Programmes and Investment Committee

Date: **16 May 2018**

Item: **Deep Tube Upgrade Programme – Piccadilly line Upgrade Stage 1: Rolling stock replacement**

This paper will be considered in public

1 Summary

Deep Tube Upgrade Programme (DTUP): Piccadilly line Upgrade Stage 1: Rolling stock replacement
Outputs and Schedule: Procurement of 94 new design trains, with increased capacity and air-cooling to replace the existing, life-expired, Piccadilly line fleet. Infrastructure upgrades and enabling works to support the introduction of the new trains to be delivered between 2023 and 2026. This is the first stage of the Piccadilly line Upgrade which will increase peak capability from 24 to 27 trains per hour before line-wide re-signalling, which will be progressed under Stage 2 of the project, to enable upgrading of services to 33 trains per hour.

1.1 The purpose of this paper is to:

(a) update the Committee on TfL's progress in the evaluation of tenders for new DTUP Rolling Stock;

(b) to seek approval for contract award for a base order for new rolling stock for the Piccadilly Line with options to procure new rolling stock on the Bakerloo, Central and Waterloo & City lines; and

(c) further Programme and Project Authority and Procurement Authority for Stage 1 of the Piccadilly line Upgrade programme.

1.2 A paper is included on the Part 2 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 the meeting.

2 Recommendations

2.1 **The Committee is asked to note the paper and the related paper on Part 2 of the agenda and to:**

(a) approve entering into contracts with the preferred bidder for a Manufacturing and Supply Agreement (MSA) and a Fleet Services Agreement (FSA) in relation to new rolling stock for the Piccadilly line

with options for the Bakerloo, Central and Waterloo & City lines as described in this paper (the Agreements);

(b) approve Programme and Project Authority for the sums set out in the paper on Part 2 of the agenda for the procurement of new rolling stock and enabling works for the introduction of new rolling stock on the Piccadilly line under Stage 1 of the Piccadilly Line Upgrade;

(c) approve Procurement Authority for the MSA and FSA for the sums set out in the paper on Part 2 of the agenda;

(d) subject to Financial Authority being in place, authorise the Chief Finance Officer to approve:

(i) any changes to the Programme and Project Authority and Procurement Authority for the MSA and FSA in value that may be required to reflect any movement in exchange rates applicable to capital expenditure under the MSA between the date of contract valuation and contract execution up to the value set out in the paper on the Part 2 agenda;

(ii) the execution of any agreement reflecting changes resulting from indexation through the life of the FSA;

(e) note that the authorities requested have a duration beyond the end of the current Business Plan and future Business Plans will need to provide for the remaining authorities, as set out in the paper on Part 2 of the agenda; and

(f) note that the exercise of any options in the contract for rolling stock for the Bakerloo, Central and Waterloo & City lines will be subject to further approvals.

3 Background

3.1 The DTUP will modernise four London Underground (LU) lines – the Piccadilly, Bakerloo, Central and Waterloo & City lines (in that order) to increase overall capacity by the renewal of life-expired train systems.

3.2 The DTUP has the following key objectives:

(a) maximising capacity: delivering a 36 per cent increase across four Deep Tube lines;

(b) reducing journey times: through faster and higher frequency train services (up to 33 trains per hour (tph) on the Central and Piccadilly lines);

(c) renewing life-expired assets more efficiently through a multi-line approach;

(d) improving safety and reliability: a step-change in performance through the introduction of modern train and signalling technologies;

(e) enhancing the customer experience: through the introduction of a consistent brand of new air-cooled, fully accessible trains; and

(f) driving down whole-life costs through greater standardisation in system specification, procurement, operations and maintenance.

Strategic Context

3.3 The Mayor's aim for 2041 is for 80 per cent of Londoners' trips to be on foot, by cycle or by using public transport. Consequently, to achieve such a modal shift, TfL's priority in support of the Mayor's Transport Strategy (MTS) is to accelerate the growth of the Tube network and improve the capacity and reliability of its train services. The DTUP will deliver a combined capacity uplift of 36 per cent across the four deep tube lines by 2035.

3.4 Following on from the modernisation of the Victoria, Jubilee, Northern and Sub-Surface lines, the DTUP will form the final phase of LU's current line modernisation programme. The DTUP lines constitute a third of the Underground network and currently carry around two million passengers per day on key corridors linking: the City, the West End, Stratford, Kings Cross/St Pancras and Heathrow Airport.

3.5 The DTUP aims to replace the life-expired rolling stock and signalling and control systems across the four 'Deep Tube' lines. Some of the rolling stock on these lines is approaching 50 years old and replacement with modern, reliable, high performance systems will address asset obsolescence and deteriorating condition, reducing whole-life costs and enabling a step-change in line capacity.

3.6 The replacement of ageing assets on these lines will also transform customer service quality through the introduction of a consistent brand of high capacity, walk-through, air-cooled trains as introduced on the Sub-Surface lines. The new trains, combined with modern signalling control systems and supporting infrastructure, will allow the introduction of high frequency automatic train operation which is already in place on the Central, Jubilee, Northern and Victoria Lines.

3.7 This supports the Mayor's strategic objective of 'providing a good public transport experience'.

3.8 Asset renewals strategies for the four lines are fully aligned to DTUP. Refurbishment and life extension works are underway on the Bakerloo line and Central line trains which will stabilise system performance and reliability until the renewal of trains and signalling on these lines under the DTUP in the late 2020's and early 2030's.

Previous Authority Requests

3.9 In March 2016, the Board approved an increase of £95m in Programme and Project Authority, to a total of £154m, including earlier feasibility phases, to:

(a) commence the procurement process for a new Signalling and Train Control System including preparation and issue of an Invitation to Tender (ITT);

(b) complete the competitive tendering and supplier negotiations for a new fleet of Deep Tube trains;

(c) commence the design and specifications for the procurement of infrastructure and railway systems upgrades on the DTUP lines; and

(d) commence power supply system upgrades and signalling enabling works on the Piccadilly line

3.10 As at April 2018 expenditure incurred against the current authority is £83m.

3.11 Work has also continued on the definition of the overall DTUP scope and requirements with infrastructure analysis and research conducted to further the development of the subsequent line upgrades on the Bakerloo, Central and Waterloo & City lines. The planned sequence of the DTUP (and the percentage line capacity uplifts to be delivered by the programme) is as shown in figure 1.

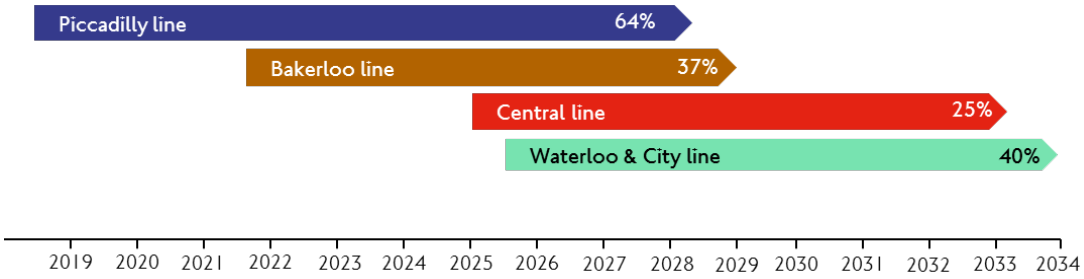

Fig.1: DTUP line upgrade sequence and capability improvements

Piccadilly line Upgrade

3.12 The DTUP delivery will commence with modernisation of the Piccadilly line. The Piccadilly line is the first in the DTUP line sequence in view of its very high levels of demand, ageing rolling stock and signalling assets and inherent line capacity constraints. The line is currently operating at capacity on the busiest sections and an increase in service frequency with higher capacity trains will cater for the forecast expansion of London's population and will support continued economic growth.

3.13 The Piccadilly line provides key transport links between Heathrow Airport, the West End and the North and West of London and carries 207 million customers per annum (11 per cent of total Underground ridership). The combination of the limited fleet size (86 trains) and legacy signalling system design capability currently restricts the peak period service to only 24 trains per hour.

3.14 The existing Piccadilly line '73' Tube Stock trains were introduced from 1975 in conjunction with the extension of services from Hounslow West to Heathrow Airport by 1977. These trains are now one of the oldest train fleets in passenger service in the UK. With a design life of 40 years, the fleet was originally scheduled for replacement by 2014 under the Public Private Partnership (PPP). With the cancellation of the PPP line upgrades, a programme of life-extension and repair works was carried out between 1996 and 2001 to enable these trains to continue to operate safely and reliably until replacement under the DTUP.

3.15 A number of age-related issues have begun to occur on these trains. This is being proactively managed through an inspection and repair regime to maintain train availability. Reliability performance has declined in the last three years and is projected to deteriorate further in the final six to eight years of asset life as it becomes more challenging to sustain reliability and availability whilst addressing an increasing volume of repairs. A similar situation and response was recently undertaken as part of a fleet renewal programme on the Docklands Light Railway.

3.16 If this life-expired fleet is not replaced, further temporary life-extension works will be required throughout the remaining life of the trains to sustain performance. Unpredictable failure modes can also lead to significant and prolonged disruption as large numbers of trains are removed from service for inspection and repair. Obsolescent design and the limited availability of specialist engineering skills can further extend the time required to restore the trains to passenger service.

3.17 Additionally, extensive modifications will be required to enable these trains to achieve compliance with the Rail Vehicle Accessibility Regulations (2009).

3.18 The basis of the DTUP development has been an integrated railway system design to ensure that all requirements and interfaces are defined, effectively specified and managed through delivery. Extensive surveys and system performance modelling have been undertaken to assess the existing Piccadilly line infrastructure and predict the impact of the increased service levels with new, higher performance trains on traction power supplies, platform equipment, air speeds and temperatures in the deep tube stations. This has enabled refinement of scope, requirements and specifications for depots, rolling stock, line-wide infrastructure and station-specific air flow, ventilation and cooling solutions.

4 Proposal

4.1 The DTUP Piccadilly line Upgrade is proposed to be delivered in two key stages to ensure best value and minimise risk:

Stage 1: Initial rolling stock order (94 trains) and enabling works (the subject of this submission);

Stage 2: Line re-signalling and procurement of seven additional trains for higher train service frequency (the subject of a further submission in 2019)

4.2 The first stage of the Piccadilly line upgrade will include design, manufacture and delivery of a base order of 94 new trains which will allow the withdrawal from passenger service of the life-expired ‘73’ Tube Stock fleet. This base order represents an essential renewal of trains already beyond their design life, to ensure continued safety and reliability of services on the Piccadilly line.

4.3 This new generation of trains will be introduced with an operator on board. They will be delivered in the mid-2020s and will be designed to last for at least 40 years. The trains will be designed to be future proof and capable of supporting the latest automatic technology.

4.4 The new trains will enable a progressive increase in service level from the current 24 trains per hour. The increased fleet size will enable an initial timetable increase to 27 trains per hour in late-2026 to expand peak capacity by around a third. Each new train will be slightly longer and have more interior space than

today. They will also feature fully open, walk through, gangways as now in service on the LU sub-surface lines.

4.5 The first stage of the DTUP Piccadilly line Upgrade is proposed to commence with a programme of asset replacement and targeted infrastructure upgrades to enable the introduction of the new rolling stock, with first delivery planned for 2023 and fleet delivery complete by 2026.

4.6 The changeover from old to new rolling stock requires staff training, process changes and enabling works to a wide range of railway assets. Changes to each of these interfaces will be carefully planned to ensure a smooth operational transition from old to new trains whilst continuing to deliver day to day services.

4.7 Infrastructure enabling works are needed on the Piccadilly line and include the upgrading of high voltage traction power supplies, the DC power distribution system, platform CCTV equipment and legacy signalling systems to support new train introduction. The core scope of the Stage 1 project is summarised in Appendix 1.

4.8 Major upgrade works will be carried out at Northfields and Cockfosters depots between 2020 and 2024 in readiness for the delivery of the new trains and the increase in fleet size. The upgrading of the train maintenance depots and the stabling sidings at South Harrow will provide modern facilities for the servicing and stabling of the new trains. These depots were constructed in the early 1930's and the building fabric, plant and equipment will require extensive reconstruction and renewal. This is to provide the environment and facilities required for the maintenance and repair of modern rolling stock for at least the next 40 years.

4.9 The key milestones for the Stage 1 project are as below:

Milestone	Forecast Date
Committee approval	16 May 2018
Rolling stock contracts executed	31 May 2018
First train delivered	August 2023

4.10 If granted, the authorities requested will enable the operation of 27 trains per hour peak services on the Piccadilly line from 2026. Further authority will be sought in late 2019 for Stage 2 of the project to purchase a new line-wide signalling and control system and a minimum of seven additional trains needed to further enhance service levels and enable automatic train operation.

4.11 On completion of the line-wide re-signalling, and with the purchase of seven additional trains (to a total of 101 trains) the Piccadilly line timetable will be progressively uplifted to 33 trains per hour. This will exploit the new signalling, infrastructure and train performance capability.

4.12 The new signalling system will be designed with a capability to allow further timetable enhancements to a maximum of 36 trains per hour – as now being achieved on the Victoria line – to meet expected future demand growth. This

capability will require the purchase of a further eight trains at a later stage (to a maximum fleet size of 109 trains) subject to affordability.

4.13 The MTS also includes proposals to optimise London Underground services in West London. This strategy assumes that on delivery of the DTUP Piccadilly line upgrade, Ealing Broadway will be served by Piccadilly line trains. This will enable increased capacity of at least 25 per cent to be introduced on the busier Richmond and Wimbledon branches of the District line.

5 Benefits and Value

5.1 The forecast demand trend for public transport in London shows continued growth over the next 25 years, as defined in the latest draft London Plan.

5.2 The upgrade of the Piccadilly line will increase peak period capacity in the busiest central area sections by over 60 per cent in stages by the end of the 2020's. The introduction of new trains and signalling will allow a progressive series of uplifts in service frequency as the new signalling system is installed, tested and commissioned. This much-needed extra capacity will equate to 21,000 additional customer spaces per hour in both directions in the peaks.

5.3 The replacement of the life-expired 1970's trains with a new generation of high capacity, walk-through trains will transform the customer environment and enhance journey quality with provision of air-cooling, in-car audio-visual customer information and security systems.

5.4 Following withdrawal, the process for disposal of the existing '73' Tube Stock trains will ensure that any residual economic value from either recycling or re-use of components and materials is fully optimised.

5.5 The new Piccadilly line trains will be the first of a new generation of around 250 Deep Tube trains which will enable optimisation of whole-life costs through greater standardisation of equipment, spares and maintenance facilities. Economies of scale will also be achieved in staff training and deployment in train maintenance and operations through greater commonality in train design, systems and maintenance processes across the four DTUP lines.

5.6 Accessibility will be significantly improved by the new train design which will be fully compliant with the Rail Vehicle Accessibility Regulations (RVAR 2009).

5.7 The key benefits of the full Piccadilly line upgrade are:

(a) higher train capacity through longer, more spacious and accessible rolling stock with enhanced customer environment and security features;

(b) high frequency (capability for 36 trains per hour) services and automatic train operation to enable an overall 64 per cent increase in line peak capacity and enable wider network capacity benefits;

(c) significant reductions in journey times; and

(d) replacement of life-expired rolling stock and signalling assets with modern, highly reliable, energy-efficient systems.

6 Procurement Processes

Rolling Stock

6.1 Following the issue of a pre-qualification Questionnaire in March 2014, five bidders were shortlisted in October 2014 for the procurement and maintenance technical support of the new trains.

6.2 A comprehensive Technical Specification, tender evaluation models and associated procurement documentation for the new rolling stock were completed to allow release of the Invitation to Negotiate (ITN) in January 2016 to the five bidders who pre-qualified.

6.3 During the tender period two of the bidders chose to work together within an unincorporated joint-venture, reducing the short-list of bidders to four (Alstom, Bombardier/Hitachi JV, CAF, Siemens). CAF subsequently declined to submit a bid, and three bids were received in September 2016.

6.4 The DTUP rolling stock procurement is for a Manufacture Supply Agreement (MSA) for new train fleets, and a Fleet Services Agreement (FSA) for whole-life technical support by the manufacturer. Upon awarding the MSA for the Piccadilly line trains TfL will also commit to the Piccadilly Line FSA. The FSA is intended to ensure that the high level of reliability expected of the new trains is sustained through the provision of spares and technical expertise to the in-house LU fleet maintenance team.

6.5 The MSA and FSA include options for new rolling stock for the Bakerloo, Central and Waterloo and City lines which are exercisable at TfL's discretion.

6.6 In undertaking the tendering and evaluation process DTUP has adhered to the procurement strategy and tender evaluation criteria as approved in 2015, prior to the issue of the ITN, following assurance reviews by External Experts and IIPAG. The tender evaluation criteria were based upon a whole life cost and benefit approach to ensure TfL obtained the optimum value for money across the asset life.

6.7 The tender evaluation captured carbon emission costs resulting from the estimated energy usage of each bidder's train in operational service. It also included the cost of carbon emissions estimated to result from energy usage by infrastructure cooling schemes needed to deal with different levels of heat generated in tunnels from each bid train design.

6.8 The evaluation follows approved HM Treasury 'Green Book' methodology to monetise the cost of carbon for each bidder.

6.9 The basis for tender evaluation was 'Most Economically Advantageous Tender' which was defined in the Instructions to Bidder (ITB) through detailed criteria and requirements. Tender evaluation was conducted in a number of stages:

Stage 1	Mandatory requirements
Stage 2	Technical compliance
Stage 3	Project deliverability
Stage 4a	Contract compliance

Stage 4b Whole life cost and benefits

6.10 The Most Economically Advantageous Tender is the tender which obtained the highest 'Net Present Value' (NPV) score (at Stage 4b), having first passed Stage 1 and obtained at least the threshold scores for Stages 2,3 and 4a.

6.11 The DTUP rolling stock procurement has now concluded following the evaluation of tenders and recommendation of a preferred bidder. The award of a contract for the supply of the new trains is planned for late-May 2018. Further detail on the procurement process is set out in the paper included on Part 2 of the agenda.

Signalling and Train Control

6.12 The procurement process for the DTUP Signalling and Train Control system has also commenced. Following the issue of an OJEU notice in March 2016, three potential suppliers have been shortlisted to proceed to the tendering stage. An Invitation to Negotiate was released in April 2018 with tenders scheduled for return in Autumn 2018.

7 Financial Impact

7.1 The DTUP programme has a current Programme and Project Authority of £154m for the current procurement and preparatory phase.

7.2 The TfL Business Plan approved in December 2017 includes funding of £1,549m to 2022/23 for the DTUP Programme, which includes the start of the Piccadilly line Upgrade, including replacement of the '73' Tube Stock fleet.

7.3 Full details of the estimated final cost (EFC) of the Piccadilly line upgrade and the Programme and Project Authority being requested for Stage 1 of the project are contained in the paper in Part 2.

8 Benchmarking and Lessons Learned

8.1 Extensive benchmarking and lessons learned studies have been undertaken in the development and procurement of the new DTUP rolling stock.

8.2 The DTUP rolling stock procurement has incorporated lessons learned from recent train contracts. It has been based on a standard contract type from the recent Crossrail and London Overground train procurements.

8.3 Sharing of lessons learned has also taken place across a range of disciplines from recent upgrades on the Victoria Line, Jubilee Line and the current Four Lines Modernisation programme (4LM). This has been aided by the previous involvement of DTUP team members in these programmes.

8.4 Industry benchmarking studies have been used in the preparation of the DTUP rolling stock cost estimates using data from the procurement of trains worldwide.

9 Assurance Reviews

9.1 DTUP has been subject to a series of annual Integrated Assurance Reviews (IARs) during programme development. An IAR was held in March 2018 with a focus on the Piccadilly line Upgrade Stage 1 authority request. The IAR review concluded that there are no critical issues. A management response to the

recommendations has been provided and all recommendations have been accepted as detailed in the management response.

9.2 A Rolling Stock Contract Award Integrated Assurance Review (IAR) was also undertaken by TfL Project Assurance, External Experts Jacobs UK Ltd. and the Independent Investment Programme Assurance Group. This review identified no critical issues and concluded that the project is in a good position to proceed to the next stage.

9.3 An independent external review of the DTUP cost estimate was completed during January 2018. This has validated the estimate assumptions used for the new rolling stock and confirms that estimates for high-value infrastructure elements are appropriate for their current state of maturity.

List of appendices to this report:

Appendix 1: Stage 1 Authority: Core scope summary

Appendix 2: Rolling Stock Tender Evaluation Stages Summary

Exempt supplementary information is included in a paper on Part 2 of the agenda.

List of background papers:

IIPAG and TfL Assurance reports, with management responses

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Appendix 1: Piccadilly line Upgrade: Stage 1 – Core Scope summary

(i) New Rolling Stock

A new fleet of 94 high performance, higher capacity trains will be procured to replace the existing Piccadilly line fleet and support a 27 trains per hour peak service prior to the completion of line-wide re-signalling.

The new train design will be six metres longer than the existing trains to maximise the use of the available platform space throughout the line. This increase in train length, along with a more spacious train interior layout will provide an additional 19 per cent passenger capacity per train.

The new trains will be fully accessible and will feature walk-through interiors with inter-car gangways. Features will include: saloon air-cooling for the first time on a deep tube train, all double-doors to improve boarding and alighting, modern audio/visual communications and customer information systems.

The modern train design, equipment and sub-systems will significantly improve service reliability. The new train specification requires an average fleet reliability of 120,000km Mean Distance Between Service Affecting Failures (MDBSAF) to be achieved following an initial period of post-delivery reliability growth. The existing fleet currently achieves an average of 32,000 MDBSAF.

The work stream spans the design, manufacture, supply, testing, commissioning, integration and delivery of new trains and equipment. In addition, the scope will include delivery of cab training simulators, spares, special tools and a saloon mock-up for customer engagement.

Provisions exist within the new trains contract for the procurement of additional trains as required to meet rising demand. A fleet of 101 trains will be needed to support a further timetable uplift to 33 trains per hour following re-signalling, and a maximum of 109 trains will be required to fully exploit the new signalling capability of 36 trains per hour.

(ii) Legacy Signalling Enabling works

The introduction of the new rolling stock and its initial operation under the control of the existing signalling system will require works at all Piccadilly line locations. This is needed to re-position train stopping marks, ensure visibility of line side signals and upgrade platform CCTV equipment.

Modifications will also be necessary to existing signalling track circuits. This is to ensure electro-magnetic compatibility between the legacy signalling system and the new rolling stock. This will eliminate the potential for system interference with the train-borne traction control equipment.

(iii) Power Supply - DC Electrical Track Equipment

Upgrades are required to the DC traction power system to provide the increased capacity needed to support the introduction of the new rolling stock. Switches and feeder cables will be uprated for compatibility with a 750V, 4500A system and existing earthing systems will be assessed and upgraded.

(iv) Power Supply – High Voltage Systems and Distribution

Upgrade works are required at the High Voltage (11kV) power sub-stations to provide the increased traction power capacity required by the new trains, signalling and upgraded depots to enable higher frequency services. Upgrading of the sub-station plant includes transformer rectifier and switchboard replacements.

Switchgear and coupling transformers will also be upgraded at three primary 22kV distribution sites and a further three sub-stations will be modified to support signalling track circuit immunisation. In addition to the sub-station upgrades, new High Voltage distribution cabling will also be installed.

A new substation will be required to support the expanded stabling facilities at South Harrow and a new Transformer Room will be provided at Boston Manor.

(v) Depots and Stabling Facilities

Major upgrades and remodelling of track layouts will be undertaken at Cockfosters and Northfields depots. This is needed to increase stabling capacity and provide modern train maintenance, repair and cleaning facilities to support the new rolling stock. The works include track replacement, infrastructure and power supply renewal and the design and construction of the new train maintenance and servicing facilities.

Additionally, train stabling facilities at South Harrow will be upgraded and expanded to provide additional stabling capacity for the increased Piccadilly line fleet size. Limited works will also be carried out at Uxbridge and Arnos Grove sidings.

(vi) Track

Track upgrade and renewal schemes are required to improve track quality and geometry to support the introduction of the new rolling stock. Localised improvements will enable higher speeds and support the planned increase in service frequency and performance.

Design and installation work is required for new low loss composite conductor rail as part of the traction power supply upgrade solution. The new design of conductor rail (now in use on other upgraded LU lines) will support the introduction of the new trains and enable regenerative braking to maximise energy efficiency.

The installation of upgraded train arrestors and buffer faces is required at terminal locations to ensure compatibility with the new rolling stock. Detailed survey, design and enabling works will also be progressed prior to implementation of track remodelling schemes at Cockfosters, Chiswick Park, Northfields and South Harrow. This will be required to support the new Signalling and Train Control System.

(vii) Platform-Train Interface (PTI)

Localised platform modifications will be carried out at ‘Step Free’ stations on the Piccadilly line to provide level access to the new trains at Rail Vehicle Accessibility Regulations-designated doorway positions.

The One Person Operation Closed Circuit TV (OPO CCTV) system will be upgraded to provide real-time images of the Platform-Train Interface (PTI) for display on the platform or in the train cab. High quality visual information allows the train operator to mitigate any PTI risks and ensure the safe departure of the train from the platform in all driving modes.

(viii) New Signalling and Train Control System

The Stage 1 project will include the continuation of the procurement process for the new Piccadilly line Signalling and Train Control system. An Invitation to Negotiate was issued to shortlisted suppliers in April 2018. Following the evaluation of Tender responses and selection of a single preferred bidder, the project will proceed into a second Tender Validation Stage in 2019.

(ix) Programme Management

The above programme deliverables will be enabled through the resourcing of a programme management team which will provide essential project controls, estimating, assurance, safety management and reporting functions as well as project management and engineering resources for delivery of the line upgrade work streams.

This authority submission includes the DTUP programme management and engineering resource inputs required for the further development of the Bakerloo, Central and Waterloo & City line upgrades. This includes the necessary surveys, requirements development and specification preparation which must be commenced during the Piccadilly line upgrade to ensure continuity of supply for the follow-on orders for new rolling stock and signalling systems.

Appendix 2: Rolling Stock Tender Evaluation Stages Summary

Stage 1 – General Review and Mandatory Requirements

(i) TfL's review of each proposal at Stage 1 involved three elements, assessing completeness, qualifications and compliance with mandatory requirements:

(ii) TfL reviewed each proposal to ascertain its completeness and checked that it fully complies with the ITN requirements.

(iii) TfL reviewed each proposal to identify any qualifications therein. Proposals, which contained qualifications, may have been, at LU's discretion, rejected. In exercising such discretion LU will have regard to the number and/or materiality of any qualifications. Provided that a proposal is not rejected at Stages 1 to 3, any qualifications that remain in the proposal will be evaluated and scored as set out in Stage 4A.

(iv) TfL reviewed each proposal to ascertain compliance with the mandatory requirements. The mandatory requirements were comprised of seven procurement/commercial requirements and nine technical specification requirements relating to: wide-open gangways, saloon cooling, floor height, wheel rail interface, and seating dimensions.

(v) Any proposal that did not meet the mandatory requirements during Stage 1 was not evaluated further.

Stage 2 – Technical compliance and maintainability evaluation

(vi) Those proposals which progress past Stage 1 were evaluated further, taking account of the quality of the technical and maintenance proposals.

(vii) Compliance against the technical specification involves weighted scoring of the bid against each requirement, based on the response and evidence provided to support it. Bids could have been excluded if they failed to meet threshold scores for each sub-sub-criteria, sub-criteria or overall score.

(viii) For maintainability the bidders' maintenance plans were assessed and a score awarded to proposals that demonstrated the continued achievement of the performance, reliability and availability requirements throughout the design life of the rolling stock. This assessment considered the practicality and deliverability of the maintenance proposals, including the cost and availability of spares, when reviewed against the physical and operational constraints of the relevant line.

(ix) Any proposal that was rejected during Stage 2 was not evaluated further.

Stage 3 – Project Deliverability

(x) Proposals which progressed past Stage 2 were evaluated further, taking account of the quality of the deliverability proposals.

(xi) This evaluation stage was based on detailed weighted scoring of the bid management plans and project programmes, to determine whether the plans provide confidence that they will support successful delivery of the requirements,

essentially testing the capability of the suppliers to deliver the rolling stock to the required quality, cost and programme.

(xii) Any proposal that was rejected during Stage 3 was not evaluated further.

Stage 4A – Contractual Compliance

(xiii) Proposals which progressed past Stage 3 were evaluated further, taking account of any contract qualifications proposed. These were used to assess the extent to which the bidders were proposing changes to the contract terms, and the impact on legal and/or commercial risk allocation of those changes.

(xiv) Any proposal that was rejected during Stage 4A was not evaluated further.

Stage 4B - Whole Life Costs and Benefits and Contractual Compliance

(xv) Those proposals which pass Stages 1 to 4A proceeded to Stage 4b of the evaluation which assesses the Total Commercial Score of the proposals. This score is based on a Whole Life Cost and Benefit (WLC&B) Assessment as described below.

(xvi) To facilitate an overall optimisation TfL constructed an evaluation model with fixed valuation of the features of the train which TfL are best placed to assess (e.g. the effect of door width on boarding and alighting rates) and allows the bidders to vary the inputs which they are best placed to assess (e.g. the effect of door width on door opening and closing times). This model builds on prior experience in evaluating performance/benefit requirements for rolling stock procurements (e.g. Victoria Line Upgrade 09 Tube Stock, Thameslink new trains) and whole life cost evaluation deployed on Crossrail.

(xvii) The WLC&B evaluation produces an overall economic assessment of the bid in Net Present Value (NPV), across all four lines. The bidder who successfully passed stages 1-4A of the evaluation process, and achieved the highest NPV score in Stage 4B is the preferred bidder.