

## Project Representative Report

**Item: Project Status Report 161 and Crossrail  
Response Period 12 FY2021-22**

**Date: Period 12 (5 February 2022 - 4 March 2022 )**

---

### 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

### 2 Contents

1	Crossrail response on the Project Representative Sponsor Summary Report Period 12 FY2021-22 .....	2
2	Project Status Report 161 Period 12 FY2021-22 .....	21



Crossrail Limited  
5 Endeavour Square  
London E20 1JN  
T: 0343 222 0000  
Helpdesk  
T: 0345 602 3813  
[www.crossrail.co.uk](http://www.crossrail.co.uk)

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

20 April 2022

Dear ██████████

**Re: Crossrail PRep Project Status Report 161 – Period 12**

I am writing in response to the PRep Sponsor Summary cover letter for Period 12.

Since my last correspondence, the planned mass volunteer Trial Operations exercises that commenced on 29 January 2022 are now complete. The final exercise on 20 March 2022 was a 24TPH demonstration starting at Paddington station. Identified process improvements have been taken forward to provide clear and specific guidance to the teams and our RFLI, MREL, LU colleagues in response to targeted scenarios.

Reliability continues to build towards the accepted levels required for transition to Passenger Service. Timetable Demonstrations commenced on 28 March 2022 with consistent growth of the key measures of trips completed: PPM and 15-minute delays. These measures have often achieved the required standard for Passenger Service. The teams remain focussed to make this consistent. Central to this was the completion of scheduled works during the Easter blockade which brought the ELR200 signalling software drop and final upgrade to the communication system software. These works are expected to reduce a considerable number of operational workarounds.

Since my last update, there has been a growing maturity of the assurance process in relation to outstanding and final updated documentation. The next key assurance milestone, Stage 3A Revenue Service Assured is planned for ██████████. As you know this is the culmination of years of work on the Programme and we are confidently proceeding to this key milestone.

In parallel to Stage 3A opening timescales, planning for Stage 5B Minus is being proactively managed through weekly team and senior management reviews to ensure timely progress is made. Siemens have workstreams to improve the automatic transition performance in the Great Eastern and MTR is implementing mitigations to enable a 5B Minus timetable to operate in the event we remain in manual transition.

**MOVING LONDON FORWARD**

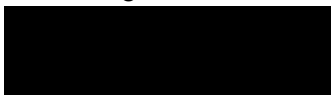




We are also completing the final tuning and performance management of the London Fire Brigade radio system coverage. This is a key requirement to achieve before Revenue Service can commence.

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**

## Appendix – CRL Response to Period 12 PRep Report

Programme Response Category	PRep Period 12 Sponsor Summary Content	CRL Period 12 Response
<p><b>Headlines: Progress and Look Ahead</b></p>	<p>Completion of assurance delivery has proved to be more challenging than expected and the risks of processing a significant workload in the approach to passenger opening, noted in recent reports, have been realised in practice. This has driven a 4-week delay in the Stage 3a Revenue Service Assured milestone, which is now set at [REDACTED]. The ability for the Programme to absorb this delay is underwritten in a revised assurance plan, which de-risks final safety acceptance through ITAP 'noting' the contents of current submissions; ITAP acceptance of top-level safety submissions will take place after the Easter 2022 Blockade.</p> <p>We are aware that CRL, RfLI and other major operating stakeholders have already committed to the new assurance dates, although no relief is yet evident for the Stage 3a Opening date, and it is not clear how downstream schedule impacts have been avoided.</p> <p>Notwithstanding the change to the Stage 3a Revenue Service Assured date, CRL continues to drive internally the completion of the technical and safety assurance case for the railway to the previous target of [REDACTED] March 2022. However, a sizeable workload remains to close SJ</p>	<p>The use of 'for noting' of the main railway level assurance was to make sense of the difference between the Revenue Service Ready - Assured and Stage 3A Revenue Service Assured milestones. Agreed that several 'for noting' items became delayed to [REDACTED], to deal with changes in supporting evidence. However, it is still to de-risk the [REDACTED] milestone.</p> <p>CRL achieved a robust Assurance Baseline for 'Passenger Service Ready' on [REDACTED] March 2022 as planned. Several documents are with the ORR and RFLI for approval, and these expect to be closed out by the end of April 2022. This is in time for Passenger Revenue Services to commence in May 2022. A number of residual issues are in the process of being resolved, most notably the fine tuning of the radio system for the London Fire Brigade.</p> <p>CRL agrees that the Revenue Service Ready - Assured milestone on [REDACTED] March 2022 was used to focus on completing as much assurance as possible. A fully detailed assurance baseline was achieved for the remaining EOWs and SJ dependencies to be addressed during April 2022</p>

## Appendix – CRL Response to Period 12 PRep Report

	<p>Dependencies and EOWs in support of the remaining safety submissions, and completion before the end of March 2022 will not be achieved. Similarly, with Technical Files still being completed, the delay to the milestone provides sufficient time for the Authority to Place into Service (APIS) to be secured following ORR review. Completion of assurance will rely upon co-ordinated delivery of CRL and RfLI submissions which are closely related and interdependent.</p> <p>Reliability growth and the resolution of issues to achieve the minimum agreed railway reliability thresholds for entry into passenger service remain top priorities for CRL and RfLI. Timetable operation during Trial Running has experienced more disruption than anticipated because of variable railway reliability and the need to complete project works. As a consequence, RfLI is slightly behind on its Trial Operations exercises, and has decided not to complete those that it considers non-critical. This will allow more time for the delivery of process improvement activities, implementation of solutions to the top 5 issues affecting reliability, and readiness preparations for the deployment of software upgrades H5.7 and ELR200.</p>	<p>against the Stage 3A Revenue Service Assured milestone of █ March 2022. The strategy included submission of all Technical Files to the ORR with the final one going by █ to give the ORR a █ review period to obtain APIS letters back.</p> <p>The final railway level assurance items for noting at ITAP on █ is the final step of coordination between CRL and RfLI deliverables before submission to ITAP for acceptance on █.</p> <p>Agree. As planned the Elizabeth Line entered a period of Timetable Demonstration on 28 March 2022. This will continue until Revenue Service. A small number of exercises have been aborted and opportunities are being looked to accommodate reschedule following the timetabled demonstration period. Planning is also ongoing to deliver six 'Staff Access Events' as an opportunity to thank staff who have been directly involved in delivering the Elizabeth line, but more critically an opportunity to get useful feedback on the operating railway in a passenger facing environment.</p> <p>Planning is on target for the execution of further upgrades to the Signalling and Communications and Control systems during the planned Easter Blockade. Completion of these activities is expected to reduce circa 32 operational workarounds, which will significantly reduce work the Timetable Managers have to do at the RCC. This will further improve reliability and performance of the railway prior to the opening.</p>
--	--	--

## Appendix – CRL Response to Period 12 PRep Report

	<p>In parallel, RfLI is preparing a resilience plan and addressing improvements to minimise delays. Performance improvement will result in an increase in Public Performance Measure (PPM), which, at an average to date of [REDACTED], is still currently below the target level of 95%; follow-on disruptions to initial delays continue to have a negative effect on overall PPM levels.</p> <p>The schedule window for preparing for passenger service is reducing, and RfLI is expected to step-up its readiness activities as CRL transitions to a significantly reduced organisation size after the end of March 2022. With project delivery drawing to a substantial close in April 2022, a period is available for stable timetable running, mixed with routine operational service management activities, which is effectively clear of the distractions of exercises and engineering work. Critically, this will be the last such opportunity before the start of passenger service, and all parties must make the most of the limited time available.</p> <p>The intention last period had been for RfLI to carry out 7 weeks of Timetable Running to embed learning from the Trial Operations phase and build up reliability before entering passenger service. We expect these workstreams to continue as planned from 28 March 2022, and for RfLI to confirm by mid-April 2022 whether the improvement in railway performance is sufficient to meet the internal target date for Stage 3a Opening of [REDACTED] May 2022. The corresponding</p>	<p>Agree.</p> <p>Project delivery works will continue beyond the end of March 2022 with the completion of Bond Street station, the Communication and Control Work Bank and Signalling Work Bank. Works are anticipated to continue to the end [REDACTED] as per the DCS1.2 plan. The CRL team will be accurately sized to deliver this. Access has been factored in to complete the commissioning of these works.</p> <p>Agree.</p>
--	--	---

## Appendix – CRL Response to Period 12 PRep Report

	<p>P80 date remains within the declared opening window of the first half of 2022.</p> <p>Preparations will need to begin by the end of [REDACTED] to support the earliest start to Stage 5B Minus services in [REDACTED] 2022. Based upon current railway performance, further demonstrations will need to be undertaken before [REDACTED] to give confidence that the railway can successfully transition from 12 to 22 TPH. Emerging issues with the GEML signalling transition and the inability to bring forward planned train and signalling software upgrades are likely to impact the deterministic start date for Stage 5B Minus. The complexity and inter-relationship of works beyond Stage 3a Opening mean that the P50 dates associated with all of the Stage 5 openings require further validation by CRL.</p> <p>CRL is reporting a [REDACTED] increase for Bond Street Station following its schedule update, with the new deterministic target for opening the station declared as between [REDACTED]. CRL has drawdown contribution from its Programme Risk to cover this increase, but it has also increased its Project Risk, following reassessment of the remaining works and associated risk at Bond Street Station.</p>	<p>The signalling automatic transition issues are related to the Wi-fi traffic and coverage. Siemens are optimising the performance of the system based on the current level of traffic, by improving the antenna coverage and locations, the processing demands during transition and segregation of channel use. These actions are expected to improve the transition performance. The Great Eastern Fringe has been reverted to manual from automatic transition to reduce the number of emergency breaking events on the way into the platform at Stratford. However, if a product change is required, this is unlikely to be implemented by [REDACTED] therefore, MTR are implementing mitigating measures to be able to operate a 22TPH service with manual transition still in place.</p> <p>Noted.</p>
--	--	--

## Appendix – CRL Response to Period 12 PRep Report

	<p>Sponsors' particular attention is drawn to the following:</p> <p>A [REDACTED] delay to the Stage 3a Revenue Service Assured milestone to [REDACTED] provides relief to safety assurance completion, but the impacts on Stage 3a Opening are not yet clear.</p> <p>CRL and RfLI concerns remain with variable reliability performance, and little time is available for improvement before Stage 3a Opening, targeted for achievement in [REDACTED] May 2022.</p>	<p>CRL responds to the Sponsors as follows:</p> <p>The Revenue Service Ready - Assured milestone for [REDACTED] March 2022 was held. The Stage 3A Railway Assured milestone for [REDACTED] is not a [REDACTED] delay and represents the next step of de-risking the railway level assurance. There is no impact on the current planned date for Stage 3A Passenger Service in May 2022.</p> <p>As planned the Elizabeth Line entered a period of Timetable Demonstration on the 28 March 2022; this will continue until Revenue Service. Planning is well in hand for the execution of further upgrades to the Signalling and Communications and Control systems during the planned Easter Blockade. This will continue to improve reliability and performance of the railway prior to the opening.</p> <p>The formal Trial Operations exercises are now complete with the five mass volunteer exercises all safely conducted. The key areas of focus during the Timetable Demonstration phase include demonstration of service contingencies and service recovery due to disruption, moving to a customer rather than an infrastructure centric focus, improving consistency of passenger information, protecting, and embedding a one team approach and staff engagement through leadership roaming visits to improve engagement as well as provide an opportunity for feedback. Consolidation and completion of the above-</p>
--	---	---



## Appendix – CRL Response to Period 12 PRep Report

	<p>Completion of RfLI and MTREL readiness preparations depend upon the successful deployment of ELR200 to deliver a reliable and stable final Stage 3a railway configuration.</p> <p>CRL has declared a window for full opening to passengers of Bond Street Station, but there are risks with the testing and commissioning that remains.</p> <p>Issues continue to emerge which threaten the earliest start for Stage 5B Minus, with no firm mitigation plans; a P50 date to enable through services has yet to be determined.</p>	<p>mentioned activities is expected to improve railway reliability.</p> <p>Agree.</p> <p>Noted.</p> <p>As mentioned above, MTR is implementing a mitigation plan to enable a 5B Minus timetable to operate in the event we remain in manual transition.</p>
<p><b>Health &amp; Safety</b></p>	<p>In Period 12, a new system of safety measurement was implemented that aligns with the reduced size of the CRL organisation and Programme. The process requires further refinement and additional briefings are planned to ensure that the scoring properly reflects site safety activities<sup>3</sup>. No significant incidents were reported in the period.</p>	<p>CRL disagree with the Project Representative’s assessment.</p> <p>The new system of safety measurement was implemented in Period 10 and refined in Period 11.</p> <p>There was one significant incident in the period at Bond Street, as a result of storm Eunice a fence line was blown over - no injuries occurred.</p>

## Appendix – CRL Response to Period 12 PRep Report

<p><b>Programme Overview:</b></p> <p><b>Schedule</b></p>	<p>The deterministic date for the Stage 3a Revenue Service Assured railway has slipped from [REDACTED]. The principal schedule risk for this milestone continues to be the completion of the safety assurance process, including the delivery of the Technical Files and the issuing of the APIS by the ORR.</p> <p>CRL has maintained the P50 date for Stage 3a Opening unchanged from Period 11 at [REDACTED] May 2022.</p> <p>CRL is proposing to retain the start of the Timetable Demonstration period of 28 March 2022, but timetable running will take place in practice, regardless of when the Stage 3a Revenue Assured milestone is achieved. In the event that the current deterministic and P50 dates for the start of passenger service are maintained, there will be greater pressure on this final period of timetable running to deliver the increase in overall system reliability necessary to support Stage 3a Opening in May 2022.</p> <p>The main risk to meeting the deterministic date for Stage 3a Opening is the failure to achieve the required level of overall system reliability and resilience. The P80 date of [REDACTED] June 2022 remains within the declared opening window of the first half of 2022.</p>	<p>The [REDACTED] March 2022 milestone was for the Revenue Service Ready - Assured which was held as a de-risking of the railway level assurance. The new milestone of Stage 3A Revenue Service Assured on [REDACTED] is to further de-risk the railway level assurance before opening for Passenger Revenue Earning Service in May 2022 based on a final reliability and performance decision.</p> <p>Noted.</p> <p>Agree.</p> <p>Agree.</p>
--	--	---

## Appendix – CRL Response to Period 12 PRep Report

<p><b>Commercial and Risk</b></p>	<p>Delays in the completion of workstreams supporting the delivery of Auto-Reverse functionality, which is necessary for running a 24 TPH service, has resulted in slippage of Stage 5B Opening to [REDACTED]. CRL continues to develop the possible introduction of a modified stage, Stage 5B Minus, with a service frequency of up to 22 TPH without Auto-Reverse functionality. The feasibility and benefits of this interim service configuration are being validated as part of DCS v1.3 development. However, there are emerging issues such as the Auto-Transition functionality at the GEML signalling transition that put an earliest start date for Stage 5B Minus at risk. While CRL has used the QSRA for Stage 5B as a starting point and developed an initial assessment for Stage 5B Minus, the analysis retains a number of risks associated with the growth from 12 TPH to 22 TPH but omits all of the risks associated with implementing Auto-Reverse.</p> <p>At the close of Period 11, CRL reverted its AFCDC to the Period 10 forecast of £15,963m. At Period 12, CRL is reporting no change to this final Period 11 forecast. However, from Period 12 onwards, CRL is adopting a revised cost forecast strategy with the objective of improving cost certainty. CRL is proposing a Target AFCDC using period-end project cost estimates,</p>	<p>This is part of the DCS1.3 development work. As mentioned above, a mitigation plan is in place to ensure that Stage 5B Minus can proceed if auto transition is not resolved in time. Auto Reverse functionality requires software changes from Alstom and Siemens. The 'Plateau' team is coordinating the joint development, testing and assurance of the solutions. Currently testing of Auto Reverse continues, with additional changes to be tested in [REDACTED] and fully loaded trains in [REDACTED] in readiness for Stage 5B in [REDACTED]. This is still being optimised to improve the schedule further.</p> <p>Agree.</p>
-----------------------------------	---	---

## Appendix – CRL Response to Period 12 PRep Report

	<p>risks and opportunities. It is also considering discontinuing the Programme QCRA activity and moving to a contingency model, comprising risk provisioning and reconciliation of the current cost risk assessment with the budget submissions made at Period 11.</p> <p>Although CRL is holding its forecast, there remain emerging cost pressures. At Bond Street Station this is due to the slippage of station opening to [REDACTED]; and at Canary Wharf Station it is due to the extension of care and custody contractor support. However, these cost pressures have been offset by project QRA drawdown, by cost reductions from accruals reconciliation and by scope reviews to contain costs within the current AFCDC.</p> <p>Schedule milestones continue to slip, affecting previously declared P50 dates. These delays are likely to absorb the majority of CRL’s Risks and Provisions allowances to offset emerging issues. It is therefore likely that CRL will outturn close to its P50 forecast.</p> <p>The Period 12 draft P50 AFCDC is [REDACTED] above the current £825m funding threshold and [REDACTED] under the £1.1bn funding limit. The Period 12 Risks and Provisions allowances amount to [REDACTED], of which [REDACTED] is set aside under the COO reserve. At Period 12, CTG is [REDACTED] and CRL is reporting zero opportunities. Consequently, we believe that the Risks and</p>	<p>Agree.</p> <p>Agree.</p> <p>Agree. CRL has not been able to “bank” the benefits of creating and delivering opportunities. The current position is that the likelihood of containing the CTG within the additional £825m is substantially reduced.</p>
--	---	--

## Appendix – CRL Response to Period 12 PRep Report

<b>Organisation</b>	<p>Provisions allowances offer limited opportunity to effect forecast cost reductions to such a magnitude that the £825m funding threshold can be reached. We maintain that CRL is successful in containing its costs, but that the funding target is likely to increase; further, we expect it to be set below the current AFDCD and under the £16,064m funding request limit.</p> <p>CRL is working to close out the contract for Paddington Station as forecast by the end of March 2022, with demobilisation of the Canary Wharf Station contractor targeting the same date. Thereafter, the only station at which substantial resources are engaged will be Bond Street.</p> <p>CRL is transitioning to a smaller organisation and delivery resources are leaving the Programme. RfLI is undertaking a resilience assessment of its organisation and suppliers, in order to ensure readiness for passenger service. While it has continued to recruit resources for key operating positions, RfLI continues to monitor critical specialist roles and ensure succession plans are in place, in order to maintain team performance levels.</p>	<p>At the time of writing, Paddington station Contract Close-out has been re-forecast for end of April 2022 while Contractor demobilisation at Canary Wharf station has been achieved.</p> <p>Agree.</p>
---------------------	---	--

## Appendix – CRL Response to Period 12 PRep Report

<p><b>Stage 3 Trial Operations and Passenger Service</b></p>	<p>The final Trial Operations Phase 2 mass evacuation exercise was completed on 13 March 2022 and, as with the previous four evacuations, it achieved a conditional pass. The internal Trial Operations exercises are expected to be complete by the end of March 2022. RfLI and MTREL are supporting their general readiness preparations with feedback and supplementary instruction on the lessons learned from all of the exercises.</p> <p>Trial Operations have taken place against a background of inconsistent reliability, and the consequential impacts upon timetable trials and exercises have significantly increased pressure on RfLI and MTREL staff. As a result, revised working practices to reduce workload have had to be developed and introduced. While the Trial Operations period has provided an opportunity to simulate passenger service operating practices, underlying poor railway reliability may have compromised the planned operation of services and the conduct of the exercises.</p> <p>The primary reliability metrics are PPM and delays over 15 minutes. The PPM criterion for entering passenger service is 95%, and the current average is [REDACTED]. The measure for delays over 15 minutes is approximately one every two operating days, assessed over 4 weeks: the last 4 weeks delivered approximately [REDACTED]. Both</p>	<p>Agree.</p> <p>Agree.</p> <p>The decision on Entry to Revenue Service will be a holistic assessment of overall performance, informed by the T-Minus process through weekly meetings that include consideration of performance against metrics. System upgrades in April 2022 (including the roll-out of H5.6 to the fleet) will deliver improvements to performance and other initiatives that are ongoing to improve process and response. This includes a specific</p>
--	---	--

## Appendix – CRL Response to Period 12 PRep Report

	<p>measures have yet to meet passenger service entry thresholds.</p> <p>The current causes of unreliability are broadly those reported last period and include: train specific issues; the GEML signalling transition; Platform Screen Doors; start of service arrangements; and train/signalling WiFi interference. Technical improvements are underway, with further train software upgrades expected (i.e. H5.7 by mid-May 2022 and H5.8 by early July 2022) and ELR 200 remains scheduled for delivery during the Easter 2022 Blockade. However, technical upgrades alone are unlikely to produce the necessary improvements to reliability, and changes in organisation and processes are also necessary.</p> <p>RfLI and MTREL are responsible for minimising the impact of delay by efficiently recovering the service, but some operating procedures frustrate this process. Both organisations are aware of this and are progressively implementing change, but the modification of rules concerning safety will take longer due to the need for structured analysis and review. Implementation of significant change may also require specific staff briefing or training.</p>	<p>focus on 15-minute delays. Timetable Demonstration began on 28 March 2022 and provides more consistent operations (without disruption from Trial Operations). Service performance metrics are improving. Over the period from 28 March 2022 to 4 April 2022, Average PPM was ■■■ and the average number of 15-minute delay events was ■■■ (against a target of 0.5).</p> <p>Agree. RfL and CRL acknowledge that improvements to people and processes are key; initiatives are ongoing to address this. These include work by RfL/MTR to improve operations and work by Alstom and Siemens to improve fleet reliability. The Reliability and Resilience Delivery Group tracks outcomes from these initiatives and progress to achieve the criteria by the final T-minus review date. Any interventions related to Process improvement, training and organisation changes are also discussed and actions agreed/tracked as part of the blockers/enablers weekly meeting.</p> <p>The Project Representative is correct to state RfLI and MTREL are responsible for minimising the impact of delay by efficiently recovering the service, however, some concerns have been raised by the Train Operator in relation to operating procedures that are considered to frustrate this process. Both organisations have commenced a review of these rules and procedures to establish if a clarification is required or an actual change is needed. This</p>
--	--	--

## Appendix – CRL Response to Period 12 PRep Report

<p><b>Stations Commissioning and Handover</b></p>	<p>The ongoing difficulties and uncertainties in delivering reliability growth are significant. CRL and RfLI will need to be confident by [REDACTED] 7, that the railway will meet agreed reliability thresholds for passenger service, to allow a commitment to opening on [REDACTED] May 2022 to be made. This decision carries risk, because there will have been little timetable running to prove that the outcomes of software upgrades such as ELR200 have been successful.</p> <p>Full handover completion to LU was achieved for Farringdon, Liverpool Street and Tottenham Court Road Stations.</p> <p>CRL is targeting completion of all related assurance activities at Canary Wharf Station by [REDACTED] March 2022, which will allow the contractor to demobilise. The contractor is expected to</p>	<p>process review was completed on [REDACTED]. No requirement has so far been identified to modify rules but if any are identified, this will take several weeks to complete with clear processes to analyse and review. Any clarification or change will subsequently require a staff briefing or relevant training.</p> <p>As mentioned above, on 28 March 2022 the Programme achieved the milestone to start the Timetable Demonstrations. During this period the operational team will run the railway without disruption of Trial Operations or Programme work. This is essential to build consistency, assist to improve processes and procedures as well as evidence further reliability prior to opening the railway for Passenger Service. The first week of Timetable Demonstrations provided some of the best days on the railway with 99-100% train trips completed and reliability /PPM. The operational team will continue working on any challenges to deliver the expected consistency over the coming weeks.</p> <p>Agree. Whitechapel station also achieved full handover on 13 April 2022.</p> <p>Demobilisation at Canary Wharf station has taken place with a re-forecast to the completion of assurance activities now set for end of April 2022 and MoBo support until the end of May 2022.</p>
---	---	--



## Appendix – CRL Response to Period 12 PRep Report

<b>Assurance</b>	<p>continue to provide MoBo support until the end of May 2022, while asset data delivery is completed. CRL continues to focus on the close-out of SJ Dependencies and EOWs, with approximately 40 requiring closure for passenger service. Close-out completion continues to target the end of March 2022.</p> <p>CRL is now forecasting completion of both ticket halls at Bond Street Station by the end of [REDACTED] with opening to passengers in [REDACTED] and overall station completion in [REDACTED]; these are all deterministic dates. There remain approximately 540 EOWs to close in order to allow entry into passenger service and cost increases are associated with the revised dates. Challenges remain with the retention of resources, and CRL is likely to rely on the support of Tier 2 specialists.</p> <p>The Paddington Station SJ has been accepted by ITAP for entry into passenger service. The Whitechapel Station Tier 1 contractor has completed demobilisation, and contract completion documentation is expected by the end of March 2022.</p> <p>The date for the Stage 3a Revenue Service Assured Railway milestone has slipped to [REDACTED]. A revised assurance methodology is set out in a new CRL Revenue Service Assurance Strategy document, recently</p>	<p>Largely agree. At the time of writing, there are only 13 open EOWs required for Entry into Revenue Service. EOWL quantity for station opening is under evaluation and will likely be reduced via triaging with the Infrastructure Manager. Tier 2 specialist support is not a likely mitigation for resource retention challenges.</p> <p>Contract completion at Whitechapel station is targeted for the end of April 2022.</p> <p>Agree. Noting statements above regarding milestone status.</p>
------------------	--	--

## Appendix – CRL Response to Period 12 PRep Report

<p><b>Future Stages</b></p>	<p>prepared by CRL and agreed with RfLI and other stakeholders. The strategy reduces current ITAP assurance activity to ‘noting’ of submissions only, postponing final acceptance until major Programme works up to and including ELR200 deployment in the Easter 2022 Blockade have been completed. This is intended to facilitate de-risking of the approval of final top-level safety documents (e.g. COS SJ, RfLI SJ, DoCoRs and Risk Assessments and Statements, final CESAC) by ‘banking’ as much assurance as early as possible, and reducing to a minimum the amount of new material requiring ITAP review immediately prior to passenger service.</p>		
	<p>The milestones for Stage 5 implementation are unchanged since last period, with the forecast dates given in Figure 2-1. However, the underpinning schedules for both Stage 5B and 5B Minus are still to be validated, and the P50 dates are subject to change<sup>s</sup>.</p>		<p>Agree.</p>
	<p>The decision to proceed with Stage 5B Minus will need to be made during [REDACTED], to enable train planning to be developed in time to meet the deterministic start date of [REDACTED]. The primary consideration will be whether the railway is capable of delivering a reliable and maintainable 22 TPH service and, as last period, RfLI continues to establish the commitment criteria. There will be little, if any, passenger service experience to draw upon.</p>		<p>Agree.</p>

## Appendix – CRL Response to Period 12 PRep Report

	<p>RfLI is seeking to carry out six 24 TPH service demonstrations before Stage 5B Minus, with one scheduled to take place before the [REDACTED] decision deadline. Further train and signalling software upgrades, in conjunction with process improvements, are required to improve performance, before the opening of Stage 5B Minus. The impact of these has been quantified, although previous upgrades have generally not immediately delivered all the benefits expected of them.</p> <p>When achieved, Stage 5B Minus opening will mark the start of Crossrail service operation in two patterns: between the Central Section and the GWML and between the Central Section and the GEML.</p> <p>NR and RfLI have made progress in developing their Integrated Operating Model and service recovery strategies. NR also appears to be on course with its resource plan and training. However, integration of services is likely to reveal issues in the early stages, which could compound problems which already exist in an underperforming railway.</p> <p>The decision to proceed with Stage 5B will be influenced by the full availability of Auto-Reverse functionality. At Westbourne Park, acceptable safe implementation of Auto-Reverse is now likely to require the prior delivery of infrastructure works, train software and signalling CBTC software changes. These additional requirements have yet to be finalised. The</p>	<p>Agree.</p> <p>Stage 5B and 5B service plans have been designed to mitigate this risk, as a precursor to the final state train plan in Stage 5C.</p> <p>The enabling works at Westbourne Park currently would take beyond [REDACTED]. Therefore, mitigations are being developed to allow the use of Auto Reverse by [REDACTED]. These include a risk assessment to allow operations without physical change and implementation of temporary intruder detection</p>
--	---	---

## Appendix – CRL Response to Period 12 PRep Report

	<p>current software schedule shows that the necessary CBTC upgrade will not be commissioned until [REDACTED] (the internal date being targeted by RfLI), which is when Stage 5B is to be implemented. NR, RfLI and MTREI will need to commit to Stage 5B by the end of [REDACTED] and the current compressed schedule introduces risk into that decision. Investigations are underway into possible earlier Auto-Reverse completion, but this will be difficult to achieve in practice.</p> <p>Stage 5C marks when service patterns changes from the two in Stage 5B Minus, to one in which GWML and GEML services are integrated through the Central Section.</p> <p>The slow rate of reliability growth remains a major concern for Stage 3 and, in the longer term, for the implementation of Stages 5B Minus and 5B. Reliability must improve significantly over the next three periods to inform the decision to commit to Stage 5B Minus, but this will be challenging when management focus will be on Stage 3a opening. While earliest delivery of full Auto-Reverse functionality might facilitate a preferred Stage 5B opening in [REDACTED], progress with the resolution of issues to date has not been encouraging. We understand that the signalling software upgrade containing the Auto-Reverse fixes is unable to be delivered until [REDACTED], leaving little time for deployment.</p>	<p>system. Work continues to scope and develop the solutions that can meet the timescales.</p> <p>Agree.</p> <p>Representative data has been more limited since the start of large-scale Trial Operations exercises /scenarios. This meant the underlying performance from a reliability perspective was more difficult to determine. However, more learning will be garnered from 27 March 2022 onwards during the Timetable Demonstration phase, which will be a critical period of structured reliability growth.</p>
--	---	--



**Crossrail Project Representative**

**Crossrail Joint Sponsor Team**

**Sponsor Summary**

**Project Status Report 161**

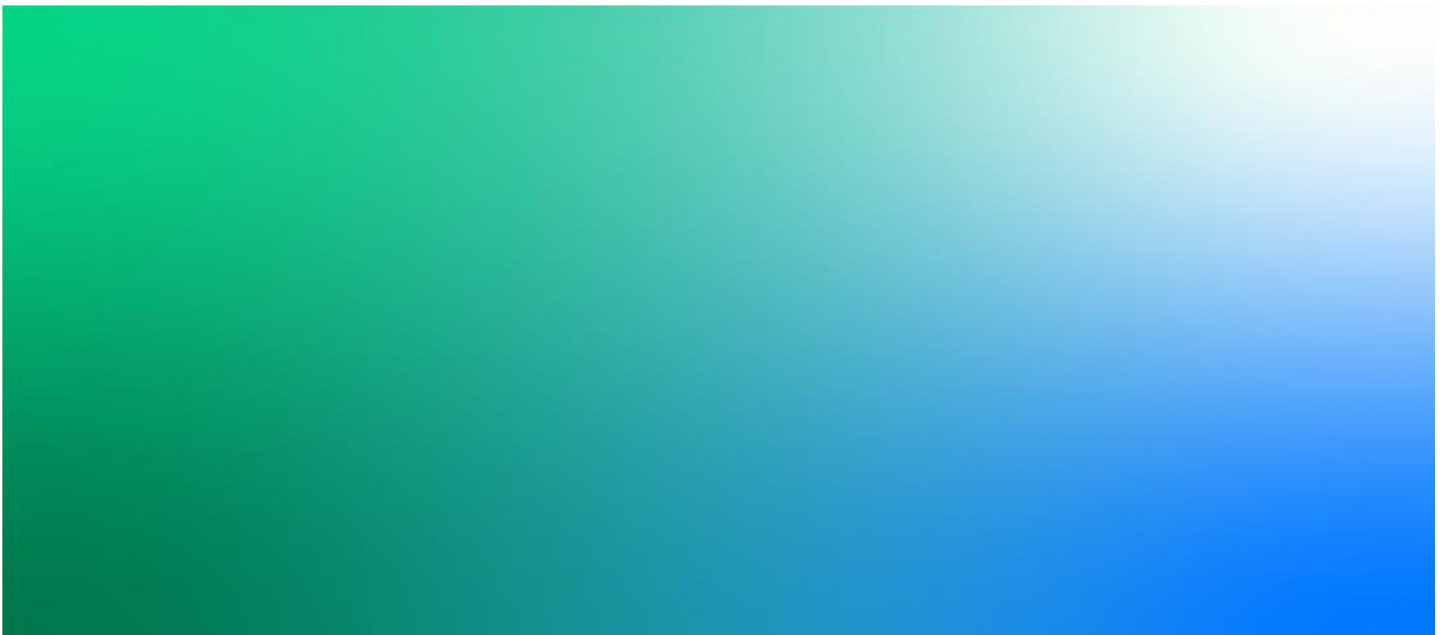
**Period 12 | FY2021/22**

**5 February 2022 – 4 March 2022**

**Official – Sensitive Commercial**

**Document No: B2387600/161/1.12**

**1 April 2022**



## Sponsor Summary PSR 161

Project No: B2387600  
 Document Title: Sponsor Summary for PSR 161  
 Document No.: B2387600/161/1.12  
 Date: 1 April 2022  
 Client Name: Crossrail Joint Sponsor Team  
 Client No: RM 3730  
 Project Manager: [REDACTED]  
 Author: PRep Team

Jacobs U.K Limited  
 2<sup>nd</sup> Floor Cottons Centre  
 Cottons Lane  
 London SE1 2QG  
 England  
 Phone: +44 (0)203 980 2000  
 www.jacobs.com

© Copyright 2019 Jacobs U.K. Limited. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This report has been prepared by Jacobs UK Ltd (Jacobs) pursuant to its contract (the Contract) entitled "TTW00033 Crossrail Project: Crossrail Joint Sponsor Project Representative" and dated 30 March 2020 with the Department for Transport (DfT) and Transport for London (TfL), DfT and TfL being the Clients. This report is prepared on behalf of, and for the exclusive use of the Clients and is subject to, and issued in accordance with, the provisions of the Contract. Jacobs neither has nor accepts any liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

Note: This report relies on the information set out in CRL's Period 12 reports augmented by more current information received by PRep during the course of our routine discussions with CRL since the Period close on 4 March 2022. Note that information emerging after the close of Period 12 is subject to formal confirmation by CRL in its Period 12 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.	28 March 2022	PSR 161 Period 12 FY 2021-22 Sponsor Summary v1.11 ~ Draft	<span style="background-color: black; color: black;">[REDACTED]</span>	<span style="background-color: black; color: black;">[REDACTED]</span>	<span style="background-color: black; color: black;">[REDACTED]</span>	<span style="background-color: black; color: black;">[REDACTED]</span>
2.	01 April 2022	PSR 161 Period 12 FY 2021-22 Sponsor Summary v1.12 ~ Final	<span style="background-color: black; color: black;">[REDACTED]</span>	<span style="background-color: black; color: black;">[REDACTED]</span>	<span style="background-color: black; color: black;">[REDACTED]</span>	<span style="background-color: black; color: black;">[REDACTED]</span>

## Sponsor Summary

### 1. Headlines

#### 1.1 Progress and Look Ahead

Completion of assurance delivery has proved to be more challenging than expected and the risks of processing a significant workload in the approach to passenger opening, noted in recent reports, have been realised in practice. This has driven a 4 week delay in the Stage 3a Revenue Service Assured milestone, which is now set at [REDACTED]. The ability for the Programme to absorb this delay is underwritten in a revised assurance plan, which de-risks final safety acceptance through ITAP 'noting' the contents of current submissions; ITAP acceptance of top-level safety submissions will take place after the Easter 2022 Blockade.

We are aware that CRL, RfLI and other major operating stakeholders have already committed to the new assurance dates, although no relief is yet evident for the Stage 3a Opening date, and it is not clear how downstream schedule impacts have been avoided.

Notwithstanding the change to the Stage 3a Revenue Service Assured date, CRL continues to drive internally the completion of the technical and safety assurance case for the railway to the previous target of [REDACTED] March 2022. However, a sizeable workload remains to close SJ Dependencies and EOWs in support of the remaining safety submissions, and completion before the end of March 2022 will not be achieved. Similarly, with Technical Files still being completed, the delay to the milestone provides sufficient time for the Authority to Place into Service (APIS) to be secured following ORR review. Completion of assurance will rely upon co-ordinated delivery of CRL and RfLI submissions which are closely related and interdependent.

Reliability growth and the resolution of issues to achieve the minimum agreed railway reliability thresholds for entry into passenger service remain top priorities for CRL and RfLI. Timetable operation during Trial Running has experienced more disruption than anticipated because of variable railway reliability and the need to complete project works. As a consequence, RfLI is slightly behind on its Trial Operations exercises, and has decided not to complete those that it considers non-critical. This will allow more time for the delivery of process improvement activities, implementation of solutions to the top 5 issues affecting reliability, and readiness preparations for the deployment of software upgrades H5.7 and ELR200. In parallel, RfLI is preparing a resilience plan and addressing improvements to minimise delays. Performance improvement will result in an increase in Public Performance Measure (PPM), which, at an average to date of [REDACTED]<sup>1</sup>, is still currently below the target level of 95%; follow-on disruptions to initial delays continue to have a negative effect on overall PPM levels.

The schedule window for preparing for passenger service is reducing, and RfLI is expected to step-up its readiness activities as CRL transitions to a significantly reduced organisation size after the end of March 2022. With project delivery drawing to a substantial close in April 2022, a period is available for stable timetable running, mixed with routine operational service management activities, which is effectively clear of the distractions of exercises and engineering work. Critically, this will be the last such opportunity before the start of passenger service, and all parties must make the most of the limited time available.

---

<sup>1</sup> Performance over the 20 days of operation between 28 January 2022 and 15 March 2022. Excludes the days on which Trial Operations exercises were carried out.

The intention last period had been for RfLI to carry out 7 weeks of Timetable Running to embed learning from the Trial Operations phase and build up reliability before entering passenger service. We expect these workstreams to continue as planned from 28 March 2022, and for RfLI to confirm by mid-April 2022 whether the improvement in railway performance is sufficient to meet the internal target date for Stage 3a Opening of [REDACTED] May 2022. The corresponding P80 date remains within the declared opening window of the first half of 2022.

Preparations will need to begin by the end of [REDACTED] to support the earliest start to Stage 5B Minus services in [REDACTED] 2022. Based upon current railway performance, further demonstrations will need to be undertaken before [REDACTED] to give confidence that the railway can successfully transition from 12 to 22 TPH. Emerging issues with the GEML signalling transition and the inability to bring forward planned train and signalling software upgrades are likely to impact the deterministic start date for Stage 5B Minus. The complexity and inter-relationship of works beyond Stage 3a Opening mean that the P50 dates associated with all of the Stage 5 openings require further validation by CRL.

CRL is reporting<sup>2</sup> a [REDACTED] increase for Bond Street Station following its schedule update, with the new deterministic target for opening the station declared as between [REDACTED]. CRL has drawdown contribution from its Programme Risk to cover this increase, but it has also increased its Project Risk, following reassessment of the remaining works and associated risk at Bond Street Station.

The Sponsors' particular attention is drawn to the following:

- A [REDACTED] delay to the Stage 3a Revenue Service Assured milestone to [REDACTED] provides relief to safety assurance completion, but the impacts on Stage 3a Opening are not yet clear.
- CRL and RfLI concerns remain with variable reliability performance, and little time is available for improvement before Stage 3a Opening, targeted for achievement in [REDACTED] May 2022.
- Completion of RfLI and MTREL readiness preparations depend upon the successful deployment of ELR200 to deliver a reliable and stable final Stage 3a railway configuration.
- CRL has declared a window for full opening to passengers of Bond Street Station, but there are risks with the testing and commissioning that remains.
- Issues continue to emerge which threaten the earliest start for Stage 5B Minus, with no firm mitigation plans; a P50 date to enable through services has yet to be determined.

## 1.2 Health and Safety

In Period 12, a new system of safety measurement was implemented that aligns with the reduced size of the CRL organisation and Programme. The process requires further refinement and additional briefings are planned to ensure that the scoring properly reflects site safety activities<sup>3</sup>. No significant incidents were reported in the period.

<sup>2</sup> CRL EPPR held on 23 March 2022.

<sup>3</sup> Crossrail Weekly Dashboard Week 3 Period 12.



## 2. Programme Overview

### 2.1 Schedule

The Period 12 completion milestones are set out in Figure 2 - 1.

The deterministic date for the Stage 3a Revenue Service Assured railway has slipped from [REDACTED] to [REDACTED]. The principal schedule risk for this milestone continues to be the completion of the safety assurance process, including the delivery of the Technical Files and the issuing of the APIS by the ORR. CRL has maintained the P50 date for Stage 3a Opening unchanged from Period 11, at [REDACTED] May 2022.

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

Figure 2 – 1: Summary of Programme Completion Cardinal Milestones<sup>4</sup>

CRL is proposing to retain the start of the Timetable Demonstration period of 28 March 2022, but timetable running will take place in practice, regardless of when the Stage 3a Revenue Assured milestone is achieved. In the event that the current deterministic and P50 dates for the start of passenger service are maintained, there will be greater pressure on this final period of timetable running to deliver the increase in overall system reliability necessary to support Stage 3a Opening in May 2022.

The main risk to meeting the deterministic date for Stage 3a Opening is the failure to achieve the required level of overall system reliability and resilience. The P80 date of [REDACTED] June 2022 remains within the declared opening window of the first half of 2022.

<sup>4</sup> Period 12 Executive Programme Performance Review meeting pack issued 21 March 2022.

Delays in the completion of workstreams supporting the delivery of Auto-Reverse functionality, which is necessary for running a 24 TPH service, has resulted in slippage of Stage 5B Opening to [REDACTED]. CRL continues to develop the possible introduction of a modified stage, Stage 5B Minus, with a service frequency of up to 22 TPH without Auto-Reverse functionality. The feasibility and benefits of this interim service configuration are being validated as part of DCS v1.3 development. However, there are emerging issues such as the Auto-Transition functionality at the GEML signalling transition that put an earliest start date for Stage 5B Minus at risk. While CRL has used the QSRA for Stage 5B as a starting point and developed an initial assessment for Stage 5B Minus, the analysis retains a number of risks associated with the growth from 12 TPH to 22 TPH, but omits all of the risks associated with implementing Auto-Reverse.

## 2.2 Commercial and Risk

At the close of Period 11, CRL reverted its AFCDC to the Period 10 forecast of £15,963m. At Period 12, CRL is reporting no change to this final Period 11 forecast. However, from Period 12 onwards, CRL is adopting a revised cost forecast strategy with the objective of improving cost certainty. CRL is proposing a Target AFCDC using period-end project cost estimates, risks and opportunities. It is also considering discontinuing the Programme QCRA activity and moving to a contingency model, comprising risk provisioning and reconciliation of the current cost risk assessment with the budget submissions made at Period 11.

Although CRL is holding its forecast, there remain emerging cost pressures. At Bond Street Station this is due to the slippage of station opening to [REDACTED]; and at Canary Wharf Station it is due to the extension of care and custody contractor support. However, these cost pressures have been offset by project QRA drawdown, by cost reductions from accruals reconciliation and by scope reviews to contain costs within the current AFCDC.

Schedule milestones continue to slip, affecting previously declared P50 dates. These delays are likely to absorb the majority of CRL's Risks and Provisions allowances to offset emerging issues. It is therefore likely that CRL will outturn close to its P50 forecast.

The Period 12 draft P50 AFCDC is [REDACTED] above the current £825m funding threshold and [REDACTED] under the £1.1bn funding limit. The Period 12 Risks and Provisions allowances amount to [REDACTED], of which [REDACTED] is set aside under the COO reserve. At Period 12, CTG is [REDACTED] and CRL is reporting zero opportunities. Consequently, we believe that the Risks and Provisions allowances offer limited opportunity to effect forecast cost reductions to such a magnitude that the £825m funding threshold can be reached. We maintain that CRL is successful in containing its costs, but that the funding target is likely to increase; further, we expect it to be set below the current AFCDC and under the £16,064m funding request limit.

## 2.3 Organisation

CRL is working to close out the contract for Paddington Station as forecast by the end of March 2022, with demobilisation of the Canary Wharf Station contractor targeting the same date. Thereafter, the only station at which substantial resources are engaged will be Bond Street.

CRL is transitioning to a smaller organisation and delivery resources are leaving the Programme. RfLI is undertaking a resilience assessment of its organisation and suppliers, in order to ensure readiness for passenger service. While it has continued to recruit resources for key operating positions, RfLI continues to monitor critical specialist roles and ensure succession plans are in place, in order to maintain team performance levels.

## 2.4 Stage 3 Trial Operations and Passenger Service

The final Trial Operations Phase 2 mass evacuation exercise was completed on 13 March 2022 and, as with the previous four evacuations, it achieved a conditional pass. The internal Trial Operations exercises are expected to be complete by the end of March 2022. RfLI and MTREL are supporting their general readiness preparations with feedback and supplementary instruction on the lessons learned from all of the exercises.

Trial Operations have taken place against a background of inconsistent reliability, and the consequential impacts upon timetable trials and exercises have significantly increased pressure on RfLI and MTREL staff. As a result, revised working practices to reduce workload have had to be developed and introduced. While the Trial Operations period has provided an opportunity to simulate passenger service operating practices, underlying poor railway reliability may have compromised the planned operation of services and the conduct of the exercises.

The primary reliability metrics are PPM and delays over 15 minutes. The PPM criterion for entering passenger service is 95%, and the current average is █████<sup>5</sup>. The measure for delays over 15 minutes is approximately one every two operating days, assessed over 4 weeks; the last 4 weeks<sup>6</sup> delivered approximately █████. Both measures have yet to meet passenger service entry thresholds.

The current causes of unreliability are broadly those reported last period, and include: train specific issues; the GEML signalling transition; Platform Screen Doors; start of service arrangements; and train/signalling WiFi interference. Technical improvements are underway, with further train software upgrades expected (i.e. H5.7 by mid-May 2022 and H5.8 by early July 2022) and ELR 200 remains scheduled for delivery during the Easter 2022 Blockade. However, technical upgrades alone are unlikely to produce the necessary improvements to reliability, and changes in organisation and processes are also necessary. RfLI and MTREL are responsible for minimising the impact of delay by efficiently recovering the service, but some operating procedures frustrate this process. Both organisations are aware of this and are progressively implementing change, but the modification of rules concerning safety will take longer due to the need for structured analysis and review. Implementation of significant change may also require specific staff briefing or training.

The ongoing difficulties and uncertainties in delivering reliability growth are significant. CRL and RfLI will need to be confident by █████ █████<sup>7</sup>, that the railway will meet agreed reliability thresholds for passenger service, to allow a commitment to opening on █████ May 2022 to be made. This decision carries risk, because there will have been little timetable running to prove that the outcomes of software upgrades such as ELR200 have been successful.

## 2.5 Stations Commissioning and Handover

Full handover completion to LU was achieved for Farringdon, Liverpool Street and Tottenham Court Road Stations.

---

<sup>5</sup> Performance over the 20 days of operation between 28 January 2022 and 15 March 2022. Excludes the days on which Trial Operations exercises were carried out.

<sup>6</sup> A total of 13 operating days, excluding those affected by Trial Operations exercises between 14 February 2022 and 13 March 2022.

<sup>7</sup> To allow railway opening publicity to be completed.

CRL is targeting completion of all related assurance activities at Canary Wharf Station by [REDACTED] March 2022, which will allow the contractor to demobilise. The contractor is expected to continue to provide MoBo support until the end of May 2022, while asset data delivery is completed. CRL continues to focus on the close-out of SJ Dependencies and EOWs, with approximately 40 requiring closure for passenger service. Close-out completion continues to target the end of March 2022.

CRL is now forecasting completion of both ticket halls at Bond Street Station by the end of [REDACTED], with opening to passengers in [REDACTED] and overall station completion in [REDACTED]; these are all deterministic dates. There remain approximately 540 EOWs to close in order to allow entry into passenger service and cost increases are associated with the revised dates. Challenges remain with the retention of resources, and CRL is likely to rely on the support of Tier 2 specialists.

The Paddington Station SJ has been accepted by ITAP for entry into passenger service. The Whitechapel Station Tier 1 contractor has completed demobilisation, and contract completion documentation is expected by the end of March 2022.

## 2.6 Assurance

The date for the Stage 3a Revenue Service Assured Railway milestone has slipped to [REDACTED]. A revised assurance methodology is set out in a new CRL Revenue Service Assurance Strategy document, recently prepared by CRL and agreed with RfLI and other stakeholders. The strategy reduces current ITAP assurance activity to 'noting' of submissions only, postponing final acceptance until major Programme works up to and including ELR200 deployment in the Easter 2022 Blockade have been completed. This is intended to facilitate de-risking of the approval of final top-level safety documents (e.g. COS SJ, RfLI SJ, DoCoRs and Risk Assessments and Statements, final CESAC) by 'banking' as much assurance as early as possible, and reducing to a minimum the amount of new material requiring ITAP review immediately prior to passenger service.

## 2.7 Future Stages

The milestones for Stage 5 implementation are unchanged since last period, with the forecast dates given in Figure 2-1. However, the underpinning schedules for both Stage 5B and 5B Minus are still to be validated, and the P50 dates are subject to change<sup>8</sup>.

The decision to proceed with Stage 5B Minus will need to be made during [REDACTED], to enable train planning to be developed in time to meet the deterministic start date of [REDACTED]. The primary consideration will be whether the railway is capable of delivering a reliable and maintainable 22 TPH service and, as last period, RfLI continues to establish the commitment criteria. There will be little, if any, passenger service experience to draw upon. RfLI is seeking to carry out six 24 TPH service demonstrations before Stage 5B Minus, with one scheduled to take place before the [REDACTED] decision deadline. Further train and signalling software upgrades, in conjunction with process improvements, are required to improve performance<sup>9</sup> before the opening of Stage 5B Minus. The impact of these has been quantified, although previous upgrades have generally not immediately delivered all the benefits expected of them.

When achieved, Stage 5B Minus opening will mark the start of Crossrail service operation in two patterns: between the Central Section and the GWML and between the Central Section and the GEML.

<sup>8</sup> EPPR meeting held on 23 March 2022.

<sup>9</sup> A particular concern is spurious emergency brake applications when entering Stratford Station Platform 5 (Eastbound).

NR and RfLI have made progress in developing their Integrated Operating Model and service recovery strategies. NR also appears to be on course with its resource plan and training. However integration of services is likely to reveal issues in the early stages, which could compound problems which already exist in an underperforming railway.

The decision to proceed with Stage 5B will be influenced by the full availability of Auto-Reverse functionality. At Westbourne Park, acceptable safe implementation of Auto-Reverse is now likely to require the prior delivery of infrastructure works, train software and signalling CBTC software changes. These additional requirements have yet to be finalised. The current software schedule shows that the necessary CBTC upgrade will not be commissioned until [REDACTED] (the internal date being targeted by RfLI), which is when Stage 5B is to be implemented. NR, RfLI and MTREL will need to commit to Stage 5B by the end of [REDACTED], and the current compressed schedule introduces risk into that decision. Investigations are underway into possible earlier Auto-Reverse completion, but this will be difficult to achieve in practice.

Stage 5C marks when service patterns changes from the two in Stage 5B Minus, to one in which GWML and GEML services are integrated through the Central Section.

The slow rate of reliability growth remains a major concern for Stage 3 and, in the longer term, for the implementation of Stages 5B Minus and 5B. Reliability must improve significantly over the next three periods to inform the decision to commit to Stage 5B Minus, but this will be challenging when management focus will be on Stage 3a opening. While earliest delivery of full Auto-Reverse functionality might facilitate a preferred Stage 5B opening in [REDACTED], progress with the resolution of issues to date has not been encouraging. We understand that the signalling software upgrade containing the Auto-Reverse fixes is unable to be delivered until [REDACTED], leaving little time for deployment.