

TRANSPORT FOR LONDON

BRIEFING NOTE

Subject: Weekly Mayoral update on Crossrail / Elizabeth line

Date: 12 July 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 The Crossrail team is continuing to work with Siemens to review the scope of work required for the railway's opening in December. A senior level review meeting is taking place this week.
- 2.2 Station fit-out and testing activities remain ongoing. Detailed completion reviews of all major contracts took place last week. The reviews considered their completion programme dates, key risks and issues and readiness for handover to London Underground and Rail for London.
- 2.3 The combined results of these reviews including the approvals required and the time to build system and train reliability will be considered in next week and an overall assessment of readiness for a December launch will be discussed with the Crossrail Ltd (CRL) Board and Sponsors at the end of July.
- 2.4 A senior-level meeting with contractors took place last week to focus on the critical issue of the operation and maintenance manuals. These materials are needed to support the handover and bringing into use of the railway for Paddington to Abbey Wood services. The meeting focussed on increasing the pace of submissions, improving the quality and accelerating the review process by CRL and the Infrastructure Managers (London Underground and Rail for London).
- 2.5 CRL continues to work with the Department for Transport (DfT), Network Rail (NR) and train operators on the critical project issue of securing railway access from NR for the installation and testing of the signalling transitions to the east and west of the tunnel sections. Positive progress has been made and access has now been approved by NR routes directors for periods in August, September and November. The impact on



passenger services (which is minimal) during the access periods is being confirmed to DfT.

- 2.6 NR has retendered the upgrades of some of the western stations (Acton Mainline, Ealing Broadway, West Ealing, Southall, Hayes and West Drayton). NR still plan delivery of the upgrades by December 2019, but the delay to the award of construction contracts risks the completion date.

3 Costs

- 3.1 CRL's costs are reported on a periodic basis and are available up to the end of Period 2 (up to 26 May 2018). The forecast for the delivery of the central section has remained at £12,723m at the end of Period 2, £211m above the available TfL Contingency.
- 3.2 The forecast cost for Network Rail's (NR) 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.
- 3.3 TfL has now reached a deal with the DfT and HM Treasury on how to jointly resolve the funding shortfall. Together with the DfT, TfL will contribute to the £300m of additional funding to CRL for the project. Separately, the DfT has agreed additional funding of around £300m for Network Rail's works.
- 3.4 The Sponsors expect 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 for publication. The DfT are working with the Rail Minister and Special Political Advisors to identify a time to submit the WMS to align with other government announcements. Publication is expected on 23 July.

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 03 (up to 23 June 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	07-Sep-18	-14		*↓
ETCS Approval to Operate for Driver Training	12-Oct-18	12-Oct-18	-0	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. Target date rebaselined in the period.	*↓
ORR Authorisation for On-board Signalling	19-Nov-18	26-Nov-18	-7		
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					
Signalling infrastructure ready for DT in Zones 3 & 4	07-Jun-18	23-Jul-18	-46	Availability now forecast for Testing Window 7 commencing 27 July. Some risk to forecast date.	*↓
GSM-R infrastructure ready for DT in Zones 1 to 4	30 July-18	09-Sep-18	-41	Risk increased based on recent update from Siemens. Siemens programme currently being reviewed	↔
Start Dynamic Testing (Zones 1,2,3 & 4)	30-Jun-18	27-Jul-18	-27	Potential risk from knock on impact of delay in signalling infrastructure readiness in Z3&4	*↑
Pre-Trial Running					
Commence Transition Testing @ GEML	30-Jun-18	12-Aug-18	-43	Confirmation of NR possessions received.	*↔
All 22 kV S,S&P locations energized	30-Jun-18	29-Jul-18	-29	Fault with voltage transformers has led to delay.	*↔
ORR Issue Amended Safety Cert. & Authorisation to	04-Jul-18	26-Jul-18	-22	Was due back from ORR 4 July as they have now been in	*↔



MTR-C				receipt for 4 months. Expected date now 26 July.	
Commence Transition Testing @ GWML	14-Jul-18	09-Sep-18	-57	Confirmation of NR possessions received	*↔
Delivery Yellow Plant (RPM, ET01, ET02)	27-Jul-18	15-Sep-18	-50	First delivery of engineering trains will be 27 July. RPM September date. Low risk of further delay or impact on operations	*↔
Train CBTC Authorised for FLU for Trial Running	26-Jun-18	17-Jul-18	--21	Partially achieved. Final scope authorisation required for 17 July.	*↔
Commencement of pre-trial Running under CCRRB (Construction Rule Book)	12Sep-18	12-Sep-18	0	MOHS milestone date now revised. Await ORR issue of ROGS exemption prior to running 4+ trains	*↔
22no. Cl.345 FLUs Available for Trial Running	13-Aug-18	13-Aug-18	0		*↔
Combined Elizabeth line trials					
Training completed for RFL in support of Handover of Routeway	05-Jul-18	14-Sep-18	-71	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.	*↔
Final COS safety case updated and submitted to RABC	31-Aug-18	20-Sep-18	-20		*↓
Handover of routeway under ROGS to RfLI as IM	05-Aug-18	1-Oct-18	-57	Reflects revised plan for handovers, trial running and trial operations.	↔
Commence combined Elizabeth line trials (trial operation)	01-Oct-18	01-Oct-18	0	Reflects revised plan for handovers, trial running and trial operations.	*↔
Passenger Service					
Submit Technical File to ORR	17-Sep-18	09-Nov-18	-53	Impact to be mitigated by staged submittal to ORR	*↔
Train 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	27-Oct-18	13	Programme received from C610 received to complete removal after 1 Oct handover	*↑



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		↔
LU Stations 'Staged Completion' - for LU Familiarisation and Trial Ops.					
Whitechapel Station	16-Aug-18*	16-Aug-18	0	Handover to IM 16-Nov-18	*↔
Bond Street Station	31-Oct-18*	31-Oct-18	0	Handover to IM 28-Nov-18	↔
Liverpool Street Station	02-Sep-18*	28-Sep-18	-26	Handover to IM 24-Oct-18	*↓
Tottenham Court Road Station	10-Aug-18	01-Oct-18	-52	Handover to IM 26-Oct-18	*↓
Farringdon Station	17-Aug-18	28-Aug-18	-11	Handover to IM 29-Oct-18	*↓
RFLI Stations 'Staged Completion' - for RFLI/MTR Familiarisation and Trial Ops.					
Paddington Station	29-Jul-18*	01-Oct-18	-64	Handover to IM 26-Nov-18	↓
Custom House Station	n/a	n/a	0	Station ready for Handover to IM 24-Aug-18	↔
Woolwich Station	09-Sep-18*	01-Oct-18	-22	Handover to IM 31-Oct-18	*↓
Canary Wharf Station	05-Jul-18*	28-Sep-18	-85	Handover to IM 08-Dec-18	*↓
Date with * = Dates are drawn from first draft of handover execution plans					
Stage 4 - Paddington to Abbey Wood & Shenfield					
Required no. units available for Stage 4 (55 FLU & 5 RLU)	17-May-19	8-May-	9		↔



		19			
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
ROGS	Railways and Other Guided Transport Systems (Safety) Regulations
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 9 July 2018

Note No: 18

Key Activities and Issues

- 51 trains have been completed in Derby by Bombardier, which is in line with the plan.
- Five 7-Car trains continue to be used on TfL Rail services between Paddington and Hayes & Harlington based at Old Oak Common. Ten 7-Car trains are available for passenger service on the Liverpool Street to Shenfield line. Availability remains good since the timetable has been adjusted to make greater use of the trains on the Shenfield line.
- The final group of sidings were brought into use on 11 June at Old Oak Common Depot. Full signalling commissioning is scheduled for the end of August but opportunities are being pursued to bring this date forward.
- Bombardier remains focused on its reliability growth plan. The June 26 target of a mean distance between service affecting failures (the standard industry measure) of 10,000 miles was not achieved, the current figure is around 4,000-5,000 miles. Two failure modes dominate performance:-
 - Driver's information screens failing on the 7-Car fleet. The train has two screens and is designed so that critical information can be displayed on the remaining single display. Trains have been modified to include a reset for the monitors. This means that these events do not always cause a delay but still cause extra work for the drivers and controllers. A solution has been identified and is embedded in the 9-Car unit software. A 7-car version is under review with Bombardier's software team
 - There has been a sharp spike in failures of driver's CCTV monitors over the last period and these have been diagnosed as a firmware issue within the monitor and are being replaced.

Bombardier are finalising their plan, due last week, to include further physical modifications and software updates that will reduce or eliminate the most significant current faults, some of which have emerged since the previous plan was developed.

- Six 9-Car trains are being used for driver training on the Great Western route (between Paddington and Heathrow / Reading) and six 9-Car trains are being used for testing, five in the Elizabeth line central tunnel section between Whitechapel and Abbey Wood (Dynamic Testing) and one for pre-testing in the Heathrow tunnels.
- The latest dynamic testing 'window' in the tunnels is currently underway. Testing is mainly of signalling functions using the current software (Release 7.2.1.3) from Bombardier and from Siemens (Release 3.0.10). Tests in the previous window (29 June -



4 July) included various signalling functions, train stopping accuracy, radio coverage and Driver CCTV. The tests were very largely completed within the test window and detailed analysis of the results is now underway at Siemens. There was an issue where the train required resetting when changing direction, this is being analysed by Bombardier and Siemens to confirm the root cause and solution.

- A further train software release (7.2.2) is being produced to incorporate fixes to the defects identified in release 7.2.1.3. The number of defects in 7.2.1.3 has been raised with the Chairman of the Bombardier Board. In order to accommodate further fixes the planned build of Release 7.2.2 was deferred and has been held open to include a fix for a Siemens defect as this is the best place to execute a fix quickly. This is not expected to directly impact other dates in the tunnel testing programme, as the software will still be available in time for the relevant testing. However, this delay (plus the potential lead time for Siemens assurance information) will affect the dates for achieving full certification for running to/from the Network Rail (NR) network so there will be less opportunity to run trains on NR to build reliability. Bombardier issued an updated programme on 7 July which is being reviewed by TfL.
- Weekly meetings continue between Bombardier, Siemens, Crossrail and TfL, to coordination of software releases, testing and bug fixing. Direct BT/Siemens liaison and escalation meetings are also taking place.
- Due to the delay to completion of Release 7.2.2, the building of Release 7.3 (to be used for Heathrow services) has been put back. This in itself will not impact the existing driver training (12 Oct) or public service approval (19 Nov) dates for the Heathrow software but the implications for the compliance and assurance timescales have yet to be determined. Bombardier have committed to updated their programme for 7.3 this week.
- With a large amount of testing and the number of releases ahead, assurance is a key area of focus and assurance resources and production of evidence is a potential critical constraint on the programme. Evidence for the approval of multi-train testing in the tunnels was submitted in line with the programme date of 26 June but further submissions have been required to satisfy the requirements of the Approvals Board. Because of delays to other elements of the Crossrail construction and testing schedule, multi-train testing will not now take place until 27 July.



Key Programme Milestones – changes from dates previously reported are shown in red

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
Commence build of TCMS release 7.3 (the Stage 2 passenger service software)	26 June	To be confirmed
Independent Safety Assessment body ('ISA') approval for European Train Control System MR3 software necessary for Stage 2	6 August	To be confirmed
Independent Safety Assessment body ('ISA') approval for TCMS release 7.3	18 September	18 Sept
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	Completed
Approval of CBTC signalling for Central Operating Section Trial Operations	22 Jun	Submitted 26 Jun, further submissions underway
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	Completed

