

Date: 12 December 2017

Item: Elizabeth Line Operational Readiness and Integration

This paper will be considered in public

1 Summary

1.1 This paper updates on recent progress towards staged opening of the Elizabeth line as well as transition of the Crossrail Project to become an integral part of TfL.

2 Recommendation

2.1 **The Committee is asked to note the paper.**

3 Background

3.1 Construction is being undertaken by Crossrail Limited (CRL), a wholly owned subsidiary of TfL, sponsored jointly by TfL and the Department for Transport.

3.2 A review of Crossrail Project/Elizabeth line readiness reporting is underway to ensure Board and Committee members receive appropriate briefing. The report on Sponsor Board proceedings is elsewhere on the agenda. There will also be a separate briefing to the Committee on the approach to physical integration of the project

3.3 Construction is now 89 per cent complete. The major construction activities are electrification, signalling and communications and ventilation systems, as well as fitting out of stations including lifts and escalators and platform edge doors.

3.4 The strong safety performance of the project continues but particular vigilance is being exercised as the environment changes from construction to railway testing, with a significant re-briefing in preparation for energisation.

3.5 Key milestones are included in Appendix 1.

4 Current Operations

4.1 TfL Rail (pre-Elizabeth line) services between Liverpool Street and Shenfield continue to operate with high reliability. In Period 8, the Public Performance Measure (PPM) was 91.2 per cent and the Moving Annual Average (MAA) 94.5 per cent remains among the highest nationwide. Customer Satisfaction remains at 85.

5 Progress towards Phased Opening

- 5.1 The Elizabeth line opens in five stages through to December 2019.
- 5.2 **Stage 1** introduction of the first of the new Class 345 trains to run on existing tracks between Liverpool Street and Shenfield.
- 5.3 In total twenty five trains have been built. Eight of the 160m long units have been accepted for passenger service with three trains in passenger service and two on driver training diagrams each day. The rate of introduction is being managed in step with a programme of modifications and software upgrades to ensure the trains are reliable in service. The manufacturer, Bombardier, is stepping up both the rate of implementation of improvements and the level of support to operations. Good progress has been made in completing the commissioning and handover of the Driver Only Operation (DOO) CCTV system.
- 5.4 **Stage 2** planned for May 2018 will provide four trains per hour between Paddington and Heathrow replacing the current two trains per hour Heathrow Connect service, operating to Terminals 2/3 and Terminal 4.
- 5.5 For Stage 2 Bombardier are fitting the Class 345 trains to operate with European Train Control System (ETCS) signalling on the Heathrow branch. ETCS testing started on 20 October at Melton test track in Leicestershire, but subsequent progress is behind plan due to immaturity and instability of train software. The train is due to undertake testing in the Heathrow tunnels before Christmas with a second period scheduled for January/February 2018. In addition, the wayside and train elements are due to be tested in a laboratory environment at Charleroi in Belgium.
- 5.6 The development and assurance of the train signalling and software remains the most significant single risk to timely commencement of Stage 2 services, as successful completion of testing has to be followed swiftly by submission of assurance information to the relevant authorities and the training of more than 60 drivers. The latter will be supported by a cab simulator, development of which is on programme and which is shortly to be moved from Ilford, where it has been used to train drivers for Stage 1, to Old Oak Common depot.
- 5.7 Stage 2 also requires work to the tracks and stations. The installation of the DOO CCTV system at stations on the route is now well underway and Network Rail (NR) will undertake the necessary work to extend the bay platform at Hayes and Harlington Station with a planned completion of April 2018.
- 5.8 At Heathrow, work by TfL continues, in conjunction with the airport, to fit Oyster and Contactless ticketing facilities as well as to roll out new ticket vending machines ready for May 2018. Plans are also in place to update and amend signage and customer information.
- 5.9 At Old Oak Common, the work on the main depot for the train fleet, commissioning of systems and equipment is underway. The first Class 345 was hauled into the depot on 7 November (Picture Appendix 2). Depot signalling will be commissioned in stages, from November 2017 through to full commissioning

in the first half of 2018. Depot energisation is now planned for the start of January 2018, revised from late November 2017.

- 5.10 **Stage 3.** From December 2018 passenger services will operate in the central tunnel, between Paddington (new underground platforms) and Abbey Wood. From this date services will be referred to as the Elizabeth line.
- 5.11 The start of bringing the Elizabeth line into railway use took place on 28 October 2017, when a Class 345 train was brought into the tunnel for the first time and hauled to Abbey Wood where it will be based whilst undertaking initial testing (Appendix 2).
- 5.12 The next stage is energisation of the south east section of the infrastructure. This is now scheduled to commence in January 2018. This delay was caused by the failure of high voltage transformer equipment at Pudding Mill Lane during initial testing. Once power is on, 'dynamic testing' (operating one, and subsequently more, trains in the tunnel to sequentially test the infrastructure) will get underway. The programme for dynamic testing was brought forward when Crossrail's programme was updated in April 2015. Even with this change, it allows more time for subsequent stages of commissioning and integration than was originally planned.
- 5.13 Dynamic testing will start in the section between Abbey Wood and Canary Wharf (Zones 1&2) and will then be extended to encompass the rest of the central section (Zones 3&4). Significant work remains to be completed in Zones 3&4 with installation of power, communications and signalling systems critical to extending dynamic testing.
- 5.14 For Stage 3 the Class 345 train requires further development to incorporate Communications Based Train Control (CBTC) signalling, added to the two other systems that will already be fitted to the train. The software for this stage is also under test on the Melton test track. Given the critical importance of train signalling, regular meetings continue between Bombardier, the project team and, ultimately, with the Managing Director London Underground (LU) and the Commissioner.
- 5.15 Intensive work continues to complete the fit out of the new stations in the central section of the Elizabeth line. Farringdon and Tottenham Court Road are already nearing physical completion, others, including, Bond Street, Liverpool Street and Paddington have more work left to complete.
- 5.16 Dynamic testing will continue until summer 2018, with a plan to halt testing at certain times so that outstanding work can take place. In the summer of 2018, the completed railway infrastructure is due to be officially handed over to TfL followed by final testing of capacity and performance of the infrastructure ('Trial Running') using up to 22 trains.
- 5.17 Handover of the railway requires TfL and the Office of Rail and Road to be satisfied that the operational and maintenance teams are fully trained and competent, and that comprehensive safety management systems are in place to underpin both the operation and maintenance. Training and the production and transfer of asset information, to support effective maintenance, are a particular focus.

- 5.18 Until December 2018, TfL will undertake 'trial operations' including staff familiarisation, extensive emergency exercises and a 'shadow' timetabled service to confirm reliability prior to opening.
- 5.19 **Stage 4.** In May 2019 Shenfield to Liverpool Street services will be connected into the peak central tunnel section to run as far as Paddington, increasing the service in the central tunnel from 15 to 24 trains per hour. This requires intensive use of the signalling transition between the surface and tunnel systems at Stratford, which will be tested in the first half of 2018 and then used to transfer trains between Ilford Depot and the central section through trial operations and Stage 3 running.
- 5.20 **Stage 5.** In December 2019 services from the West will be connected into the central tunnel and Elizabeth line trains are extended in the West to Maidenhead and Reading. This is the final phase of Elizabeth line service introduction. This includes use of the other transition to and from the national network at Westbourne Park, which is also due to be tested in the first half of 2018 and will be used to bring trains into the central tunnel for testing and trial operations, so allowing real time experience in advance of passenger operations.
- 5.21 In the West, NR is in the process of tendering station rebuilding works covering the area out to Hayes and Harlington and is planning to complete the upgrade and rebuilding of stations in the West by the time Stage 5 opens in December 2019. Separately TfL is procuring step free access works at the four stations which are not currently step free and where no NR works are planned. This contract will be let in December 2017 for completion in 2019.
- 5.22 As Elizabeth line services share the tracks with other operators' services, final work on the detail of the full December 2019 timetable continues. This supports the application to NR for track access for Elizabeth line trains, which is due to be finally agreed in early 2018.

6 Recruitment and training

- 6.1 There are now 175 people working directly on Elizabeth line operations, the majority are in training for maintenance and operational roles. The diversity of staff within these roles continues to grow, from the historically low base within the industry.
- 6.2 MTR continues its efforts to increase gender diversity in the latest intake for train drivers. An open day at the train simulator in Ilford, aimed particularly at women took place in November.
- 6.3 Recruitment of the additional people LU will need to staff the joint stations in the centre of London commences in the first half of 2018.

7 Crossrail Integration into TfL as the Elizabeth line

- 7.1 As the project moves towards completion, regular reporting on operational readiness is being provided to the Mayor. A joint TfL/CRL Elizabeth line Readiness Board has also been established, chaired by the Commissioner as well as a joint TfL/ CRL Communications Board, chaired by the Managing

Director Customers, Communications and Technology, to ensure a smooth transfer of stakeholder relations and to plan launch activities.

- 7.2 The Elizabeth line is being fully integrated into TfL's signage and wayfinding, customer contact and social media activities, as well as extending digital information screens and advertising.
- 7.3 There is an extensive programme of complementary measures around Elizabeth line stations both in central London and on the surface sections of the railway. These are being completed in stages with some new facilities, including maps and cycle parking, already complete.
- 7.4 The Crossrail Project has responsibility for providing the end to end railway including Stages 4 and 5 which open through to 2019, but much of the work of CRL will be over by the second half of 2018 and CRL will reduce in size and transfer certain activities to TfL. Secondments and other joint activities continue to transfer expertise into TfL and to Crossrail 2 in particular, as well as joint working and learning with the new TfL Major Projects directorate. A further session for CRL to learn more about to key opportunities within TfL took place on 23 November 2017.

8 Conclusion

- 8.1 While there is a significant amount of work still to complete and commissioning the new railway will inevitably bring the challenges that are to be expected with a project of this magnitude, the Elizabeth line continues to be on course to open, as planned and within available funding, in stages through to December 2019.

List of appendices to this report:

Appendix 1: Key Milestones towards Elizabeth line Opening

Appendix 2: Photographs of Construction Activities

List of Background Papers:

None

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Key Milestones towards Elizabeth line Opening

Completion of end-to-end track in tunnel	September 2017
Complete Final Design Overviews	Autumn 2017
Energisation and Start of Dynamic Testing	January 2018*
Bringing into use of Old Oak Common Depot	January 2018**
Network Rail Signalling Data Change (Paddington-Maidenhead) including interfaces to central tunnels and Old Oak Common Depot	Christmas 2017
Stage 2 commencement of services to Heathrow	May 2018
Trial Running – capacity and performance testing	Summer 2018
TfL takes over infrastructure and commences Trial Operations	Summer 2018
Stage 3 Opening of Central Operating Section	December 2018
Stage 4 Opening (Shenfield/Abbey Wood – Paddington)	May 2019
Stage 5 Opening (Shenfield/Abbey Wood-Heathrow/Reading)	December 2019

*Rescheduled from Autumn 2017

**While a train was hauled into Old Oak Common in November 2017, energisation of the depot has been rescheduled to January 2018

First Class 345 train entering the Tunnel Portal at Pudding Mill Lane and subsequently at Abbey Wood



Romford Route Control Centre



First Train at Old Oak Common Depot

