

TRANSPORT FOR LONDON

BRIEFING NOTE

Subject: Weekly Mayoral update on Crossrail / Elizabeth line

Date: 21 May 2018

Manifesto commitment(s)

Not applicable

Mayor's Transport Strategy (MTS)

A good public transport experience

Proposal 57: The Mayor, through TfL, will work with the DfT to open the Elizabeth line in 2019, with services initially providing 24 trains per hour through central London and increasing in frequency during the 2020s as demand requires.

1 Purpose

- 1.1 Weekly update to the Mayor outlining progress and challenges ahead of the launch of the Elizabeth line.
- 1.2 The Mayor is asked to **NOTE** this briefing.

2 Headlines

- 2.1 TfL Rail services between Paddington and Heathrow commenced on 20 May 2018. These services use the existing (former Heathrow Connect) rolling stock to the airport (two trains per hour) and the new Class 345 trains between Paddington and Hayes & Harlington (two trains per hour).
- 2.2 Tunnel fit-out activities are continuing in advance of the next train testing window on 25 May. Station fit-out and testing activities remain ongoing. The “power on” of the western tunnel section (Paddington to Whitechapel) remains on schedule to start testing in that section from 11 June.
- 2.3 Creation of testing windows has improved the productivity of tunnel fit-out activities and testing carried out by reducing down-time between team handovers and logistical constraints in accessing the tunnels. However, challenges remain in completing some critical activities including all the testing and cable installation required by the dates established in CRL’s current master operational handover schedule.
- 2.4 A revised plan is under development with input from all involved parties that will continue to allow sufficient fit-out and testing activity, trial running and operational readiness prior to commencement of Elizabeth line services in December 2018. Further details will be provided in the coming weeks once finalised.
- 2.5 The provision of asset data, operation and maintenance manuals and training materials by contractors remains challenging. This is needed to support the handover and bringing into use of the railway for Paddington to Abbey Wood services. Crossrail Ltd (CRL) is applying pressure on contractors at senior level to provide materials to meet training and handover plans, and working with TfL to prioritise the production schedule.



- 2.6 There is a significant volume of safety assurance and approvals required in order to support increasingly complex aspects of dynamic testing and ultimately bring the railway into safe operation. CRL has escalated its concerns with contractors around the need to increase the rate of submissions to the safety assurance bodies.

3 Costs

- 3.1 CRL's costs are reported on a periodic basis and are available up to the end of Period 13 (up to 31 March 2018). The forecast for the delivery of the central section has increased at the end of Period 13 to £12,723m, from £12,467m in Period 12. This follows a review to incorporate the implications of the revised Master Operational Handover programme, previously reported delays to energisation and lower than expected levels of productivity on the systemwide and stations contracts.
- 3.2 At the end of Period 13, the forecast cost to complete the Crossrail works exceeds the £600m TfL contingency by £211m. A breach in funding will be reported formally in the Crossrail semi-annual construction report that will be made available to TfL and DfT officials (Sponsors) following the CRL Board meeting on 24 May.
- 3.3 The forecast cost for Network Rail's delivery of the On Network Works (ONW) remains unchanged at £2,530m, against the original budget of £2,300m. Under the Crossrail agreements, this cost overrun is a DfT held risk. NR has indicated further risks in the range of [REDACTED] with a funding request of [REDACTED] to be funded from NR contingency.
- 3.4 We are working with the DfT to agree how to jointly resolve the funding shortfall. The Sponsors anticipate the increase in costs above the currently agreed funding will be made public in the annual Written Ministerial Statement (WMS) that is being prepared for Parliament. The DfT has brought forward the date of the WMS to the week commencing 11 June in response to the media speculation regarding the increase in costs.
- 3.5 In addition, TfL, DfT, and CRL will coordinate the release of press statements to accompany the WMS. This is an opportunity to explain the context of the cost increase, promote the successes of the project and share the challenges remaining ahead of opening the central section in December 2018.

4 Programme and Schedule

- 4.1 The key commitments and dates in Crossrail's Master Operational Handover Schedule (MOHS) 2018 with key issues are provided in the appendix A.

5 Appendix

- Appendix A: Key milestones from MOHS 2018 schedule with key issues
- Appendix B: List of Acronyms
- Appendix C: Joint TfL and Bombardier Weekly Report



Appendix A: Key milestones from MOHS 2018 schedule by Stage and key issues including change since last period. The latest available dates are from Period 01 (up to 28 April 2018).

Key: On track ●
 Behind target but not impacting on critical path to Stage 3 ●
 Behind target and at risk of impacting critical path to Stage 3 services ●

Elizabeth Line Readiness Key Milestones	Target	Forecast	Variance	Critical path RAG	Periodic Trend
Stage 2 Phase 2 - Paddington to Heathrow					
ETCS Ready for Formal Heathrow Testing	24-Aug-18	24-Aug-18	0		↔
ETCS Approval to Operate for Driver Training	24-Aug-18	12-Oct-18	-49	Bombardier's software file is late. This has delayed approval to start driver training and ORR authorisation. This means the start of Phase 2 (when all the C345s will go in the Heathrow tunnels) services has been delayed. Start date tbc	↔
ORR Authorisation for On-board Signalling	28-Sep-18	19-Nov-18	-52		
Commence Stage 2 Phase 2 with ETCS functionality	28-Oct-18	TBC	<i>(Dependent on Unit Availability for Driver Training)</i>		
Stage 3 - Paddington to Abbey Wood					
Dynamic Testing					
PSD Ready for Dynamic Testing in Zone 1	09-Apr-18	28-May-18	-49	The contractor programme is being challenged by CRL.	↓
Provide all Trains to Systemwide for Dynamic Testing (3rd & 4th FLUs)	14-May-18	07-Jun-18	-24	Non critical 1 day delay	↓
Linewise SCADA available in Zones 3 & 4	30-May-18	31-May-18	-1		↔
Signalling infrastructure ready for DT in Zones 3 & 4	07-Jun-18	07-Jul-18	-30	High risk to the forecast date with aggressive mitigation required and not yet agreed by contractor	↓
GSM-R infrastructure ready for DT in Zones 1 to 4	08-Jun-18	29-Jun-18	-21	Medium risk based on update from Siemens	↓
Permanently energise OHLE Zones 3 & 4	10-Jun-18	10-Jun-18	0		↔
Start Dynamic Testing (Zones 3 & 4)	11-Jun-18	11-Jun-18	0		↔
Start Dynamic Testing (Zones 1,2,3 & 4)	30-Jun-18	17-Jul-18	-17	Knock on impact from delay in signalling infrastructure readiness in Z3&4	↓



Trial Running					
All 11 kV S,S&P locations energized	15-Apr-18	19-May-18	-34		↓
ORR Issue Safety Authorisation to RfLI	07-Jun-18	07-Jun-18	0		↔
Commence Transition Testing @ GEML	30-Jun-18	15-Jul-18	-15	Confirmation of NR possessions required. Infrastructure and transition software low risk	↓
All 22 kV S,S&P locations energized	30-Jun-18	28-Jul-18	-28	Fault with voltage transformers is leading to further delay. Response plan in development	↓
ORR Issue Amended Safety Cert. & Authorisation to MTRC	04-Jul-18	04-Jul-18	0		↔
Training completed for RFL in support of Handover of Routeway	05-Jul-18	03-Aug-18	-29	Production of training materials is being prioritised to ensure RfL can train the maintenance and station staff first as they are the most urgent people	↔
Commence Transition Testing @ GWML	14-Jul-18	12-Aug-18	-29	Securing NR possessions not yet achieved. Discussions continuing to finalise.	↓
Delivery Yellow Plant (RPM, ET01, ET02)	27-Jul-18	04-Aug-18	-8		↓
Sufficient RFLI Ops & Maintenance. Staff Trained and Competent as IM	03-Aug-18	03-Aug-18	0		↔
Training Delivered to allow the Introduction of the RFLI Rule Book	03-Aug-18	03-Aug-18	0		↔
Handover - Railway Systems	05-Aug-18	05-Aug-18	0	Delays in the installation, testing and commissioning of the signalling system introduces a knock on risk to commencement of trial running	↔
CBTC Authorised for FLU for Trial Running	05-Aug-18	26-Jun-18	40		↔
Handover to Operator / Commencement of Trial Running	05-Aug-18	05-Aug-18	0	Delays in the installation, testing and commissioning of the signalling system introduces a knock on risk to commencement of trial running	↔



22no. Cl.345 FLUs Available for Trial Running	13-Aug-18	29-Jun-18	45		↑
Stage 3 - Paddington to Abbey Wood					
Trial Operations					
All Stations 'Staged Completion' - for RFLI/LU/MTR Familiarisation and Trial Ops.	<i>Refer to detailed Station Table</i>				
Final COS safety case updated and submitted to RABC	31-Aug-18	31-Aug-18	0		↔
Commence Trial Operations	09-Sep-18	09-Sep-18	0	Potential knock on to this milestone if trial running is delayed	↔
Passenger Service					
Submit Technical File to ORR	17-Sep-18	17-Sep-18	0		↔
CBTC Authorised for Passenger Service	10-Oct-18	02-Aug-18	69		↑
PML ATS Re-energised including NR feed	15-Oct-18	15-Oct-18	0		↓
Temporary services recovery complete	09-Nov-18	30-Nov-18	-21	CRL continuing to challenge contractor programme and discuss with RfL whether some services could be removed later by maintenance team	↑
Opening of Stage 3 - Central Section Paddington L/L to Abbey Wood	09-Dec-18	09-Dec-18	0		↔
Substantial Completion of Stage 3					
Plumstead Maintenance Facility Completion (Initial IM access)	21-Nov-18	21-Nov-18	0		↓
Final Handover of all Stations, Shafts and Portals	28-Nov-18	28-Nov-18	0		↔
Plumstead Stabling Sidings Completion	29-Mar-19	29-Mar-19	0		↔
Stage 3 - Paddington to Abbey Wood					
LU Stations 'Staged Completion' - for LU Familiarisation and Trial Ops.					



Whitechapel Station	16-Aug-18	16-Aug-18	0		↔
Bond Street Station	31-Oct-18	31-Oct-18	0		↔
Liverpool Street Station	02-Sep-18	02-Sep-18	0		↔
Tottenham Court Road Station	02-Aug-18	02-Aug-18	0		↔
Farringdon Station	17-Aug-18	17-Aug-18	0		↔
RFLI Stations 'Staged Completion' - for RFLI/MTR Familiarisation and Trial Ops.					
Paddington Station	29-Jul-18	29-Jul-18	0		↔
Custom House Station	28-Jul-18*	28-Jul-18	0		↔
Woolwich Station	09-Sep-18	09-Sep-18	0		↔
Canary Wharf Station	05-Jul-18	05-Jul-18	0		↔
Date with * = Final Handover date not Staged Completion					
Stage 4 - Paddington to Abbey Wood & Shenfield					
Required no. units available for Stage 4 (55 FLU & 5 RLU)	17-May-19	8-May-19	9		↓
Opening of Stage 4 - Paddington L/L to Abbey Wood and Shenfield	19-May-19	19-May-19	0		↔
Stage 5 - Full Crossrail Service					
70 Trains Delivered for Stage 5. (Including RLU to FLU Reconfiguration)	13-Dec-19	16-Oct-19	58		↔
Opening of Stage 5 - Reading & Heathrow to Abbey Wood and Shenfield	15-Dec-19	15-Dec-19	0		↔



Appendix B: List of Acronyms

Acronym	Description
APIS	Authorisation for Placing Into Service
ATC	Alstom, TSO, Costain joint venture
ATFS	Auto Transformer Feeder Station
BT	Bombardier Transportation
CBTC	Communications Based Train Control
CRL	Crossrail Limited
DfT	Department for Transport
ET01/02	Engineering Train
ETCS	European Train Control System
FLU	Full Length Unit
GEML	Great Eastern Mainline
GSM-R	Global System for Mobile Communications – Railway
GWML	Great Western Mainline
LU	London Underground
MNO	Mobile Network Operators
MOHS	Master Operating Handover Schedule
MTRC	Mass Transit Railway - Crossrail
MTS	Mayor's Transport Strategy
ORR	Office of Rail & Road
PML	Pudding Mill Lane
PSD	Platform Screen Door
RAB (C)	RfL Assurance Board for Crossrail
RfL	Rail for London
RPM	Railway Profiling Machine
S, S&P	Station Shafts and Portals
TBC	to be confirmed
TCMS	Train Control Management System
TfL	Transport for London
TPH	Trains per hour
WBP	Westbourne Park



Appendix C: Joint TfL and Bombardier Weekly Report

Elizabeth line - Bombardier Weekly Report 21 May 2018

Note No: 12

Key Activities and Issues

- 4x trains have been completed in Derby by Bombardier, which is in line with the plan.
- Five 7-Car trains are based at Old Oak Common Depot and are being used on TfL Rail services between Paddington and Hayes & Harlington from this week. TfL Rail has taken over the Heathrow Connect services, using the existing rolling stock to the airport and the Class 345 trains between Paddington and Hayes & Harlington. The remaining 10 7-Car trains remain at Ilford Depot and are available for passenger service on the Liverpool Street to Shenfield line.
- Bombardier is focused on delivering its reliability growth plan. This targets a mean distance between service affecting failures (the standard industry measure) of 10,000 miles by 26 June 2018. It is based on 15 modifications and software updates that will reduce or eliminate current faults. Reliability continues to improve, for the last three weeks, it is around 4000 miles between service affecting failures, up from 2000 miles four weeks previously, but it is not yet clear if the target figure will be achieved by 26 June.
- Three 9-Car trains are being used for driver training on the Great Western route (between Paddington and Heathrow / Reading) and three 9-Car trains are being used for testing, two in the Elizabeth line central tunnel section between Whitechapel and Abbey Wood (Dynamic Testing) and one for pre-testing in the Heathrow tunnels.
- Dynamic testing in the tunnels between Canary Wharf and Woolwich will resume at the end of this week and will include train and signalling testing and platform screen door interfaces.
- Tunnel testing is currently taking place using release 7.1 of the train control management software. This has improved the efficiency of testing compared with earlier releases, however a number of further improvements will be included in release 7.2.
- Release 7.2 of the train control management software has been tested on the rigs at Derby. A bug affecting the start-up of the system delayed testing for much of last week but it is believed a solution has now been found and testing is expected to start on a train at the Melton test track later this week. This is 17 days behind the original plan. Bombardier is looking at how it mitigates this delay to ensure that it does not affect planned dates for testing in the tunnels and believes whilst float has been exhausted, this delay will not affect the schedule for testing in the tunnels.
- Bombardier has produced a plan and programme for assurance activities. With such a large amount of testing and the number of releases ahead, this is a key area of focus. A



meeting with the safety regulator (the Office of Rail and Road) is taking place on 21 May at which the ORR will be briefed on Bombardier's approach to securing the necessary approvals. Bombardier continues to review the resources assigned to this crucial activity.

- Going forward, testing schedules will depend on the software releases from Siemens, who supply the signalling system that is fitted to the tunnels. Weekly meetings continue between Bombardier, Siemens, Crossrail and TfL, to improve joint testing, coordination of software release programmes and bug fixing. These meetings are productive and time devoted to them has been increased.
- Good progress continues to be made in bringing Old Oak Common Depot in to full use. The next stage of signal commissioning, took place successfully on the 17 May, having been deferred from 7 May as the necessary testing had not been completed by Atkins, the signalling supplier. This delay should not have any implications for future signalling commissioning nor on depot operations.
- Further pre-testing of the European Train Control System ('ETCS') in the Heathrow tunnels took place on 18 May and using the more up to date Release 7 series software and the results are now being analysed.



Key Programme Milestones

Stage 2	P80 Programme (V3_5_1) 11 th Jan	Current Forecast
Approval for driver training on Great Western routes excluding European Train Control System	27 Feb	Completed - submitted 5 March
Commence build of TCMS release 7.3 (the Stage 2 passenger service software)	26 June	26 June
Independent Safety Assessment body ('ISA') approval for European Train Control System MR3 software necessary for Stage 2	6 August	6 August
Independent Safety Assessment body ('ISA') approval for TCMS release 7.3	18 September	18 September
Approval for European Train Control System driver training on Great Western	24 Aug	12 Oct
Approvals for European Train Control System Passenger Service	28 Sept	19 Nov
Stage 3		
Completion of Transition testing at Melton ready for Central Operating Section Dynamic Testing	29 Jan	Completed
Commence build of TCMS release 7.2 (the Stage 3 passenger service software)	24 April	Completed
Independent Safety Assessment body ('ISA') approval for European Train Control System MR2 software necessary for Stage 3	22 May	11 June
Approval of CBTC signalling for Central Operating Section Trial Operations	22 Jun	22 Jun
Availability of 22 trains for Trial Running in the Central Operating Section	13 Aug	13 Aug
Approval of Class 345 for Stage 3 Passenger Service	10 Oct	10 Oct
Start of Stage 3 Passenger Service	9 Dec	9 Dec
Old Oak Common Depot		
Section A Brought into Use	1 Mar	Completed
Section B1 Brought into Use	11 Apr	Completed
Section C Brought into Use	30 May	11 June

