

TRANSPORT FOR LONDON

BRIEFING NOTE

Subject: Weekly Mayoral update on Crossrail / Elizabeth line

Date: 04 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 Additional train testing in the tunnels started on 29 June and finished on 4 July. This included train and signals testing using the latest software releases from Bombardier and Siemens, as well as testing of train stopping accuracy, radio coverage and Driver CCTV. Overall, a significant amount of testing in the full tunnel lengths was successfully undertaken.
- 2.2 The Crossrail team is working with Siemens over the next two weeks to review the scope of work required for the railway's opening in December.
- 2.3 Station fit-out and testing activities remain ongoing. A series of detailed completion reviews of all major contracts are taking place over the next two weeks. These will consider their completion programme dates, key risks and issues and readiness for handover to London Underground and Rail for London.
- 2.4 The combined results of these reviews including the approvals required and the time to build system and train reliability will be considered in July and an overall assessment of readiness for a December launch will be taken.
- 2.5 CRL has continued to work with the 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 in August and early September. Positive progress is being made but access is not completely secure yet.
- 2.6 NR are retendering 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 have 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 have 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 statement, joint Q&A pack prepared by DfT, TfL, CRL, and NR and TfL's reactive lines will be shared with the Mayor's Press Office in advance.

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.

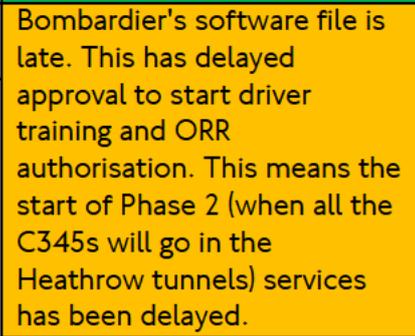
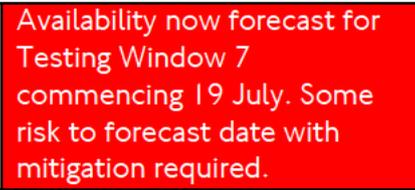
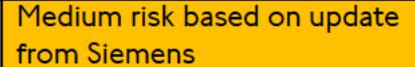
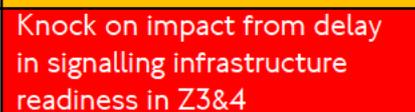
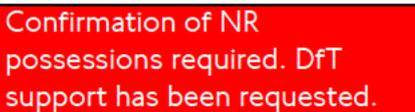
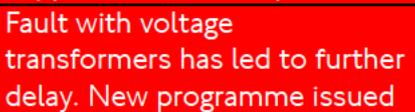
5 Appendix

- **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 02 (up to 26 May 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.	↔
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					
Signalling infrastructure ready for DT in Zones 3 & 4	07-Jun-18	19-Jul-18	-42	 Availability now forecast for Testing Window 7 commencing 19 July. Some risk to forecast date with mitigation required.	↔
GSM-R infrastructure ready for DT in Zones 1 to 4	30-Jul-18	25-Jul-18	5	 Medium risk based on update from Siemens	↔
Start Dynamic Testing (Zones 1,2,3 & 4)	30-Jun-18	06-Aug-18	-37	 Knock on impact from delay in signalling infrastructure readiness in Z3&4	↓
Pre-Trial Running					
Commence Transition Testing @ GEML	30-Jun-18	11-Aug-18	-42	 Confirmation of NR possessions required. DfT support has been requested.	↓
All 22 kV S,S&P locations energized	30-Jun-18	29-Jul-18	--29	 Fault with voltage transformers has led to further delay. New programme issued	↓
ORR Issue Amended Safety Cert. & Authorisation to MTR-C	04-Jul-18	04-Jul-18	0		↔
Commence Transition	14-Jul-	09-	-57	 Securing NR possessions not	↓



Testing @ GWML	18	Sep-18		yet achieved. Discussions continuing to finalise. DfT support has been requested.	
Delivery Yellow Plant (RPM, ET01, ET02)	27-Jul-18	04-Aug-18	-8		↓
CBTC Authorised for FLU for Trial Running	26-Jun-18	02-Jul-18	-6		↓
Commencement of pre-trial Running under CCRRB (Construction Rule Book)	05-Aug-18	11-Sep-18	-37	Revised milestone description and date based on extended durations for construction and dynamic testing. MOHS milestone date yet to be formally revised	↓
22no. Cl.345 FLUs Available for Trial Running	13-Aug-18	10-Aug-18	3		↓
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. Training quality concerns and requirement for re-running courses introduced low-medium risk.	↓
Sufficient RFLI Ops & Maintenance. Staff Trained and Competent as IM	03-Aug-18	10-Sep-18	-38	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	31-Aug-18	0		↔
Handover of routeway under ROGS to RfLI	05-Aug-18	1-Oct-18	-57	Reflects revised plan for handovers, trial running and trial operations.	↔
Commence combined Elizabeth line trials (trial operation)	09-Sep-18	01-Oct-18	-22	Reflects revised plan for handovers, trial running and trial operations.	↔
Passenger Service					
Submit Technical File to ORR	17-Sep-18	17-Sep-18	0		↔
CBTC Authorised for Passenger Service	10-Oct-18	02-Aug-	69		↔



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PML ATS Re-energised including NR feed	15-Oct-18	09-Oct-18	6		↑
Temporary services recovery complete	09-Nov-18	30-Sep-18	40	Mitigated programme from C610 received.	↑
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 8-Oct-18	↔
Bond Street Station	31-Oct-18*	31-Oct-18	0	Handover to IM 28-Nov-18	↔
Liverpool Street Station	02-Sep-18*	02-Sep-18	0	Handover to IM 24-Oct-18	↔
Tottenham Court Road Station	10-Aug-18	14-Sep-18	-35	Handover to IM 12-Oct-18	↓
Farringdon Station	17-Aug-18	17-Aug-18	0	Handover to IM 29-Oct-18	↔
RFLI Stations 'Staged Completion' - for RFLI/MTR Familiarisation and Trial Ops.					
Paddington Station	29-Jul-18*	08-Sep-18*	-41	Handover to IM 15-Oct-18	↓
Custom House Station	n/a	n/a	0	Station ready for Handover to IM 27-Jul-18	↔
Woolwich Station	09-Sep-18*	09-Sep-18*	0	Handover to IM 31-Oct-18	↔
Canary Wharf Station	05-Jul-18*	31-Aug-	-57	Handover to IM 01-Oct-18	↔



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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-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
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 2 July 2018

Note No: 17

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 and the timetable has been adjusted to make greater use of the trains on the Shenfield line.
- Good progress continues at Old Oak Common Depot. The final group of sidings were brought into use on 11 June. Full signalling commissioning is scheduled for August but opportunities are being sought to bring this date forward.
- Bombardier remains focused on delivering 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. Bombardier's plan is being updated over the next 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 in the tunnels started on 29 June and will finish 4th July. The testing includes train and signalling testing using the latest software (Release 7.2.1.3) from Bombardier and also from Siemens (Release 3.0.10) as well as tests of train stopping accuracy, radio coverage and Driver CCTV.
- A further Release (7.2.2) is being produced to incorporate fixes to the defects in 7.2.1.3. The number of defects has been raised with the Chairman of the Bombardier Board. Bombardier is looking to enhance their measurement of software quality. In order to accommodate further fixes, as well as the results of Siemens' own analysis of issues, the planned build of Release 7.2.2 was deferred to 29 June (originally 15 June). 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 in the tunnels.
- Due to the defects which are being addressed in Release 7.2.2, the building of Release 7.3 (to be used for Heathrow services) has been delayed from 26 June to 6 August. The delay will enable the build to follow testing of the Release 7.2.2 and allow enough time to incorporate any issues identified in Release 7.2.2. Bombardier believe this will not



impact the existing driver training (12 Oct) or public service approval (19 Nov) dates for the Heathrow software. A further meeting to review the Bombardier programme will take place on 4 July.

- Bombardier has produced a plan and programme for assurance activities. With a large amount of testing and the number of releases ahead, this is a key area of focus. Evidence for the approval of multi-train testing in the tunnels was finalised in line with the programme date of 26 June. Although because of delays to other elements of the Crossrail construction and testing schedule, multi-train testing will not now take place until 27 July.
- Tunnel testing also depends on the software releases from Siemens, who supply the signalling system that is fitted to the tunnels as well as the corresponding part of the signalling equipment on board the train. 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 have also been established.
- Further pre-testing of the ETCS in the Heathrow tunnels has been deferred as the latest software (Release 7.2) has some ETCS functions switched off. This will simplify approvals for the central section testing and testing using the previous software version (Release 6.1) has been completed.



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	6 Aug
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 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	Completed
Approval of CBTC signalling for Central Operating Section Trial Operations	22 Jun	Submitted 26 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	Completed

