

Date: 15 December 2021

Item: London Underground Railway Systems Enhancements Programme

This paper will be considered in public

1 Summary

Railway Systems Enhancements				Total Authority
Existing Financial Authority	EFC	Existing Programme and Project Authority	Authority Reduction Requested	
£ 150.1m	£ 167.7m	£ 245.1m	£ (73.8m)	£ 171.3m

**Outputs and Schedule:** A programme initiated in 2013 to deliver Power, Signalling and Rolling Stock enhancements to improve and sustain system capability and reliability in support of planned capacity increases on the Victoria, Jubilee and Northern lines. The majority of authorised programme scope has been delivered. Remaining works to be completed include:

- (a) Northern line Signalling software updates to improve reliability and support increased service frequency on the Morden branch;
- (b) rolling Stock modifications to optimise performance on the Jubilee and Northern lines and remove legacy signalling equipment;
- (c) power supply system upgrades on the Northern line to replace life expired assets and improve system resilience; and
- (d) Jubilee line Signalling system software updates.

1.1 This paper provides an update for the Committee on progress with delivery of the London Underground (LU) Railway Systems Enhancements (RSE) Programme, as authorised in July 2018. The last update was provided to the Committee in October 2019.

## **2 Recommendations**

- 2.1 The Committee is asked to note the paper and approve a reduction in Programme and Project Authority of £73.8m for the Railway Systems Enhancements Programme, giving a total revised Programme and Project Authority of £171.3m.**

## **3 Background and Context**

- 3.1 The Railway Systems Enhancement (RSE) (formerly 'World Class Capacity') programme was authorised in 2013 to deliver service capacity increases on the Victoria, Jubilee and Northern lines.
- 3.2 In 2017 the Programme successfully delivered an end to end 36 trains per hour (tph) peak service capability on the Victoria line making it one of the highest frequency metro services in the world. The Programme then delivered enabling works which supported an extended duration of 30tph peak services on the Jubilee line from 2018.
- 3.3 After careful consideration to balance investment priorities across the network, the decision was made in 2017 not to proceed with the procurement of additional trains to enable service uplifts on the Jubilee and Northern lines. Following this decision, the RSE Programme was refocused to the optimisation of existing infrastructure, train and signalling system capability on the Jubilee and Northern lines to maximise utilisation and performance within the Programme and Project Authority of £245.1m.
- 3.4 The revised RSE Programme, as authorised by the Committee in July 2018, included the following scope for the Jubilee and Northern lines:
- (a) Jubilee Line capacity optimisation (JLO) to deliver up to 32 trains per hour between West Hampstead and North Greenwich stations in the peak periods;
  - (b) Northern Line capacity optimisation (NLO) to deliver 31 trains per hour on the Morden branch in the peak periods (one of the most congested parts of the entire London Underground network in the peak periods) and also to facilitate a small improvement in peak capacity on the Bank branch and opening of Northern Line Extension services to Battersea;
  - (c) rolling Stock modification works to optimise train system performance and reliability to support the service level enhancements following the Jubilee and Northern line signalling upgrade projects; and
  - (d) essential Power system works on the Northern line to replace life-expired equipment, address asset condition concerns and provide additional network resilience to support increased service levels on the Northern and the Sub-Surface lines (District, Circle, Hammersmith & City and Metropolitan) following the Four Lines Modernisation (4LM) Programme.
- 3.5 Since the previous update to the Committee in October 2019, the TfL Capital Investment Programme has been under severe financial pressure following the impact of the coronavirus pandemic on TfL ridership and revenues.

- 3.6 Despite the pandemic disruption, good progress has been made with the RSE programme through collaboration and new ways of working to mobilise resources and the supply chain. This has enabled completion of several projects which have supported the opening of services on the Northern line Extension to Battersea in September 2021.
- 3.7 In 2020 the JLO elements of the RSE programme, including enhanced signalling capability and fleet availability improvements to support a 32tph peak service, were deferred. These scope items remain paused and are not currently prioritised within the TfL Capital Investment Programme in view of the currently reduced levels of demand on the tube network.
- 3.8 London's economic recovery and projections of demand growth on the LU network are the subject of ongoing modelling and analysis by TfL. Service levels on the Jubilee line form a key element of this review and JLO programme is expected to be re-instated in line with demand forecasts and funding availability, albeit unlikely in the next five years.
- 3.9 This paper provides a summary of progress achieved since October 2019 and a review of costs and outcomes against the baseline of the July 2018 authority. The paper also seeks a reduction in the Programme and Project Authority to reflect scope reductions, delivery efficiencies and the deferral of the JLO programme elements.

## **4 Programme Delivery Since October 2019**

### **Northern Line**

- 4.1 The RSE programme has successfully implemented the Northern line capacity improvements to enable introduction of a new Working Timetable (WTT58) in September 2021. This has enabled 31 trains per hour on the Morden branch in the peak periods. The new timetable has also facilitated a small improvement in peak period capacity on the Bank branch and has released an extra train within the existing fleet to support the extension of Northern Line services to Nine Elms and Battersea Power Station.
- 4.2 In June 2020, a new mobile wheel lathe was commissioned at Morden depot on the Northern line. This has enabled changes to the maintenance production process to reduce turnaround timescales for wheel turning. The resulting improvement in overall fleet availability has supported the timetable changes introduced for the initial extension of services to Nine Elms and Battersea Power Station and will support the improved service to be implemented on the Northern Line Extension from mid-2022.
- 4.3 Track upgrades have been completed to enable higher train speeds in the Kennington area to improve customer journey times and support both a 31 trains per hour service on the Morden branch and the new Nine Elms and Battersea services.
- 4.4 An initial package of power system enhancement works has been progressed on the Northern line to replace life-expired equipment, address asset condition concerns and support the service enhancements described above.

- 4.5 All the above works have enabled the introduction of services on the Northern Line Extension to be possible within the capability of the existing fleet and signalling system without the need for reductions in service elsewhere on the Northern line.

### **Jubilee Line**

- 4.6 Following the re-scoping exercise in late 2017, the Jubilee Line Optimisation (JLO) sub-programme was developed to optimise capability and availability from the existing rolling stock and signalling assets and hence enable achievement of a peak service level of 32 trains per hour in the central area.
- 4.7 The scope of works for the existing Jubilee line 96 Tube Stock fleet to improve its reliability and availability included development of a real time on-train condition monitoring system (RTCM) and the provision of a new wheel lathe at Stratford Market depot to improve wheel turning productivity.
- 4.8 The programme also included Signalling system modifications required to enable higher peak services to be operated on the Jubilee line. The package of signalling software-related changes was planned to be delivered to support an uplift in peak services to operate at 32tph between West Hampstead and North Greenwich stations on the Jubilee line from mid-2022.
- 4.9 In 2020, the signalling enhancements and RTCM scope elements of the JLO programme were deferred. Work continued with the new wheel lathe installation at Stratford Market depot which was completed by August 2020. The re-instatement of the proposed peak capacity uplifts on the Jubilee line will be considered in the context of demand growth recovery over the next few years and overall investment prioritisation.
- 4.10 For the Jubilee line signalling system, further works have been identified to allow completion of software updates by the supplier. This will ensure consistency of operational functionality and software status between the Sub-Surface, Northern and Jubilee line systems.

### **Legacy Rolling Stock Work**

- 4.11 Rolling Stock modifications have been undertaken to complete the removal of redundant legacy signalling equipment and updating of the train-borne management system following the earlier Jubilee and Northern line signalling upgrade projects.
- 4.12 Additionally, modifications to train braking systems are being progressed on the Northern and Jubilee line fleets to better optimise friction and regenerative braking performance regimes.
- 4.13 Works are also underway to enable an uplift in train entry/exit speeds at Neasden and Stratford Market depots on the Jubilee line to support the Metropolitan line service enhancements being delivered by the Four Lines Modernisation (4LM) programme.

## 5 Financial Implications and Authority Proposal

- 5.1 Financial Authority is currently provided through the two-year Budget for 2021/2022 and 2022/23 as approved by the Board on 28 July 2021. It is noted that the current funding agreement with Government expires on 11 December 2021 and additional funding will need to be agreed beyond this period, therefore a subsequent prioritisation of the TfL Investment Programme will be required to ensure that all projects are affordable within the funding envelope provided and as such revised authority may need to be sought.
- 5.2 Table 1 below shows the current financial status of the RSE Programme including the original authority, current EFC and Financial Authority in line with the 2021 Budget. Financial Authority beyond 2024/25 will require provision in future Business Plans and Budgets.

	Prior years	FY2022	FY2023	FY2024	FY2025	FY2026	Total all years
<b>Financial Authority (Gross)</b>	<b>138.0</b>	<b>6.8</b>	<b>5.4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>150.1</b>
<b>Programme and Project Authority</b>							
Existing Authority							245.1
This Authority Request							- 73.8
<b>Total Programme and Project Authority</b>	<b>138.0</b>	<b>9.9</b>	<b>8.9</b>	<b>12.5</b>	<b>2.0</b>	<b>-</b>	<b>171.3</b>
Future Authority Requests	-	-	-	-	-	-	-
<b>Current EFC (Gross)</b>	<b>138.0</b>	<b>8.7</b>	<b>7.8</b>	<b>11.4</b>	<b>1.8</b>	<b>-</b>	<b>167.7</b>

**Table 1: Project Authority and Estimated Final Cost breakdown (all costs £m outturn values)**

- 5.3 The RSE Programme and Project Authority of £245.1m exceeds the Financial Authority due to scope reductions and efficiency savings achieved and reflected in the Business Plan. To reflect these reductions since 2019, it is now proposed to reduce the overall Programme and Project Authority by £73.8m, from £245.1m to a total of £171.3m.
- 5.4 A new authority will be sought for a Jubilee line capacity optimisation scheme in line with future business plans and investment prioritisation.
- 5.5 By reducing the authority by £73.8m, the revised authority value remains above the current EFC by £3.6m. This represents 14 per cent of the Cost of Work to Go (COWG). It remains prudent to not align the EFC and authority values completely as the EFC is dynamic and may fluctuate period on period, predominantly through the active review and management of risk and opportunity.

- 5.6 Authority granted by the Committee which relate to both the current funding period up 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.
- 5.7 All financial commitments related to this request will be overseen in accordance with TfL Business controls in respect of draw down.

## 6 Efficiencies and Scope Reduction

- 6.1 Since the July 2018 when original authority was granted by the Committee, the RSE Programme has continued to refine train system scope, specifications, and costs to deliver the Northern line capacity improvements and enable the Northern Line Extension to Battersea whilst work on the optimisation of the Jubilee line (JLO) has been paused. Details of EFC movements are tabled in Appendix 1.
- 6.2 These refinements have resulted in scope and cost reductions compared with the originally authorised (July 2018) baseline position, as shown in Table 2 below:

Scope element	£(m)'s	Change Year
<b>Original RSE Authority (July 2018)</b>	<b>245.1</b>	
Original Authority headroom	- 13.5	2018
Jubilee line Capacity Optimisation Programme - deferred	- 15.9	2020
Northern line East Finchley Reversing facility - descope	- 18.5	2019
Power high voltage cables scope transferred to DTUP	- 10.3	2019
Power Enhancement (Resilience Package) scope reduction/Value Engineering	- 19.0	2020
VLU2 and other efficiencies	- 4.2	2018
<b>Total reduction</b>	<b>- 81.4</b>	
Original Authority minus total reduction	<b>163.7</b>	
Signalling software updates (Jubilee line)	<b>4.0</b>	2021
Current Estimated Final Cost (EFC)	<b>167.7</b>	
Authority Headroom (14% COWG)	<b>3.6</b>	
Revised Programme and Project Authority	<b>171.3</b>	2021

**Table 2: Changes from Authority position since July 2018**

6.3 The key scope and efficiency reductions made since 2018 are:

- (a) The Jubilee Line Capacity Optimisation (JLO) programme to achieve a service level of 32 trains per hour in the central area was paused in 2020. Whilst work was progressed with the delivery of a new wheel lathe at Stratford Market depot and initial feasibility work for a remote train condition monitoring system, capacity optimisation through signalling system enhancements will remain deferred until supported by demand growth and a demonstrable requirement for capacity enhancements as an investment priority;
- (b) An enhancement scheme was originally included as part of the Northern line capacity optimisation to provide a new 'scissors' crossover at East Finchley to enhance reversing capability. Following further modelling and value analysis to demonstrate the robustness of peak timetable uplifts and the introduction of NLE services without additional reversing capability, this scheme was removed from scope.
- (c) High voltage cable replacement and associated optical fibre cable scope which supports future service enhancements on the Piccadilly line was originally included in the Northern Line Upgrade (NLU2) and later RSE scope. These works have been transferred to the Piccadilly line Upgrade programme to co-ordinate their delivery as part of a wider package of HV power scope upgrades on the Piccadilly line;
- (d) Power Package 2 (PP2) scope was reviewed in summer 2020 in response to the impact of the pandemic on TfL's financial position to prioritise the scope and maximise value. This review considered the probability and consequence of asset failures and available mitigations to further prioritise scope. This resulted in a reduction of the PP2 scope including sub-station upgrades at Elephant & Castle, Clapham Common, Stockwell and Highgate and lower priority sub-station ventilation works. The deferral of prioritised PP2 works by 3 years is under consideration and the impact of deferral is currently being assessed; and
- (e) The Victoria Line Upgrade 2 programme elements and the Northern line wheel lathe projects have been successfully completed with the costs lower than their original authorities, resulting in efficiency savings. At Morden depot a mobile wheel-turning solution was adopted instead of a fixed lathe installation, improving flexibility, and reducing the cost and complexity of building construction.

## 7 Benefits and Value

7.1 Since the last update, the RSE Programme has delivered the following capacity outcomes on the Jubilee and Northern lines:

	Start Capacity (Trains Per Hour)	End Capacity (Trains Per Hour)	Capacity Increase	Completion Date at Oct 2019 P&IC	Current Status
Victoria line	33	36	9%	Delivered 2017	Complete
Jubilee line	30	32	7%	Mid-2022	Deferred
Northern line (Morden branch) *	30	31	3%	Autumn 2021	Delivered Sept 2021
Northern line (Bank Branch) *	26	27	4%	Autumn 2021	Delivered Sept 2021
Northern line (other existing branches)	24	24	No change		

\*morning peak hour in the Northbound direction

### Table 3: Capacity outcomes

7.2 As authorised in July 2018, the business case for the revised Northern line capacity improvements was sub-divided as below:

- (a) Working Timetable 58 (WTT58): The project to deliver improved customer journey times was financially positive with a payback period of 10 years; and
- (b) the remaining elements of scope to provide train resources to operate services to Nine Elms and Battersea whilst maintaining service levels on the rest of the Northern line had a range of benefit to cost ratios up to 5.7:1. This included the new wheel lathe facility at Morden depot and Kennington speed uplift track work.

7.3 With the successful delivery of WTT58 in 2021, the Business case remains financially positive, using current projections of reduced demand, with a payback period of 11 years.

7.4 The value engineering and reduced cost of the Morden wheel lathe solution has improved the overall benefit-cost ratio from 3.3:1 in 2018 to a currently assessed value of 5.7:1.

7.5 The business case for the second package of Power works is financially positive based on an assessment of the probability and consequence of equipment failures at specific locations on the Northern line. Following the line upgrade re-signalling and the increase in service levels, equipment failures can result in a need to reduce services, or for a partial line suspension until the fault is rectified with significant disruption to customer service.



- 7.6 This package of Power works will provide the necessary power system capacity and redundancy to achieve the required levels of system resilience. This will reduce the probability of asset failures and allow services to be maintained across the line in the event of any localised equipment failures. Further scope detail is included in Appendix 2.
- 7.7 The business case for the deferred Jubilee line optimisation (JLO) enhancements has been weakened by the current reduction in peak demand. The business case remains highly sensitive to demand levels since the main objective of the scheme is to alleviate peak crowding levels on the central section of the line. Analysis using a range of TfL demand growth scenarios indicates that JLO would no longer be revenue positive. The case for the scheme will continue to be assessed using updated demand models to enable its re-instatement as early as possible as part of TfL's investment prioritisation process.

## **8 Assurance**

- 8.1 As part of continuous assurance, a briefing was given by the programme team to IIPAG and TfL Project Assurance to update on programme progress. No significant concerns were identified. An action was allocated to the programme team to provide a reconciliation of the original EFCs against the latest EFCs or final costs, with an explanation of variances together with an update on the associated business cases (see Appendix 1).
- 8.2 The cost-to-go for works currently underway is £9.6m across 6 projects, these are at different stages in their lifecycle, but all are in their delivery stage. This estimate includes risk provisions for these works, there is a separate £3.6m provision to cover cost and scope uncertainty, notably for remedial works to address asset concerns on the Northern and Jubilee Lines, this is currently being costed and negotiated with the supplier.
- 8.3 The separate Northern Line Power Package 2 project under the programme has just restarted. This has a current EFC of £15.7m and is the subject of a separate assurance review which is currently underway.
- 8.4 A management response to the recommendations made has been provided and all recommendations have been accepted.

### **List of appendices to this report:**

Appendix 1: Baseline comparison of EFC's and benefits

Appendix 2: RSE Programme Remaining Scope

### **List of Background Papers:**

None

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