

## Programmes and Investment Committee



**Date:** 28 June 2017

**Item:** London Underground World Class Capacity Sub Programme Review (*Corrected Version*)

**This paper will be considered in public.**

### 1 Summary

<b>LU World Class Capacity Sub-Programme (excluding JNAT)</b>				
Financial Authority	Estimated Final Cost (EFC)	Existing Programme and Project Authority	Additional Authority Requested	Total Programme and Project Authority
£ 544.7m	£ 529.4m	£ 167.9m	£ 77.2m	£245.1m

- 1.1 A paper is included on Part 2 of the agenda, which contains exempt supplementary information. The information is exempt by virtue of paragraph 3 of Schedule 12A of the Local Government Act 1972 in that it contains information relating to the business affairs of TfL. Any discussion of that exempt information must take place after the press and public have been excluded from this meeting.

### 2 Recommendations

- 2.1 **The Committee is asked to note the paper and the supplementary paper on Part 2 of the agenda and:**
- (a) **approve additional Programme and Project Authority of £77.2m (outturn including risk) plus that shown in the paper on Part 2 of the agenda for the World Class Capacity Sub-Programme; and**
  - (b) **authorise Delegated Officers to grant Procurement Authority, to not exceed the value shown in the paper on Part 2 of the agenda, for the award of a design, manufacture and supply contract for 27 additional Jubilee and Northern Line trains as described in the paper on Part 2 of the agenda.**

### 3 Background

- 3.1 In 'A City for all Londoners' (October 2016), the Mayor stated his intent to improve the transport system to ensure a world-class experience. The World Class Capacity Sub-Programme directly maps to Policy 5, "Tackling crowding and improving public transport reliability and journey times".

- 3.2 The World Class Capacity (WCC) Sub-Programme seeks to provide a level of peak service capacity amongst the highest in the World. The Four Lines Modernisation (4LM) Programme addresses the District, Circle, Hammersmith & City and Metropolitan Lines, the Deep Tube Upgrade Programme the Bakerloo, Central, Piccadilly and Waterloo & City; and the WCC the Victoria, Jubilee and Northern Lines.
- 3.3 The Victoria, Jubilee and Northern Lines have already benefited from successful upgrades initiated under the previous Public Private Partnership (PPP) arrangements but concluded by London Underground.
- 3.4 The WCC Sub-Programme has been established to increase the passenger capacity, which is measured by the number of trains per hour passing through a station. The Sub-Programme will deliver:

<b>Peak Trains per Hour</b>	<b>Start Capacity</b>	<b>End Capacity</b>	<b>Capacity Increase</b>	<b>Completion Date</b>
Victoria Line ('VLU2')	33	36	9%	Delivered
Jubilee Line ('JLU2')	30	Up to 36	20%	December 2020
Interim improvement to the Northern Line train service (Morden Branch)	30	32	7%	April 2019
Northern Line ('NLU2') (Central area and northern branches)	24	30	25%	April 2023

- 3.5 These projects are at differing stages of the Project Life Cycle; VLU2 is in benefits realisation, JLU2 is in delivery, NLU2 is about to move from design into delivery.
- 3.6 The increase in capacity on the Victoria Line has been achieved with the existing number of trains however, additional trains are required for the Jubilee and Northern Line capacity upgrades. The design, procurement and delivery of the Jubilee and Northern Line Additional Trains (JNAT) is managed as a separate project which combines the requirements of JLU2 and NLU2 into a joint order to enable economies of scale.
- 3.7 The Sub-Programme is completed by the final close-out activities of the original Jubilee and Northern Line Upgrades mainly comprising removal of redundant equipment (spend to go of £7.0m) and Jubilee and Northern Line Train Brake remedial project (£1.5m). Given the relatively small level of remaining expenditure, these activities are not expanded on further in this paper.
- 3.8 The LU WCC Sub-Programme brings together projects that have the same strategic objective and share common resource requirements for their delivery.
- 3.9 The TfL Business Plan includes the latest estimated costs for the projects that will be delivered within this Sub-Programme. This includes the considerable delivery efficiencies identified at 4.4 below.

## 4 Strategic Case

- 4.1 Demand for public transport continues to grow. Consequently one of the six TfL priorities in support of the Mayor's Transport Strategy is to "accelerate the growth and increase the capacity of our network".
- 4.2 The original wave of PPP specified Line Upgrades on the Victoria, Jubilee and Northern Lines met their targets and delivered capacity increases of 21, 33 and 25 per cent respectively. In all cases they provided the potential for further enhanced capacity at incremental cost. The Victoria Line had available trains and required signalling modifications to release this, while the Jubilee and Northern Lines are trains constrained but have spare signalling capacity. All three lines require certain levels of power, track and depot enabling works.
- 4.3 Individually all three major projects have very strong business cases comprising reduced passenger journey times and less over-crowding. The resultant additional passenger journeys will generate revenue of £15m pa on both the Victoria and Jubilee Lines and £23m pa on the Northern Line. The overall appraisals show VLU2 is financially positive, JLU2 and NLU2 return benefit to cost ratios of 8.6:1 and 6.4:1 respectively.
- 4.4 In order to demonstrate value for money and make this programme affordable within the constraints of the Business Plan, the overall cost has been subject to challenge and is significantly reduced. Value Engineering has reduced the cost of NLU2 by £157m through scope reductions (without adversely impacting the benefits expected), risk review and innovative procurement. Similarly JLU2 now has an EFC of £77.6m set against a Project Authority of £104.1m achieved by removing aspects of scope that do not directly affect the timing and quantum of benefits.
- 4.5 There is no primary safety impact as a result of delivering these works however, NLU2 in particular will contribute to reduced overcrowding on the extremely busy Morden branch. This will be expected to reduce the number of times that customers are prevented from accessing stations with narrow platforms to control their safety.

## 5 Proposal

5.1 The LU World Class Capacity Sub-Programme comprises the following projects (all figures £m including risk and inflation):

Description	Financial Authority	Estimated Final Cost (at Period 1)	Existing Programme and Project Authority	This Authority Request	Future Requests
<u>Victoria Line Upgrade (2)</u> : Signalling and rolling stock modifications, power enhancements, cooling at Forest Road. Further details are attached as Appendix 1.	42.6	42.8	45.0	0	0
<u>Jubilee Line Upgrade (2)</u> : Signalling and rolling stock modifications, power enhancements, four cooling schemes and additional depot and stabling facilities. Further details are attached as Appendix 2.	93.2	77.6	104.1	0	0
<u>Northern Line Upgrade (2)</u> : Signalling and rolling stock modifications, power enhancements, additional reversing facility at East Finchley and additional depot and stabling facilities. Further details are attached as Appendix 3.	392.1	392.1	11.3	67.9	314.0
<u>Jubilee &amp; Northern Line Additional Trains</u> : Purchase of 10 additional seven car Jubilee Line trains and 17 six car Northern Line trains. Further details are attached as Appendix 4.	xx	xx	xx	xx	0
<u>Northern Line Train Service Interim Improvement</u> : Signalling, track and power supply modifications to support an increase in peak service from Morden. Further details are attached as Appendix 5.	16.8	16.9	7.5	9.3	0
<b><u>TOTAL</u></b>	<b>544.7</b>	<b>529.4</b>	<b>167.9</b>	<b>77.2</b>	<b>314.0</b>

xx – figures are shown at section 6 of the paper on Part 2 of the agenda.

The Programme and Project Authorities quoted in the table above are not reflective of the EFC savings realised.

## Authorities sought

- 5.2 This paper is seeking additional Programme and Project Authority of £77.2m comprising £67.9m for the NLU2 Project and £9.3m for Northern Line Train Service Interim Improvement. The benefits that will be achieved from the proposed investment are summarised in appendices 2 and 3.
- 5.3 As part of the Jubilee and Northern Line Additional Trains project, Programme and Project Authority is sought as shown in the paper on Part 2 of the agenda and it is requested that Procurement Authority for the award of a design, manufacture and supply contract for 27 new trains be delegated to Delegated Officers, subject to not exceeding the maximum sums set out in the paper on Part 2 of the agenda.

### Financial implications (excluding JNAT)

- 5.4 Summary of the Programme costs and funding to 31 March 2024 (excluding JNAT):

Costs and Funding (£m)	Prior Years	2017/18	2018/19	2019/20	2020/21	2021/22 to 2023/24	Total
Cost (Outturn)							
Estimated Final Cost	68.3	37.0	58.2	88.7	114.4	162.8	529.4

Forecast Budget/Plan	67.8	36.7	73.1	96.1	95.4	175.7	544.7
Plan Surplus/(Shortfall)	-0.5	-0.3	14.9	7.4	-19.0	12.9	15.3
EFC of Approved Projects	68.3	24.5	22.8	19.9	2.7	0.0	138.2
Current Authority							167.9
This Authority Request	0	12.5	33.1	15.2	7.1	9.4	77.2
Future Requests			2.3	53.6	104.6	153.5	314.0

- 5.5 All revenue expectations and additional operating and maintenance costs are built into the approved budgets.
- 5.6 Some funding contained within the programme costs extend beyond the current Business Plan, provision for these costs will be included in future Business Plans.

## 6 Assurance

- 6.1 A TfL Project Assurance (PA) and Independent Investment Programme Advisory Group (IIPAG) Assurance Review of the World Class Capacity Sub-Programme took place in May 2017. No critical issues were identified and the five recommendations made are being addressed.
- 6.2 A separate Integrated Assurance Review (IAR) of the next tranche of NLU2 funding took place in April 2017. No critical issues were identified and the recommendations made are being addressed.

- 6.3 A further IAR, with IIPAG, for the Contract Award recommendation for the Jubilee and Northern Line Additional Trains will take place in July 2017.
- 6.4 The Northern Line Train Service Improvement project underwent an IAR in August 2016. Apart from a requirement to clarify the financial authority position (completed via the 2016 Business Planning process) there were no critical issues found. A further 'light touch' review is proposed with TfL Project Assurance prior to seeking Procurement Authority in August 2017.

**List of appendices to this paper:**

- Appendix 1 Summary of Victoria Line Upgrade 2  
Appendix 2 Summary of Jubilee Line Upgrade 2  
Appendix 3 Northern Line Upgrade 2  
Appendix 4 Jubilee and Northern Line Additional Trains  
Appendix 5 Northern Line Train Service Interim Improvement

**List of background papers:**

WCC Sub-Programme Review: IIPAG and Project Assurance Reports  
NLU2 IAR IIPAG and Project Assurance Reports and Management Response

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## Appendix 1 – Summary of Victoria Line Upgrade 2

### 1 Background

- 1.1 The Victoria Line World Class Capacity Project will deliver a 36 trains per hour (tph) three hour peak service on the whole line to meet high demand for services. The Business Case is financially positive with an eight year pay back period.
- 1.2 The project was initiated in 2014 and has now delivered its full scope of signalling, train, power and track modifications providing the upgraded capability of running a 36tph service.
- 1.3 The new Victoria Line Timetable giving a 36tph service for 90 minutes of each peak was successfully introduced from 21 May 2017.

### 2 Proposal

- 2.1 A phased approach to service improvements has been taken to minimise risk of large step changes as shown in 2.2 below. No further asset changes are necessary to support introduction of the full three hour peak service from June 2018.

#### Benefits

- 2.2 The Victoria Line service has been increased as follows:

Timetable	Date	Service frequency	
		Seven Sisters to Brixton	Walthamstow to Seven Sisters
Baseline (end of VLU1)	January 2013	Peak: 33tph Off-peak: 24tph	Peak: 18tph Off-peak: 18tph
Timetable upgrade 1: 34tph	June 2014	Peak: 34tph Off-peak: 24tph	Peak: 24.5tph Off-peak: 18tph
Timetable upgrade 2: off-peak increase	June 2015	Peak: 34tph Off-peak: 27tph	Peak: 24.5tph Off-peak: 18tph
Timetable upgrade 3: 34tph from Walthamstow	May 2016	Peak: 34tph Off-peak: 27tph	Peak: 34tph Off-peak: 27tph
Timetable upgrade 4: 36tph for 90 mins in the peak <small>*All VLU2 physical scope complete</small>	May 2017	Peak: 36tph Off-peak: 27tph	Peak: 36tph Off-peak: 27tph
Timetable upgrade 5: 36tph for 3 hours in the peak	June 2018	Peak: 36tph Off-peak: 27tph	Peak: 36tph Off-peak: 27tph

2.3 The economic appraisal of the VLU2 project is shown below:

<b>Economic Appraisal (all at Present Value)</b>	
Estimated Final Cost, £m	-46
Optimism Bias	0
OPEX	-163
<b>TOTAL COSTS</b>	<b>-209</b>
Revenue	404
<b>Net Financial Effect</b>	<b>195</b>
Total Benefits	1,487
Benefit : Cost Ratio	Financially Positive

### **Delivery**

- 2.4 There is a remaining spend to go of £3.8m, including £1.3m of risk allowance which will be retained within the project for any potential issues identified as needed as the new timetable is introduced.
- 2.5 A Gate 6 (Project Closure) Review is planned for summer 2018 when the full benefits have been realised.

## **Appendix 2 – Summary of Jubilee Line Upgrade 2**

### **1 Background**

- 1.1 The initial Jubilee Line Upgrade was delivered by Tube Lines under the PPP adding 25 per cent capacity and additionally providing a seventh car to each train. Benefit realisation was complete in 2011 with introduction of a 30 trains per hour (tph) peak service.
- 1.2 JLU2 was initiated in 2014 and has a target of providing a 36tph service between West Hampstead and North Greenwich stations by the end of 2020. This option requires 10 additional trains (see also Appendix 4).
- 1.3 In March 2016, £104.1m Project Authority was approved by the Board for the implementation phase of the project, with a target of achieving savings of 10 per cent. The scope comprised:
  - (a) power strengthening works at six substations;
  - (b) four cooling ventilation fan upgrades;
  - (c) train depot enabling works at Stratford Market Depot and Neasden Depot;
  - (d) renewal and upgrade of tracks at West Hampstead;
  - (e) modifications to signalling systems, including automation options;
  - (f) minor modifications to existing trains; and
  - (g) maintenance and operating changes.
- 1.4 The track renewal at West Hampstead has been completed and implementation of power and cooling works are underway.
- 1.5 As part of the 2016/17 Business Planning process, a further review of scope has been carried out and this challenged the affordability, delivery and operational risks of the proposed automation measures. This review concluded that implementation of a highly resilient 34.3tph service should become the base case, but the target to still deliver 36tph remains and will continue to be explored through continuing optimisation of the signalling design. Both 34.3 and 36tph service patterns have strong business cases (see 2.3 below) and require the same infrastructure and 10 additional trains.
- 1.6 Value Engineering completed to date has reduced the EFC to £77.6m and further opportunities continue to be explored.

### **2 Proposal**

- 2.1 The proposal is for continued delivery of the amended scope as described above.

#### **Benefits**

- 2.2 The project will deliver the following benefits:
  - (a) an increase in duration of the 30tph peak service from one to three hours each peak from March 2018 using the new reversing facility at West Hampstead;

- (b) an increase to 31.3tph (a train every 115 seconds) from April 2019 using the additional power and cooling capability; and
- (c) an increase to 34.3 (a train every 105 seconds) or 36tph (100 seconds) from late 2020 using the 10 additional JNAT trains.

2.3 The economic appraisal of the JLU2 project 34.3tph scenario is shown below:

Economic Appraisal (all at Present Value)	
Estimated Final Cost, £m	-165
Optimism Bias	-9
OPEX	-133
<b>TOTAL COSTS</b>	<b>-307</b>
Revenue	215
<b>Net Financial Effect</b>	<b>-92</b>
<b>Total Benefits</b>	<b>792</b>
<b>Benefit : Cost Ratio</b>	<b>8.6:1</b>

For the 36tph scenario, the benefit to cost ratio is also 8.6:1.

The Business Case is assessed over the remaining life of the existing trains to the early 2040s.

### Delivery

2.4 The risk provision is £17.2m of which the top risks are:

Risk No	Risk Description	Mitigation Actions	Target Cost (£m)
1	Stratford Market Depot train throughput rate	Early modelling of potential train throughput to ensure full service can be met from 07:00	£3.2m
2	Increased scope or complexity of power works	Procurement broken into packages of work. Use of experienced contractors	£1.6m
3	Software updates require rework to rectify defects	Use of embedded engineer and simulators	£1.6m
4	JLU2 causes unforeseen operational issues	Use of engineering simulator to identify issues	£1.5m
5	Signalling modification cost uncertainty	Early informal engagement prior to commencing formal tendering process.	£1.1m

## Appendix 3 – Northern Line Upgrade 2

### 1 Background

- 1.1 The initial Northern Line Upgrade was initiated by Tube Lines under the PPP and completed by London Underground adding 20 per cent capacity. Benefit realisation was complete in 2014 with introduction of a 24tph peak service in the central area.
- 1.2 NLU2 was initiated in 2014 with a feasibility study examining eight service pattern options. In January 2016, a preferred option was selected for implementation which had a target of providing a 30tph service on both the Charing Cross and Bank branches and both northern branches. This option requires 17 additional trains (see also Appendix 4).
- 1.3 The 30tph quoted throughout this paper for NLU2 is a summary figure. In reality, to most closely match passenger demand, the Northern Line timetable offers a slightly different service level in the morning and evening peaks, whether northbound or southbound and different between branches. For NLU2 this can produce service levels ranging from 28.8 to 32.8tph depending on specific location and time, but generalised as 30tph.
- 1.4 The Northern Line Extension (NLE) will have an initial 16tph peak service through utilising existing trains. This will be increased to 30tph as part of NLU2 from April 2023.
- 1.5 When last presented for Project Authority approval (17 March 2016 Board) the cost estimate for this project was £555.1m (excluding additional trains). Value Management has been applied reducing the EFC to £392.1m without adversely impacting the capacity to be delivered (see also Appendix 8).
- 1.6 Concept design is now broadly complete and this paper requests the first (of three) tranches of implementation authority. This approach allows critical path items to commence in advance of areas where there is less certainty (see 2.2).

### 2 Proposal

- 2.1 The proposed full scope of NLU2 comprises:
  - (a) provision of five additional train stabling spaces at Morden Depot;
  - (b) provision of a new train depot at Highgate;
  - (c) track upgrade at East Finchley;
  - (d) modifications to signalling systems;
  - (e) power strengthening works at 22 substations and power cable upgrades;
  - (f) minor modifications to existing trains; and
  - (g) maintenance and operating changes.
- 2.2 In order to balance risk, workstream maturity and affordability, all within the context of achieving the overall NLU2 programme timescales, three phases of funding

application are proposed. Phases 2 and 3 will be via annual updates to the Committee in 2018 and 2019 respectively.

2.3 This tranche of £67.9m will include delivery of works to accommodate the additional trains and to upgrade power and track to support them:

- (a) detailed design and implementation of all works at Morden depot and minor signalling modifications (£17.0m);
- (b) completed specifications to support procurement and design development for Highgate Depot (£3.4m);
- (c) upgrade of five substations (where asset condition is assessed as poor and ability to support today's railway is at risk) (£25.3m);
- (d) design of all train modifications (£1.3m);
- (e) development of an train storage solution and Highgate depot enabling works (£7.4m);
- (f) Project Management and Engineering to develop a new signalling specification (£5.6m);
- (g) enabling works at Edgware depot to support train delivery (£0.7m); and
- (h) risk provision of £7.2m.

2.4 Key milestones for the Project are:

Milestone	Target Date
Morden Depot start on site	October 2017
Highgate Existing Depot cleared	May 2019
New Highgate Depot complete	May 2021
East Finchley Scissors complete	February 2022
Morden Signalling Complete	October 2022
Introduction of 30tph Timetable	April 2023

2.5 The top risks are (for the complete NLU2 programme):

Risk No	Risk Description	Mitigation Actions
1	Train modification costs are higher due to more complex scope and interfaces	Early engagement with the contractor to identify cost and complexity of works
2	Train storage solution is not yet confirmed and further works are required to provide options	Early site trials to assess technical options and inform decision based on whole life cost

Risk No	Risk Description	Mitigation Actions
3	Signalling supplier costs may be under-estimated due to pricing uncertainty or changes in scope or requirements	Early supplier engagement
4	Power costs are estimated based on an assumed agreement with UK Power Networks	Early engagement with UK Power Networks and also assessment of alternatives
5	The project may need to undertake out of sequence working to ensure train availability for service is maintained	10 year co-ordination plan combining all significant rolling stock works is being produced to verify proposals and safeguard service availability with appropriate collaboration with Alstom

2.6 The current EFC for NLU2 includes a risk value of £62.0m of which £7.2m is included in the authority request for this tranche.

### 3 Benefits and Value

3.1 The economic appraisal of the NLU2 project is shown below:

Economic Appraisal (all at Present Value)	
Estimated Final Cost, £m	-633
Optimism Bias	-21
Avoided Costs	360
OPEX	-263
<b>TOTAL COSTS</b>	<b>-557</b>
Revenue	345
<b>Net Financial Effect</b>	<b>-211</b>
Total Benefits	1,346
<b>Benefit : Cost Ratio</b>	<b>6.4:1</b>

The Business Case is assessed over the remaining life of the existing trains to the early 2040s.

3.2 The Northern Line is currently constrained by the number of trains and so, with the exception of the Northern Line Train Service Interim Improvement (Appendix 5), no other opportunities exist for early benefit delivery until the additional trains are available.

## 4 Delivery of Preferred Option

- 4.1 Maintenance of the current fleet of 106 Northern Line trains is undertaken by Alstom through the PFI Train Service Contract. The baseline assumption is that a new standalone maintenance facility will be required at Highgate, with LU maintaining the additional trains. An update will be provided at the next annual submission to the Committee.

## 5 Financial Implications

- 5.1 NLU2 will be delivered within the Financial Authority of £392.1m – excluding additional trains. The EFC will be updated as tender prices are received from suppliers and the delivery plan is refined.

- 5.2 Summary of the costs and funding (excluding JNAT):

Costs and Funding (£m)	Prior Years	2017/18	2018/19	2019/20	2020/21	2021/22 to 2023/24	Total
Cost (Outturn)							
Estimated Final Cost	6.7	8.7	33.4	68.8	111.7	162.8	392.1
<b>Investment Funding</b>							
Forecast Budget/Plan	6.6	8.9	36.1	72.0	92.7	175.6	392.1
Current Project Authority	6.6	4.7					11.3
EFC of Current Phase	6.7	3.4					10.1
This Authority Request	0	5.3	30.9	15.2	7.1	9.4	67.9
Future Requests	0	0	2.3	53.6	104.6	153.5	314.0

## 6 Commercial

- 6.1 A Procurement Strategy has been produced for the entire project scope based on value and risk. For Rolling Stock and Signalling modifications the work will be single sourced to the Original Equipment Manufacturer (Alstom and Thales respectively). Power and Enabling works will be via Framework Contractors. East Finchley crossover will be by Track Partnerships. Depot signalling and Highgate Depot (main works) will be tendered.

## 7 Assurance

- 7.1 A TfL Project Assurance (PA) and Independent Investment Programme Advisory Group (IIPAG) Integrated Assurance Review of the NLU2 Project took place in April 2017. No critical issues were identified in either review and the recommendations made are being addressed.

## **Appendix 4 – Jubilee and Northern Line Additional Trains**

### **1 Background**

- 1.1 Trains will be provided for the following two projects:
  - a) Jubilee Line World Class Capacity (JLU2) which will increase the number of trains per hour (tph) on the Jubilee Line from 30tph (current peak service) to up to 36tph peak service by December 2020; and
  - b) Northern Line World Class Capacity (NLU2) which will increase the number of trains per hour on the Northern Line from 24tph (current peak service) to 30tph peak service by 2023.
- 1.2 Procurement and delivery of the additional trains is managed as a separate project which combines the requirements into a joint order to enable economies of scale. Further information about the procurement process is provided in the paper on Part 2 of the agenda.
- 1.3 The proposed order size comprises 172 cars (10 seven car trains for Jubilee and 17 six cars for Northern Line). The additional trains will have the same dimensional characteristics as the current Jubilee/Northern Line trains, but will feature modern subsystems. The Procurement Strategy is based around procurement of an attractive order size and keeping competitive tension between suppliers for as long as possible in order to achieve the best price.
- 1.4 The form of contract to be used is based on that developed for new vehicles for London Overground. Relevant sections have been aligned with those included in the Deep Tube Upgrade Programme contract with specific requirements added for the Northern/Jubilee trains.

### **2 Proposal**

- 2.1 Technical evaluation of the bids is complete and whole life costs evaluation and benchmarking commenced in May. This will conclude with a 'Preferred Bidder' Report in early July 2017 allowing final terms and conditions to be agreed to support award of contracts in September 2017.
- 2.2 Jubilee Line trains will be delivered first as they have the stronger business case and the other enabling assets and infrastructure will be ready first, with the Northern Line trains following.
- 2.3 Details of the tender evaluation process are provided on Part 2 of the agenda.

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## Appendix 5 - Northern Line Train Service Interim Improvement

### 1 Background

- 1.1 The Northern line Upgrade Phase 1 (NLU1) primarily comprised the re-signalling of the Northern line. This reduced inter-station runtimes which, together with an increase in the trains in service, enabled a 20 per cent increase in train frequency. In addition to the introduction of upgraded signalling, a range of infrastructure works were implemented to fully utilise the increased train performance now achieving peak service of 24tph in the Central Area and 30tph on the Morden branch. To allow closure of the project and reallocation of resources, NLU1 was declared complete in 2016 subject to addressing minor agreed defects however, the original service target on the Morden branch was 32tph.
- 1.2 A package of improved train utilisation, further track enhancements, improvements to the braking system, software improvements and strengthening of the power system have been developed to support an increase in train frequency. The peak train service from Morden will be increased to 32tph from April 2019.
- 1.3 This project has previously received initial Project Authority totalling £7.5m to allow infrastructure works to progress in advance of obtaining a firm price for the signalling scope.

### 2 Proposal

- 2.1 It is proposed to continue with the full project scope as follows:
- (a) track works to accommodate higher train speeds;
  - (b) braking improvements;
  - (c) signaling system modifications to support higher capacity service at pinchpoints; and
  - (d) power works to support higher capacity service.

#### Delivery

- 2.2 The track and power workstreams are being delivered by LU and are underway. The enhancement to the signalling system will be delivered as a software upgrade by Thales with an estimated cost of £6m, utilising the existing framework contract with Thales.
- 2.3 Key delivery milestones are as follows:

Milestone	Target Date
Thales Procurement Authority request	August 2017
Completion of power enhancements	January 2018
Completion of all track renewal works	February 2018
Thales software rollout complete	March 2019
<b>Northern line train service uplift</b>	<b>April 2019</b>
Project Completion	July 2019

### 3 Financial Implications

3.1 Project Authority of £7.5m has been previously approved for design works, long lead items and infrastructure works allowing the project to continue to programme prior to a Thales quotation. This paper seeks the remaining Project Authority of £9.3m, which is fully budgeted. The overall EFC is currently £16.9m reflecting a small cost pressure which will be reviewed in the fullness of the Thales quotation.

Costs and Funding	Prior Yrs, £m	2017/18	2018/19	2019/20	2020/21	Future	Total
Cost (Outturn)							
Feasibility and Design	0.5						0.5
Implementation	3.0	10.0	1.8				14.8
Risk		1.3	0.3				1.6
Estimated Final Cost	3.5	11.3	2.1				16.9

Investment Funding							
Budget/Plan	3.5	11.5	1.9				16.8
Plan Surplus/Shortfall	0.0	0.2	-0.2				0
Current Authority	3.5	3.9					7.5
This Authority Request	0.0	7.2	2.1				9.3
Future Requests							0

3.2 Operating cost increases for power, track and train maintenance as a result of greater rolling stock usage and the increased mileage are forecast to increase by £0.5m per annum. The service improvement is expected to generate additional revenue of £2.6m per annum. Both are included in the Business Case and Business Plan.

3.3 The top risks are (for the complete NLU2 programme):

Risk No	Risk Description	Mitigation Actions	Target Cost (£m)
1	Thales estimate inaccurate	Current estimate based on Thales 'Rough Order of Magnitude' which they have confirmed they do not expect to exceed. Formal request for Tender issued	£0.6
2	Rework of software	Review software implementation strategy to confirm that the changes are appropriate. Use of simulator to test	£0.3
3	Signalling scope does not fully meet performance expectation	Use of model to confirm performance outputs at each stage of the design development process	£0.2
4	Additional track works required (more sites)	Confirm scope of finalised track workbank	£0.1

Risk No	Risk Description	Mitigation Actions	Target Cost (£m)
5	Additional track works required (more scope at known sites)	Site surveys to inform number of sleepers to be replaced	£0.1

3.4 The economic appraisal of the project is shown below:

Economic Appraisal (all at Present Value)	
Estimated Final Cost, £m	-17
Optimism Bias	-1
OPEX	-9
<b>TOTAL COSTS</b>	<b>-27</b>
Revenue	47
<b>Net Financial Effect</b>	<b>20</b>
Total Benefits	175
Benefit : Cost Ratio	Financially Positive

## 4 Commercial

4.1 The Procurement Strategy groups the work as follows:

- (a) signalling/Braking System will be undertaken by Thales under the terms of the Capital Project Framework;
- (b) track will be delivered internally with track work labour being supplied via the track work framework agreement after mini competition. Materials will be supplied via existing material frameworks; and
- (c) traction Power Supply will be undertaken by the LU Power and Cooling team with design undertaken in house and contracts awarded for cable and switch installation by using existing frameworks following mini competition.

## 5 Assurance

5.1 An Independent Assurance Review covering the entire project scope was undertaken by Jacobs, as the external expert, in August 2016. Apart from a requirement to clarify the financial authority position (completed via the Business Planning process) there were no critical issues found. A further 'light touch' review is proposed with TfL Project Assurance prior to seeking Procurement Authority in August 2017.

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