

Project Representative Report

**Item: Project Status Report 155 and Crossrail Response
Period 6 FY2021-22**

Date: Period 6 (21 August 2021 – 17 September 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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[REDACTED]
Project Representative
Jacobs

5 November 2021

Dear [REDACTED]

Re: Crossrail PRep Project Status Report 155 – Period 6

I am writing in response to the PRep Sponsor Summary cover letter for Period 6.

We have completed the “ELR100” Blockade. This has obviously been many months of preparation and we commenced as planned on 10 October 2021 for a duration of 15 days.

[REDACTED]

In our letter you note that, at that time, the railway configuration for the commencement of Trial Operations was uncertain. The initial performance results of the resumption of Trial Running have been very encouraging, with several days of reliability greater than 91%; a huge uplift in performance and in line with our best-case projections. We are clear on the configuration that would support the start of TO on [REDACTED] November 2021. There are a small number of “gaps” in the TVS functionality that will be delivered at Christmas. The only practical implication of the TVS gaps, is we cannot undertake the six mass evacuation exercises that are planned for TO. In context, these evacuations are a subset of the 150 planned scenarios and drill that make up TO.

[REDACTED]

The Project Representative is accurate to point out that CRL continues to drive opportunities to complete the Programme within the £825m funding package and correctly notes that cost pressures are stabilising but remain challenging. Demobilisation of our Tier 1 contractors has been integral to cost containment and since my last update, Woolwich, Tottenham Court Road, Liverpool Street, Paddington, Liverpool Street stations have joined Farringdon as the latest stations where demobilisation has taken place. We remain committed to demobilising an additional three stations by the [REDACTED] where the Tier 1 contractors have

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substantially completed the bulk of their site works, with Paddington station being next in the demobilisation sequence by the end of [REDACTED].

CRL acknowledges the Project Representative's concerns at Bond Street station regarding cost pressures and associated risk to the completion strategy ahead of Passenger Service. Since my last update and despite challenges, Bond Street station achieved its SC2 milestone and will be enacted on during TO at the most appropriate point. Handover of the urban realm to the Oversight Developer was also achieved as planned. The "decoupling" of Bond Street as a critical dependency for Revenue Service has been the right thing to do to de-risk the main Programme and provide the best opportunity for getting this final station the earliest possible opening date.

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,

[REDACTED]

Mark Wild
CEO, Crossrail

Appendix – CRL Response to Period 6 PRep Report

Programme Response Category	PRep Period 6 Sponsor Summary Content	CRL Period 6 Response
<p>Observations in the Period</p>	<p>CRL has completed demonstrations on the Great Eastern and Great Western Transitions, which indicate that stable timetable services are able to be maintained for significant periods. Two of a series of Auto-Reverse tests under Trial Running were completed, but significantly more successful testing is required to support the assurance case for this functionality. Further Tunnel Ventilation System (TVS) testing was completed at Liverpool Street and Woolwich Stations ahead of the October 2021 Blockade, and Bismarck testing has also proceeded to plan.</p> <p>Despite ongoing Operational Restrictions and recurrence of known faults, 12 TPH trials have continued using a “soft ramp-up” to establish stable daily service patterns. This has enabled further build-up of staff confidence and some mileage accumulation. Resolution of known faults requires the deployment of both ELR100 and ELR110.</p> <p>Demobilisation of Tier 1 Station contractors has gained momentum, with three station Tier 1 contractors from the total of 8 stations demobilised at the end of September 2021.</p>	<p>Noted. Trial Running resumed on 27 October 2021, after completion of the Blockade was followed by two days of maintenance works. Since resuming timetabled service, Trial Running has been very reassuring with several days of reliability greater than 91%. This bodes well for the significant tests to follow and reinforcement of reliability growth software expected in December 2021.</p> <p>Reliability growth is an element of the weekly PSSG meeting. Step improvements are expected due to the new software drops, that is, ELR100, TVS mode changes, Rolling stock software. Reliability reviews included in the Programme lead into the Crossrail Engineering Safety Assurance Case process for transition into Trial Operations and Revenue Service. Any deviation from the current plan shall be discussed at the Executive level.</p> <p>The Project Representative is accurate that three stations have been demobilised as at 30 September 2021. Further demobilisation took place at Liverpool Street station at the end of October 2021 with Paddington station planned for end of [REDACTED]</p>

Appendix – CRL Response to Period 6 PRep Report

<p>Headline Concerns</p>	<p>Preparations for the October 2021 Blockade have continued. The successful delivery of planned TVS commissioning and ELR100 signalling software deployment, are vital to the achievement of acceptable railway performance levels before Trial Operations. However, an emerging issue with the testing of TVS incident mode functionality is resulting in a change to the planning and sequencing of activities during the Trial Operations period. While still under review between CRL and RfLI, the consequential impact is likely to be an extended Christmas 2021 Blockade in order to complete TVS functionality commissioning and train testing, with train evacuation exercises postponed to early 2022.</p> <p>The Safety Assurance process requires mitigation measures to maintain schedule. CRL management is confident that open Dependencies can be closed or mitigated to meet the target date for entry into Trial Operations of ■ November 2021 and has increased its resource to support this effort. However, the number of Dependencies is significantly higher than originally anticipated by CRL/RfLI. The slow production of assurance evidence to close Dependencies is resulting in</p>	<p>The Blockade was a success with overall ELR100 commissioning programme accomplished as planned.</p> <p>[REDACTED]</p> <p>Entry into Trial Operations configuration progress is monitored in the weekly Passenger Service Steering Group and any outstanding items are to be completed for Trial Operations [REDACTED] Trial Operations shall be deliverable in the 11-week window [REDACTED].</p> <p>CRL notes the Project Representative’s concerns and agrees with its overall assurance assessment. Whilst close-out and mitigation of dependencies is going to the wire and the considerable amount of assurance evidence to produce ahead of Trial Operations, CRL have sufficient StEJ panel meetings in place as well as resources focussing on closure evidence to indicate that CRL will achieve sufficient closures and mitigations by ■ November 2021. [REDACTED]</p>
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	<p>an increased demand for assessment by Structured Engineering Judgement (StEJ). We are concerned that close-out is currently behind schedule to achieve ■ November 2021.</p> <p>Reliability growth in the Trial Running period remains well below forecast. While mileage accumulation continues, performance in the Central Section is more than 60% below the target set by DCS v1.1. Trials with the current versions of system software are providing limited performance improvement, and significant uplifts are reliant on planned upgrades.</p> <p>Train reliability remains below expected levels. An opportunity was missed to pre-test the main train software update for reliability improvement and this requires re-planning to integrate testing with ELR100. A schedule window at the end of the October 2021 Blockade is being investigated, but at the risk of delay to the start of the Trial Operations period. With the main train software upgrade due in mid-December 2021, time is diminishing to demonstrate a significant improvement in train reliability against the deterministic date of ■ February 2022 for entry into Passenger Service.</p>	<div style="background-color: black; height: 20px; width: 100%;"></div> <p>Performance has been impacted by known Communication Based Train Control (CBTC), European Train Control System (ETCS) and Train Control and Management System (TCMS) defects. There has been some improved ETCS and TCMS stability seen in the Y0.638 configuration which was used in the final week of Trial Running before the start of the Blockade on 10 October 2021. Further significant reliability uplift is not expected until CBTC ELR100 is commissioned in the Central Operating Section on 25 October 2021 and ALSTOM have introduced the H5.3 reliability boost train software in December 2021.</p> <p>Sufficient H1.3 and H1.4 testing was completed in the allocated windows of the Blockade, thus will not delay the start of Trial Operations on ■ November 2021.</p> <p>Reliability growth is an element of the weekly PSSG meeting. Step improvements are expected due to new ELR100, TVS mode changes and Rolling Stock software drops. Reliability reviews included in the programme lead into the CESAC process for transition into Trial Operations and Revenue Service. Any deviation from the current plan shall be discussed at the Executive level.</p>
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Appendix – CRL Response to Period 6 PRep Report

	<p>Canary Wharf and Bond Street Stations are the last two that are under CRL’s responsibility for delivery and are maintaining schedule to achieve their respective SC3 ROGS and SC2 configurations against planned dates. To meet its scheduled date for SC3 ROGS, Canary Wharf Station is progressing with implementation of ‘Maintenance on Behalf of Others’ (MoBo) while it completes the requirements for Asset Data.</p> <p>The agreed Bond Street Station SC2 configuration for entry into Trial Operations is expected to be achieved in early October 2021. The detailed plans for station completion and functionality for Passenger Service beyond this date are subject to final management endorsement. [REDACTED]</p> <p>While a final decision will take account of the anticipated costs and the practicalities and restrictions of working within a live railway environment, completion of the TVS works is dependent upon maintaining the SC2 configuration state.</p> <p>CRL continues to drive to a target date of [REDACTED] November 2021, but several intractable issues have already had the effect of reducing the extent and functionality of the infrastructure that is able to be taken into full Trial Operations. For</p>	<p>Noted.</p> <p>SC2 milestone has been achieved at Bond Street station and will be enacted on [REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p>
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	<p>example, it will not be possible to determine the effectiveness of the October 2021 Blockade software upgrades until early November 2021, with little opportunity left for corrective fixes. In the meantime, integrated system reliability remains below expected levels. Train reliability improvement awaits the introduction of an important train borne software upgrade, which, given its scheduled deployment, may pose a risk to early entry into Passenger Service. Commissioning of the remaining TVS functionality cannot now be completed until December 2021, and train evacuation exercises have been rescheduled to early 2022. The size and nature of the safety assurance workload arising from the completion of all of these issues is uncertain. Nevertheless, given the pressure to maintain momentum, we anticipate that CRL will look to deliver some form of 'Trial Operations' which is not yet fully defined, on, or as close as possible to, [REDACTED] November 2021.</p> <p>The full impact on the completion of the Trial Operations period may not become fully apparent until early 2022, and it is likely that the start of Stage 3 Passenger Service will be pushed even closer to its P50 date of [REDACTED] May 2021₂. The P80 date is just within the latter part of the declared opening window of the first half of 2022. Slippage of Stage 3 opening will reduce the time available for reliability growth, upon which the commitment to Stages 5B and C depends.</p>	<p>Reliability reviews are built into the schedule (some are represented as Cardinal Events) and are linked to the CESAC review. CRL is reliant on the software upgrades to provide step change improvements in reliability. Key reliability reviews are undertaken after each software upgrade to ascertain that reliability has been achieved.</p> <p>Periodic reports continue to support an opening window of the first half of 2022. The Deterministic date of the [REDACTED] November for the start of Trial Operations is expected to be met [REDACTED]. The P50 date for Revenue Service remains within the opening window.</p>
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	<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 plan for Trial Operations is undergoing significant change to accommodate emerging issues, but it cannot be made robust until the October 2021 Blockade outcomes are properly understood. • Overall reliability remains low and improvement relies upon major software upgrades to signalling, trains, tunnel ventilation and communications systems, which extend into early 2022. • 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 C. 	<p>In response to the Project Representative’s five issues for attention, CRL responds as follows:</p> <p>CRL has provided re-assurance of this concern, covered in responses above.</p> <p>[REDACTED] teams are in the process of amending any relevant assurance products to reflect this including any impact on StEJ activities. At key decision points as part of assurance preparations, gates will be carried out [REDACTED]</p> <p>Reliability improvements are expected as a result of the new ELR100, TVS mode changes and Rolling Stock software drops. Reliability reviews included in the Programme lead into the CESAC process for transition into Trial Operations and Revenue Service. Any deviation from the current plan shall be discussed at Executive level.</p> <p>[REDACTED] teams are currently making amends to any relevant assurance product to reflect this including any impact on</p>
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	<ul style="list-style-type: none"> • Prolonged completion of systems integration and safety assurance threatens opportunities to realise reductions in risks and cost provisions 	<p>StEJ activities. Trial Operations shall be deliverable in the 11-week window [REDACTED]</p> <p>The Programme team continues to closely manage the schedule; coordinating activities to optimise delivery and mitigate risks driven by the underlying objective to deliver a safe and reliable Elizabeth line at the earliest opportunity.</p>
<p>Health & Safety</p>	<p>The investigation findings to the two separate voltage transformer RIDDOR incidents in Periods 4 and 5 are expected in Period 7. RfLI's investigation into 3 SPADs that occurred in Period 5 has yet to be concluded. Two LTIs were reported by CRL in Period 6; the cause of one, an electrical incident at Canary Wharf Station, was determined to be localised, with no direct implications for other Central Section installations. With overall safety indicators remaining within those set by the Programme, CRL is applying a particular focus on safety, as the Tier 1 contractors maintain demobilisation to the end of 2021.</p>	<p>The investigation findings into the Voltage Transformer RIDDOR incidents have been received and are informing the remedial action planning. It should be noted that the SPADS are not RfLI investigations. They are driver errors, therefore, fall within MTREL remit. The final report has been received and RfLI has commented and accepted this and the associated actions are now being progressed.</p>
<p>Programme Overview:</p> <p>Schedule</p>	<p>The Period 6 deterministic Cardinal Milestone dates for Trial Operations and Stage 3 Passenger Service remain unchanged from Period 5.</p> <p>Bond Street Station remains on schedule to achieve SC2 on 8 October 2021, and pre-testing</p>	<p>Noted.</p> <p>SC2 status has been achieved at Bond Street station [REDACTED]</p>

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	<p>of ELR100 is progressing well. CRL management decision is pending on the final delivery strategy for Bond Street Station for SC3 ROGS in 2022 and its opening state relative to the start of Passenger Service.</p> <p>There are increasing schedule pressures on activities leading to the Routeway SJ milestones, which are flowing through into the completion of the safety assurance process. TVS mode functionality testing and reliability growth are also both experiencing schedule pressures, and further blockade works will be required over the Christmas 2021 period; the plans for these are under development. As a result, train evacuation exercises which are planned as part of Trial Operations, and which can only be safely undertaken with the TVS in its end-state, must be deferred until early 2022.</p> <p>Successful commissioning of ELR100 and TVS software are important enablers for reliability growth; there must also be a corresponding significant improvement in train reliability. It is expected that the next train software upgrade, now scheduled for late in the October 2021 Blockade, will provide some improvement. However, the most significant upgrade is expected in December 2021. Poor reliability presents a significant risk to entry into Passenger Service.</p> <p>CRL planning and readiness for the October 2021 Blockade, which has a system software upgrade and commissioning focus, is at an</p>	<p>[REDACTED]</p> <p>[REDACTED] Trial Operations approach is significant to mitigate the pressure on the assurance schedule for the entry into Trial Operations on [REDACTED] November 2021. This allows for completion of the remaining upgrade work to support the mass evacuation exercises which have been rescheduled to suit.</p> <p>Noted.</p> <p>The October Blockade commenced as planned on 10 October 2021 and has been successfully delivered. [REDACTED]</p>
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<p>Commercial and Risk</p>	<p>advanced stage. The 15-day access window is planned between 9 and 25 October 2021, and will include the deployment of ELR100 signalling software, the TVS Windows 10 upgrade, and communications systems upgrades. This will be a challenging period of major software integration and commissioning in a short timeframe. The TVS work is confined to a small number of incident congestion mode tests, but these are logistically difficult to plan and implement, and have the potential for significant schedule impact, if unsuccessful. 12 TPH and 24 TPH headway demonstrations will be undertaken once ELR100 has been commissioned, after Blockade completion and prior to Trial Operations. This will be a critical period for the Programme, being the last opportunity for CRL to confirm systems integration and train reliability ahead of a commitment to Trial Operations.</p> <p>CRL’s draft Period 6 AFCDC is reported as stable at £15,940m⁵. There are indications that CRL’s interventions are containing cost increases, and there are early signs of emerging pressures stabilising. However, cost pressures are being realised in Stations and Routeway, which we believe might be covered by risk and provision allowances, which CRL reported is [REDACTED]⁶.</p> <p>Pressure to maintain the deterministic start date for Trial Operations of [REDACTED] November 2021, and</p>	<p>Noted. Cost pressures currently being realised are being offset where appropriate using drawdowns from available risks and allowances (subject to formal approval through Change Control).</p> <p>It is noted that [REDACTED] Trial Operations may introduce a requirement to draw</p>
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	<p>emerging potential changes to the Trial Operations Plan, mean that the opportunity to not spend all the prolongation risk is receding. Milestone achievement is moving toward the P50 schedule and consequently P50 risk provisions are likely to be expended.</p> <p>CRL continues to examine the opportunities to reduce or control the cost-to-go, 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 expected changes to the Trial Operations Plan. It is unlikely that these actions will be completed until the end of Period 7.</p> <p>The Period 6 draft AFCDC of £15,940m remains £151m above the current funding threshold, and £124m under the £1,071bn funding request limit of £16,064m. Although the QCRA at Period 6 was reduced by [REDACTED], this decrease did not include retirement or elimination of risk, and further lessens the opportunity for risk reductions. In order for CRL to be within the approved funding, the majority of remaining project, programme and prolongation risk will need to be eliminated or retired, together with the realisation of demobilisation and scope opportunities; we consider this unlikely.</p> <p>[REDACTED]</p> <p>[REDACTED] CRL has</p>	<p>down on the prolongation risk. The CRL management team is co-ordinating activities with all delivery stakeholders, with the aim of minimising any prolongation to the plan.</p> <p>CRL agrees with the Project Representative's comments regarding recognition of the Cost to Go opportunities. The current Indirect resource demobilisation strategy (CRL 22) is already reflected in the DCS 1.2 cost baseline.</p> <p>The Programme maintains that the single biggest opportunity to staying within the £825m is to meet the deterministic schedule. There are further opportunities alongside this that can be delivered including the retirement or elimination of risks and provisions.</p> <p>Noted.</p>
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<p>Organisation</p>	<p>developed its alternative delivery strategy (ADM/RWT) and has included its approach to the transfer of liabilities, such as defects, warranties, and design performance. CRL will further refine its ADM/RWT plan in Period 7.</p> <p>Following the demobilisation of the first of the Stations Tier 1 contractors from Farringdon Station at the end of August 2021, we expect to see a steady decline in site resources in the coming periods. Tottenham Court Road and Woolwich Stations are forecasting Tier 1 contractor demobilisation at the end of September 2021, with Liverpool Street and Paddington Stations at the end of October 2021. The [redacted] Routeway contract is forecast to be [redacted] after [redacted] and with this Tier 1 contractor demobilised by [redacted] thereafter, RfLI will take on all maintenance activities.</p> <p>CRL is continuing to implement its plan for a reduced organisation structure, to be effective in [redacted].</p> <p>[redacted] While CRL is expected to move quickly, resource end dates are linked to schedule deterministic dates, which may not be achieved. While there remains a risk that resources will leave the Programme earlier than CRL would like, it has identified a critical mass of</p>	<p>Noted.</p> <p>CRL continues to maintain a list of key staff that it requires to be retained up to their deterministic end-dates. Management is focussed on keeping a close eye on this list to ensure risks of people leaving of their own volition is minimised.</p>
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<p>Stage 3 Trial Running, Trial Operations and Passenger Service</p>	<p>resources and skills that it will retain to complete the works.</p> <p>In the meantime, following approval of the DCS v1.2 Workforce Plan, the full-time equivalent resources are forecast to increase slightly in Period 6 to 991 (up by 23 from Period 5). Of the 54 vacant roles identified in the DCS v1.2 Workforce Plan, 25 are not under active recruitment, and the budget associated with these roles will be assigned to other separate activities.</p> <p>Delivery of 12 TPH trials has proved to be challenging, but careful management by CRL, RfLI and MTREL has maximised the benefits, despite a range of ongoing faults. For example, the controlled cycling of test trains has allowed problematic units to be identified and issues resolved. While there is little new learning available until the deployment of ELR100, there has at least been continuity of MTREL driver and RCC staff workload. Trial Running has allowed the proper investigation of extreme air pressures which prevent Platform Screen Doors (PSD) from opening. It has also highlighted the absence of a local lockout facility; this would allow individual doors to be disabled, while retaining full operational functionality of other platform doors. Local lockout functionality is normal in similar metro systems and the current</p>	<p>Recruitment activity has significantly reduced, with the primary focus being Bond Street posts. It is anticipated that the total number of posts being actively recruited will decline further as Trial Operations approaches.</p> <p>Noted.</p>
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	<p>situation is currently being challenged by RfLI because it is too operationally restrictive.</p> <p>CRL has completed 12TPH demonstrations on the Great Eastern and Great Western Transitions. The demonstrations were completed over three weekends, with two on the Great Eastern and one on the Great Western. A success rate of 98% was achieved, with 3 failures linked to a particular train. The transition times achieved across both interfaces demonstrated that 2½ minute headways are able to be supported.</p> <p>Reliability growth is below planned levels and is a concern to the Elizabeth Line Reliability Board (ELRB). The planned Reliability Review Point 7 at ELRB in early November 2021 will be a key decision point for entry into Trial Operations. However, by then only one week of Trial Running will have been completed following commissioning in the October 2021 Blockade of the new TVS, ELR100 and train software upgrades. This may prove too short a period upon which to form such an important judgement. Completion of TVS safety assurance will also be necessary to allow volunteer operational exercises to take place in November/December 2021 for Trial Operations.</p>	<p>Noted.</p> <p>As mentioned above, step improvements are expected from the new ELR100, TVS mode changes and Rolling Stock software drops. Reliability reviews included in the programme lead into the CESAC process for transition into Trial Operations and Stage 3 Revenue Service. Any deviation from the current plan shall be discussed at Executive level.</p> <p style="background-color: black; color: black;">[REDACTED]</p> <p style="background-color: black; color: black;">[REDACTED]</p> <p style="background-color: black; color: black;">[REDACTED]</p> <p style="background-color: black; color: black;">[REDACTED]</p> <p>he TVS SJ has been produced but dependency numbers will remain high during the [REDACTED] Trial Operations period. This provides more time to close remaining dependencies and to fully assure the TVS for passenger use. Currently the system is only assured for up to 20 people on a train.</p>
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<p>Stations Commissioning and Handover</p>	<p>The number of Operational Restrictions has continued to grow in the period, and now totals 83. While ELR100 will facilitate the removal of some of these, a similar number of additional ones will be introduced, and a number of fault fixes will not now be realised until the deployment of ELR110, in December 2021. RfLI's initial assessment is that the number and nature of these Operational Restrictions is just manageable for entry into Trial Operations; RfLI assumes that those due for closure will be achieved and that no significant issues requiring new Operational Restrictions will emerge after ELR100 commissioning. A follow-on train borne software upgrade in early 2022, after ELR110 deployment, is expected to further enhance train reliability and performance.</p> <p>System Testing with a Train (STT) requires the completion of four demonstrations, but for three of these CRL has yet to confirm the access arrangements. The tests also include the proof of 24 TPH capability. The schedule opportunity is small and multi-stakeholder agreement will be required to allow these tests to be completed as planned before the start of Trial Operations.</p> <p>Tottenham Court Road and Woolwich Stations achieved substantial demobilisation of their Tier 1 Contractors as planned at the end of September 2021. Liverpool Street and</p>	<p>ELR100 is set to deliver a NET reduction of 18 Operational Restrictions (ORs). An assessment of the ORs that remain, and their severity has been undertaken. Additionally, a review to provide the Operations team with a subjective view of the impact of ELR100 and ELR110 from a human factor perspective. The Operations team continue to assert that the level of ORs will not prevent entry into Trial Operations.</p> <p>At the time of writing, CRL has agreed access for the remaining three demonstrations to take place.</p> <p>In line with the Project Representative's comments, Tottenham Court Road and Woolwich stations have achieved substantial demobilisation of their Tier 1 Contractors as planned at the end</p>
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	<p>Paddington Stations will follow by the end of October 2021.</p> <p>CRL and the IMs have finalised agreement of the scope that is to be completed before and after Passenger Service, for each of the 7 transferred stations. [REDACTED]</p> <p>[REDACTED] CRL has focussed on the completion of Asset Data delivery with the Tier 1 contractors. The interventions adopted by CRL seem to be working, with Woolwich Station Asset Data delivery completed, and it is now in a position to remove the MoBO one week earlier than planned. Other stations are also showing improvement.</p> <p>CRL is maintaining management focus on the two remaining stations. Bond Street Station is on schedule for SC2 completion on 8 October 2021; the removal of welfare facilities above the station has been completed as planned, and handover to the Oversight Developer by end of September 2021 remains on target. Completion of fire systems, electrical and emergency lighting and the closure of associated assurance products and safety certificates prior to SC2 remains outstanding. The plan for Bond Street Station completion after SC2 is expected to be confirmed in early December 2021. We understand that options for schedule and cost have been subject to management evaluation, [REDACTED]</p>	<p>of September 2021. Demobilisation at Liverpool Street station took place at the end of October 2021, with Paddington station expected by the end of [REDACTED]</p> <p>Noted.</p> <p>As mentioned above, Bond Street station has achieved its SC2 milestone and handover of urban realm to the Oversight Developer was achieved as planned. The Project Representative is accurate to state that cost, schedule and above all – safety, has been the attention of management focus. Stakeholder engagement is intact, and all relevant parties are working as One Team to achieve [REDACTED] Bond Street station. [REDACTED]</p>
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	<p>[REDACTED]. The station ventilation system must be maintained in the SC2 configuration state for TVS commissioning, prior to completion and handover for SC3 ROGS. [REDACTED] to station opening will require stakeholder support, particularly in relation to the transition of maintenance responsibilities. Given recent safety-related incidents at Bond Street Station, clarity of roles and responsibilities is required between CRL and its delivery contractors. This will be beneficial as CRL's management team maintains a focus on safety.</p> <p>Canary Wharf Station is working towards a planned BIU date of [REDACTED] November 2021, but there are challenges with the clearance of the SJ Dependencies. A MoBO is to be implemented at Canary Wharf Station associated with the mechanical and electrical works, initially planned for [REDACTED]. A number of electrical circuit breakers needs to be changed ahead of Trial Operations. While both CRL and RfLI are working collaboratively to meet the planned BIU date, maintaining clarity and open communication on issues affecting the assurance process will be fundamental to ensure the planned date is successfully achieved.</p> <p>[REDACTED]</p>	<p>[REDACTED]</p> <p>The Bringing Into Use (BIU) date at Canary Wharf station has been deferred to reflect the requirements and challenges recently identified in order to achieve BIU.</p> <p>[REDACTED] the BIU date is under review and will be confirmed on [REDACTED] at the T-2 Trial Operations readiness review. Assurance has been the primary challenge at an acceptable level to be able to meet the transfer. With that said, Electrical circuits have been completed and the MoBO has been agreed with RFLI.</p> <p>The Project Representative is correct to point out the access challenges encountered at Paddington station. These challenges have</p>
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Appendix – CRL Response to Period 6 PRep Report

<p>Assurance</p>	<div style="background-color: black; width: 100%; height: 40px; margin-bottom: 10px;"></div> <p>Abbey Wood Station remains on target for BIU and RCC integration on 30 September 2021, and CRL has already started the formal handover process to the Infrastructure Manager, with completion forecast for [REDACTED]. Delivery of escalator spares will complete functionality at this station.</p> <p>CRL has recently instigated weekly meetings to identify and resolve issues that have caused the slow transfer of scope from the Tier 1 contractors to the ADM/RWT. With the station scope items for Passenger Service now agreed between CRL and the IM, the Tier 1 contractor demobilisation dates are generally on target. It is anticipated that a smoother process will be implemented that will accelerate the flow of scope and budget to the ADM/RWT. Within the ADM/RWT, five entities are expected to receive an allocation of scope and budget from the COO reserve, to complete residual scope items.</p> <p>The assurance process is currently under considerable pressure. There are indications that, to achieve the start of Trial Operations on [REDACTED] November 2021, further mitigation measures are necessary, including more Structural</p>	<p>impacted on Paddington’s completion of its contract certification. Key items are being reviewed and agreed with RFLI that will continue to support demobilisation and contract certification.</p> <p>Abby Wood station has achieved BIU. Safety justification dependencies’ legacy items and minor outstanding works list are aggressively being worked on through Network Rail and the access planning teams.</p> <p>Noted.</p> <p>The further mitigation measures have already been agreed and worked through. [REDACTED]</p>
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Appendix – CRL Response to Period 6 PRep Report

<p>Future Stages</p>	<p>Engineering Judgements than were originally anticipated.</p> <p>Completion of the assurance process for entry into Trial Operations relies upon the delivery of EOWLs and closure of Dependencies. Generally, closure of Stations EOWLs is progressing well, and completion ahead of Trial Operations appears achievable. However, Routeway-related assurance delivery is more problematic, because of the workloads associated with ELR100 deployment and TVS mode testing. Some System Testing with the Train is outstanding at Canary Wharf Station, and a backlog of assurance evidence is building associated with Train Scenario Tests.</p> <p>Technical issues that will require resolution before entry into Passenger Service include RAMs compliance for the PSDs, and timetable demonstrations following a software update for train performance and reliability improvement. A train software update opportunity was missed in late September 2021, and new dates, which minimise the impact on the start of Passenger Service, are being considered.</p> <p>The RfLI led Elizabeth Stage 5 Oversight Group has held its third meeting and appears to have a good understanding of the workstreams and</p>	<p>[REDACTED] This will reflect the increased risk profile to allow mass evacuation trials to commence for Revenue Service.</p> <p>[REDACTED]</p> <p>Noted. An opportunity was missed in late September 2021 to pre-test the main train software update for reliability improvement which requires re-planning to integrate testing with ELR100 commissioning to hold the planned date for delivery of this train software in December 2021.</p> <p>Network Rail has identified a number of timetable options for 5C which are subject to further review and development.</p>
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Appendix – CRL Response to Period 6 PRep Report

	<p>challenges of Stages 5B and C. Our current observations are:</p> <ul style="list-style-type: none"> ✦ The start date of Stage 5B is dependent upon Stage 3 opening approximately [REDACTED] in advance, allowing personnel and systems to bed-in. This means that Stage 3 should open before June 2022, to support Stage 5B opening in [REDACTED]. ✦ System reliability (incorporating train reliability) should be in a state of continuous improvement up to Stage 5C, to facilitate the doubling of train frequency and more complex service patterns. ✦ Stage 5C timetable modelling has so far not produced a viable model, due to interactions with GW services and freight. Compromises are likely to be required from all affected parties. <p>Two initial Auto-Reverse functionality tests have been carried out as part of Trial Running and the results are under review. Auto-Reverse is necessary to support Stage 5B performance and Stage 3 contingency operations and must be successfully demonstrated before entry into Passenger Service.</p> <p>CRL continues to pursue bookings for additional possessions for pre-commissioning testing of future signalling software releases ELR200 and ELR210. These releases are important for the opening of Stages 5B and 5C.</p>	<p>CRL would like the Project Representative to note that this was an operational proving activity, not functional testing. Functionality has been proven previously as part of STT. Therefore, two days of Auto-Reverse use as part of timetabled Trial Running have been carried out.</p> <p>Noted.</p>
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Crossrail Project Representative

Crossrail Joint Sponsor Team

Sponsor Summary

Project Status Report 155

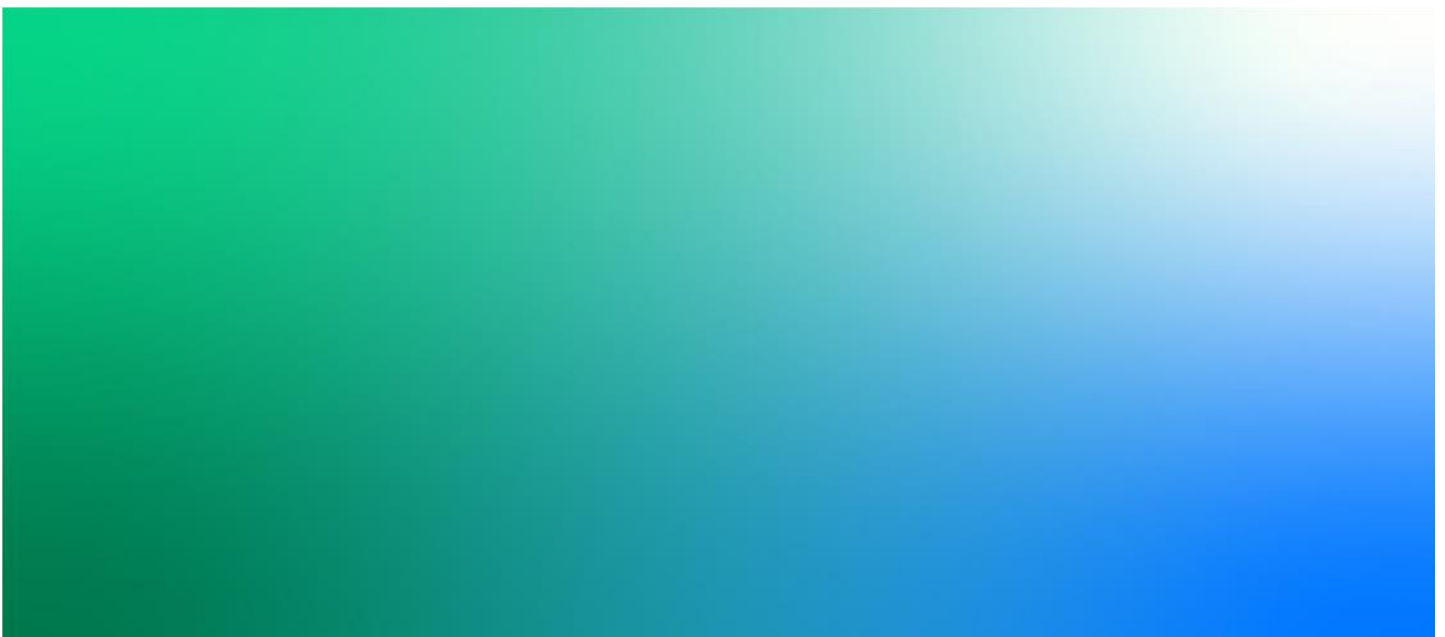
Period 6 | FY2021/22

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Sponsor Summary PSR 155

Project No: B2387600
 Document Title: Sponsor Summary for PSR 155
 Document No.: B2387600/155/1.9
 Date: 15 October 2021
 Client Name: Crossrail Joint Sponsor Team
 Client No: RM 3730
 Project Manager: ██████████
 Author: PRep Team

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Note: This report relies on the information set out in CRL's Period 6 reports augmented by more current information received by PRep during the course of our routine discussions with CRL since the Period close on 17 September 2021. Note that information emerging after the close of Period 6 is subject to formal confirmation by CRL in its Period 6 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.	11 October 2021	PSR 155 Period 6 FY 2021-22 Sponsor Summary v1.8 ~ Draft	████	████	████	████
2.	15 October 2021	PSR 155 Period 6 FY 2021-22 Sponsor Summary v1.9 ~ Final	████	████	████	████

Sponsor Summary

1. Observations

CRL has completed demonstrations on the Great Eastern and Great Western Transitions, which indicate that stable timetable services are able to be maintained for significant periods. Two of a series of Auto-Reverse tests under Trial Running were completed, but significantly more successful testing is required to support the assurance case for this functionality. Further Tunnel Ventilation System (TVS) testing was completed at Liverpool Street and Woolwich Stations ahead of the October 2021 Blockade, and Bismarck testing has also proceeded to plan.

Despite ongoing Operational Restrictions and recurrence of known faults, 12 TPH trials have continued using a “soft ramp-up” to establish stable daily service patterns. This has enabled further build-up of staff confidence and some mileage accumulation. Resolution of known faults requires the deployment of both ELR100 and ELR110.

Demobilisation of Tier 1 Station contractors has gained momentum, with three station Tier 1 contractors from the total of 8 stations demobilised at the end of September 2021.

1.1 Headline Concerns

Preparations for the October 2021 Blockade have continued. The successful delivery of planned TVS commissioning and ELR100 signalling software deployment, are vital to the achievement of acceptable railway performance levels before Trial Operations. However, an emerging issue with the testing of TVS incident mode functionality is resulting in a change to the planning and sequencing of activities during the Trial Operations period. While still under review between CRL and RfLI, the consequential impact is likely to be an extended Christmas 2021 Blockade in order to complete TVS functionality commissioning and train testing, with train evacuation exercises postponed to early 2022.

The Safety Assurance process requires mitigation measures to maintain schedule. CRL management is confident that open Dependencies can be closed or mitigated to meet the target date for entry into Trial Operations of ■ November 2021, and has increased its resource to support this effort. However, the number of Dependencies is significantly higher than originally anticipated by CRL/RfLI. The slow production of assurance evidence to close Dependencies is resulting in an increased demand for assessment by Structured Engineering Judgement (StEJ). We are concerned that close-out is currently behind schedule to achieve ■ November 2021.

Reliability growth in the Trial Running period remains well below forecast¹. While mileage accumulation continues, performance in the Central Section is more than 60% below the target set by DCS v1.1. Trials with the current versions of system software are providing limited performance improvement, and significant uplifts are reliant on planned upgrades.

Train reliability remains below expected levels. An opportunity was missed to pre-test the main train software update for reliability improvement and this requires re-planning to integrate testing with ELR100. A schedule window at the end of the October 2021 Blockade is being investigated, but at the risk of delay to the start of the Trial Operations period. With the main train software upgrade due in mid-December 2021, time is diminishing to demonstrate a significant improvement in train reliability against the deterministic date of ■ February 2022 for entry into Passenger Service.

¹ Crossrail Programme Assurance Group No. 29 held on 27 September 2021.

Canary Wharf and Bond Street Stations are the last two that are under CRL's responsibility for delivery, and are maintaining schedule to achieve their respective SC3 ROGS and SC2 configurations against planned dates. To meet its scheduled date for SC3 ROGS, Canary Wharf Station is progressing with implementation of 'Maintenance on Behalf of Others' (MoBo) while it completes the requirements for Asset Data.

The agreed Bond Street Station SC2 configuration for entry into Trial Operations is expected to be achieved in early October 2021. The detailed plans for station completion and functionality for Passenger Service beyond this date are subject to final management endorsement. [REDACTED]

[REDACTED] While a final decision will take account of the anticipated costs and the practicalities and restrictions of working within a live railway environment, completion of the TVS works is dependent upon maintaining the SC2 configuration state.

CRL continues to drive to a target date of [REDACTED] November 2021, but several intractable issues have already had the effect of reducing the extent and functionality of the infrastructure that is able to be taken into full Trial Operations. For example, it will not be possible to determine the effectiveness of the October 2021 Blockade software upgrades until early November 2021, with little opportunity left for corrective fixes. In the meantime, integrated system reliability remains below expected levels. Train reliability improvement awaits the introduction of an important trainborne software upgrade, which, given its scheduled deployment, may pose a risk to early entry into Passenger Service. Commissioning of the remaining TVS functionality cannot now be completed until December 2021, and train evacuation exercises have been rescheduled to early 2022. The size and nature of the safety assurance workload arising from the completion of all of these issues is uncertain. Nevertheless, given the pressure to maintain momentum, we anticipate that CRL will look to deliver some form of 'Trial Operations' which is not yet fully defined, on, or as close as possible to, [REDACTED] November 2021.

The full impact on the completion of the Trial Operations period may not become fully apparent until early 2022, and it is likely that the start of Stage 3 Passenger Service will be pushed even closer to its P50 date of [REDACTED] May 2021². The P80 date is just within the latter part of the declared opening window of the first half of 2022. Slippage of Stage 3 opening will reduce the time available for reliability growth, upon which the commitment to Stages 5B and C depends.

Issues for particular Sponsor attention are as follows:

- Past general concerns remain with: schedule, cost, and risk; integrated systems testing; assurance delivery; reliability growth; and stations completion.
- The plan for Trial Operations is undergoing significant change to accommodate emerging issues, but it cannot be made robust until the October 2021 Blockade outcomes are properly understood.
- Overall reliability remains low and improvement relies upon major software upgrades to signalling, trains, tunnel ventilation and communications systems, which extend into early 2022.
- 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 C.
- Prolonged completion of systems integration and safety assurance threatens opportunities to realise reductions in risks and cost provisions.

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

1.2 Health and Safety

The investigation findings to the two separate voltage transformer RIDDOR incidents in Periods 4 and 5 are expected in Period 7. RfLI's investigation into 3 SPADs that occurred in Period 5 has yet to be concluded. Two LTIs were reported by CRL in Period 6; the cause of one, an electrical incident at Canary Wharf Station, was determined to be localised, with no direct implications for other Central Section installations. With overall safety indicators remaining within those set by the Programme, CRL is applying a particular focus on safety, as the Tier 1 contractors maintain demobilisation to the end of 2021.

2. Programme Overview

2.1 Schedule

The Period 6 deterministic Cardinal Milestone dates for Trial Operations and Stage 3 Passenger Service remain unchanged from Period 5.

Bond Street Station remains on schedule to achieve SC2 on 8 October 2021, and pre-testing of ELR100 is progressing well. CRL management decision is pending on the final delivery strategy for Bond Street Station for SC3 ROGS in 2022 and its opening state relative to the start of Passenger Service.

There are increasing schedule pressures on activities leading to the Routeway SJ milestones³ which are flowing through into the completion of the safety assurance process. TVS mode functionality testing and reliability growth are also both experiencing schedule pressures, and further blockade works will be required over the Christmas 2021 period; the plans for these are under development. As a result, train evacuation exercises which are planned as part of Trial Operations, and which can only be safely undertaken with the TVS in its end-state, must be deferred until early 2022.

Successful commissioning of ELR100 and TVS software are important enablers for reliability growth; there must also be a corresponding significant improvement in train reliability. It is expected that the next train software upgrade, now scheduled for late in the October 2021 Blockade, will provide some improvement. However, the most significant upgrade⁴ is expected in December 2021. Poor reliability presents a significant risk to entry into Passenger Service.

CRL planning and readiness for the October 2021 Blockade, which has a system software upgrade and commissioning focus, is at an advanced stage. The 15-day access window is planned between 9 and 25 October 2021, and will include the deployment of ELR100 signalling software, the TVS Windows 10 upgrade, and communications systems upgrades. This will be a challenging period of major software integration and commissioning in a short timeframe. The TVS work is confined to a small number of incident congestion mode tests, but these are logistically difficult to plan and implement, and have the potential for significant schedule impact, if unsuccessful. 12 TPH and 24 TPH headway demonstrations will be undertaken once ELR100 has been commissioned, after Blockade completion and prior to Trial Operations. This will be a critical period for the Programme, being the last opportunity for CRL to confirm systems integration and train reliability ahead of a commitment to Trial Operations.

³ Crossrail Weekly Dashboard, Period 7, Week 1.

⁴ Alstom trainborne software upgrade H5.4 – EPPR 6 October 2021.

2.2 Commercial and Risk

CRL's draft Period 6 AFCDC is reported as stable at £15,940m⁵. There are indications that CRL's interventions are containing cost increases, and there are early signs of emerging pressures stabilising. However, cost pressures are being realised in Stations and Routeway, which we believe might be covered by risk and provision allowances, which CRL reported is [REDACTED].

Pressure to maintain the deterministic start date for Trial Operations of [REDACTED] November 2021, and emerging potential changes to the Trial Operations Plan, mean that the opportunity to not spend all the prolongation risk is receding. Milestone achievement is moving toward the P50 schedule and consequently P50 risk provisions are likely to be expended.

CRL continues to examine the opportunities to reduce or control the cost-to-go, 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 expected changes to the Trial Operations Plan. It is unlikely that these actions will be completed until the end of Period 7.

The Period 6 draft AFCDC of £15,940m remains £151m above the current funding threshold, and £124m under the £1,071bn funding request limit of £16,064m. Although the QCRA at Period 6 was reduced by [REDACTED] to [REDACTED], this decrease did not include retirement or elimination of risk, and further lessens the opportunity for risk reductions. In order for CRL to be within the approved funding, the majority of remaining project, programme and prolongation risk will need to be eliminated or retired, together with the realisation of demobilisation and scope opportunities; we consider this unlikely.

[REDACTED]
[REDACTED] CRL has developed its alternative delivery strategy (ADM/RWT) and has included its approach to the transfer of liabilities, such as defects, warranties, and design performance. CRL will further refine its ADM/RWT plan in Period 7.

2.3 Organisation

Following the demobilisation of the first of the Stations Tier 1 contractors from Farringdon Station at the end of August 2021, we expect to see a steady decline in site resources in the coming periods. Tottenham Court Road and Woolwich Stations are forecasting Tier 1 contractor demobilisation at the end of September 2021, with Liverpool Street and Paddington Stations at the end of October 2021. The [REDACTED] Routeway contract is forecast to be [REDACTED] after [REDACTED] and with this Tier 1 contractor demobilised by [REDACTED]; thereafter, RfLI will take on all maintenance activities.

CRL is continuing to implement its plan for a reduced organisation structure, to be effective in [REDACTED]. [REDACTED]

[REDACTED] While CRL is expected to move quickly, resource end dates are linked to schedule deterministic dates, which may not be achieved. While there remains a risk that resources will leave the Programme earlier than CRL would like, it has identified a critical mass of resources and skills that it will retain to complete the works.

⁵ EPPR held on 6 October 2021.

⁶ EPPR held on 6 October 2021 and verified via e-mail from CRL Finance 7 October 2021.

In the meantime, following approval of the DCS v1.2 Workforce Plan, the full-time equivalent resources are forecast to increase slightly in Period 6 to 991 (up by 23 from Period 5). Of the 54 vacant roles identified in the DCS v1.2 Workforce Plan, 25 are not under active recruitment, and the budget associated with these roles will be assigned to other separate activities.

2.4 Stage 3 Trial Running, Trial Operations and Passenger Service

Delivery of 12 TPH trials has proved to be challenging, but careful management by CRL, RfLI and MTREL has maximised the benefits, despite a range of ongoing faults. For example, the controlled cycling of test trains has allowed problematic units to be identified and issues resolved. While there is little new learning available until the deployment of ELR100, there has at least been continuity of MTREL driver and RCC staff workload. Trial Running has allowed the proper investigation of extreme air pressures which prevent Platform Screen Doors (PSD) from opening. It has also highlighted the absence of a local lockout facility; this would allow individual doors to be disabled, while retaining full operational functionality of other platform doors. Local lockout functionality is normal in similar metro systems and the current situation is currently being challenged by RfLI because it is too operationally restrictive.

CRL has completed 12TPH demonstrations on the Great Eastern and Great Western Transitions. The demonstrations were completed over three weekends, with two on the Great Eastern and one on the Great Western. A success rate of 98% was achieved, with 3 failures linked to a particular train. The transition times achieved across both interfaces demonstrated that 2½ minute headways are able to be supported.

Reliability growth is below planned levels and is a concern to the Elizabeth Line Reliability Board (ELRB)⁷. The planned Reliability Review Point 7 at ELRB in early November 2021 will be a key decision point for entry into Trial Operations. However, by then only one week of Trial Running will have been completed following commissioning in the October 2021 Blockade of the new TVS, ELR100 and train software upgrades. This may prove too short a period upon which to form such an important judgement. Completion of TVS safety assurance will also be necessary to allow volunteer operational exercises to take place in November/December 2021 for Trial Operations.

The number of Operational Restrictions has continued to grow in the period, and now totals 83⁸. While ELR100 will facilitate the removal of some of these, a similar number of additional ones will be introduced, and a number of fault fixes will not now be realised until the deployment of ELR110, in December 2021. RfLI's initial assessment is that the number and nature of these Operational Restrictions is just manageable for entry into Trial Operations; RfLI assumes that those due for closure will be achieved and that no significant issues requiring new Operational Restrictions will emerge after ELR100 commissioning. A follow-on trainborne software upgrade in early 2022, after ELR110 deployment, is expected to further enhance train reliability and performance.

System Testing with a Train (STT) requires the completion of four demonstrations, but for three of these CRL has yet to confirm the access arrangements⁹. The tests also include the proof of 24 TPH capability. The schedule opportunity is small and multi-stakeholder agreement will be required to allow these tests to be completed as planned before the start of Trial Operations.

⁷ Elizabeth Line Reliability Board held on 14 September 2021.

⁸ Executive Programme Performance Review held on 6 October 2021.

⁹ Integrated Project Reviews held on 28 September 2021.

2.5 Stations Commissioning and Handover

Tottenham Court Road and Woolwich Stations achieved substantial demobilisation of their Tier 1 Contractors as planned at the end of September 2021. Liverpool Street and Paddington Stations will follow by the end of October 2021.

CRL and the IMs have finalised agreement of the scope that is to be completed before and after Passenger Service, for each of the 7 transferred stations. [REDACTED]

[REDACTED] CRL has focussed on the completion of Asset Data delivery with the Tier 1 contractors. The interventions adopted by CRL seem to be working, with Woolwich Station Asset Data delivery completed, and it is now in a position to remove the MoBO one week earlier than planned. Other stations are also showing improvement.

CRL is maintaining management focus on the two remaining stations. Bond Street Station is on schedule for SC2 completion on 8 October 2021; the removal of welfare facilities above the station has been completed as planned, and handover to the Oversight Developer by end of September 2021 remains on target. Completion of fire systems, electrical and emergency lighting and the closure of associated assurance products and safety certificates prior to SC2 remains outstanding. The plan for Bond Street Station completion after SC2 is expected to be confirmed in early December 2021. We understand that options for schedule and cost have been subject to management evaluation, [REDACTED]

The station ventilation system must be maintained in the SC2 configuration state for TVS commissioning, prior to completion and handover for SC3 ROGS. [REDACTED] station opening will require stakeholder support, particularly in relation to the transition of maintenance responsibilities. Given recent safety-related incidents at Bond Street Station, clarity of roles and responsibilities is required between CRL and its delivery contractors. This will be beneficial as CRL's management team maintains a focus on safety.

Canary Wharf Station is working towards a planned BIU date of [REDACTED] November 2021, but there are challenges with the clearance of the SJ Dependencies. A MoBO is to be implemented at Canary Wharf Station associated with the mechanical and electrical works, initially planned for [REDACTED]. A number of electrical circuit breakers needs to be changed ahead of Trial Operations. While both CRL and RfLI are working collaboratively to meet the planned BIU date, maintaining clarity and open communication on issues affecting the assurance process will be fundamental to ensure the planned date is successfully achieved.

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Abbey Wood Station remains on target for BIU and RCC integration on 30 September 2021, and CRL has already started the formal handover process to the Infrastructure Manager, with completion forecast for [REDACTED]. Delivery of escalator spares will complete functionality at this station.

CRL has recently instigated weekly meetings to identify and resolve issues that have caused the slow transfer of scope from the Tier 1 contractors to the ADM/RWT. With the station scope items for Passenger Service now agreed between CRL and the IM, the Tier 1 contractor demobilisation dates are generally on target. It is anticipated that a smoother process will be implemented that will accelerate the flow of scope and budget to the ADM/RWT. Within the ADM/RWT, five entities are

expected to receive an allocation of scope and budget from the COO reserve, to complete residual scope items.

2.6 Assurance

The assurance process is currently under considerable pressure. There are indications that, to achieve the start of Trial Operations on ■ November 2021, further mitigation measures are necessary, including more Structural Engineering Judgements than were originally anticipated.

Completion of the assurance process for entry into Trial Operations relies upon the delivery of EOWs and closure of Dependencies. Generally, closure of Stations EOWs is progressing well, and completion ahead of Trial Operations appears achievable. However, Routeway-related assurance delivery is more problematic, because of the workloads associated with ELR100 deployment and TVS mode testing. Some System Testing with the Train is outstanding at Canary Wharf Station, and a backlog of assurance evidence is building associated with Train Scenario Tests.

Technical issues that will require resolution before entry into Passenger Service include RAMs compliance for the PSDs, and timetable demonstrations following a software update for train performance and reliability improvement. A train software update opportunity was missed in late September 2021, and new dates, which minimise the impact on the start of Passenger Service, are being considered.

2.7 Future Stages

The RfLI led Elizabeth Stage 5 Oversight Group has held its third meeting and appears to have a good understanding of the workstreams and challenges of Stages 5B and C. Our current observations are:

- The start date of Stage 5B is dependent upon Stage 3 opening approximately ■ in advance, allowing personnel and systems to bed-in. This means that Stage 3 should open before June 2022, to support Stage 5B opening in ■.
- System reliability (incorporating train reliability) should be in a state of continuous improvement up to Stage 5C, to facilitate the doubling of train frequency and more complex service patterns.
- Stage 5C timetable modelling has so far not produced a viable model, due to interactions with GW services and freight. Compromises are likely to be required from all affected parties.

Two initial Auto-Reverse functionality tests have been carried out as part of Trial Running and the results are under review. Auto-Reverse is necessary to support Stage 5B performance and Stage 3 contingency operations, and must be successfully demonstrated before entry into Passenger Service.

CRL continues to pursue bookings for additional possessions for pre-commissioning testing of future signalling software releases ELR200 and ELR210. These releases are important for the opening of Stages 5B and 5C.