management Systems to remove redundant functionality; brake performance modifications; depot injection rate increase to support Four Line Modernisation programme
Railway Systems Enhancements	Northern and Jubilee Signalling modifications	3	4	0.1	Completion of Northern line Extension signalling. Delivery of Northern line frequency uplift. Core safety modifications to Jubilee line signalling

Railway Systems Enhancements	Northern and Sub-service railway power modifications	0.3	2.7	5.8	Power system resilience works for Northern line and Sub Surface Railway supplies
Lifts and Escalators	Primary and Secondary Means of Vertical Transport Lifts	6.4	9.6	14	Renewals of 2 lifts at Holloway Road that are Primary Means of Vertical Transport, and replacement of 7 hydraulic lifts that are Secondary Means of Vertical Transport
Lifts and Escalators	Pumps	2.2	1.6	0	Renewals of Pumps
Lifts and Escalators	Escalators	25.5	28.4	37	21 Escalators in 23/24, 27 in 24/25, 23 in 25/26. Includes capitalised maintenance renewals
Systems - Power Renewals	Station Emergency Lighting Replacements	2.7	6.7	4.6	Replace 40 Station Emergency Lighting to mitigate obsolescence and increasing failure risks of station closures.
Systems - Power Renewals	Holborn Station DC Switchboard	1.8	0	0	Replace switchgear to mitigate operational capacity constraint and fire risk on existing overloaded equipment
Systems - Power Renewals	Greenwich Generator controls	1.5	0.1	0.4	Replace obsolete and unreliable generator control systems to enable continued emergency and export power generation
Systems - Electrical Renewals	Station Uninterrupted Power Supply Replacements	3.6	4.6	1	Replace 30 life expired Station signalling and power control system Uninterrupted Power Supply to provide reliable critical operational supplies
Systems - Electrical Renewals	Station & Depot LED's	4.3	7.3	2.9	Install emergency lighting and full LED conversations to achieve carbon and energy saving objective.
Systems – Mechanical, Fire and Comms	Jubilees Line Extension Tunnel Vent Control Midlife	3.5	3	0	Renew compressors to restore system reliability to acceptable levels
Systems – Mechanical, Fire and Comms	Jubilee Line Extension Staircase Pressurisation	2	2.2	0.1	Mid-life renewal on fans and associated equipment, upgrade of control systems
Systems – Mechanical, Fire and Comms	Stratford Market Depot and Bermondsey Dampers	0.5	0.2	0	Upgrade of smoke damper systems at both depots
Systems – Mechanical, Fire and Comms	King's Cross CCTV Help points	0.2	0	0	Upgrade of CCTV help points
Systems – Mechanical,	JLE Communications upgrade	6.4	4.4	0	Upgrade of communication systems to meet standards

Fire and Comms					
Systems – Mechanical, Fire and Comms	Depot Fire Hydrant Systems	0.3	0.2	1.6	Upgrade of fire hydrant systems at multiple depots
Systems – Mechanical, Fire and Comms	Osbourne House	1.5	4.1	1.2	Osbourne House communication equipment renewal
Systems – Mechanical, Fire and Comms	Asset Resilience Systems	0.2	0.6	0	Initiation activities (capex and opex)
Systems – Mechanical, Fire and Comms	Waterloo Call Points Feasibility	0.1	0.8	0	Upgrade of call points within the station
Systems – Mechanical, Fire and Comms	Stations Fire Hydrant	0.6	5.9	7.4	Develop solutions to meet legal and safety standards
Systems – Mechanical, Fire and Comms	St James's Park Communication Systems	0.3	1.8	3.3	Upgrade systems to meet legal and safety standards
Systems – Mechanical, Fire and Comms	Tunnel Vents	0.1	0.8	0.8	Tunnel ventilation upgrades
Systems – Mechanical, Fire and Comms	Escalator Machine Chambers	0.2	0.2	0.2	Remedial works to cool escalator machine chambers on the Victoria Line
Systems – Mechanical, Fire and Comms	Platform Air Handling Units	0.6	4.8	6.1	Replacing 18 units at Green Park and Oxford Circus
Systems – Mechanical, Fire and Comms	Water Mist Suppression	0.2	0.3	0.3	Replacement of non-compliant system
Systems – Mechanical, Fire and Comms	Fire Panels	0.2	4.3	4.7	Replacement of 725 Fire Control Panels across 389 sites
Systems – Mechanical, Fire and Comms	ASL Routers	0.1	1.5	1.5	Replacement of non-compliant and obsolete routers

Systems – Mechanical, Fire and Comms	Emergency Voice Alarms	0.1	0.4	1.5	Upgrade of non-compliant emergency voice alarm systems on 8 Jubilee Line Extension stations
Systems – Mechanical, Fire and Comms	Baldwin Boxall Public Address Systems	0.1	0.2	0.2	Upgrade to systems
Systems – Mechanical, Fire and Comms	London Fire & Emergency Radio System	0.1	0.1	0.1	Capital Maintenance
Systems – Mechanical, Fire and Comms	Edenaire Cooling Units	0	0	0	Replacement of units with a modern equivalent
Systems – Mechanical, Fire and Comms	Jubilee Line One Person Operation CCTV trains and cameras	0.1	0.1	0.1	Capital Maintenance of system
Built Environment and Civils	Built Environment	6.4	19.6	34.4	Renewal of high criticality LU station and building assets to maintain safety and legislative compliance
Built Environment and Civils	Civils	9.6	11.4	14.6	Renewal of LU civil infrastructure assets e.g. embankments and bridges to maintain safety and legislative compliance
Staff Welfare Renewals	Staff Welfare	4.5	10	14.3	Renewal of colleague welfare facilities
Safe Track Access	Permanent Current Rail Indicator Devices (P-CRIDs)	1.1	5.4	11.2	Track access is one of LU's highest areas of safety risk to our people. The purpose of the Safe Track Access Programme is to enhance the safety of staff accessing the track during engineering hours following a number of High Potential Incidents on the London Underground network. P-CRIDs perform a vital safety role, allowing staff to have positive confirmation that traction current has been discharged before they enter the track environment. The first phase of the P-CRID project replaces the existing life-expired devices on the Jubilee, Northern and Piccadilly lines before the new device is rolled out to all LU lines in a second phase.

Safe Track Access	Competence Management System (CMS)	0.9	0.1	0	The purpose of this project is to provide an improved Competency Management System (CMS) IT database for staff undertaking protection activities on LU track infrastructure. This is to ensure there is a consistent, controlled and robust training and licensing process that provides assurance that individuals are correctly competent to undertake their tasks.
ELARP	Great Eastern Stations	3.1			Mini-programme of station asset renewals over multiple years (future costs in-year to confirm). Ilford station staircase, handrails, footbridge, fire systems, roof. Footbridge renewal at Chadwell Heath. Romford station fire system, Harold Wood cable hangers, safe access and management systems for buildings, fire prevention measures, surveys.
ELARP	Plumstead Depot Minor Works	0.5			Multiple minor projects including, security gates, container lighting, heating and racking, small power enhancements, Infrastructure Maintenance Vehicle gantry modification and Robel coupling modification
ELARP	Points & Re-railing	0.2	0.4	1.6	Connaught Tunnel and Custom House re-railing works
ELARP	Crossrail Integration Facility	0.9	0.2		Relocation of the facility
ELARP	Digital Private Network Signalling System Migration	0.5			Voice migration from Digital private network signalling system life-expired platform
ELARP	Canary Wharf Lighting Upgrade	0.4			LED Lighting Upgrade – Tranche 1
ELARP	Royal Oak Portal Security	0.5			Enhanced site security improvements to Royal Oak Portal and Westbourne Park
ELARP	Miscellaneous Projects	2.9	0.6		Including: Customs House Fire Systems Integration, Bird Repellent Works, Installation of new ladders and fall protection, fire stopping, chevron lighting, Roving public address systems, CCTV upgrades, Thermal sensors