

Project Representative Report

**Item: Project Status Report 156 and Crossrail Response
Period 7 FY2021-22**

Date: Period 7 (18 September 2021 - 15 October 2021)

1 Overview

- 1.1 The P-Rep is in place to provide the Sponsors, TfL and the Department for Transport, with oversight of project delivery, advise and raise points of challenge to the Sponsors and scrutinise progress.
- 1.2 The P-Rep observations are shared with Crossrail and are discussed in detail by Crossrail, P-Rep and the Commissioner. Crossrail then produces a written response to the P-Rep report.
- 1.3 In line with the commitments made by the Mayor for greater transparency of the Crossrail project, please find below the latest P-Rep Sponsor Summary and Crossrail's Management Response.
- 1.4 It has been necessary to make some redactions to the reports prior to publication to protect commercially sensitive material. We have sought to keep such redactions to a minimum

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██████████
Project Representative
Jacobs

22 November 2021

Dear ██████████

Re: Crossrail PRep Project Status Report 156 – Period 7

I am writing in response to the PRep Sponsor Summary cover letter for Period 7.

As noted in your letter and as I mentioned in my previous update, the October Blockade was a success with Trial Running resuming on 28 October 2021 after two days of maintenance works. Since the ELR100 software commissioning, 12TPH running service has recorded much improved performance levels in line with our reliability growth plans. With that said, we are aware that there are still further Alstom and Siemens software builds due by the end 2021.

The last few weeks have been an exceptionally busy time for the Programme as we enter a critical but historic period in the Crossrail journey with the commencement of Trial Operations. At the time of writing we are due to commence the first phase of Trial Operations, clearly this is a very important milestone that has been the product of some excellent collaborative work across the Programme. However, the Project Representative is accurate to point out the challenges that remain. We are cognizant of these challenges which continue to be the attention of management focus as we remain committed to following our gated process with firm pass/fail criteria for the start of the second phase of Trial Operations; we plan to get to the second phase in the early part of 2022.

The phased approach to Trial Operations is the right and best strategy for the Programme. It maintains the momentum of the Programme by splitting Trial Operations into two phases, with limited number of mass evacuation exercises following when the Tunnel Vent System modifications have been completed by Christmas 2021. In the past, the Project Representative has observed that the Programme tends to “plan to target dates”. Here, we have extended the period of Trial Operations from the DCS1.2 base plan. Hopefully this gives the Project Representative confidence in the rigorous data led approach we have to planning.

As mentioned above, we are fully aware and do not underestimate the challenges that remain. The timely delivery of assurance products to support the second phase of Trial Operations and the subsequent transition to Passenger Service will be dependent on successful completion of remaining works, tests, and the processing of assurance evidence. However, the two-stage approach to Trial Operations will provide an opportunity to carry out assurance delivery over a longer time span.

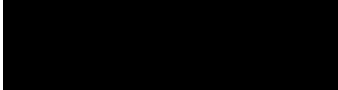
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I hope this response provides a useful summary of the measures in place to address the specific issues you have highlighted. A more comprehensive response focussed on the content of the Sponsor Summary report will be issued as an Appendix to this letter.

Kind regards,



Mark Wild
CEO, Crossrail

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	<p>and safety limitations of the infrastructure until critical works are completed, while seeking to maintain the planned start of Stage 3 Passenger Service in the first half of 2022.</p> <p>The schedule for assurance is extremely tight, although the adoption of the two-phase Trial Operations plan provides some relief, deferring the preparation of critical final safety submissions which support the step-change in safety risk at Phase 2. The principal submissions rely upon the closure of a significant number of Dependencies in limited time, and this is giving rise to an increased demand for assessment by Structured Engineering Judgement (StEJ). CRL's desire to meet the deterministic date for Trial Operations will place significant pressure on delivery teams, and additional ITAP review meetings will be held during November 2021. Given the assurance workload, it is possible that 20 November 2021 might not be met, but the ability to carry out Trial Running, or some limited Trial Operations activities, whether the Phase 1 milestone has been achieved or not, reduces the schedule criticality of this transition. Thereafter, the timely delivery of assurance to support Phase 2 and Passenger Service will rely upon successful completion of the remaining works, tests, and the processing of assurance evidence.</p>	<p>The schedule for assurance activities to reach the Deterministic Programme date was agreed to be sufficient to allow for completion of the railway level assurance through the CRL COS Entry into Trial Operations (EiTO) SJ, the RFLI SJ and the RFLI TORAC to support the overall CESAC acceptance through the RFLI ITAP. This includes the burn down of the SJ dependencies using Structured Engineering Judgement (StEJ) where necessary. This was stressed by emergent issues for several railway systems, particularly the TVS system affecting the fire strategy and was also further stressed by Canary Wharf station falling short of its intended SC3ROGS status. The joint response to consider the overall Programme risks and agree to a phased approach to Trial Operations around the inherent risks involved in planned activities has maintained the ability to reach the deterministic milestone for EiTO Part A. This includes the preparation of all the expected assurance documentation to support Trial Operations, but this will now need to be revisited in light of further system changes expected in December 2021 to achieve expected revenue ready COS railway configuration.</p>

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	<p>While plans to address Voltage Transformer (VT) failures and the lack of independent Platform Screen Doors (PSD) lock-out functionality have yet to be finalised, investigations are in progress. CRL has indicated that replacement VTs, appropriate for use in a railway environment, have been identified, with an expected timing for installation and testing throughout the Central Section before the end of the year. CRL has also suggested that conversion of PSDs to independent control might be possible by the end of 2021. However, given that plans for each are not yet complete, impacts upon schedule dates for Phase 2 Trial Operations and Passenger Service may yet be unavoidable.</p>	<p>The necessary disruptive access to resolve the Voltage Transformer and PSD issues have been secured and agreed with RFLI.</p> <p>Following investigations, the below actions are in place to support EiTO and permanent resolution for Entry into Revenue Service:</p> <ul style="list-style-type: none"> - Implement interim strategy to permit EiTO Phase 1 via SCADA system. - Replacement orders for VTs (18 outdoors; 18 indoors). Testing and Commissioning plans are currently being finalised. <p>To improve the performance and reliability of Platform-Train interface the following measures are in place:</p> <ul style="list-style-type: none"> - Plan to conduct a technical workshop on operations safety of close and lock override function with MTR. - PTI Steering Group meeting held on implementation of Westrace Network Communication (WNC) and Congestion Mode Software (v11), plus reinstating close and lock override function by ■ December 2021. The detailed programme shall be submitted shortly.
	<p>Train software upgrades to date have not delivered the expected improvements in train reliability, and there is now an increased reliance on train software reliability build H5.3, which is planned to be uploaded in December 2021. In</p>	<p>The Elizabeth Line Reliability Board (ELRB) meeting held on 9 November 2021 provided a 'Green' rating to Trial Operations, Gate 1a, whilst maintaining a 'Red' rating for entry to Revenue Service. The ELRB will focus on future review</p>

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	<p>combination with signalling software ELR110, scheduled for deployment during the December 2021 Blockade, the new train software is planned to deliver significant reliability improvement. Given past performance, it is possible that expectations might not be met, and this may have implications for entry into Passenger Service and for Stage 5B.</p>	<p>points covering capability to support 24TPH. The ELR100 software drop is a step change in performance with new train control configuration (Y0.640 including ELR100). During the first eight days of Trial Running from 28 October 2021 to 7 November 2021, subsequent to the completion of the Blockade, the following improvements have been achieved:</p> <ul style="list-style-type: none"> - Average PPM up from 54% to 89.1%. - Average mileage completed up from 74% to 96.1%. - Average initial delay minutes down from 191 minutes to 134 minutes. <p>Any ELR100 emerging issues are being investigated and mitigations discussed as part of the ELRB and PSSG weekly meetings. Train reliability is dependent on Alstom reliability builds H5.3 and H5.4 during the Christmas Blockade.</p>
	<p>The delay to TVS completion provides some schedule respite for Canary Wharf and Bond Street Stations. A late assessment of Canary Wharf Station readiness has shown that it will not now meet the SC3 ROGS milestone of [REDACTED] November 2021, with fire suppression testing, LV board works and the associated ACs outstanding. This milestone must now be achieved in time for the mass evacuation exercises in January 2022. Bond Street Station achieved the SC2 readiness milestone as planned, although additional possessions are</p>	<p>Canary Wharf station's Bringing into Use (BIU) target date is [REDACTED] November 2021 to support assurance and additional testing requirements identified. Bond Street station is committed to accelerate works as safely as possible to support the opening [REDACTED]</p>

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	<p>required to complete TVS system testing. The schedule is tight and additional access requires priority planning. [REDACTED]. The deferral of the mass evacuation exercises means that SC2 enactment is likely to take place by [REDACTED] January 2022, thereby providing more time for station works completion.</p> <p>Implementation of the two-phase Trial Operations plan moves the deterministic date for the start of Stage 3 Passenger Service to [REDACTED] March 2022 and the P50 date to [REDACTED] May 2021², the P80 date remains just within the declared opening window of the first half of 2022. Stage 3 opening will effectively only be an interim milestone, with meaningful revenue benefits realised only once Stages 5B and 5C are opened. With Stage 3 opening now forecast for [REDACTED] March 2022, there may be insufficient time to gather reliability evidence from operational service, and 24 TPH service trials, to support the Stage 5C timetable bidding process. The risk also remains that schedule delays will reduce the opportunity to achieve sufficient reliability growth to allow Stage 5B opening in [REDACTED].</p> <p>Despite the fixes being introduced up to the end of the Trial Operations period, it is possible that original reliability targets will not be met, and some works will remain. [REDACTED]</p>	<p>Stage 3 Passenger Service planned for [REDACTED] March 2022 will provide a six-month reliability mileage accumulation and service reliability growth at 12 TPH. Planned upgrades to the signalling system, [REDACTED] will give the Programme step change reliability improvements to allow for 24TPH in [REDACTED] during Stage 5B. Reliability reviews are planned and shall be carried out as the new software drops are commissioned.</p> <p>CRL is committed to opening a reliable 12TPH Passenger Service schedule on the [REDACTED] March 2022. [REDACTED]</p>
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	<p style="text-align: right;">One</p> <p>advantage of this approach would be to maximise the opportunity to build reliability in a passenger operating environment, ahead of Stage 5B. However, this approach would represent a significant commitment, requiring agreement between all stakeholders.</p> <p>Issues for particular Sponsor attention are as follows:</p> <ul style="list-style-type: none"> • Past general concerns remain with schedule, cost, and risk; integrated systems testing; assurance delivery; reliability growth; and stations completion. • The October 2021 Blockade outputs will have a major influence on the future course of the Programme, and early emerging trial running service performance is encouraging. • The Trial Operations plan has been phased, with major rail system software upgrades in late 2021 / early 2022 now expected to deliver the 	<p>.</p> <p>In response to the Project Representative’s five issues for attention, CRL responds as follows:</p> <p>As the railway systems mature and the stations complete their transfer to the IMs, the level of uncertainty has been reducing. Reaching a level of readiness to enter Trial Operations is another reflection of this growing level of certainty in terms of integration testing, reliability growth and completion of stations.</p> <p>The Blockade was a success with overall ELR100 commissioning programme accomplished as planned and as mentioned above, early Trial Running has been reassuring with average PPM up from 54% to 89.1%; average mileage completed up from 74% to 96.1% and average initial delay minutes down from 191 minutes to 134 minutes.</p> <p>.</p> <p>Agree and noted.</p>
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<p>Health & Safety</p>	<p>There has been a third VT failure in Period 7, following those reported as RIDDORs in Periods 4 and 5. Resolution is a priority for CRL and the results of investigations and testing by the manufacturer are still awaited. Two High Potential Near Misses were reported by CRL and two incidents by RfLI, in Period 7. The overall safety indicators remain within those set by the Programme. With CRL committed to demobilisation of the Station Tier 1 contractors by the end of 2021, the last SHELТ meeting will be held in November 2021; other forums, such as the Elizabeth Line HSE Contractor Performance meeting, will be adopted to monitor safety performance within the operational railway.</p>	<p>The investigation findings into the Voltage Transformer RIDDOR incident have been received by RFLI and the investigation team. The manufacturer has been engaged in establishing the root cause of the failures and this has enabled a recovery plan to be formulated for implementation.</p>
<p>Programme Overview:</p> <p>Schedule</p>	<p>In Period 7, CRL has reported a 21-day movement in the key Cardinal Milestone deterministic date for Stage 3 Passenger Service, to 1 March 2022. All other dates are being held in line with the DCS v1.2 baseline. The movement is driven by the resequencing of TVS activities, updates to Technical Files, Safety Assessment Reports forecasts and subsequent ORR approval timescales. CRL is adopting a phased approach to Trial Operations and has re-sequenced activities to mitigate schedule pressures and to protect the deterministic Trial Operations start date of 20 November 2021.</p> <p>A number of Stage Gates have now been introduced. Gate 1a in November 2021 to enable</p>	<p>Agree and noted.</p> <p>The T minus process for both Trial Operations and Revenue Service is on-going. The T-1</p>

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	<p>commencement of lower risk/value exercises from 20 November 2021, Gate 1b in [REDACTED] December 2021, to allow commencement of higher risk/value exercises from the [REDACTED] January 2022, and Gate 2 in [REDACTED] February 2022, to review and approve moving to Entry into Passenger Service in [REDACTED] March 2022.</p> <p>CRL report that the planned ELR100 and TVS Windows 10 upgrade activities were completed during the recent October Blockade, followed by the restart of 12 TPH Trial Running activities as planned on 28 October 2021.</p> <p>Station projects remain on track to meet their Tier 1 demobilisation dates in line with DCS v1.2, with Farringdon Tier 1 contractor demobilised from site this period. Bond Street achieved SC2 enactment readiness.</p> <p>Overall System Reliability and growth remains an area of concern to commencement into Passenger Service. A step-change improvement in reliability is expected and necessary after delivery of the TVS upgrades, and the deployment of ELR100 and ELR110. If these are not achieved as planned, there will be an immediate impact upon the critical path to both Trial Operations and Stage 3 Passenger Service.</p>	<p>meeting for Phase 1 was held on 16 November 2021 with a conditional 'GO' outcome; the conditions are currently being worked through. Phase 2 T-4 meeting is planned for [REDACTED] December 2021 with T-2 to take place on [REDACTED] January 2022. For Revenue Service, T-4 is planned for [REDACTED] February 2022 and T-2 to take place on [REDACTED] February 2022. Each of these scheduled meeting shall provide a GO/No GO gate.</p> <p>Agree.</p> <p>Agree.</p> <p>Agree. The latest review shows that the deployment of ELR100 software was generally successful in addressing or mitigating key contributors to service disruption. The Programme is confident that the TVS upgrades and ELR110 will provide further improvements to achieve Trial Operations and Stage 3 Passenger Service.</p>
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<p>Commercial and Risk</p>	<p>Mass evacuations are now planned to be undertaken in January 2022 and will form final activities on the critical path to Stage 3 Passenger Service. Failure of these exercises leaves little room for recovery although there is a potential contingency to undertake during Shadow Running.</p> <p>General slippage to SJ dates as a result of extended review periods has required mitigation to retain the overall assurance schedule. Any continuation of schedule slippage is likely to delay Entry into Trial Operations. Updated TVS assurance documentation requires submission to ITAP on January 2022 and this could require key personnel working over the Christmas 2021 period. Missing the submission date may jeopardise ability to start the mass evacuation exercises and have a direct impact upon the achievement of Stage 3 Passenger Service.</p> <p>CRL’s draft Period 7 AFCDC is reported as stable at £15,940m₃. The early indications are that CRL’s interventions continue to contain cost increases, and that emerging pressures are stabilising. Pressures continue to emerge, albeit at a significantly reduced level, and we believe these will be covered by risk and provision allowances; at Period 7, CRL report these allowances to be [REDACTED]</p>	<p>As mentioned above, the Trial Operations Plan includes [REDACTED]. This is followed by a [REDACTED] shadow running period. All of these [REDACTED] serve to de-risk the achievement of the mass evacuation exercises</p> <p>The bow wave of SJs have been forecast and managed through the process of assurance reviews by RFLI and the RFLI ITAP to achieve the Deterministic Programme date for EITO Part A.</p> <p>The review of these SJs to support EITO Part B, post-December 2021 works, will also require a similar level of management to hold any agreed Deterministic Programme date and avoid an impact on achieving Stage 3 Passenger Service.</p> <p>Agree and noted.</p>
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	<p>The changes to the Trial Operations plan and the pressure to maintain the deterministic start date of 20 November 2021 may affect CRL’s opportunity to avoid spending its prolongation risk. There is additional risk arising from activities being carried out during and after the December 2021 Blockade that are necessary to support progress to Stage 3 opening. Milestone achievement is moving towards the P50 schedule and, consequently, P50 risk provisions are likely to be expended.</p> <p>With CTG reduced by [REDACTED], CRL continues to examine opportunities to reduce or control the CTG, and we expect CRL to include AFCDC adjustment values for these. We also expect CRL to update the AFCDC to reflect its Indirect resource demobilisation strategy, and the effects from changes to the Trial Operations plan. These actions are anticipated for completion in Period 8.</p> <p>The Period 7 draft AFCDC of £15,940m remains £151m above the current funding threshold, and £124m under the £1,071bn funding request limit of £16,064m. The cumulative sum of Project, Programme and Prolongation Risk at Period 7 was reduced by [REDACTED] to [REDACTED]. However, this</p>	<p>CRL recognises the Project Representative’s observation that changes to the Trial Operations plan could introduce additional risk. However, CRL maintains that the best approach to achieve Stage 3 opening and avoid spending additional costs in prolongation, is to achieve EiTO on or close to the planned date and to phase Trial Operations activities as required. Completion of the bulk of testing, commissioning and assurance required to enter Trial Operations will drive confidence into the schedule and allow the continued demobilisation of contractors and staff further reducing the cost base. CRL remains committed to early identification of any additional risks and proactive intervention and control in order to achieve the best outcome for the schedule and outturn cost.</p> <p>Agree.</p> <p>The Programme maintains that the single biggest opportunity to staying within the £825m budget is to meet the Deterministic schedule. Central provisions are currently being managed to enable the offset of any emerging cost pressures as the Programme moves into the Trial Operations</p>
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<p>Organisation</p>	<p>reduction did not include retirement or elimination of risk, but mainly included transfers to Provision Allowances and offsetting emerging cost pressures. This may lessen the opportunity for CRL to reduce the AFCDC to its current authorised funding level.</p> <p>At Period 7, CRL is progressing the identified scope items that can be transferred to the RWT. CRL will be progressing transfer of its pre- Stage 3 Passenger Service items from the Scope-to Go-list in Period 8.</p> <p>While demobilisation of the station Tier 1 contractors is maintaining schedule, the demobilisation of the routeway contractors will be affected by the additional works associated with the TVS, VTs and PSDs. This may result in prolongation and additional costs.</p> <p>While CRL has seen a steady decline in its Indirect resources, a small number of other resources must be recruited following the adoption of DCS v1.2. Approximately 300 CRL resources are expected to be demobilised between November 2021 and January 2022, for CRL to achieve its strategy for a reduced organisation for the start of 2022⁴. With pressure on the deterministic dates to which CRL’s Workforce Planning is linked, CRL is expected to ensure there is a sufficient contingency to accommodate schedule delays to safeguard the</p>	<p>stage and any future releases made at the appropriate time.</p> <p>Agree.</p> <p>Whilst TVS, VTs and PSD works <i>may</i> impact demobilisation, the potential impacts of these are contained within the current AFCDC.</p> <p>A small number of people have left before their planned end-dates. The Workforce Plan is kept under constant review to assess and agree changes on a two-weekly basis. The attendees are continually assessing Programme requirements, leavers and changes to the DCS1.2, amongst other Programme occurrences and can rapidly respond to unexpected leavers. The Workforce Plan is continually flexed to meet requirements. However, there is a risk of people leaving earlier, as the job market becomes more</p>
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<p>Stage 3 Trial Running, Trial Operations and Passenger Service</p>	<p>critical resources required to complete systems integration, assurance, and Trial Operations activities. However, there continues to be a trickle of resources away from the Programme before their committed end dates, and CRL may find it difficult to extend employment agreements at short notice if, for example, the December 2021 Blockade requires additional works, or deterministic dates slip further.</p> <p>As CRL transitions towards its new reduced organisational structure, the remaining work is demanding and complex, requiring significantly more management effort than anticipated.</p> <p>Initial indications from the resumption of trials after the October 2021 Blockade are that the major software commissioning are delivering the planned improvements. However, there remains a significant amount of further work up to early January 2022, with an additional blockade planned to be undertaken over the 2021 Christmas period, which must be delivered. Delays to TVS completion and to the final railway safety assurance workload, have forced the adoption of a two-phase approach to Trial Operations. This means that the evacuation exercises have been replanned from late 2021, to [REDACTED] January 2022.</p> <p>RfLI's latest assessment indicates that there will be 50 Operational Restrictions in place at the</p>	<p>buoyant. The workforce planning group will continue to keep this under close review.</p> <p>CRL agrees that the remaining work is complex, however, this was anticipated due to the staging model of the Programme.</p> <p>Agree and noted.</p> <p>At the time of writing, RFLI Operations team have confirmed that the level of Operational</p>
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	<p>start of Trial Operations Phase 1, with two of significant concerns. Further fixes supporting enhanced reliability performance will be dependent on the successful commissioning of the ELR110 signalling software during the December 2021 Blockade.</p> <p>Investigations continue into the 3 VT failures which have occurred since Period 4. While the wider impacts on the schedule for Trial Operations and Passenger Service are yet to be fully understood, CRL and RfLI will continue with as much Trial Running as possible. It is likely that all VTs will need to be replaced, and this is likely to be necessary before the 24 TPH demonstrations can start; the demonstrations are scheduled for January 2022.</p> <p>As reported last period, the PSDs have performed inconsistently, and this has impacted Trial Running service reliability. With the lack of local lock-out capability, CRL targets providing this functionality by the end of 2021. This is a significant piece of work required at a late stage in the Programme and is heavily dependent on access arrangements being prioritised until the end of the year. Supply chain commitment to installation and assurance delivery will be necessary prior to starting Trial Operations Phase 2, and this may represent a significant risk.</p> <p>Leading up to the October 2021 Blockade, train reliability has only marginally improved, with a</p>	<p>Restrictions in place for Trial Operations is manageable and does not pose a threat to EiTO.</p> <p>In line with previous comments regarding the VT failures, investigations have been completed and a fix has been identified and agreed as part of the reliability dashboard critical issues. The VTs are being replaced and the Recovery Programme, Testing and Commissioning strategy and access requirements have also been agreed. The replacement VTs targeted delivery date is December 2021.</p> <p>PSD modifications including (WNC) and PSD Congestion Mode Software fixes are now planned and commitment from senior contractor personnel has been obtained by the TfL Commissioner that these fixes will be implemented in time.</p> <p>As mentioned previously, the latest review shows ELR100 was generally successful in addressing</p>
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	<p>software upgrade in early September 2021 unable to fix the predominant AWS/TPWS faults. Significant improvement is now expected when fixes are delivered through the ELR110 signalling and H5.3 train software updates, which are both are scheduled in December 2021. While significant improvement in reliability growth is predicted in late January 2022 as a result of these software updates, past performance suggests this might be a challenge to achieve.</p> <p>CRL continues to manage a wide range of other completion issues related to the rail systems or arising from systems integration. Examples include excessive RCC alarms, HV cable immersion tests, C644 power switching investigations, radio system tests and CCTV faults. These issues vary in complexity and carry with them different risks to the achievement of both Trial Operations and Passenger Service, and all are being tracked to completion centrally by CRL.</p> <p>Further demands for access to the routeway continue to emerge, despite CRL's efforts to make the October 2021 Blockade as complete and all-encompassing as possible. These demands are proving difficult to manage and require a significant co-ordination effort to address. Late access requests, for example for TVS and PSD works, additional shifts at Bond Street Station, and HV cable immersion testing, provide significant challenges for access</p>	<p>or mitigating several key contributors to service disruption. The Programme is confident that the TVS upgrades and ELR110 will provide further improvements to achieve Trial Operations and Stage 3 Passenger Service.</p> <p>Agree and noted.</p> <p>The access arrangements for the remaining work has been agreed with RFLI and finalised into the plan.</p>
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<p>Stations Commissioning and Handover</p>	<p>planning and the achievement of target deterministic dates.</p> <p>Liverpool Street Station Tier 1 contractor demobilised as planned at the end of October 2021. The Paddington Station Tier 1 contractor substantially demobilised at the end of October 2021, with a small residual team remaining to complete demobilisation activities. This will bring the total number of demobilised station Tier 1 contractors to five.</p> <p>Finalisation of the scope for completion by the ADM/RWT has continued, but this has proved more difficult than envisaged by CRL because of the lack of a single source of information. With the expectation that the process for station works will now be completed by early November 2021, CRL is working to ensure that all scope allocated to the Tier 1 contractors is delivered before demobilisation. As the stations approach the BIU [redacted] day 'milestone,' the focus will be on the preparation of all the documentation from the Tier 1 contractors, which is necessary to support the ECP contract close-out process.</p> <p>CRL continues to focus on the commissioning of the remaining stations. Bond Street Station achieved SC2 readiness on 8 October 2021. However, CRL's plan to complete all physical</p>	<p>Four stations' Tier 1 contractors have substantially demobilised to date, with the Tier 1 at Paddington station currently in the process of demobilisation which has entailed complex removal of office equipment underneath the parking structure requiring speciality contracts to support. With that said, CRL remains committed to demobilisation of all Tier 1 station contractors by the end of December 2021.</p> <p>This statement is correct for all stations with the exception of Canary Wharf, Whitechapel and Bond Street where the physical works are planned to be complete in [redacted] [redacted] respectively.</p> <p>Agreed, however, the Project Representative should note that the Bond Street station delivery team is accelerating works as safely as possible to support [redacted] while</p>
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	<p>works by the end of [REDACTED] is at risk, and several activities may extend beyond this date. The deferral of SC2 Enactment to early [REDACTED] in time for Trial Operations Phase 2, will provide extra time to complete the remaining works. Planning for additional routeway access is also required. [REDACTED]</p> <p>The countdown process for Canary Wharf Station indicates that the target for achieving the planned BIU on [REDACTED] November 2021 is too challenging and this has now been deferred, with a new date yet to be confirmed. Additional works such as cable replacement were required in the period, while activities relating to certification for fire, lighting and other mechanical elements, outstanding O&M Manuals, and low voltage distribution boards, have continued. While testing of the fire systems is expected to continue, the extent is subject to clarification between CRL and RfLI</p> <p>There remains a significant number of critical Dependencies impacting the assurance documentation which have contributed to deferring a decision on the station BIU date. RfLI and MTREL resources continue to mobilise in advance of this date. The deferral of the Trial Operations Phase 2 mass evacuation trials to [REDACTED] January 2022 removes station completion</p>	<p>the [REDACTED]</p> <p>Agreed. Canary Wharf station’s new target date for BIU and transfer to the Infrastructure Manager is [REDACTED] November 2021.</p> <p>Majority of stations have now reached the status of SC3ROGS and BIU (or equivalent) with transfer to their respective Infrastructure Manager. Two stations remain to achieve that status with Canary Wharf expected to reach it on [REDACTED] November 2021. Bond Street station has reached its initial SC2 readiness with a programme to achieve SC3ROGS and BIU under review. A part of the programme risk decision for</p>
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<p>Assurance</p>	<p>from the critical path, but cost increases are emerging, and this is a concern.</p> <p>The assurance process continues to be under significant pressure^{7,8} and the preparation of safety documentation to meet deterministic dates is proving onerous. The closure rate for Safety Justifications (SJs) remains behind plan, and a large number of StEJ assessments are required to mitigate the approximately 220 Dependencies that remain (with approximately 130 completed to date). The two-stage approach to Trial Operations provides an opportunity to carry out assurance delivery over a longer period. The critical final safety submissions which support the step-change in safety risk associated with the mass evacuation exercises are now required in early 2022, rather than November 2021.</p> <p>The staged approach adopted for TVS completion will require evidence to be processed following the works planned in the December 2021 Blockade. The completion of assurance delivery before the deterministic date for the</p>	<p>a two-phase Trial Operations was to accommodate the status of these two stations. They will continue to burn down the critical EOWLs and dependencies to reach SC3ROGS status.</p> <p>The schedule for assurance to reach the Deterministic Programme date was agreed to be sufficient to allow for completion of the railway level assurance through the CRL COS EITO SJ, the RFLI SJ and the RFLI TORAC to support the overall CESAC acceptance through the RFLI ITAP, including the burn down of the SJ dependencies using StEJ where necessary. The number of SJ Dependencies needing to be closed or agreed as mitigated for EITO Part A was reduced to 16 dependencies - not closed or agreed mitigated in principle as at 12 November 2021.</p> <p>All the expected assurance documentation to support Trial Operations has been prepared to support EITO Part A, however, many will now need to be revisited in light of further system changes expected in December to achieve an expected revenue ready COS railway configuration to support mass evacuation exercises after EITO Part B.</p> <p>Noted.</p>
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Appendix – CRL Response to Period 7 PRep Report

<p>Future Stages</p>	<p>start of Trial Operations Phase 2 will be challenging.</p> <p>There has been progress with the development of Stage 5B and 5C timetable submission process. MTREL has submitted a timetable bid for Stage 5B, and there are reasonable grounds to assume that the reciprocal offer from NR will be acceptable. There has also been progress with modelling of Stage 5C services on the GWML, with an increased expectation that a solution can be found to support the bidding timetable for [REDACTED].</p> <p>Both Stage 5B and 5C timetables will need to be supported by operating policies and contingency plans that are understood and adhered to by stakeholders. This is to ensure that Elizabeth Line performance is not disproportionately affected when GWML is subject to perturbation. NR and Elizabeth Line control room staff collaboration and behaviour will also be an important factor in service delivery, and there is likely to be a need for a prior period of learning, so each becomes familiar with the other's general operating principles and service requirements. Performance could be affected during this period.</p> <p>For Stage 5C to be successful, Stage 5B must be operating well; this is because the Stage 5C service pattern is more complex and has greater interaction with main line services. Unlike for</p>	<p>The timetable that was bid was for [REDACTED] and this timetable supports the delivery of Stage 5B which does not need to happen at a timetable change date.</p> <p>CRL would like the Project Representative to note that it is both the Great Eastern and Great Western Main Lines that could potentially have performance issues that would affect the Elizabeth line.</p> <p>Agreed. Greater interaction with main line services, includes through services from the Great Eastern and Great Western routes.</p>
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Appendix – CRL Response to Period 7 PRep Report

	<p>Stage 5B, where the provision of train paths in the [REDACTED] timetable will allow Stage 5B introduction any time after that date, introduction of Stage 5C services can only take place at a later national timetable change.</p> <p>The main risks to Stage 5B opening in [REDACTED] are:</p> <p>Auto-Reverse – Current operating plans require this functionality to be available, but long-standing safety authorisation issues continue to delay commissioning. Unresolved technical problems result in the service turnaround time being more than the timetable requirement. These need to be addressed urgently, or mitigations found.</p> <p>Reliability Growth – The current level of reliability when operating a 12 TPH service is poor. It is anticipated that improvement will be demonstrated with ELR100 now deployed, with further growth through ELR110, ELR200 and ELR210, train reliability software builds and other key system improvements. These works are likely to prove challenging to deliver and will require the support of fully resourced teams during 2022.</p> <p>In summary, Stage 3 opening is an interim milestone in the context of the Elizabeth Line,</p>	<p><u>Auto-Reverse</u> – Safety authorisation is being sought through the Office of Road and Rail and will rest on its decision. Technical problems around Start of Mission are being addressed through the Plateau team.</p> <p><u>Reliability Growth</u> – Initial running with configuration YO.640 (containing ELR100) has provided a step change in performance and much improved stability in the service with associated improvement in performance metrics. Some new issues are being addressed with important fixes prioritised for ELR110 which will be installed in December 2021. This should see further improvement along with fixes already planned for ELR110 and upgrades to the train systems. These improvements are supporting a ‘pivot’ to reliability and a focus on wider system issues, being captured in the Critical Issues system.</p> <p>Noted.</p>
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Appendix – CRL Response to Period 7 PRep Report

	with meaningful revenue benefits realised only once Stages 5B and 5C are opened.	
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Crossrail Project Representative

Crossrail Joint Sponsor Team

Sponsor Summary

Project Status Report 156

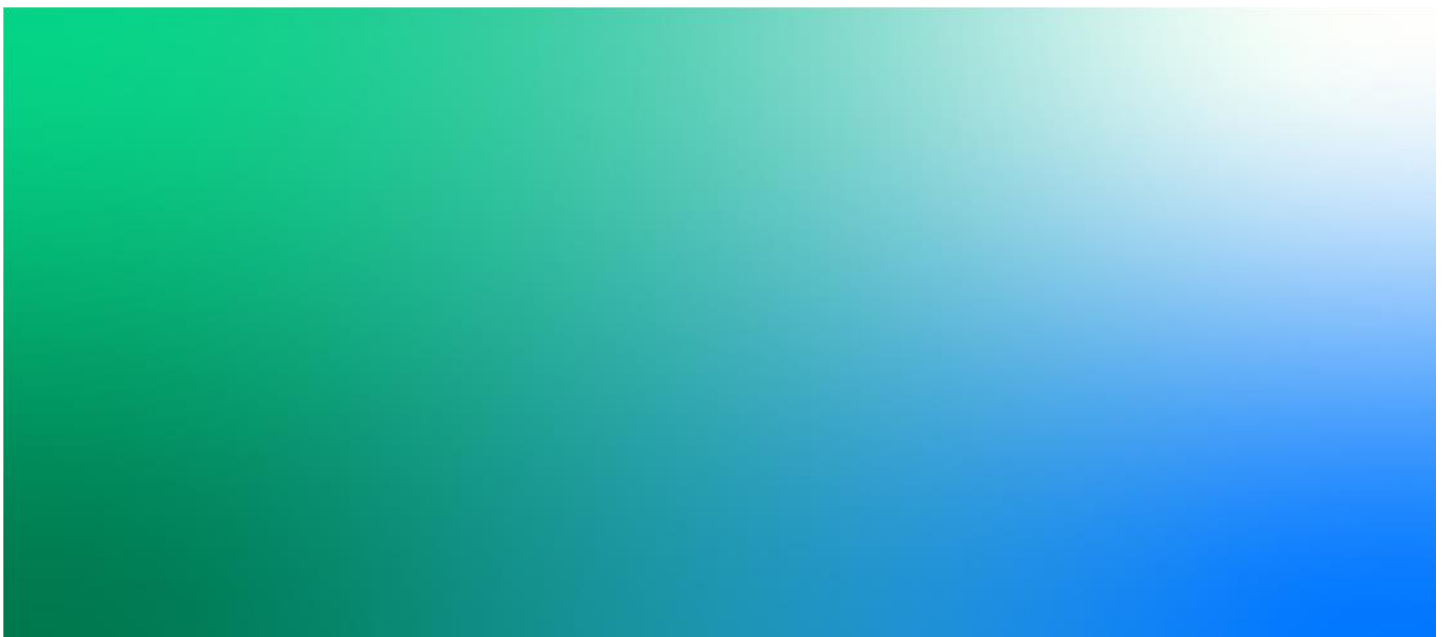
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12 November 2021



Sponsor Summary PSR 156

Project No: B2387600
Document Title: Sponsor Summary for PSR 156
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Client No: RM 3730
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Note: This report relies on the information set out in CRL's Period 7 reports augmented by more current information received by PRep during the course of our routine discussions with CRL since the Period close on 15 October 2021. Note that information emerging after the close of Period 7 is subject to formal confirmation by CRL in its Period 7 reports. This report is supplemented by our weekly reports to JST and regular meetings with JST staff.

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
1.	8 November 2021	PSR 156 Period 7 FY 2021-22 Sponsor Summary v1.6 ~ Draft	████	████	████	████
2.	12 November 2021	PSR 156 Period 7 FY 2021-22 Sponsor Summary v1.9 ~ Final	████	████	████	████

Sponsor Summary

1. Headlines

1.1 Progress and Look Ahead

CRL and RfLI teams continue to push hard to achieve the milestones contained in the current Delivery Control Schedule, DCS v1.2. The October 2021 Blockade has been completed and the period up to 20 November 2021, the deterministic date for Trial Running, will be used to assess the success of the systems commissioning undertaken for train, signalling, TVS and communications and control system software. The outcomes will have a major influence on the future course of the Programme, with the anticipated improvement in overall reliability allowing transition into the Trial Operations with greater confidence.

CRL and RfLI committed in Period 7 to split Trial Operations into two phases, in order to accommodate TVS works that could not be incorporated into the October 2021 Blockade. Phase 1 is targeted to start on 20 November 2021, once the safety argument for entry has been accepted by ITAP. Phase 1 is effectively a period of overlapping Trial Running and Trial Operations activities, with exercises limited by the participation of a maximum of 20 people per train, as defined by the current Fire Strategy. Phase 2 is planned to start on January 2022, following the completion of TVS works during the December 2021 Blockade; thereafter, mass evacuation exercises, with fire brigade attendance, can take place. This is a significant and necessary late change in strategy by CRL, devised to allow progress within the functional and safety limitations of the infrastructure until critical works are completed, while seeking to maintain the planned start of Stage 3 Passenger Service in the first half of 2022.

The schedule for assurance is extremely tight, although the adoption of the two-phase Trial Operations plan provides some relief, deferring the preparation of critical final safety submissions which support the step-change in safety risk at Phase 2. The principal submissions rely upon the closure of a significant number of Dependencies in limited time, and this is giving rise to an increased demand for assessment by Structured Engineering Judgement (StEJ). CRL's desire to meet the deterministic date for Trial Operations will place significant pressure on delivery teams, and additional ITAP review meetings will be held during November 2021. Given the assurance workload, it is possible that 20 November 2021 might not be met, but the ability to carry out Trial Running, or some limited Trial Operations activities, whether the Phase 1 milestone has been achieved or not, reduces the schedule criticality of this transition. Thereafter, the timely delivery of assurance to support Phase 2 and Passenger Service will rely upon successful completion of the remaining works, tests, and the processing of assurance evidence.

While plans to address Voltage Transformer (VT) failures and the lack of independent Platform Screen Doors (PSD) lock-out functionality have yet to be finalised, investigations are in progress. CRL has indicated that replacement VTs, appropriate for use in a railway environment, have been identified, with an expected timing for installation and testing throughout the Central Section before the end of the year. CRL has also suggested that conversion of PSDs to independent control might be possible by the end of 2021. However, given that plans for each are not yet complete, impacts upon schedule dates for Phase 2 Trial Operations and Passenger Service may yet be unavoidable.

Train software upgrades to date have not delivered the expected improvements in train reliability, and there is now an increased reliance on train software reliability build H5.3, which is planned to be uploaded in December 2021. In combination with signalling software ELR110, scheduled for deployment during the December 2021 Blockade, the new train software is planned to deliver significant reliability improvement¹. Given past performance, it is possible that expectations might not be met, and this may have implications for entry into Passenger Service and for Stage 5B.

The delay to TVS completion provides some schedule respite for Canary Wharf and Bond Street Stations. A late assessment of Canary Wharf Station readiness has shown that it will not now meet the SC3 ROGS milestone of ■ November 2021, with fire suppression testing, LV board works and the associated ACs outstanding. This milestone must now be achieved in time for the mass evacuation exercises in January 2022. Bond Street Station achieved the SC2 readiness milestone as planned, although additional possessions are required to complete TVS system testing. The schedule is tight and additional access requires priority planning, ■■■■■■■■■■

■■■■■■■■■■ The deferral of the mass evacuation exercises means that SC2 enactment is likely to take place by ■■■■ January 2022, thereby providing more time for station works completion.

Implementation of the two-phase Trial Operations plan moves the deterministic date for the start of Stage 3 Passenger Service to ■ March 2022 and the P50 date to ■ May 2021², the P80 date remains just within the declared opening window of the first half of 2022. Stage 3 opening will effectively only be an interim milestone, with meaningful revenue benefits realised only once Stages 5B and 5C are opened. With Stage 3 opening now forecast for ■■■■ March 2022, there may be insufficient time to gather reliability evidence from operational service, and 24 TPH service trials, to support the Stage 5C timetable bidding process. The risk also remains that schedule delays will reduce the opportunity to achieve sufficient reliability growth to allow Stage 5B opening in ■■■■■■■■■■.

Despite the fixes being introduced up to the end of the Trial Operations period, it is possible that original reliability targets will not be met, and some works will remain. ■■■■■■■■■■

■■■■■■■■■■. One advantage of this approach would be to maximise the opportunity to build reliability in a passenger operating environment, ahead of Stage 5B. However, this approach would represent a significant commitment, requiring agreement between all stakeholders.

Considerations for Sponsors' particular attention are as follows:

- Past general concerns remain with: schedule, cost, and risk; integrated systems testing; assurance delivery; reliability growth; and stations completion.
- The October 2021 Blockade outputs will have a major influence on the future course of the Programme, and early emerging trial running service performance is encouraging.
- The Trial Operations plan has been phased, with major rail system software upgrades in late 2021 / early 2022 now expected to deliver the reliability necessary for Stage 3 Passenger Service.
- Deferring train evacuation exercises to early 2022 threatens Trial Operations completion, Stage 3 Passenger Service start, and reduces the reliability growth opportunity before Stages 5B and 5C.
- Prolonged completion of systems integration and safety assurance threatens opportunities to realise reductions in risks and cost provisions.

¹ Crossrail Weekly Dashboard, Week 4 Period 7.

² Integrated Project Review Part B, meeting on 29 September 2021.

1.2 Health and Safety

There has been a third VT failure in Period 7, following those reported as RIDDORs in Periods 4 and 5. Resolution is a priority for CRL and the results of investigations and testing by the manufacturer are still awaited. Two High Potential Near Misses were reported by CRL and two incidents by RfLI, in Period 7. The overall safety indicators remain within those set by the Programme. With CRL committed to demobilisation of the Station Tier 1 contractors by the end of 2021, the last SHELTER meeting will be held in November 2021; other forums, such as the Elizabeth Line HSE Contractor Performance meeting, will be adopted to monitor safety performance within the operational railway.

2. Programme Overview

2.1 Schedule

In Period 7, CRL has reported a 21-day movement in the key Cardinal Milestone deterministic date for Stage 3 Passenger Service, to ■ March 2022. All other dates are being held in line with the DCS v1.2 baseline. The movement is driven by the resequencing of TVS activities, updates to Technical Files, Safety Assessment Reports forecasts and subsequent ORR approval timescales. CRL is adopting a phased approach to Trial Operations and has re-sequenced activities to mitigate schedule pressures and to protect the deterministic Trial Operations start date of 20 November 2021.

A number of Stage Gates have now been introduced. Gate 1a in November 2021 to enable commencement of lower risk/value exercises from 20 November 2021, Gate 1b in ■ December 2021, to allow commencement of higher risk/value exercises from the ■ January 2022, and Gate 2 in ■ February 2022, to review and approve moving to Entry into Passenger Service in ■ March 2022.

CRL report that the planned ELR100 and TVS Windows 10 upgrade activities were completed during the recent October Blockade, followed by the restart of 12 TPH Trial Running activities as planned on 28 October 2021.

Station projects remain on track to meet their Tier 1 demobilisation dates in line with DCS v1.2, with Farringdon Tier 1 contractor demobilised from site this period. Bond Street achieved SC2 enactment readiness.

Overall System Reliability and growth remains an area of concern to commencement into Passenger Service. A step-change improvement in reliability is expected and necessary after delivery of the TVS upgrades, and the deployment of ELR100 and ELR110. If these are not achieved as planned, there will be an immediate impact upon the critical path to both Trial Operations and Stage 3 Passenger Service.

Mass evacuations are now planned to be undertaken in January 2022 and will form final activities on the critical path to Stage 3 Passenger Service. Failure of these exercises leaves little room for recovery although there is a potential contingency to undertake during Shadow Running.

General slippage to SJ dates as a result of extended review periods has required mitigation to retain the overall assurance schedule. Any continuation of schedule slippage is likely to delay Entry into Trial Operations. Updated TVS assurance documentation requires submission to ITAP on ■ January 2022 and this could require key personnel working over the Christmas 2021 period. Missing the submission date may jeopardise ability to start the mass evacuation exercises and have a direct impact upon the achievement of Stage 3 Passenger Service.

2.2 Commercial and Risk

CRL's draft Period 7 AFCDC is reported as stable at £15,940m³. The early indications are that CRL's interventions continue to contain cost increases, and that emerging pressures are stabilising. Pressures continue to emerge, albeit at a significantly reduced level, and we believe these will be covered by risk and provision allowances; at Period 7, CRL report these allowances to be [REDACTED].

The changes to the Trial Operations plan and the pressure to maintain the deterministic start date of 20 November 2021 may affect CRL's opportunity to avoid spending its prolongation risk. There is additional risk arising from activities being carried out during and after the December 2021 Blockade that are necessary to support progress to Stage 3 opening. Milestone achievement is moving towards the P50 schedule and, consequently, P50 risk provisions are likely to be expended.

With CTG reduced by [REDACTED], CRL continues to examine opportunities to reduce or control the CTG, and we expect CRL to include AFCDC adjustment values for these. We also expect CRL to update the AFCDC to reflect its Indirect resource demobilisation strategy, and the effects from changes to the Trial Operations plan. These actions are anticipated for completion in Period 8.

The Period 7 draft AFCDC of £15,940m remains £151m above the current funding threshold, and £124m under the £1,071bn funding request limit of £16,064m. The cumulative sum of Project, Programme and Prolongation Risk at Period 7 was reduced by [REDACTED] to [REDACTED]. However, this reduction did not include retirement or elimination of risk, but mainly included transfers to Provision Allowances and offsetting emerging cost pressures. This may lessen the opportunity for CRL to reduce the AFCDC to its current authorised funding level.

At Period 7, CRL is progressing the identified scope items that can be transferred to the RWT. CRL will be progressing transfer of its pre- Stage 3 Passenger Service items from the Scope-to-Go-list in Period 8.

While demobilisation of the station Tier 1 contractors is maintaining schedule, the demobilisation of the routeway contractors will be affected by the additional works associated with the TVS, VTs and PSDs. This may result in prolongation and additional costs.

2.3 Organisation

While CRL has seen a steady decline in its Indirect resources, a small number of other resources must be recruited following the adoption of DCS v1.2. Approximately 300 CRL resources are expected to be demobilised between November 2021 and January 2022, for CRL to achieve its strategy for a reduced organisation for the start of 2022⁴. With pressure on the deterministic dates to which CRL's Workforce Planning is linked, CRL is expected to ensure there is a sufficient contingency to accommodate schedule delays to safeguard the critical resources required to complete systems integration, assurance, and Trial Operations activities. However, there continues to be a trickle of resources away from the Programme before their committed end dates, and CRL may find it difficult to extend employment agreements at short notice if, for example, the December 2021 Blockade requires additional works, or deterministic dates slip further.

As CRL transitions towards its new reduced organisational structure, the remaining work is demanding and complex, requiring significantly more management effort than anticipated.

³ Executive Programme Performance Review held on 3 November 2021.

⁴ Executive Group Meeting 19 October 2021, Period 6 Workforce Plan Update.

2.4 Stage 3 Trial Running, Trial Operations and Passenger Service

Initial indications from the resumption of trials after the October 2021 Blockade are that the major software commissionings are delivering the planned improvements. However, there remains a significant amount of further work up to early January 2022, with an additional blockade planned to be undertaken over the 2021 Christmas period, which must be delivered. Delays to TVS completion and to the final railway safety assurance workload, have forced the adoption of a two-phase approach to Trial Operations. This means that the evacuation exercises have been replanned from late 2021, to [REDACTED] January 2022.

RfLI's latest assessment indicates that there will be 50 Operational Restrictions in place at the start of Trial Operations Phase 1, with two of significant concern⁵. Further fixes supporting enhanced reliability performance will be dependent on the successful commissioning of the ELR110 signalling software during the December 2021 Blockade.

Investigations continue into the 3 VT failures which have occurred since Period 4. While the wider impacts on the schedule for Trial Operations and Passenger Service are yet to be fully understood, CRL and RfLI will continue with as much Trial Running as possible. It is likely that all VTs will need to be replaced⁶, and this is likely to be necessary before the 24 TPH demonstrations can start; the demonstrations are scheduled for [REDACTED] January 2022.

As reported last period, the PSDs have performed inconsistently, and this has impacted Trial Running service reliability. With the lack of local lock-out capability [REDACTED] CRL targets providing this functionality by the end of 2021. This is a significant piece of [REDACTED] work required at a late stage in the Programme, and is heavily dependent on access arrangements being prioritised until the end of the year. Supply chain commitment to installation and assurance delivery will be necessary prior to starting Trial Operations Phase 2, and this may represent a significant risk.

Leading up to the October 2021 Blockade, train reliability has only marginally improved, with a software upgrade in early September 2021 unable to fix the predominant AWS/TPWS faults. Significant improvement is now expected when fixes are delivered through the ELR110 signalling and H5.3 train software updates, which are both scheduled in December 2021. While significant improvement in reliability growth is predicted in late January 2022 as a result of these software updates, past performance suggests this might be a challenge to achieve.

CRL continues to manage a wide range of other completion issues related to the rail systems, or arising from systems integration. Examples include excessive RCC alarms, HV cable immersion tests, C644 power switching investigations, radio system tests and CCTV faults. These issues vary in complexity and carry with them different risks to the achievement of both Trial Operations and Passenger Service, and all are being tracked to completion centrally by CRL.

Further demands for access to the routeway continue to emerge, despite CRL's efforts to make the October 2021 Blockade as complete and all-encompassing as possible. These demands are proving difficult to manage and require a significant co-ordination effort to address. Late access requests, for example for TVS and PSD works, additional shifts at Bond Street Station, and HV cable immersion testing, provide significant challenges for access planning and the achievement of target deterministic dates.

⁵ Crossrail Weekly Dashboard, Week 1 Period 8.

⁶ PSSG Summary Dashboard, 20 October 2021.

2.5 Stations Commissioning and Handover

Liverpool Street Station Tier 1 contractor demobilised as planned at the end of October 2021. The Paddington Station Tier 1 contractor substantially demobilised at the end of October 2021, with a small residual team remaining to complete demobilisation activities. This will bring the total number of demobilised station Tier 1 contractors to five.

Finalisation of the scope for completion by the ADM/RWT has continued, but this has proved more difficult than envisaged by CRL because of the lack of a single source of information. With the expectation that the process for station works will now be completed by early November 2021, CRL is working to ensure that all scope allocated to the Tier 1 contractors is delivered before demobilisation. As the stations approach the BIU [REDACTED] day 'milestone,' the focus will be on the preparation of all the documentation from the Tier 1 contractors, which is necessary to support the ECP contract close-out process.

CRL continues to focus on the commissioning of the remaining stations. Bond Street Station achieved SC2 readiness on 8 October 2021. However, CRL's plan to complete all physical works by the end of [REDACTED] is at risk, and several activities may extend beyond this date. The deferral of SC2 Enactment to early [REDACTED], in time for Trial Operations Phase 2, will provide extra time to complete the remaining works. Planning for additional routeway access is also required. [REDACTED]

The countdown process for Canary Wharf Station indicates that the target for achieving the planned BIU on [REDACTED] November 2021 is too challenging and this has now been deferred, with a new date yet to be confirmed. Additional works such as cable replacement were required in the period, while activities relating to certification for fire, lighting and other mechanical elements, outstanding O&M Manuals, and low voltage distribution boards, have continued. While testing of the fire systems is expected to continue, the extent is subject to clarification between CRL and RfLI. There remains a significant number of critical Dependencies impacting the assurance documentation which have contributed to deferring a decision on the station BIU date. RfLI and MTREL resources continue to mobilise in advance of this date. The deferral of the Trial Operations Phase 2 mass evacuation trials to [REDACTED] January 2022 removes station completion from the critical path, but cost increases are emerging, and this is a concern.

2.6 Assurance

The assurance process continues to be under significant pressure^{7,8} and the preparation of safety documentation to meet deterministic dates is proving onerous. The closure rate for Safety Justifications (SJs) remains behind plan, and a large number of StEJ assessments are required to mitigate the approximately 220 Dependencies that remain (with approximately 130 completed to date). The two-stage approach to Trial Operations provides an opportunity to carry out assurance delivery over a longer period. The critical final safety submissions which support the step-change in safety risk associated with the mass evacuation exercises are now required in early 2022, rather than November 2021.

⁷ Crossrail Weekly Dashboard, Week 4 Period 7.

⁸ PSSG Summary dashboard, 20 October 2021.

The staged approach adopted for TVS completion will require evidence to be processed following the works planned in the December 2021 Blockade. The completion of assurance delivery before the deterministic date for the start of Trial Operations Phase 2 will be challenging.

2.7 Future Stages

There has been progress with the development of Stage 5B and 5C timetable submission process. MTREL has submitted a timetable bid for Stage 5B⁹ and there are reasonable grounds to assume that the reciprocal offer from NR will be acceptable. There has also been progress with modelling of Stage 5C services on the GWML, with an increased expectation that a solution can be found to support the bidding timetable for [REDACTED].

Both Stage 5B and 5C timetables will need to be supported by operating policies and contingency plans that are understood and adhered to by stakeholders. This is to ensure that Elizabeth Line performance is not disproportionately affected when GWML is subject to perturbation. NR and Elizabeth Line control room staff collaboration and behaviour will also be an important factor in service delivery, and there is likely to be a need for a prior period of learning, so each becomes familiar with the other's general operating principles and service requirements. Performance could be affected during this period.

For Stage 5C to be successful, Stage 5B must be operating well; this is because the Stage 5C service pattern is more complex, and has greater interaction with main line services. Unlike for Stage 5B, where the provision of train paths in the [REDACTED] timetable will allow Stage 5B introduction any time after that date, introduction of Stage 5C services can only take place at a later national timetable change.

The main risks to Stage 5B opening in [REDACTED] are:

Auto-Reverse – Current operating plans require this functionality to be available, but long-standing safety authorisation issues continue to delay commissioning. Unresolved technical problems result in the service turnaround time being more than the timetable requirement. These need to be addressed urgently, or mitigations found.

Reliability Growth – The current level of reliability when operating a 12 TPH service is poor. It is anticipated that improvement will be demonstrated with ELR100 now deployed, with further growth through ELR110, ELR200 and ELR210, train reliability software builds and other key system improvements. These works are likely to prove challenging to deliver, and will require the support of fully resourced teams during 2022.

In summary, Stage 3 opening is an interim milestone in the context of the Elizabeth Line, with meaningful revenue benefits realised only once Stages 5B and 5C are opened.

⁹ This bid proposes to amend the current GWML timetable to accommodate Stage 5B requirements at the [REDACTED] timetable change. Trains will continue to operate into Paddington and Liverpool Street High Level Stations at that date, but will transfer onto the Central Section when TfL and NR have confidence that a 24 TPH service can operate reliably. The current expectation is that this will occur in [REDACTED].