

**Board**

**Date: 30 January 2018**

**Item: Elizabeth Line Operational Readiness and Integration**

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**This paper will be considered in public**

**1 Summary**

- 1.1 This paper provides an update on recent progress towards the 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 is now 90 per cent complete. The major construction activities are the installation of electrification, signalling, communications and ventilation 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 with incident and injury rates demonstrating positive trends. Particular care is being exercised as the nature of work moves from construction through to fit out and railway testing, with a significant re-briefing taking place in preparation for energisation (turning on high voltage power).
- 3.4 Key milestones are included in Appendix 1.

**4 Progress towards Phased Opening**

- 4.1 The Elizabeth line opens in stages through to December 2019 as shown in Appendix 2.
- 4.2 TfL Rail (pre-Elizabeth line) services between Liverpool Street and Shenfield continue to operate with generally high reliability. There has been a recent dip in performance compared to earlier in the year as the new Class 345 trains are introduced alongside the existing services and Network Rail rebuilds the points and sidings at Gidea Park in readiness for full Elizabeth line services. In Period 10 (11 December 2017 to 6 January 2018) the Public Performance Measure (PPM) was 91.2 per cent and the Moving Annual Average (MAA) 94.1 per cent remains the fourth highest nationwide.

- 4.3 In total 31 new 345 trains have been built. Twelve of the 160 metre long units have been accepted for passenger service on the Liverpool Street to Shenfield line with up to nine trains in passenger service each day.
- 4.4 On 10 December 2017, TfL took over responsibility for 11 stations on the route between Paddington and Reading, in preparation for full Elizabeth line services in the west. Stations are being cleaned and upgraded and staffing enhanced.
- 4.5 In May 2018, TfL Rail will commence operation to Heathrow, taking over from the current Heathrow Connect service and operating to Terminals 2/3 and Terminal 4.
- 4.6 For Heathrow services Bombardier is fitting the Class 345 trains with European Train Control System (ETCS) signalling equipment, which is required for operation on the Heathrow branch. Testing continues at Melton test track in Leicestershire, but progress is behind plan due to immaturity and instability of train software. The first train testing in the Heathrow tunnels took place on 12 January 2018 and, in addition, the wayside and train elements are due to be tested in a laboratory environment at Charleroi in Belgium.
- 4.7 The development and assurance of the train signalling and software remains the most significant single risk to timely commencement of Stage 2 services. In case Bombardier is unable to complete testing in time for May 2018, a contingency plan has been developed with TfL operating the existing Class 360 units to provide a two train an hour service to Heathrow, augmented with a two train per hour service using the Class 345 trains (without using ETCS) between Paddington and Hayes and Harlington. Should this contingency be required, it is expected that the planned service would be in place by autumn 2018.
- 4.8 At Christmas 2017, Network Rail made significant progress in updating the signalling system on the lines out of Paddington. It also successfully installed the Driver Only Operation CCTV system at stations on the Heathrow route and will undertake the necessary work to extend the bay platform at Hayes and Harlington Station with a planned completion of April 2018.
- 4.9 At Heathrow, work took place at Christmas 2017 to facilitate Oyster and Contactless ticketing facilities as well as to roll out new ticket vending machines ready for May 2018. Work is also being delivered to update and amend signage and customer information.
- 4.10 The 14 hectare Old Oak Common depot will be the main base for the Elizabeth line train fleet. The first Class 345 was hauled into the depot on 7 November 2017 and the first stage of the depot's signalling system was commissioned in December 2017. The depot was energised on 9 January 2018.
- 4.11 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.
- 4.12 The first test train was brought into the tunnel on 28 October 2017 and hauled to Abbey Wood. The next stage is energisation of the south east section of the infrastructure. This has been delayed by the failure of high voltage transformer equipment at Pudding Mill Lane. Once power is on, 'dynamic testing' (operating one, and subsequently more, trains in the tunnel to sequentially test the

infrastructure) will get underway. Dynamic testing will start in the section between Abbey Wood and Canary Wharf and will then be extended to encompass the rest of the central section. Significant work is underway with installation of power, communications and signalling systems critical to extending dynamic testing.

- 4.13 The internal Master Operational Handover Schedule setting out the very detailed sequence of testing, commissioning handover and operational testing through to public opening is currently being updated.
- 4.14 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 reviews continue with Bombardier, the project team and, ultimately, with the Managing Director London Underground (LU) and the TfL Commissioner.
- 4.15 Intensive work continues to complete the mechanical and electrical fit out of the new stations in the central section of the Elizabeth line. Farringdon and Tottenham Court Road are nearing physical completion; others, including Bond Street, Liverpool Street and Paddington have more work left to complete. Installation has started on more than three quarters of the escalators and half the lifts across new the stations. The installation of platform edge screens and doors is now 70 per cent complete.
- 4.16 Dynamic testing will continue until summer 2018, when the completed railway infrastructure is due to be officially handed over to TfL followed by final testing of capacity and performance of the infrastructure.
- 4.17 Handover of the railway requires that the operational and maintenance teams are fully trained 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.
- 4.18 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, although during this period it is likely that elements of the stations will see the completion of the final works necessary for passenger service.
- 4.19 In May 2019, Shenfield to Liverpool Street services will be connected into the 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.
- 4.20 In December 2019, services from the West will be connected into the central tunnel and Elizabeth line trains will be extended in the West to Maidenhead and Reading. This is the final phase of the Elizabeth line service introduction. This includes use of the other transition to and from the national network at Westbourne Park, which was largely completed over Christmas 2017 and will be

used from summer 2018 to bring trains into the central tunnel for testing and trial operations, so allowing real time experience in advance of passenger operations.

- 4.21 In the West, Network Rail continues to progress the 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 December 2019. Separately TfL has awarded a contract, on schedule, for step free access works for Hanwell, Langley, Iver and Taplow stations which are not currently step free and where no Network Rail works are planned.
- 4.22 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 Network Rail for track access for Elizabeth line trains, which should receive final approval in early 2018.

## **5 Recruitment and training**

- 5.1 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.
- 5.2 Recruitment of additional people LU will need to staff the joint stations in the centre of London commences in the first half of 2018.

## **6 Crossrail Integration into TfL as the Elizabeth line**

- 6.1 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 TfL 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.
- 6.2 An update on Crossrail Transition was provided to the TfL Audit and Assurance Committee in December 2017. It noted that a detailed integration transition programme was being developed which divided activities into individual work streams, with each activity having a clearly defined handover date with a responsible owner in TfL and a risk assessment.
- 6.3 The Committee sought assurances that critical staff and key personnel were not lost during the process and that the transfer of support services, as well as operational activities, was managed appropriately.
- 6.4 Members requested a Crossrail transition risk register as part of regular future reporting to the Committee.
- 6.5 A digital archive was being developed to capture as much organisational memory as possible, allow the review of assets, and to mitigate against any future claims. This would be owned by TfL Archives as part of its document management systems. Sir Terry Morgan's tenure as Chairman of the Crossrail Board had been extended to 31 May 2019 as part of the legacy arrangements.

- 6.6 Members discussed issues around the transference of risk. Crossrail Limited would continue to exist as a TfL subsidiary after handover. The Project Sponsors, TfL and the Department for Transport had responsibility for deciding the final handover date and strategic arrangements and responsibilities.
- 6.7 The Committee was also keen for any lessons learnt to be passed on in the future.

**List of appendices to this report:**

Appendix 1: Key Milestones towards Elizabeth line Opening

Appendix 2: Elizabeth line staged opening

Appendix 3: Timeline and Photographs of Construction Activities

**List of Background Papers:**

None

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## Appendix 1

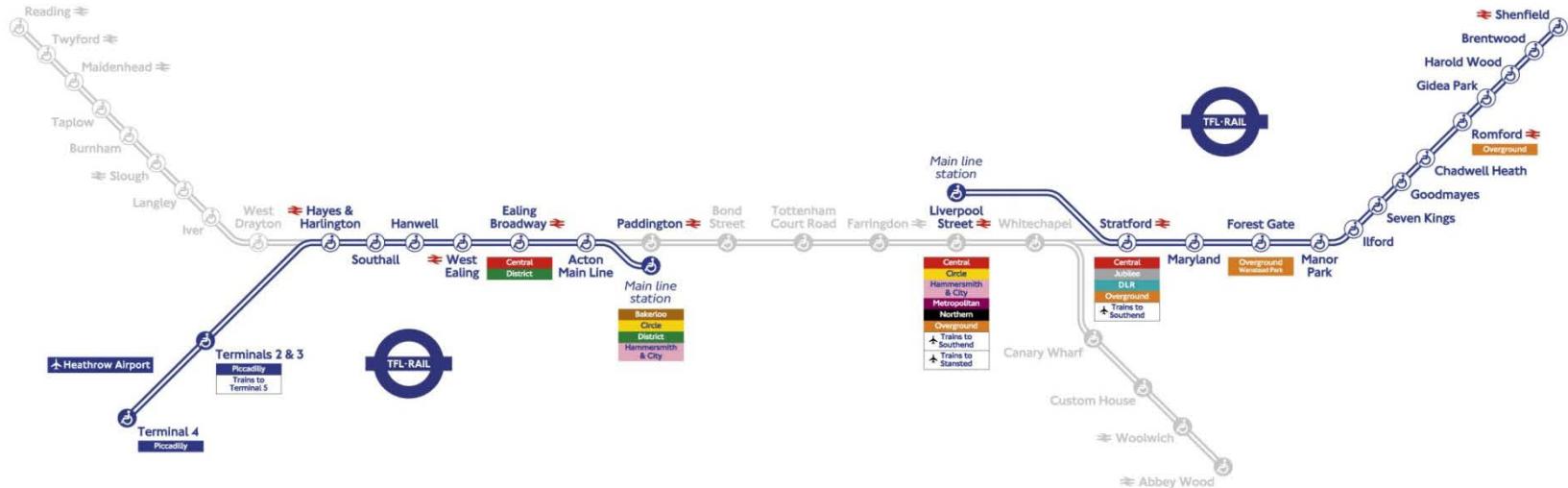
### Key Milestones towards Elizabeth line Opening

Completion of end-to-end track in tunnel	September 2017
Complete Final Design Overviews	Autumn 2017
Bringing into use of Old Oak Common Depot	Jan 2018
Network Rail Signalling Data Change (Paddington-Maidenhead) including interfaces to central tunnels and Old Oak Common Depot	Christmas 2017
Energisation	January 2018*
Stage 2 commencement of TfL Rail 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

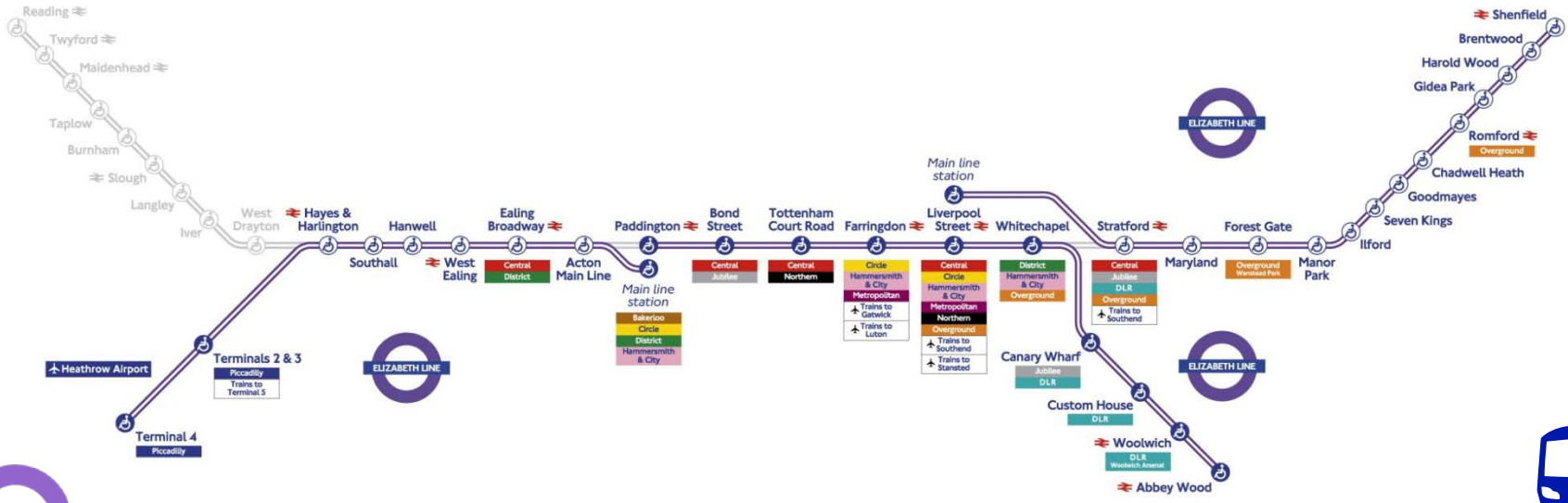
\*Rescheduled from Autumn 2017



Stage 2: 20 May 2018 New class 345 rolling stock introduced on TfL Rail services Paddington - Heathrow



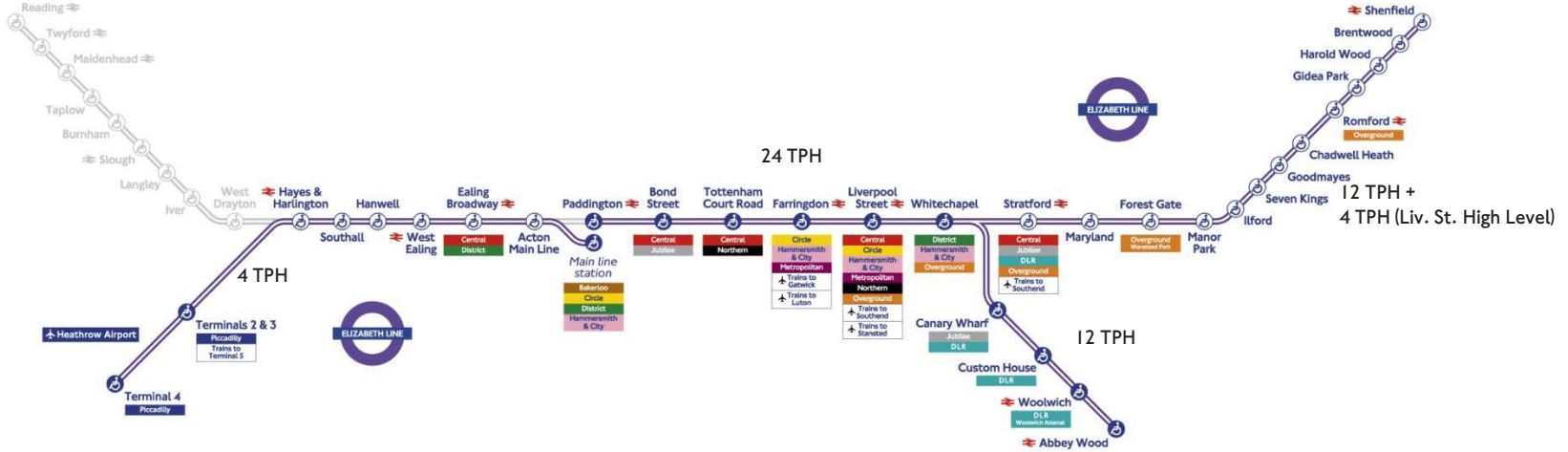
Stage 3: 9 December 2018: Elizabeth line opens. Services run Liverpool Street – Shenfield; Paddington – Heathrow; Paddington - Abbey Wood



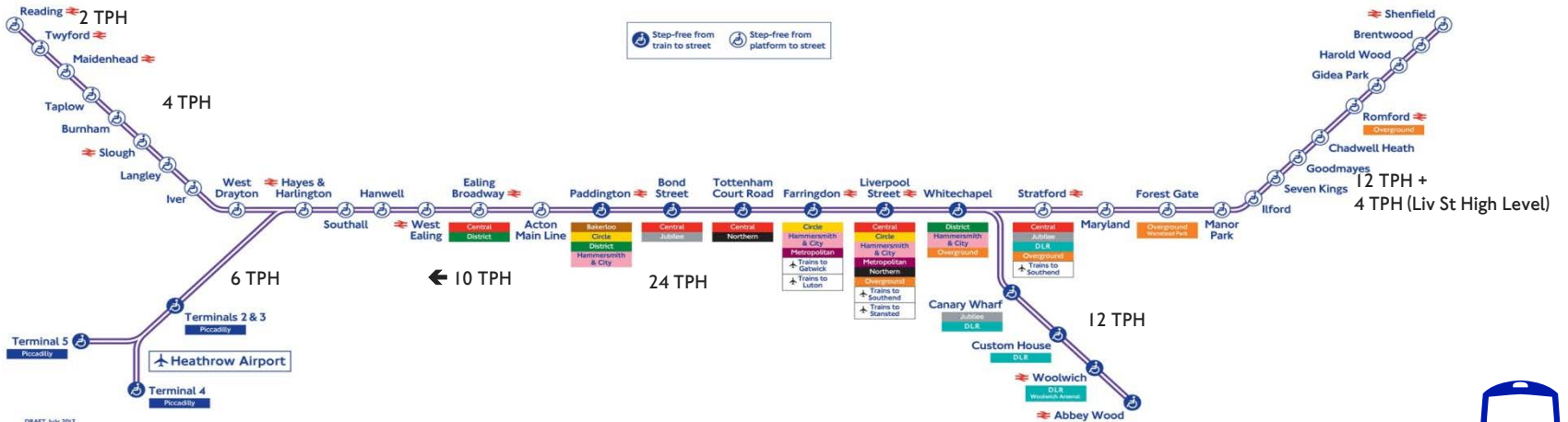
# CROSSRAIL UPDATE AND ELIZABETH LINE READINESS



## Stage 4: 19 May 2019: Elizabeth line through services extend to Shenfield



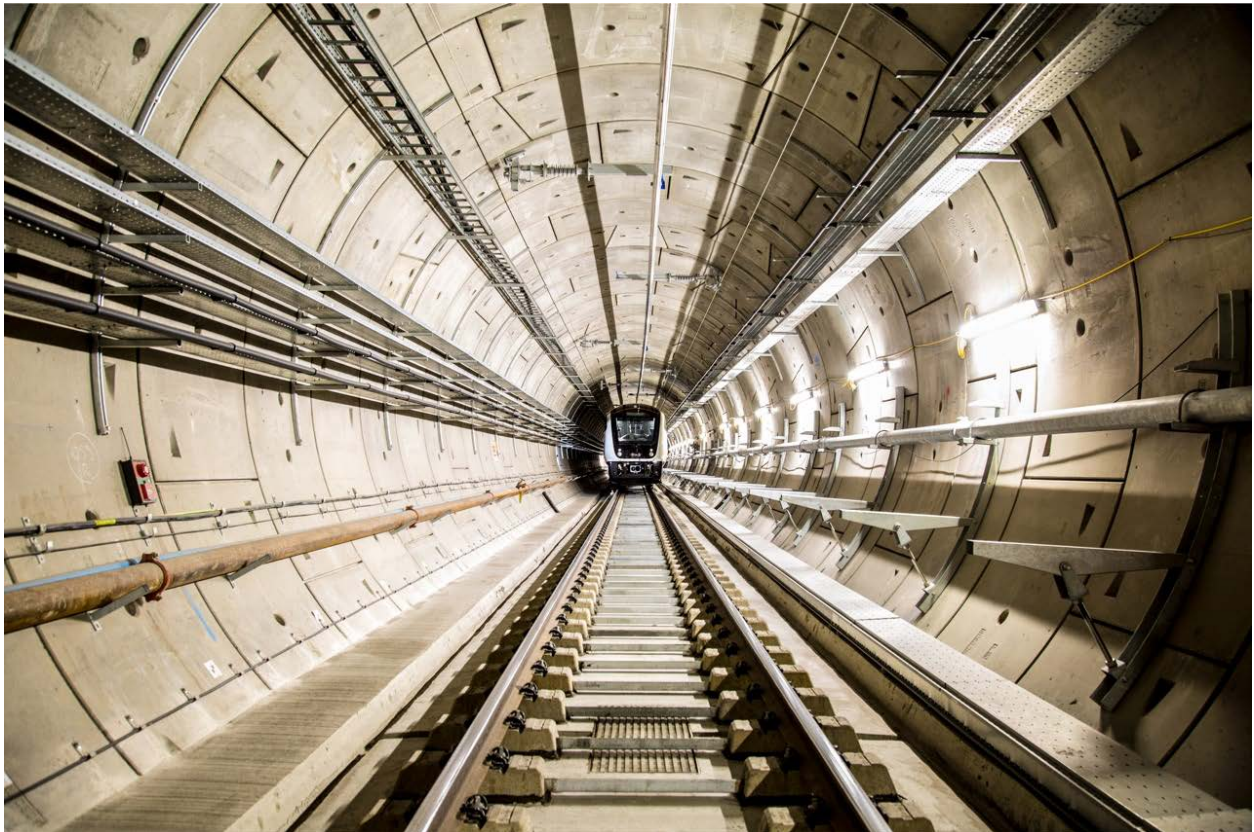
## Stage 5: December 2019: Elizabeth line fully open. Services run between Reading and Heathrow and Abbey Wood and Shenfield



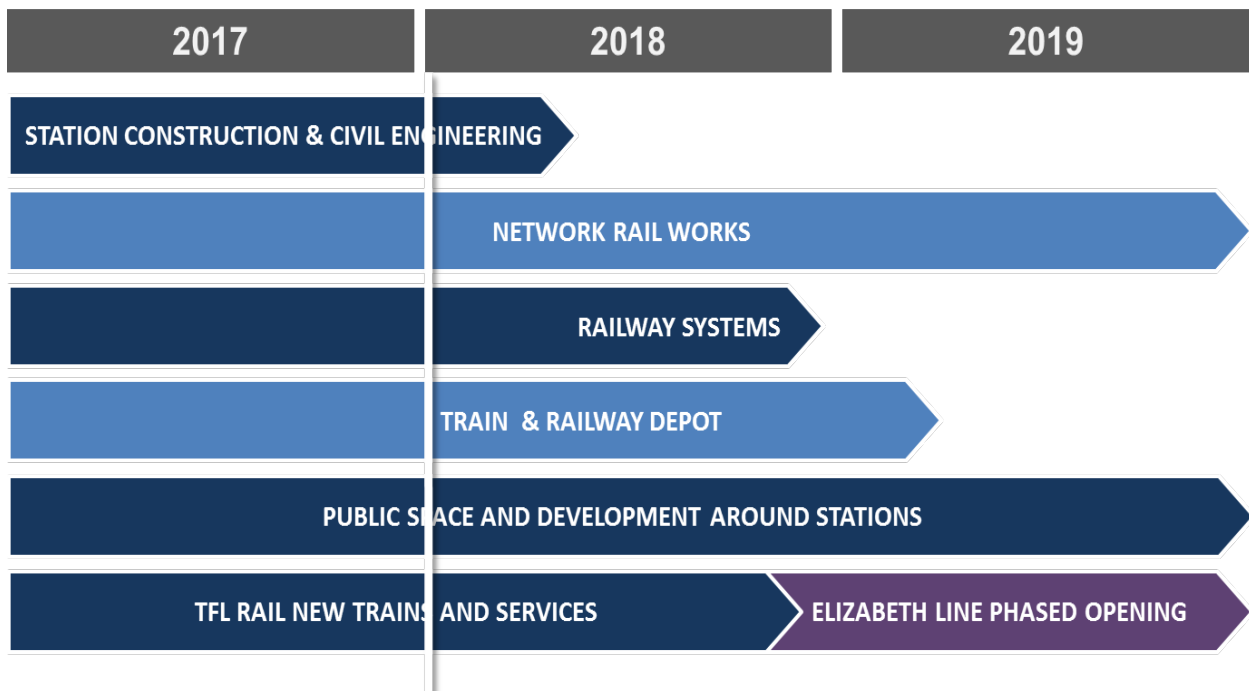
EVERY JOURNEY MATTERS



First Class 345 in the tunnel



Crossrail and Elizabeth Line Timeline



**Tottenham Court Road station**



**Paddington Station – installation of the station canopy incorporating ‘A Cloud Index’ by Spencer Finch, part of the Crossrail Art Programme**

