

TRANSPORT FOR LONDON

BRIEFING NOTE

Subject: Weekly Mayoral update on Crossrail / Elizabeth line

Date: 1 May 2018

Manifesto commitment(s)

Not applicable

Draft 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 second phase of testing a new train in the tunnels between Canary Wharf and Woolwich was carried out over the weekend. Tests included static testing of platform screen doors and testing of the drivers' CCTV system. The train has now been tested in full automatic signal mode up to 62 miles per hour.
- 2.2 Good productivity is being achieved on the installation of the emergency walkways and the overhead conducting rail in the tunnels. The energisation sequence to provide traction power from Westbourne Park to Zones 3 and 4 (Paddington to Whitechapel) remains on target to commence on 11 May to enable dynamic testing in that section to start on 11 June.
- 2.3 Crossrail Ltd (CRL) working with the future Infrastructure Managers (IMS), maintainers and operators has agreed the approach to evaluating each area's readiness for trial running, trial operations and passenger service in December 2018.
- 2.4 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. CRL is applying pressure on contractors to provide materials to meet training and handover plans.
- 2.5 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. The rate of submissions to the safety assurance bodies



needs to increase and CRL has secured additional resource to assist with this as well as establishing new weekly metrics and a daily focus on required deliverables.

3 Costs

- 3.1 CRL's costs are reported on a periodic basis. 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 in May.
- 3.3 The Crossrail Sponsors (TfL and DfT) are working together to agree how to jointly resolve the funding shortfall. In addition, the Sponsors have commissioned a review into some of the critical contracts (including systemwide and select stations) to assess the confidence of the cost scenarios and the level of required funding. For each selected contract, the team will look at contract performance, costs to date, costs to go, risk, options to accelerate the delivery and an assessment of the contractual position and commercial incentives.
- 3.4 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 and additional funding has accordingly been allocated by the Department. NR have indicated further risks in the range of [REDACTED] which are intended to be funded from NR contingency.
- 3.5 The Sponsors anticipate the increase in costs above currently agreed funding will be made public in the annual Written Ministerial Statement that is being prepared for Parliament at the end of June. At this time, we anticipate that details of any funding agreements can also be shared. In addition, TfL, DfT, and CRL will coordinate the release of press statements.

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. MOHS review held each period to review forecast dates and assess criticality and mitigations.

Elizabeth Line Readiness Key Milestones	Target	Forecast	Variance	RAG	Periodic Trend
Stage 2 Phase 1 – Paddington to Heathrow					
5 trains available for Passenger Service (Non ETCS)	23-Apr-18	23-Apr-18	0	Now achieved	↔
Opening of Stage 2 - Heathrow to Paddington High Level @T/T Change 20 May 18	20-May-18	20-May-18	0		↔
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					
WBP ATFS Energised	31-Mar-18	27-Apr-18	-27	The programme still supports the energisation sequence to deliver dynamic testing Zones 3&4 from 11 June	↓
PSD Ready for Dynamic Testing in Zone 1	09-Apr-18	09-May-18	-30	The contractor programme is being challenged by CRL. Door testing to commence 26/4	↓
CBTC Software Available for Zones 1 & 2 Auto Reverse & Isolated ETCS Testing	23-Apr-18	27-Apr-18	-4	Now achieved	↓



Provide all Trains to Systemwide for Dynamic Testing (3rd & 4th FLUs)	14-May-18	15-May-18	-1	Non critical 1 day delay	↓
Linewide SCADA available in Zones 3 & 4	30-May-18	30-May-18	0		↔
Signalling infrastructure ready for DT in Zones 3 & 4	07-Jun-18	07-Jun-18	0		↔
GSM-R infrastructure ready for DT in Zones 1 to 4	08-Jun-18	08-Jun-18	0		↑
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	30-Jun-18	0		↔
Trial Running					
All 11 kV S,S&P locations energized	15-Apr-18	21-Apr-18	-6	Forecast date has now moved to 13 May. Consequences of delayed permanent power to stations, shafts and portals are being mitigated	↓
ORR Issue Safety Authorisation to RfLI	07-Jun-18	07-Jun-18	0		↔
Commence Transition Testing @ GEML	30-Jun-18	30-Jun-18	0		↔
All 22 kV S,S&P locations energized	30-Jun-18	30-Jun-18	0		↔
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	14-Jul-18	0		↔
Delivery Yellow Plant (RPM, ET01, ET02)	27-Jul-18	27-Jul-18	0		↔
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		↔
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		↔
22no. CL345 FLUs Available for Trial Running	13-Aug-18	17-Aug-18	-4	This does not impact on initial tests in trial running because these require fewer units	↓
Stage 3 - Paddington to Abbey Wood					
Trial Operations					
All Stations 'Staged Completion' - for RFLI/LU/MTR Familiarisation and Trial Ops.	Refer to detailed Station Table				
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		↔
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	05-Dec-18	-26	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	01-Nov-18	20		↓
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	17-May-19	14-May-	3		↔



(55 FLU & 5 RLU)		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
ATC	Alstom, TSO, Costain joint venture
BT	Bombardier Transportation
CBTC	Communications Based Train Control
CRL	Crossrail Limited
DfT	Department for Transport
ETCS	European Train Control System
LU	London Underground
MNO	Mobile Network Operators
MOHS	Master Operating Handover Schedule
MTS	Mayor's Transport Strategy
ORR	Office of Rail & Road
PML	Pudding Mill Lane
RAB (C)	RfL Assurance Board for Crossrail
RfL	Rail for London
TBC	to be confirmed
TCMS	Train Control Management System
TfL	Transport for London
TPH	Trains per hour
APIS	Authorisation for Placing Into Service
WBP	Westbourne Park
ATFS	Auto Transformer Feeder Station
PSD	Platform Screen Door
FLU	Full Length Unit
GSM-R	Global System for Mobile Communications – Railway
GEML	Great Eastern Mainline
MTRC	Mass Transit Railway - Crossrail
GWML	Great Western Mainline
RPM	Railway Profiling Machine
ET01/02	Engineering Train
S, S&P	Station Shafts and Portals



Appendix C: Joint TfL and Bombardier Weekly Report

Elizabeth line - Bombardier Weekly Report 30 April 2018

Note No: 9

Key Activities and Issues

- 44 trains have been completed in Derby by Bombardier, which is in line with the plan.
- Of the 15 trains that were available at Ilford Depot, 5 trains have been moved to Old Oak Common Depot ready for Stage 2 services between Paddington and Hayes & Harlington from 20 May. The remaining 10 7-Car trains remain at Ilford Depot and are available for passenger service on the Liverpool Street to Shenfield line.
- A further 3 9-Car trains are being used for driver training on the Great Western route (between Paddington and Heathrow / Reading) and 3 trains are being used for testing, 2 in the Elizabeth line central tunnel section between Whitechapel and Abbey Wood (Dynamic Testing) and 1 for pre-testing in the Heathrow tunnels.
- Bombardier has completed the updating of its reliability growth plan and will share this with TfL this week.
- The second phase of testing a new train in the tunnels between Canary Wharf and Woolwich was carried out over the weekend. Tests included static testing of platform screen doors and testing of the drivers' CCTV system. The train has now been tested in full automatic signal mode up to 62 miles per hour.
- Tunnel testing is currently taking place using release 7.1 of the train control management software. This release resolves a number of issues with earlier versions. It has improved the efficiency of testing, however a number of bugs remain to be resolved in release 7.2.
- Bombardier has now completed building release 7.2 of the train control management software and it is currently on test on the rigs at Derby. It is scheduled to be 'fast tracked' through to testing on the track at Melton next week. This release will be developed and approved for Stage 3 passenger service. All known defects are addressed in release 7.2 although further updates will be required to address any issues discovered in future dynamic testing and trial operations.
- With the amount of testing and the number of releases ahead, safety assurance submissions and resourcing remains a key area of focus. Bombardier is strengthening its process, resources and internal governance.
- Some issues discovered in testing will need to be addressed in future releases of Siemens signalling software where they relate to the Siemens part of the system and further bilateral and joint meetings and have taken place in the last week improving integration between Bombardier, Siemens, Crossrail and TfL, in terms of joint testing, coordination of software release programmes and bug fixing.



- Progress at Old Oak common Depot remains satisfactory. The focus remains on the next stages of signalling commissioning on 7 May and bringing into use section B2 and C.
- TfL Rail remains on schedule to take over the Heathrow Connect services from 20 May 2018, using the existing rolling stock to the airport and the Class 345 trains between Paddington and Hayes & Harlington.
- One of the key activities for the success of this plan was to update some route-specific software. The software was updated, on schedule, on 11 April and has been successfully tested in runs on the Great Western route. It remains on schedule for full safety approval on 2 May and Bombardier continues to monitor this closely.
- The next pre-testing of the European Train Control System ('ETCS') in the Heathrow tunnels will take place 4 and 18 May. Laboratory testing in Charleroi, Belgium was completed on 18th April. The results (20 tests undertaken, 19 successfully, with 14 issues noted) have been written up and a report issued.



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 on 20 April
Independent Safety Assessment body ('ISA') approval for European Train Control System MR2 software necessary for Stage 3	22 May	22 May
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	30 May

