

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 Board 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 Construction at period 6 is 87 per cent complete. The major construction activities remain overhead line electrification works, power, ventilation, signalling and communications systems, as well as fitting out of stations including lifts and escalators and platform edge doors.
- 3.3 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 retraining and rebriefing of staff in preparation for energisation.
- 3.4 Powering the railway, followed by the start of dynamic testing – which will enable the operation of a Class 345 train in the tunnel for the first time, will commence shortly.
- 3.5 Key milestones (unchanged from those reported previously) 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 7, the Public Performance Measure (PPM) was 92.2 per cent, below recent highs due to infrastructure issues and some minor issues with the Class 345 train fleet. The Moving Annual Average (MAA) at 94.8 per cent remains amongst the highest nationwide. In Quarter 2 2017/8, Customer Satisfaction rose two points to 85, the highest level since the commencement of TfL Rail services in May 2015. The major challenge going forward is to retain the high level of performance whilst completing the

introduction of the new trains alongside the existing units and whilst Network Rail (NR) undertakes the imminent rebuilding of the tracks and sidings at Gidea Park.

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 was completed in June 2017.
- 5.3 In total 25 trains have been built. Eight of the 160m long units have been accepted for passenger service, based at Ilford depot. Other, 200m long units are being used for testing and readied for delivery and use on later stages. Currently, three new trains are in passenger service and two are on driver training diagrams each day. The rate of introduction is being managed in step with a programme of minor modifications and software upgrades to ensure the trains are reliable in service. Work continues to complete commissioning and handover of the platform elements of the Driver Only Operation (DOO) CCTV system.
- 5.4 Lessons learned from the introduction of the new trains and infrastructure at Stage 1 have been captured and incorporated into planning for future stages.
- 5.5 **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.
- 5.6 For Stage 2 Bombardier are fitting the Class 345 trains to operate with European Train Control System (ETCS) signalling on the Heathrow branch. Testing with ETCS started on 20 October at Melton test track in Leicestershire, slightly behind the plan. The train is due to start integration testing in the Heathrow tunnels in November 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.
- 5.7 The development and assurance of the new on train signalling system 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, which will be moved from Ilford where it has been used to train drivers for Stage 1 to Old Oak Common depot.
- 5.8 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 NR will undertake the necessary work to extend the bay platform at Hayes and Harlington Station. With the Great Western line simultaneously being upgraded for the Inter City Express Project (IEP) there remain potential constraints on the ability to gain full access to the infrastructure at the times required for the Crossrail project.
- 5.9 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.

- 5.10 At the main depot for the train fleet at Old Oak Common, the maintenance building is complete and commissioning of systems and equipment underway. The first section of the depot is planned to be brought into use at the end of November with full signalling of the depot itself commissioned in stages, principally at Christmas 2017. The remaining sections of the depot are to be brought into use in the first half of 2018.
- 5.11 From December 2018 (**Stage 3**), passenger services will operate in the central tunnel, between Paddington (new underground platforms) and Abbey Wood, via the West End, City and Canary Wharf. From this date services will be referred to as the Elizabeth line.
- 5.12 Abbey Wood was the first 'new' station to open to the public on 22 October. NR have completed a full rebuilding including a dramatic new booking hall and the addition of two extra tracks for Elizabeth line services from December 2018. Until then, the station is served only by Southeastern services.
- 5.13 The start of bringing the new central section of the Elizabeth line into railway use took place on 28 October 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.
- 5.14 The next stage is energisation of the south east section of the infrastructure in November and following the installation of power, the start of 'dynamic testing' (operating one, and subsequently more, trains in the tunnel to sequentially test the infrastructure). The programme for dynamic testing was, wisely, brought forward when Crossrail's programme was updated in April 2015. This allows more time for subsequent stages of commissioning and integration.
- 5.15 Dynamic testing is scheduled to start in November 2017, in the section between Abbey Wood and Canary Wharf and will then be extended west to encompass the rest of the central section in spring 2018. Significant work continues to be completed in these sections of the infrastructure. Throughout testing the railway also remains a construction site but is controlled under special arrangements from the Railway Control Centre (RCC) at Romford. The RCC is now live, with control of tunnel systems being enabled and the overview screen, showing the position of trains in the tunnel, brought into use.
- 5.16 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 due to be tested on the Melton test track. Given the critical importance of train signalling, regular meetings continue at all levels between Bombardier, the project team and, ultimately, with the Managing Director of London Underground and the Commissioner.
- 5.17 Intensive work continues to complete the fit out of the new stations in the central section of the Elizabeth line. Some, such as Farringdon and Tottenham Court Road are already nearing physical completion, others such as Bond Street, Liverpool Street and Paddington have more work left to complete.

- 5.18 Dynamic testing will continue until summer 2018, whilst at times the infrastructure will be closed to testing 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 who will manage the final testing of capacity and performance of the infrastructure using up to 22 trains.
- 5.19 The formal 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. Extensive approvals and regulatory steps are required and the Crossrail project has a team specifically tracking this process.
- 5.20 Up to opening in December 2018, TfL will undertake 'trial operations' including staff familiarisation, extensive emergency exercises and a 'shadow' timetabled service to confirm reliability prior to opening.
- 5.21 As the Project and operators move into the final year prior to opening, there are a number of critical activities including: completion of power and communications; the energisation and dynamic testing in each of the two sections of the new tunnel; the completion of station fit out and the extensive assurance and training necessary on the new infrastructure. The integration of systems and software is a key focus and a briefing is planned for members of the Programmes and Investment Committee.
- 5.22 In May 2019 (**Stage 4**) 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.
- 5.23 NR has also to complete its upgrading of the power supply on the Anglia route and to resolve the bottleneck caused by the slow speed exit from Ilford Depot, which inhibits the provision of the full Elizabeth line service. Work on this continues.
- 5.24 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 (**Stage 5**) 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.
- 5.25 In the West, NR is currently 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 later by the end of the year for completion in 2019.

- 5.26 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 agreed in early 2018.

6 Recruitment and training

- 6.1 There are now 175 people working directly on Elizabeth line operations, the majority are now 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. Women are particularly well represented in senior maintenance management roles and recent recruitment in signalling and control has seen around one third of women in those groups currently undergoing training.
- 6.2 MTR continue their efforts to increase gender diversity in the latest intakes for train drivers. An open day at the train simulator in Ilford, aimed particularly at women is taking 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 integrated into TfL's signage and wayfinding, customer contact and social media activities, as well as extending digital information screens which have been trialled at Ilford. Wayfinding schemes, including street maps at platform level will ensure that customers are able to choose the correct exit from the station, an important consideration given that most Elizabeth line stations in central London will have at least two entrances.
- 7.3 Train information will be displayed on screens above the platform doors, and electronic advertising screens will be incorporated into the screens themselves as well as at other key locations around the stations.
- 7.4 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.
- 7.5 Whilst the Crossrail Project has responsibility for providing the end to end railway including Stages 4 and 5 which open through to 2019, 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.

7.6 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.

8 Conclusion

8.1 Whilst 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 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

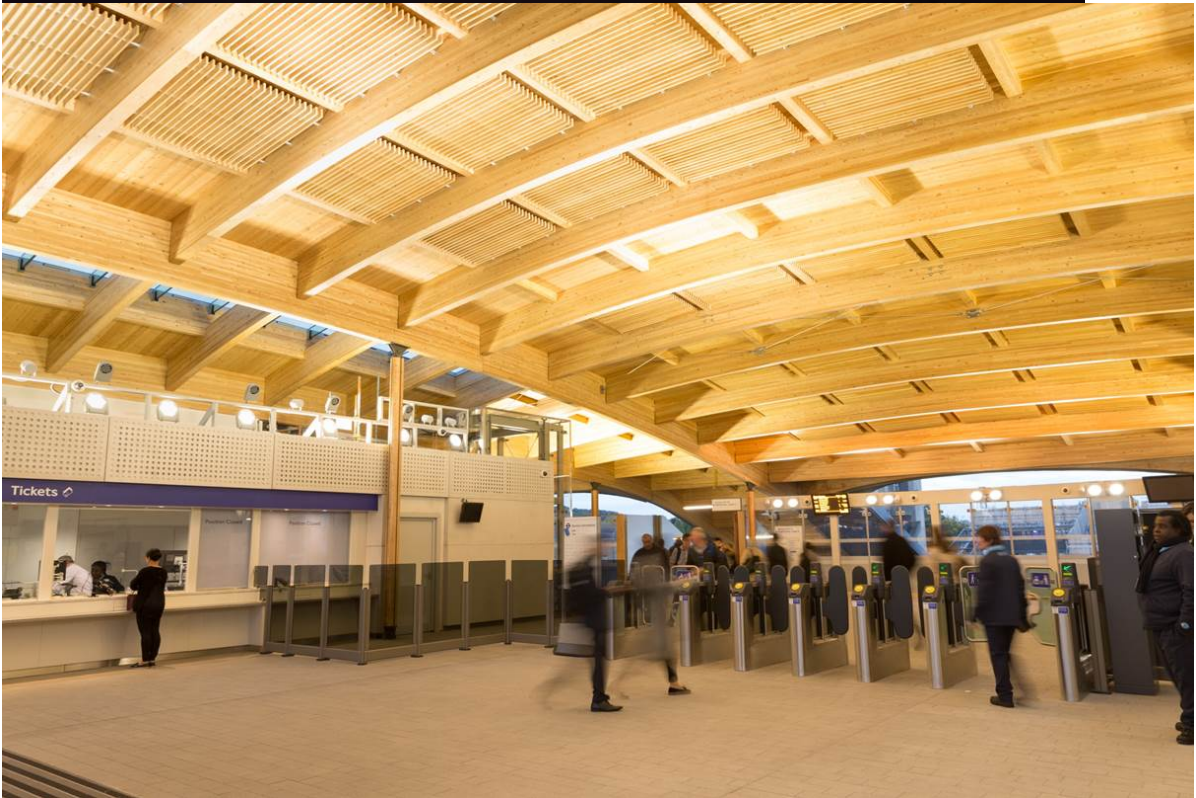
Completion of end-to-end track in tunnel	September 2017
Complete Final Design Overviews	Autumn 2017
Energisation and Start of Dynamic Testing	Autumn 2017
Bringing into use of Old Oak Common Depot	November 2017
Network Rail Signalling Data Change (Paddington-Maidenhead) including interfaces to central 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

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Class 345 – Passing the Tunnel Portal at Pudding Mill Lane



Abbey Wood Station



Romford Route Control Centre



Old Oak Common Depot

