

**Date: 5 October 2023**

**Item: Piccadilly Line Upgrade - Stage 1 Progress Update**

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**This paper will be considered in public**

**1 Summary**

- 1.1 This paper updates the Committee on delivery progress of Stage 1 of the London Underground (LU) Piccadilly line Upgrade (PLU). This follows the project's authorisation in May 2018, and the previous annual update in October 2022.
- 1.2 Supplementary information is included in Part 2 of the agenda for Members. This information is exempt and is therefore not for publication to the public or press by virtue of paragraph 3 of Schedule 12A of the Local Government Act 1972, in that it contains information relating to the business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.

**2 Recommendation**

- 2.1 **The Committee is asked to note the paper and the exempt supplementary information on Part 2 of the agenda.**

**3 Background**

- 3.1 The Piccadilly line contributes more than 10 per cent of LU's total ridership and provides key transport links between north and west London, serving Heathrow Airport, the West End and St Pancras International station.
- 3.2 Prior to the coronavirus pandemic, significant crowding was already prevalent on the Piccadilly line due to the capacity constraints of the existing trains and signalling. With Tube demand now recovering, peak crowding is returning to pre-pandemic levels and is expected to increase further as population and employment grow with economic recovery.
- 3.3 The PLU is core to the Mayor's Transport Strategy, enabling increased public transport capacity, more environmentally-friendly services that contribute to carbon reduction, and a more pleasant customer experience – which will contribute to mode shift. PLU Stage 1 and the (currently unfunded) Stage 2 signalling upgrade will enable wider economic growth, both in London and across the UK through the supply chain.
- 3.4 Upgrading the Piccadilly line is a priority for us due to very high levels of historical and projected demand, the age and condition of the existing rolling stock, and the inherent capacity constraints of the existing signalling system and limited fleet size. The existing rolling stock fleet on the Piccadilly line was introduced in the mid-1970s and is now over 45 years old.

- 3.5 The PLU aims to replace the life-expired trains and signalling systems, as well as maximise capacity on the Piccadilly line to meet existing and future demand. The PLU is scheduled to be delivered in two key stages:
- (a) **Stage 1** – Infrastructure upgrades and enabling works to support the introduction of 94 new trains to replace the existing rolling stock fleet; and
  - (b) **Stage 2** – Replacement of the existing signalling system and procurement of up to 18 additional trains to enable higher frequency services with highly reliable automatic train operation. Currently unfunded.
- 3.6 In May 2018, the Committee approved:
- (a) Programme and Project Authority of £3,294m for the procurement of new rolling stock and associated infrastructure enabling works for the introduction of new trains on the Piccadilly line; and
  - (b) Procurement Authority of £1,657m for the award of a contract for the design, manufacture, and supply of 94 new Piccadilly line trains to Siemens Mobility Limited (SML) with a Fleet Services Agreement for whole life maintenance support.
- 3.7 In July 2021, the overall Programme and Project Authority was reduced by £300m, from £3,294m to a total of £2,994m to reflect the progressive maturity of the scope and design for Stage 1 of the PLU since May 2018.
- 3.8 During 2020/21 the TfL Business Plan and Budget experienced severe financial pressure following the impact the coronavirus pandemic on ridership and revenues. This disruption had impacts on the delivery of PLU Stage 1 and the schedule for introduction of the new trains. The introduction of ‘lockdown’ restrictions severely disrupted the continuity and availability of our resources and supply chain resources, restricting physical progress across our capital delivery programme. For the Piccadilly line Upgrade, while the trains contract was able to deliver to schedule, the planned commencement of LU infrastructure upgrading and enabling works was deferred by six months.
- 3.9 As previously reported to the Committee in October 2022, delivery of the PLU continues to be challenging. Significant unforeseen inflationary and supply market pressures have emerged which are driving both schedule and cost pressures in the delivery of the infrastructure enabling works required for the operation and maintenance of new trains. Despite these challenges, the introduction of the new trains to service remains on target for 2025.
- 3.10 This paper provides a summary of progress achieved since October 2022 and the measures being pursued to reduce the schedule risks for train introduction.

## 4 Progress update and challenges

- 4.1 Since the previous report in October 2022, the PLU and our supply chain partners have made good progress towards delivery of Stage 1 of the PLU. Enabling works are advancing across the Piccadilly line to prepare the railway infrastructure and systems for the testing and introduction of the new trains to passenger service in 2025.

- 4.2 Key achievements include the completion of the first of the new trains manufactured by Siemens Mobility Limited in Vienna (Appendix 1, Figures 1 and 2); the commissioning of upgraded and expanded train stabling facilities at South Harrow (Appendix 1, Figures 3 and 4) and the design and installation of infrastructure enabling works across the Piccadilly line.

### **New Trains**

- 4.3 The new, higher capacity Siemens trains will be accessible and feature walk-through interiors, saloon air-conditioning (for the first time on a deep Tube train) and all-double doorways to improve boarding and alighting. Modern audio/visual communication systems will include digital display screens for real time customer information and advertising, a new CCTV system for the train operator to view the platform and train interface from the driving cab, and improved customer security cameras.
- 4.4 The manufacturing contract with Siemens Mobility Limited is progressing well, with the assembly and formation of the first complete train in Vienna during spring 2023. The first fully assembled train has been transferred to Siemens' Test and Validation Centre in Westphalia, Germany where it is undergoing a programme of testing and pre-delivery performance and reliability proving prior to series production.
- 4.5 Despite the delivery schedule challenges to the enabling works, the Programme currently remains on target to receive the first train in London for system testing on the Piccadilly line in summer 2024.
- 4.6 Siemens' c.£200m UK train manufacturing facility in Goole, East Yorkshire has been completed and will be opened in November 2023. This facility is creating an estimated 700 skilled jobs. It has also enabled an estimated 250 jobs during construction and up to 1,700 indirectly in the supply chain. The new UK rail manufacturing facility will support around 80 graduates and apprentices and will be complemented by an Innovation campus for rail industry research and development. It is expected that approximately 50 per cent of the new Piccadilly line trains will be assembled at the new UK facility in Goole.

### **Infrastructure enabling**

- 4.7 The first major work packages have commenced under the PLU High Voltage (HV) Power framework. Design and delivery of the critical sub-station equipment and distribution network upgrades required to support new train introduction commenced in spring 2023.
- 4.8 Surveys and design work are progressing to provide additional HV power system capacity at Sudbury Hill, Hyde Park Corner and Leicester Square sub-stations. Similar works at Northfields and Cockfosters have also commenced to support the upgrades to the train maintenance depots and the expansion of stabling facilities.
- 4.9 Enabling works are also underway at Manor House and Cobourg Street sub-stations in readiness for new HV equipment installation. Procurement of further batches of power system upgrade works within the supply framework has also commenced.

- 4.10 The existing Piccadilly line signalling system is being modified to ensure compatibility with the new trains. The repositioning of lineside signals and installation of additional signal indicators to ensure visibility from the new, longer trains is now 25 per cent complete. Additionally, track circuits for train detection are being replaced and immunisation work undertaken between South Harrow and North Ealing to ensure the existing safety signalling system is not affected by electro-magnetic interference (EMI) generated by the new trains. This work is now 75 per cent complete.
- 4.11 Surveys and designs are underway for the line-wide platform modifications that are needed for compatibility with the new train design and to provide level access at designated doorway positions to meet Rail Vehicle Accessibility Regulations (RVAR) requirements.
- 4.12 System development of digital software and train-borne equipment is progressing for the new One Person Operation Closed Circuit TV (OPO CCTV) system. Station system design and installation works are underway across the Piccadilly line, including the provision of new equipment rooms. This system will improve safety through transmission of high-quality digital images of the Platform-Train Interface (PTI) to both the train operator and the line control centre to ensure the safe departure of the train from the platform.

### **Depots and Stabling**

- 4.13 Following a complex and challenging construction programme, the expanded train stabling facilities at South Harrow were successfully commissioned into timetabled service in May 2023. This upgrade has transformed the site from its original six train capacity to 12 longer sidings, with new staff access walkways and platforms to accommodate the new rolling stock and increase overall stabling capacity on the line.
- 4.14 The first stage of the train maintenance depot upgrades at Northfields and Cockfosters has commenced, with the construction of three new sidings to the west of Northfields station. This will augment stabling capacity on the line and facilitate the extensive upgrade works to train maintenance facilities at Northfields depot, for which supply chain procurement is underway.
- 4.15 Following extensive site clearance, work is underway at Cockfosters depot to provide a new wheel turning facility for the new trains. This new construction forms the first stage of the upgrade works for the depot to provide the maintenance, servicing and stabling facilities needed for the new fleet.

### **Operational Readiness**

- 4.16 Planning for the readiness of frontline operations and maintenance teams to support the new train introduction is now well advanced. Staff training plans are rapidly maturing in line with timescales for bringing the first new trains into service. The first driving cab simulator for the trains has been built and the Operational Readiness team is currently supporting its off-site functional testing programme prior to delivery to the Piccadilly line and the commencement of Train Operator training.

4.17 Maintenance Readiness planning is underway with Siemens. Plans are being refined to ensure that maintenance facilities and equipment required for planned and casualty maintenance activities are available at each stage of the migration from existing to new trains. This planning work includes the new train rollout strategy for service introduction and inputs to the end-state facilities design for Northfields and Cockfosters depots.

### **Delivery Challenges**

4.18 Since October 2022 the Committee has been updated on the challenges facing the Programme. While significant effort is focused on mitigating cost increases, there are several factors that could result in an extension of the Programme, coupled with an increase to the Estimated Final Cost (EFC).

4.19 The key challenges faced are:

- (a) the complexity of the programme of works to upgrade the train maintenance depots during the migration from the existing to the new fleet and the need for clarity of requirements at each stage of delivery;
- (b) the interdependencies between delivery schedules for sub-programmes, including trains, depots, and infrastructure systems;
- (c) the need to commence integration testing of the railway with the first new trains before all infrastructure is forecast to be ready across the whole line; and
- (d) the reliance on the availability and retention of specialist resources.

4.20 Access to the railway will be required to complete infrastructure works and enable system integration testing. Closure planning across the network is challenging, with competing demands from other major projects and the LU Renewals programme to be balanced against the need to maintain services, including Night Tube.

## **5 Benefits and Value**

5.1 As reported in October 2022, Stage 1 of the PLU will deliver essential asset renewals with the replacement of the life-expired Piccadilly line trains, enabling the following key benefits:

- (a) longer, more spacious and fully accessible walk-through trains;
- (b) an uplift of peak services from 24 trains per hour (tph) to 27tph, with the increased fleet size, to achieve a 23 per cent overall increase in peak service capacity from current levels;
- (c) improved service performance and very high levels of reliability from modern rolling stock and sub-systems;
- (d) a greatly enhanced customer experience through the introduction of on-train air-conditioning, improved customer information and security systems; and
- (e) improved energy efficiency, reducing annual energy consumption by more than 20 per cent compared with today's Piccadilly line service, enabling

decarbonisation.

- 5.2 As authorised in May 2018, the business case for Stage 1 implementation, relative to the 'Do Minimum' base, had a Benefit-Cost Ratio (BCR) of 5.3:1.
- 5.3 Stage 2 of the PLU, if funded in future, will deliver further service enhancements through a line-wide signalling upgrade, including:
- (a) significant reductions in customer journey times;
  - (b) improved service reliability through automatic train operation; and
  - (c) fleet and signalling capability for a peak service of up to 36 tph in the central area – as now achieved on the Victoria line - to deliver a 64 per cent overall increase in peak capacity from today's service.
- 5.4 The Piccadilly line is one of London's most important lines for leisure travel which has seen the strongest growth in recent years. Passenger demand is currently approaching pre-pandemic levels, particularly at weekends and continued growth is expected. This reflects the key destinations served by the Piccadilly line including the West End and the busy interchange at King's Cross St Pancras.
- 5.5 Since October 2022, we have updated our public transport demand models to reflect latest projections of travel across the network to 2041. A range of uncertainty has been retained to inform forecasting and two demand scenarios have been used to assess the possible changes to the nature of travel, in terms of origin/destination patterns, trip lengths and trip timing.
- 5.6 Further modelling work is currently underway to process these projections of demand and update the customer benefits from the planned Piccadilly line train service enhancements. The results of this analysis, and other refinements to the business case will be included in the next update to the Committee.
- 5.7 As the latest demand scenarios do not differ significantly from those used in the October 2022 update, the PLU business case has been refreshed using the 2022 demand data, with the latest (Period 5, 2023/24) cost forecast.
- 5.8 Using the higher demand scenario, the business case for Stage 1 shows an overall BCR of 6.15:1 and a Net Present Value (NPV) of £2,447m. For the lower or 'Hybrid' demand scenario, the refreshed analysis shows a reduced BCR of 4.57:1 for Stage 1 and a Net Present Value of £2,137m. These results confirm the continued robustness of the PLU Stage 1 business case.

## **6 Assurance**

- 6.1 TfL Project Assurance (PA) and Independent Investment Programme Advisory Group (IIPAG) have assured the PLU Programme via continuous assurance on an ongoing real-time basis. They have received detailed briefings from the project team on the issues and challenges facing the Programme.
- 6.2 In addition, PA and IIPAG have undertaken a targeted assurance review to support this submission to the Committee. A number of general recommendations for improvement have been raised, including four critical issues. These relate to

the further planning needed to achieve a robust schedule and EFC baseline for the integrated programme, the availability of line closures to support the delivery of infrastructure works to be finalised, and the management of the interface between the new trains and track during and after migration.

- 6.3 Recommendations and critical issues have been accepted by the team and will be actioned accordingly.

**List of appendices to this report:**

Appendix 1: New Siemens trains and PLU delivery progress

A paper containing exempt supplementary information is included on Part 2 of the agenda.

**List of Background Papers:**

Independent Investment Programme Advisory Group (IIPAG) Report and Management Response

TfL Project Assurance Report and Management Response

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## Appendix 1: New Siemens trains and PLU delivery progress

**Figure 1: Siemens 24 Tube Stock:**

*First production train at Siemens Vienna facility – August 2023*



**Figure 2: Siemens 24 Tube Stock:**

*First production train in Vienna prior to delivery to the Siemens test track facility in Germany – August 2023*





## South Harrow Sidings Upgrade

**Figure 3:** Site construction work Feb 2023 – first four siding roads and access walkways in use and final preparations for commissioning all 12 stabling sidings.



**Figure 4:** All 12 new stabling sidings brought into use, May 2023

