

Date: 20 July 2022

Item: London Underground Four Lines Modernisation Programme

This paper will be considered in public

1 Summary

- 1.1 The purpose of this paper is to update the Committee with progress on the delivery of the London Underground (LU) Four Lines Modernisation (4LM) Programme.
- 1.2 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 the meeting.
- 1.3 Financial Authority is currently provided through the two-year Budget for 2022/23 and 2023/24, approved by the Board in March 2022. The current funding agreement with Government expires on 13 July 2022.

2 Recommendations

- 2.1 **The Committee is asked to note the paper and the exempt supplemental information on Part 2 of the agenda and:**
 - (a) **approve additional unbudgeted Programme and Project Authority for the sum set out in the paper on Part 2 of the agenda; and**
 - (b) **note that the matters for which Authority is sought above extend beyond the period of the 2022/23 Budget and provision will, therefore, need to be made for them in future Budgets.**

3 Background

- 3.1 The LU Sub-surface Railway (SSR) consists of four lines – the Metropolitan, District, Hammersmith & City and Circle lines. Pre-pandemic, the four lines carried 1.3 million passengers per day, which represented a quarter of overall LU ridership.
- 3.2 The 4LM Programme is in the process of replacing, modernising and integrating life-expired assets (Signalling, Rolling Stock, Track, Power and Depots) on the SSR. This will add capacity (through improved train frequency when demand sufficiently recovers) and improve journey time. The 4LM Programme is the largest single upgrade in the history of the network. Due to its scale and interoperation with other LU lines, Train Operating Companies and Network Rail, it has a high level of complexity. Although we already have Automatic Train

Control on the Victoria, Jubilee, Northern and Central lines on the LU network, the scale and complexity of upgrading the four lines of the SSR in one programme is a global first and will transform the overall experience for our customers.

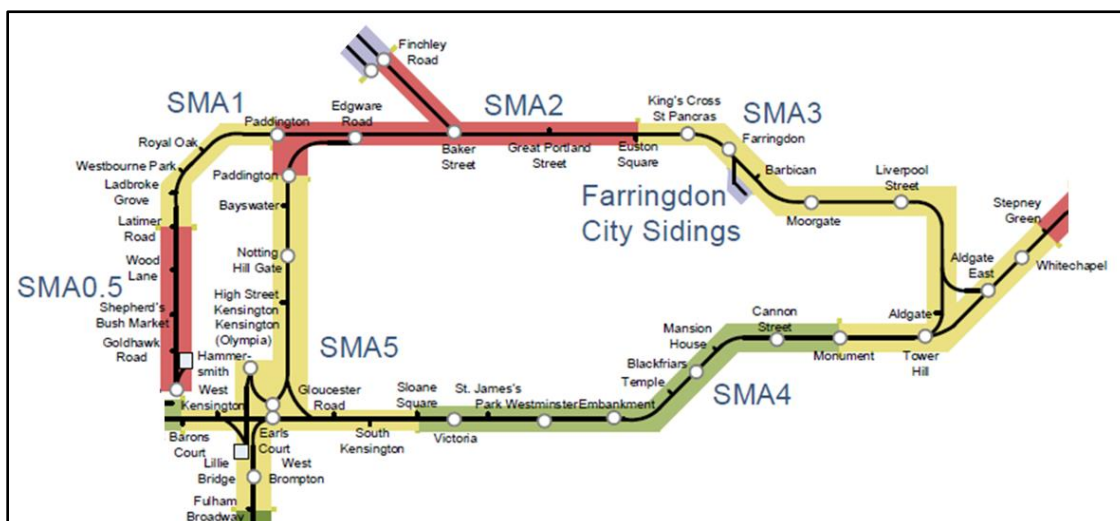
- 3.3 The renewal of life- expired assets is essential to ensure we have a reliable asset base which can be maintained at an affordable cost. Future demand and operational costs will determine the higher frequency timetable introduction dates once the capability the new signalling delivers is commissioned.
- 3.4 In July 2015 the Board approved Programme and Project Authority of £5.4bn to undertake the Programme. A subsequent request to increase Programme and Project Authority was approved by the Committee in July 2021. The Programme consists of 192 new trains, infrastructure changes, upgrades to three depots which will maintain the trains and new signalling (and associated signalling works). With the full introduction of the new fully walk through, air-conditioned trains in 2016, most of the work is now complete except for the signalling works.
- 3.5 A contract was awarded in July 2015 to Thales Rail Signalling Solutions to signal the SSR with an automatic, modern signalling system. Given the scale of the programme, the SSR has been split into sections (known as Signal Migration Areas or SMAs) for the purpose of introducing the new signalling system. Work is well advanced in the design and installation of the new signalling system and the delivery of the supporting infrastructure.
- 3.6 As reported to the Committee in July 2021 while the infrastructure works have made good progress a combination of factors (linked to software development, installation and subsequent impact of the coronavirus pandemic) has delayed the signalling. An extensive review of cost and time has been undertaken which has informed the requested change in Programme and Project Authority. A further update will be provided to the Committee when high risk development of software on the interoperable sections of the Metropolitan line has been progressed.

4 Project Update and Challenges

Signalling Go-Live

- 4.1 The section of signalling, between Sloane Square, Paddington, Fulham Broadway and Barons Court (SMA5) went live on 27 March 2022. Completion of SMA5 represented a major achievement for the programme as it involved upgrading the highly complex junction at Earl's Court and completing the implementation of Communication Based Train Control (CBTC) across the central area of the sub surface lines including the entire Circle line.
- 4.2 The area now operating under the new signalling contains 42 stations and four complex junctions. By means of comparison, the Jubilee Line has 27 stations.

Figure 1: map showing sections of the SSR now operating with ATC



Programme

- 4.3 As previously reported to the Committee in July 2021, the 4LM Programme has been under pressure and, in common with other TfL projects, it was delayed further in 2020 due to the impacts of the coronavirus pandemic. This included a safe stop from March to June 2020. The project restarted in phases from June 2020.
- 4.4 Software development continues for future signalling migration areas covering the eastern end of the District line (SMA6 and 7) and the Metropolitan line between Finchley Road and Preston Road (SMA8), including the interface with Neasden Depot and the Jubilee line.
- 4.5 Since commissioning SMA5 in March 2022, the underlying system performance has been good, but a specific software issue required fixing. To introduce further improvements to the existing sections in service, an additional software update will be implemented in November 2022 prior to the next SMA going live. Our schedule for future signal migration areas going live has therefore been reviewed and we now expect SMA6 and SMA7 (both covering the eastern end of the District line) to go live in the first quarter of 2023. The final section of signalling, SMA14 (Rayners Lane to Uxbridge), is expected to go live between spring and autumn 2025.
- 4.6 Since our last update to the Board in July 2021 the Programme has successfully delivered journey time improvements of up to ten per cent on the north side of the Circle line through a timetable change in September 2021 (this improvement was originally planned for May 2021, when the project was authorised in 2015). As an example, this means a journey between Paddington and Moorgate is reduced by two minutes. Aside from the introduction of the new trains, this is the first key benefit to be delivered for our customers, utilising the capability of the new signalling system.
- 4.7 The successful commissioning of the SMA5 area in March 2022 allows a new timetable to be introduced in September 2022 which will make improvements to customer journey times in a wider area. At this time the entire Circle line will benefit from the improved journey times the new signalling enables. This will enable a journey time timetable improvement (average 5 per cent quicker) to be

implemented on the Circle and District lines between Monument, Fulham Broadway, Barons Court and Paddington. As an example, this means a journey between Barons Court and Monument will be reduced by over a minute.

- 4.8 This timetable was not part of our plans in 2015. However, due to the reduction in ridership and the need to carefully manage the operating costs associated with timetable enhancements a decision was made to improve journey times without any uplift to the trains per hour.
- 4.9 Subject to the same evaluation of the balance between demand and operating costs the implementation date of the 30 trains per hour (tph) timetable and subsequent frequency uplifts remains under review.

Table 1: Movement of planned dates set at Programme and Project Authority in 2015

Timetable Milestones	2015 Planned Date	Current Forecast Date	Current Forecast Capability Available Date
Runtime Improvements (SMA3)	May 2021	Achieved Sept 2021	Mar 21
Runtime Improvements (SMA5)	N/A	Planned Sept 2022	Mar 22
30 trains per hour in Central Area	Dec 2021	TBC, subject to ongoing reviews of demand	Spring 2023
32 trains per hour in Central Area	May 2022	TBC, subject to ongoing reviews of demand	Summer 2025*
24 trains per hour Metropolitan Line	Dec 2021	TBC, subject to ongoing reviews of demand	Autumn 2023
26 trains per hour Metropolitan Line	Dec 2022	TBC, subject to ongoing reviews of demand	Spring to Autumn 2024
28 trains per hour Metropolitan Line	May 2023	TBC, subject to ongoing reviews of demand	Spring to Autumn 2025

* Achievement of a reliable 32tph service level is also dependent on the renewal and remodelling of Aldgate Junction which is planned for summer 2025

- 4.10 As a result of the delays to the signalling software roll out as previously reported to the Committee in July 2021 the timetable frequency improvements cannot be introduced by the dates planned in 2015. However, due to the reduction in ridership and the need to carefully manage operating costs we will need to carefully consider the timing of frequency uplifts and they may not in any case immediately follow the delivery of the signalling capability.
- 4.11 We will continue to review the implementation dates for service frequency improvements based upon balancing demand with operational costs, Network Rail timetable introduction dates, operational readiness and the dates at which capability becomes available.

Infrastructure Works

- 4.12 We have completed all the planned 29 track layout changes. These changes allow trains to run faster and deliver maintenance cost savings by installing modern track.
- 4.13 We have also completed the installation of all required 38 signal equipment rooms ready for Thales to install the signalling equipment.
- 4.14 All trackside signalling assets have now been installed on the District, Circle and Hammersmith & City lines and on the Metropolitan line as far as Preston Road.
- 4.15 Design and installation of the trackside signalling assets continues on the Uxbridge and Amersham branches of the Metropolitan line beyond Preston Road; known as Signalling Migration Areas (SMA) 9, 13 and 14. In SMA9, 74/91 assets are installed; in SMA13, 75/185 assets are installed; and in SMA14, the design is being completed to allow the installation to commence from summer 2022. March 2023 is targeted for all the installation to be completed.
- 4.16 The installation of the new cable route management system is due for completion by July 2022 with only minor snags currently outstanding. The signalling cable installation is in progress with 502km remaining from a total of circa 6000km, meaning this work is over 90 per cent complete. Completion is expected by the end of 2022.
- 4.17 Upgrade works at Ealing Common Depot bringing new facilities to allow maintenance of the new train stock are now complete (the final shed being brought into use in February 2022). Along with the already completed upgrade of Upminster Depot we have now delivered casualty and planned maintenance facilities for the District, Hammersmith & City and Circle line trains.
- 4.18 The Heavy Maintenance Facility works at Neasden Depot have made good progress in the Long Shed with works predominantly complete including track, installation of cable routes, new power supplies, new lighting and the installation of raised maintenance platforms. The procurement is in progress for the planned upgrades to the Heavy Lifting Shed and the new Staff Accommodation Block. When complete in 2024 this facility will enable planned overhaul of the Metropolitan line trains.

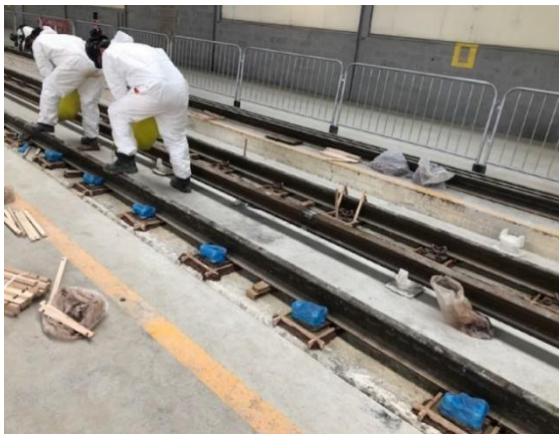


Figure 2 – Track works at Neasden Depot



Figure 3 – Cable Route installation

Train Fitment

- 4.19 We continue to progress with the fitment of signalling equipment to our fleet of Engineering Vehicles. All the 29 Battery Locomotives have been completed enabling the fleet to run across the entire SSR. Both D-Stock Rail Adhesion Trains have been fitted and await testing. We are on track to begin modification of the first Tamper Train in June 2022.

Closures

- 4.20 Closures are required to enable the delivery of the new signalling system. Crucially, they are also used to familiarise Train Operators with the new system. TfL carefully monitors the use of weekend closures to ensure that each closure is used as efficiently as possible for installation and testing of the new signalling system and infrastructure. Weekend closures are also subject to change to avoid unnecessary closures when plans change.

District Line Branches

- 4.21 As reported to the Committee in July 2021 following a review assessing and challenging costs and schedules for the Programme, the western branches of the District line will not be re-signalled. This means sections of the District line south of East Putney and west of Stamford Brook will remain under the existing signalling. Journey times in these sections will remain unchanged, however, we can still increase frequencies to up to 16 trains per hour, as originally planned.

Metropolitan line Branches

- 4.22 When the decision was made in 2021 not to continue with the re-signalling of the District line branches, we also examined the case to continue with the re-signalling of the Metropolitan Line north of Finchley Road. The re-signalling of the Metropolitan line differs from the District line because:
- (a) the existing signalling on the Metropolitan line is older than the District line. If it is not replaced the ongoing renewal and maintenance costs are significant and greater than the District line;
 - (b) our planned step-change in passenger experience relies on the line being re-signalled. If we retain the legacy signalling, then we will be unable to either reduce passenger journey times or increase train frequencies; and
 - (c) as we are close to completing the installation works our opportunity to save costs by reducing scope are limited and outweighed by the ongoing renewal and maintenance costs of retaining the existing signalling.
- 4.23 Replacing life-expired signalling is key to achieving cost effective management of our asset base. Though we may be able to achieve some immediate savings by not signalling the Metropolitan line branches, in the longer term we will spend more than we save and do not achieve any customer benefits. Despite the challenges the Programme has faced, investing in the capability of the new signalling continues to represent good value for money.

5 Benefits and Value

- 5.1 The introduction of the 192 new trains has delivered 25 per cent of the programme benefits which include:

- (a) the first step up in capacity while maintaining the current train service frequency as the new trains are longer and carry more passengers;
 - (b) an improved customer experience with walk through gangways, in-car CCTV, air conditioning, a Rail Vehicle Accessibility Regulations compliant saloon and improved Customer Information Systems; and
 - (c) the opportunity to recover energy through regenerative braking.
- 5.2 The introduction of the new signalling will deliver 75 per cent of the programme benefits, which include:
- (a) speed increases which reduce journey times between stations; and
 - (b) the ability to run trains closer together increasing service frequency up to 32tph.

6 Assurance

- 6.1 TfL Project Assurance and Independent Investment Programme Advisory Group (IIPAG) have undertaken their review of the 4LM Programme via continuous assurance. They have received detailed briefings from the project team and are fully aware of the issues and challenges on 4LM. In addition, TfL Project Assurance have undertaken a targeted review to support this submission to the Committee.

List of appendices to this report:

Appendix 1: Signal Migration Area map

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

List of background papers:

Independent Investment Programme Advisory Group Quarterly Report

TfL Project Assurance Report

Management response to IIPAG and TfL Project Assurance Reports

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Appendix 1: 4LM Signal Migration Area map

