

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 Overall, construction is now 87 per cent complete. The major physical activities remain fitting out of stations, installation of the mechanical and electrical systems including cabling, ventilation, lifts and escalators, communications, power, signalling, overhead line electrification and platform edge doors.
- 3.3 The bringing into use of such a major and complex piece of new infrastructure is itself a significant undertaking. The next phases of the project are energisation of the railway followed by the start of dynamic testing – bringing a train into part of the tunnel for the first time – towards the end of 2017.
- 3.4 Key milestones are included in Appendix 1.
- 3.5 Whilst costs continue to be closely managed as the project moves to its final stages, Crossrail remains within the available funding envelope of £14.8bn.
- 3.6 Further details on project progress and funding will be reported to the Programmes and Investment Committee and to the Finance Committee.

4 Current Operations

- 4.1 TfL Rail (pre-Elizabeth line) services between Liverpool Street and Shenfield continue to be amongst the most reliable of any of the national train operators. In Period 5 the Public Performance Measure (PPM), was 95.8 per cent, the challenge is to retain this high level of performance whilst introducing the new fleet of trains alongside the existing units and whilst Network Rail (NR) completes the 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.
- 5.3 The first new train successfully entered passenger service on 22 June and customer reaction has been very positive. Fourteen trains have been built and six have now been accepted for passenger service, based at Ilford. Currently, one or two are in passenger service and two on driver training diagrams each day. The rate of introduction of is slightly behind programme and has been restricted by the rate of commissioning of the platform elements of the Driver Only Operation (DOO) CCTV system which transmits pictures from the platform into the train cab. The outstanding issues are being resolved and the number of trains in passenger service will increase.
- 5.4 Lessons learned from the introduction of the new trains and infrastructure at Stage 1 are being captured and incorporated into planning for future stages. They include: closer monitoring of supplier programmes for software and assurance; clearer accountabilities and sign off for multi-party works such as DOO CCTV and a refocusing of the project reviews with an emphasis on opening stages as opposed to individual contracts.
- 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 the Class 345 train is being fitted by Bombardier to operate with European Train Control System (ETCS) signalling, as the tracks between Heathrow and Stockley (where trains join the current Great Western Main Line) are amongst the first in the UK to be fitted with this system. NR has completed installation and some testing of 'wayside' (track mounted) equipment but this then needs to be tested with the train, as whilst both are to a common ETCS specification, experience demonstrates that detailed incompatibility issues often arise.
- 5.7 Testing of the principal train software is underway at the Melton test track and the train is due to be start testing in the Heathrow tunnels at the end of October. The development and introduction of this complex, new, on train signalling system remains the most significant single risk to timely commencement of Stage 2 services.
- 5.8 Stage 2 also requires work to the tracks and stations. There are significant platform works to be undertaken by NR, including adjustment of platform heights, as well as the installation, testing and assurance of the DOO CCTV system.
- 5.9 At Heathrow, TfL, in conjunction with the airport, will be fitting Oyster and Contactless ticketing facilities ready for May 2018. These will also be used to extend acceptance of Oyster and Contactless to Heathrow Express (HEX) services, although HEX will continue to charge separate fares.

- 5.10 The main depot for the Elizabeth line train fleet is at Old Oak Common. The maintenance building is structurally complete and fit out of systems and equipment continues. There have been some delays to the depot signalling system but the first section of the depot is planned to be brought into use at the end of November ready to receive the trains that will operate to and from Heathrow as well as the fleet that will be delivered for testing and operation of the central tunnel.
- 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 The completion of the track throughout the tunnel was achieved in September 2017.
- 5.13 The next step in bringing the central section into use is energisation of the infrastructure followed by the start of 'dynamic testing' (operating one, and subsequently more, trains in the tunnel to sequentially test all of the infrastructure). This is planned to start in November on the south east leg of the railway between Abbey Wood and Canary Wharf.
- 5.14 Key areas of focus for the project include the handover of equipment rooms from station contractors to the power, communications and signalling teams; integrated software schedules for ventilation; communications and signalling; temporary and permanent tunnel ventilation and station fit out, particularly at Bond Street and Liverpool Street.
- 5.15 For Stage 3 the Class 345 train requires further development to incorporate Communications Based Train Control (CBTC) signalling. This is similar to the systems used on several Underground lines in London but needs to be added to the two other systems that will already be fitted to the train, 'conventional' UK signalling for the surface sections of route and ETCS for the Heathrow spur. This is complex and a matter of significant focus from the train manufacturer (Bombardier) and TfL. The Commissioner has met with Bombardier's President and CEO and there are regular updates meetings between Bombardier and the MD London Underground.
- 5.16 Dynamic testing is anticipated to be extended to cover the whole of the tunnel by March 2018. At the end of dynamic testing in Summer 2018 the railway infrastructure is officially handed over to TfL who assume primary responsibility for safety and operations and complete 'trial running' (the final testing of capacity and performance of the infrastructure) using up to 22 trains.
- 5.17 The handover of the elements of the railway is a significant focus as it requires Crossrail to have assembled the necessary evidence that the railway is functional and safe to operate and TfL, in taking over the railway, needs to be satisfied that the operational team are fully trained, competent and that comprehensive safety management systems are in place to underpin both the operation and maintenance of the complex new infrastructure. A number of approvals and regulatory steps are required, building on the evidence supplied initially by the

contractors and on the training and staff familiarisation taking place in the latter part of 2017 and the first half of 2018.

- 5.18 Between handover and opening in December 2018, TfL undertakes 'trial operations', operating and bedding down the system and undertaking drills and staff familiarisation including extensive emergency exercises, as well as using the Class 345 trains in the tunnel environment.
- 5.19 Inevitably on a project of this size, some construction work will overlap with the dynamic testing period and some peripheral work will be completed during the trial running and trial operations period.
- 5.20 In May 2019 (**Stage 4**) Shenfield to Liverpool Street services are connected into the peak central tunnel section to run as far as Paddington; at this point the service in the central tunnel increases from 15 to 24 trains per hour. This requires intensive use of the complicated transition between the surface and tunnel signalling systems at Stratford, where train will move from running on the normal suburban railway to automatic operation (drivers remain on board throughout) in the central tunnel section. In order to operate the full number of trains NR has also to complete its upgrading of the power supply on the Anglia route and the bottleneck caused by the slow speed (5mph) entry and exit to Ilford Depot needs to be eliminated.
- 5.21 In December 2019 services from the West are 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 and includes the additional services, west of Paddington agreed by the Board in March 2017. In the west NR is currently tendering a number of station rebuilding works and is planning to complete the upgrade and rebuilding of stations in the West by the time Stage 5 opens in December 2019.
- 5.22 As Elizabeth line services share the tracks with others operators' services, final work on the detail of the full December 2019 timetable continues, including joint performance modelling with NR to demonstrate that the railway can achieve its target performance of 95 per cent PPM.

6 Recruitment and Training

- 6.1 The apprentices and teams who will operate and maintain the railway are now starting training in readiness for 2018. The first apprentices started training in 2016 and a further group commenced in September 2017.
- 6.2 Recruitment is taking place in conjunction with TfL's 'Smart Sourcing' team seeking to broaden the pool of applicants including: tapping into the 'Returnship Programme' working with women and carers looking to rejoin the workforce; working with Staff Network Groups within TfL to raise the profile of the Elizabeth line; ensuring gender neutral tone in advertising and also that all managers on interview panels have completed unconscious bias and hiring skills training. Of those recruited to operational (train control and maintenance) roles to date 28 per cent identify themselves as from BAME groups and 18 per cent women. In 2017/8 London Underground will also be recruiting an additional 170 people to roles at the central stations on the Elizabeth line.

- 6.3 TfL's operating concessionaire, MTR Crossrail, is recruiting and training drivers and other station staff for the Elizabeth line. Around 120 drivers transferred in to MTR Crossrail from Abellio at the start of services in 2015 and the total number of drivers will increase to around 500 by 2019. The Commissioner has written to MTR emphasising the importance of attracting a diverse workforce and a number of initiatives are underway including targeted promotion and advertising, social media lead by MTR Crossrail's Head of Drivers, one of several women in senior roles at MTR, and the development of job shares for train drivers. 12.6 per cent of drivers in training are women compared to 3.3 per cent of the drivers who transferred in and 5.4 per cent in national rail. MTR is also looking to learn from London Underground's Night Tube recruitment and also from its operation in Melbourne Australia (where in an operating environment where gender targeted recruitment is permitted the latest group of trainee drivers comprises 45 per cent women).
- 6.4 Whilst progress in terms of diversity represents improvement on historic trends in the sector it is clear that there is much further to go.

7 Crossrail Transition and Integration Programme

- 7.1 Whilst the Project has responsibility for providing the end to end railway including Stages 4 and 5 through to 2019, much of the work of CRL will be over by the second half of 2018, when handover of the central tunnel section is planned to have been completed. The organisation will reduce in size and many support functions will transfer or be incorporated into TfL. The Business Planning round currently underway will be used to ensure that the respective plans match up, without voids or duplication, although the final stages of any major project are subject to a degree of uncertainty as to when specific activities, such as testing and commissioning, conclude.
- 7.2 Opportunities, including secondments continue to provide the opportunity for the transfer of expertise into TfL and closer working with Crossrail 2 and the new TfL Major Projects directorate is a key focus, to the benefit of all parties. A number of workshops have taken place to ensure that learning from Crossrail is captured in the developing plans for Crossrail 2.
- 7.3 A pan-TfL, Elizabeth line Operational Readiness Board will commence this month and a Communications Board has been established jointly by the Crossrail Project and TfL to ensure a smooth transfer of stakeholder and launch information as the focus changes from infrastructure to an operational focus.

8 Conclusion

- 8.1 Whilst there are significant challenges, as 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

List of Background Papers:

None

Contact: Howard Smith, Operations Director, Crossrail, TfL

Phone: 020 3197 5976

Email: howardsmith@tfl.gov.uk

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 section	December 2018
Stage 4 Opening (Shenfield/Abbey Wood – Paddington)	May 2019
Stage 5 Opening (Shenfield/Abbey Wood-Heathrow/Reading)	December 2019