



Crossrail Project Representative

Crossrail Joint Sponsor Team

Sponsor Summary

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Period 4 FY2019-20

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Note: This report relies on the information set out in CRL's Period 4 reports augmented by more current information received by PRep during the course of our routine discussions with CRL since the Period close on 22 July 2019. Note that information emerging after the close of Period 4 is subject to formal confirmation by CRL in its Period 4 reports. This report is supplemented by our weekly reports to JST and regular meetings with JST staff.

Document history and status

Revision	Date	Description	By	Review	Approved
1	14 August 2019	PSR 127 Period 04 FY 2019-20 Sponsor Summary v1.4 ~ Draft	[REDACTED]	[REDACTED]	
2	16 August 2019	PSR 127 Period 04 FY 2019-20 Sponsor Summary v1.5 ~ Final	[REDACTED]	[REDACTED]	[REDACTED]

procedures that require updating. The 2nd Line of Defence (targeted assurance reviews) need to be revisited following the completion of the DCS and the 3rd Line of Defence (TfL Auditing) has yet to start. The panel of industry experts has engaged CRL and we await its output/recommendations. We support the principles of CRL's Integrated Assurance Plan but note that it is too early to comment on its effectiveness.

Programme Execution

CRL has a major programmatic decision to make in August 2019, as to whether the stations or the rolling stock (software) are going to define the Crossrail delivery date. The stations are 'cost driven', but will be completed in the near future, despite productivity challenges; the rolling stock software is 'time driven' and has the equal chance of delaying the overall programme. If CRL believes that rolling stock software immaturity will delay the start of ROGS, there is no advantage in reducing the handover to SC1, which will incur additional cost. Alternatively, if the rolling stock software keeps to its current commitments, there is an advantage in separating SC1/2/3 as a mitigation to secure the start of ROGS. This decision is expected mid-August 2019.

Due to the large number of software modifications required under P_D+10, CRL may want to consider suspending Dynamic Testing to allow a complete focus on the Routeway infrastructure completion and assurance. Since the amount of regression testing will be substantial, the benefits of further Dynamic Testing using P_D+8 may be considered minimal. This decision needs to be made by as soon as possible, following the finalisation of the P_D+10 software freeze. This would allow the physical works in the trace to be completed, prior to Routeway testing.

This period we witnessed excellent communication of the scope of SC1/2/3 by the Whitechapel delivery team and, in our opinion, CRL may want to roll-out this approach across the programme to ensure all parties within the Crossrail programme understand the task at hand.

High Level DCS Summary

As previously detailed, CRL has held back the submission of the period schedule, while it implements mitigation actions to recover key risk.; we have therefore not been able to analyse the detailed schedule. We anticipate this approach will continue until the end of August 2019, when the DCS is finalised.

Cost & Commercial

The AFCDC at Period 4 has increased by £107m to £14,926m. We note that the Cost-to-Go (CTG) would have been expected to generally reduce in line with the money spent in the period (£81m). However, the CTG is reported as increasing by £29m, therefore the full impact is £110m increase in the project cost. The reported AFCDC increase is £107m as there has been an offset of a £3m reduction in risk.

We regard the Period 4 AFCDC to be understated until such time as the DCS contains a robust cost baseline and QRA. CRL continues to carry out its bottom-up estimate based on its DCS, to form the new cost baseline for the completion of Crossrail. Completion of the fully-costed DCS was due at the end of July 2019, but it is now expected at the end of August 2019 / early September 2019.

Our linear forecast at Period 4 continues to indicate that AFCDC and COWD do not become coincident, as illustrated in Figure 2 - 1. This is due to the many AFCDC increases since Period 5 2018/2019 and the expected future AFCDC increase arising from the re-baselining of schedule, cost and risk.

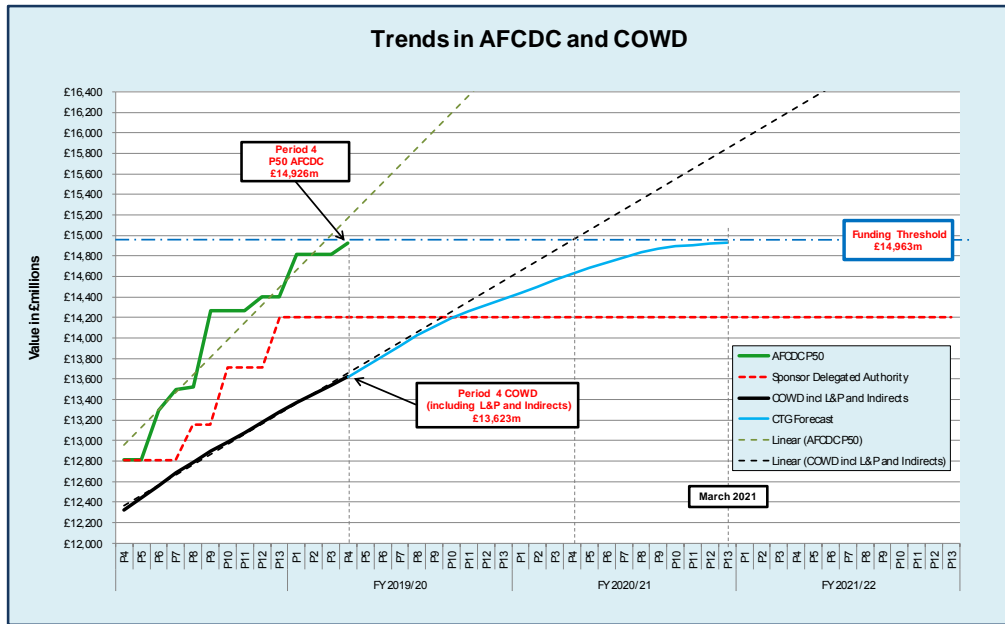


Figure 2 - 1 ~ AFDCD Headroom to Sponsor Delegated Authority

In summary, we highlight the principal indicators of potential cost escalation:

- CTG and the forecast outturn for Defined Costs indicate a continuing growth trend;
- The lack of the DCS cost plan and risk assessment is contributing to cost uncertainty;
- Tier 1 Contractor alignment to the DCS schedule remains unresolved; hence they may not yet be fully supporting the Cost and Risk elements that underpin the re-baselining exercise of the DCS AFDCD. Close monitoring of schedule submissions and acceptance are critical to support the robust cost re-baseline.

Risk

While we recognise the huge effort to stand the risk management processes back up, we are concerned that the CRL’s Risk Management Process has limited time remaining to influence the outcome of the programme. CRL is reporting that over 90% of the risk activities have mitigations attached, but the differential between Pre-Mitigation and Post-Mitigation is only 4% (see Table 2-6); this indicates CRL is taking only a limited amount of benefit in their forecasts for these mitigations. A short intense period of work is required from all parties within CRL to change the risk register from a project controls tool, to a project management tool. Since last period, we note the following changes:

Category	Period 3	Period 4
Risk Value	██████	██████
Risk Value Already Occurring	██████	██████
Number of Risks Raised / (Emerging)	588/(84)	613/(76)
Number of Risks Closed	32	50 ²
Mitigations Actions Raised	56	45
Mitigation Actions Implemented	1	0
Ave Probability ‘Unmitigated’ Risk	42%	42%
Ave Probability ‘Mitigated’ Risk	40%	38%

Figure 2 - 2 ~ Periodic Changes to Key Risk Indicators³

² The majority of these risks were withdrawn without being mitigated.

It must be noted that CRL has recognised that issues above require further development and now that the QSRA has been baselined, the team can concentrate on improving the quality of the product.

This period we have reviewed the phasing of CRL's risk register (currently CRL does not phase the risks) and we believe the current assessment does not adequately cover the future risks that may be encountered (post Stage 3). In our opinion, out of the 610 risks identified, only 6 have been allocated to this period (post stage 3). We have also observed the 'post ROGS' phase requires attention, as there is only limited activities defined in the DCS to cover this period between ROGS and stage 3 opening.

Stage 2 Phase 2

The principal risks to rolling stock software development and safety authorisation remain unchanged, with forecast dates slipping by 2 weeks in the period. However, the CRL project team is content that the technical performance of the rolling stock is now stable, based upon the Heathrow Spur test logs.

The issues with the GSM-R system on Heathrow Terminal 4 Platform 1 remain unresolved. NR needs to establish when the permanent solution can be installed, and whether the temporary solution that is already in place can be used for driver training and passenger service, if required.

Stage 3

Stations, Shafts and Portals (SSP)

Productivity levels for completion of the physical installations, testing and production of IRNs⁴, PCCs and PACs⁵ remains lower than forecast. Installation, T&C, documentation submission and certification sign-off is still taking longer than envisaged as contractors continue to underperform against plan. We have previously reported that CRL's productivity, when trended forward, suggests continued delays in achieving certification documentation sign-off. Due to this increasing schedule compression, the likelihood of meeting the required dates is significantly reduced. We are concerned to see that by the close of Period 4, forecast SC3/HO dates for most of the SSP assets are now either coincident with, or later than, their Cardinal Milestone dates.

Despite the detailed management focus applied through the Vis-Board reviews and the daily assessment of progress against plan on site, the sites are still failing to achieve their forecast submissions of T&C certification. Causation analysis of the delays has been applied in the Visualisation Management process and is being used to collect the historic data that has led to failure, in order to achieve forecast closure of IRNs/PCCs/PACs. However, CRL has been inconsistent in its approach to using the causation data and has not managed to arrest the continued failure to achieve the planned targets on all the station sites. Analysis of the causation data is not being used to address and overcome the actual causes of delay, which continue to impact on production. There is also a growing realisation by CRL that the remaining IRNs/PCCs/PACs, may require a considerable effort to achieve and will prove difficult to close and sign-off as accepted. This inevitable slow-down should be factored into the scheduled dates to understand the impact.

³ CRL Board Report Period 3 and CRL ARM Database.

⁴ Installation Release Notes (Phase 2.1).

⁵ Pre-Commissioning Certificates Phase 2.2 and Partial Acceptance Certificates Phase 2.3.

CRL is seeking to enhance Tier 2 performance through Common Supplier Performance Management (CSPM). Amongst the actions being taken are Periodic CRL/Tier 2 Director meetings⁶ and capturing key supplier activities in the DCS. CRL wants to use the DCS to reflect all requirements put onto Tier 2 contractors. Initial work is only providing reactive tracking and does not provide the necessary look ahead to anticipate potential blockages in the supply of materials and labour. The look-ahead will develop as the DCS is enhanced; but CRL will need to help suppliers balance their resources against their forecast workload and timings. CRL is introducing a Supplier Vis-Board review to assist this process.

LU has confirmed that it has mobilised a dedicated team of 4 of its staff, at each of the LU station sites, to aid the documentation flow and the transition to handover. This is a positive move that we believe should be matched by RfL for its stations.

Permanent power for Bond Street Station WTH was forecast by the end of June 2019, but this now appears to be delayed until mid-August 2019. The provision of permanent power is critical for C610, as it is required to bring the WTH ventilation fans into operation for tunnel ventilation and air-flow testing⁷. Slow progress on the MEP fit-out and delays to the supply of permanent power have continued to impact on the energisation of the downstream LV power supplies and delivery of the associated IRNs and PCCs.

Bond Street Station's contractor's Period 4 schedule submission was rejected by CRL, as there was still no alignment with CRL's DCS key dates. The contractor had, however, reflected the anticipated impact of the T-minus process on its schedule, resulting in a considerable delay to the forecast (unmitigated) key dates. There has, again, been little progress in the submission of IRNs and PCCs for the last three periods, suggesting that achieving SC1 will remain a risk to the delivery of the EOP. Bond Street has yet to establish a strategy and a contractor's programme that will deliver SC1. The schedule impact of the station's staged completion remains a major risk to the successful delivery of the EOP.

The T-3 Go/No-Go review meetings were held during the period for VDP, PML and MES. These Portals and Shafts failed their reviews. The subsequent implementation of the new T-minus process⁸, Sprint Recovery Plans and daily Vis-Board reviews have helped to mitigate the consequential delays. New dates have been forecast for HO at these locations. The forecast date for HO at Pudding Mill Lane has improved by 1 week. Mile End Shaft and Victoria Dock Portal, however, have a forecast delay of 2 weeks and 1 month respectively.

Dynamic Testing

CRL proposes to continue with the MDT regime largely in its current form until Dynamic Testing has been completed; the schedule 'footprint' extends largely unchanged from last period to MDT 37⁹, which is scheduled to start on 10 December 2019.

The most notable change has been the inability to formally secure from NR a number of GEML interface possessions, later in 2019. These are required for Siemens to demonstrate the correct functioning of the interface prior to Trial Running, although there is a lack of clear understanding within CRL (e.g. between the Plateau and Delivery Teams) that this proof is a pre-requisite¹⁰. Given NR's rejection, CRL must quickly re-assess internally, and with RfL-I and MTR-C, to determine whether or not elevation within NR is justified in a further attempt to secure the

⁶ Tier 2 Director meetings are to be held with Honeywell, Dalmatic, AEG, OTIS, KONE, Cubic etc.

⁷ Airflow testing booked for 20 September 2019, requiring air gaps in PSD to be sealed.

⁸ The new T-minus process is split into five assurance countdown steps comprising: Planning, Review, Readiness, Go/No-Go (T-4) and Acceptance.

⁹ T&C Visualisation Room, 5 August 2019.

¹⁰ Dynamic Testing Vis-Board Review held on 5 August 2019.

possessions. At a time when early agreement with stakeholders of the entry and exit criteria to the key delivery phases is critical for certainty and planning, we are concerned that this is one of many that will be subject to re-assessment as the inevitable schedule pressures are brought to bear.

The Siemens EOP schedule was accepted by CRL on 23 July 2019, but it does not take account of the latest CRL handover and assurance processes, or the scope for Stages 4 and 5. The development of a robust schedule, which properly reflects the integrated delivery of Signalling and Rolling Stock, remains an immediate priority for CRL.

Approvals, Assurance and Agreements

There is little change from the concerns raised in our previous reports¹¹. It is now likely that the production of safety and technical assurance will not increase at a pace that will support Trial Running starting in-line with the approved DCS date, unless a major intervention by CRL is undertaken.

To illustrate the issue, we have selected 3 charts that represent those on the Railway assurance Vis Boards. Points are:

- The forecast target lines reflect what is required to meet the EOP deterministic dates, as the assurance team has not been issued the DCS. This produces inaccurate reporting
- The trend lines do not support the DCS dates, which are later than the deterministic dates.

It is clear that other approaches could be more productive. The level of evidence could be reduced for Trial Running, recognising that stations are struggling to meet SC3. There will also need to be optimisation of the delivery process, in key areas such as O&M Manual production. It should be made clear that the assurance evidence is a symptom of the build not being completed, rather than simply the evidence not being produced or waiting to be processed.

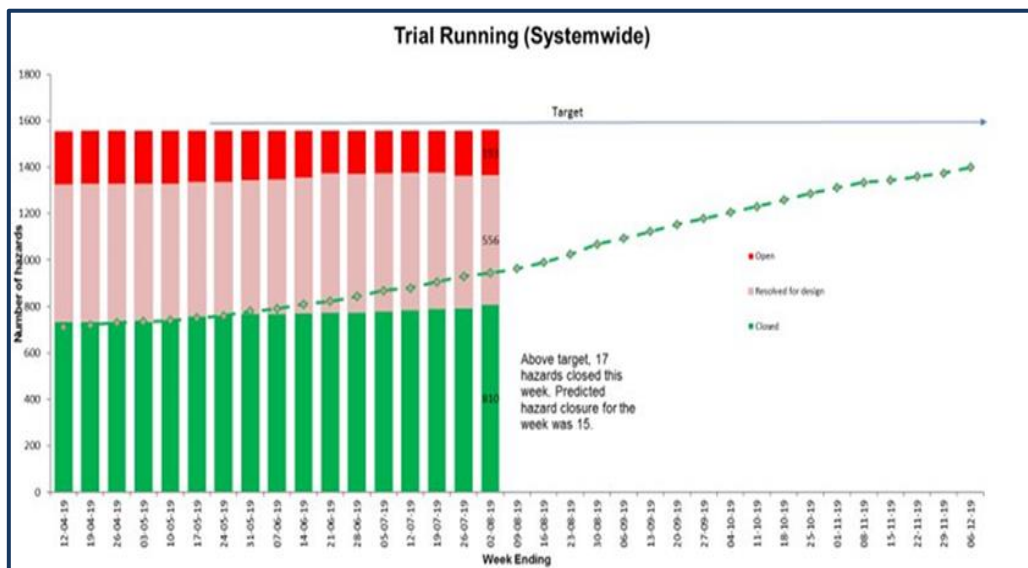


Figure 4 - 1 ~ Hazard closure for Trial Running systems. Required for Engineering Safety Justification

¹¹ PSR passim.

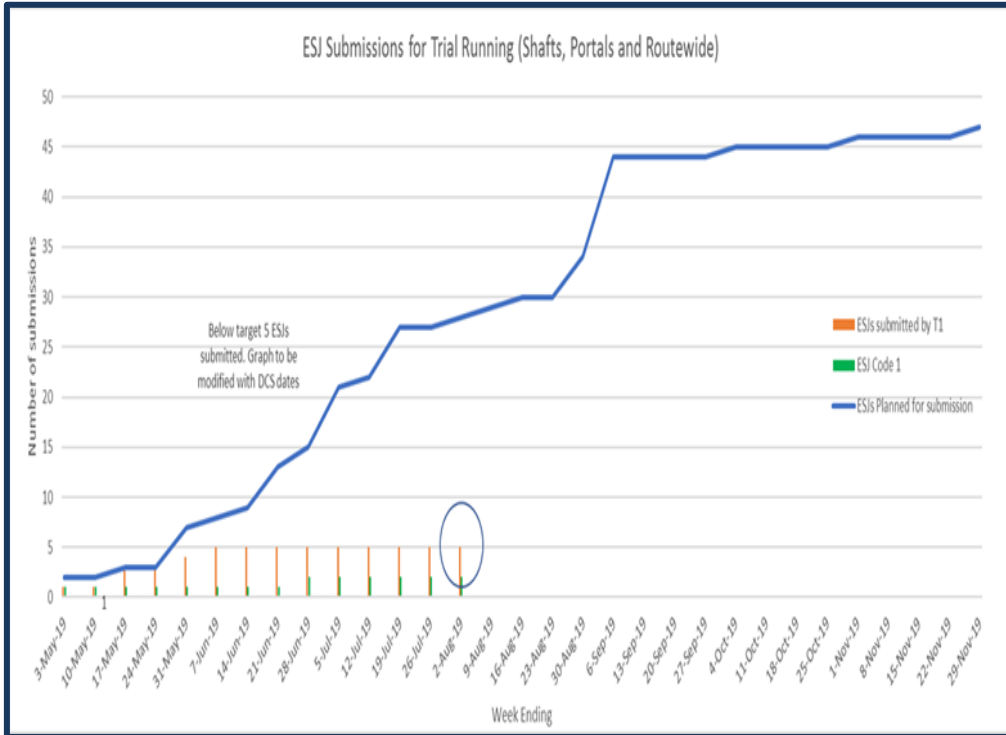


Figure 4 - 2 ~ Engineering Safety Justifications – Trial Running. Required for T- Minus process

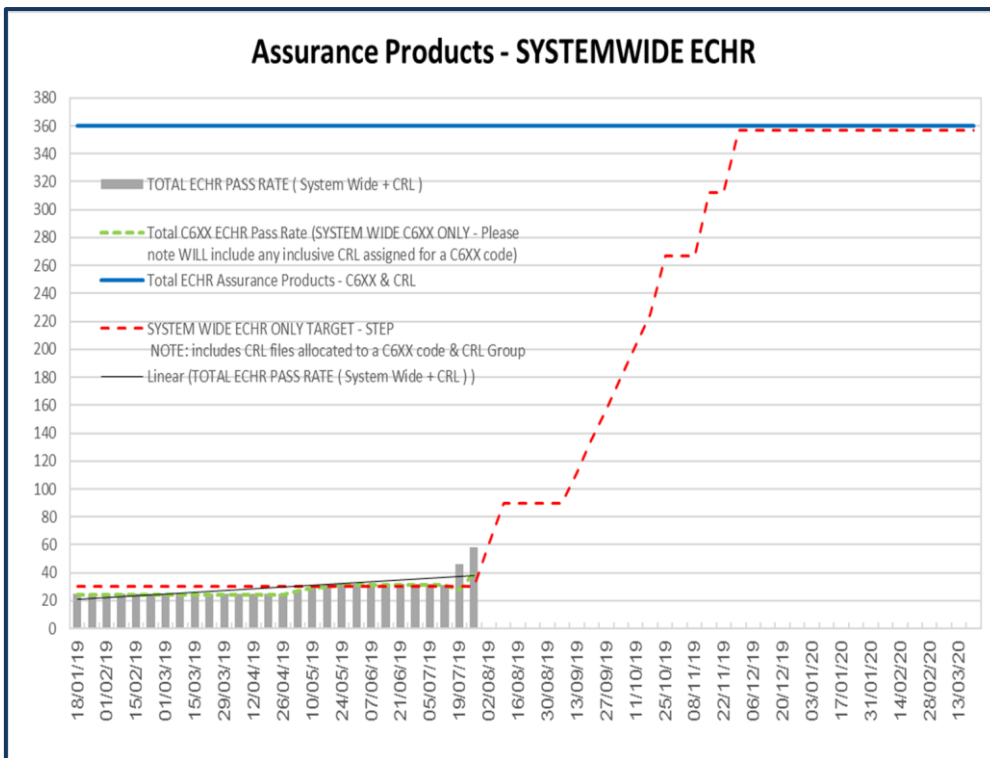


Figure 4 - 3 ~ Crossrail Assurance Reporting Environment

(Failure to deliver the required products and to pass them in CARE will risk Handover of the assets to the IMs.)

Operational Readiness Assessment

The key issues affecting Operational Readiness are now essentially associated with Handover. The handover documentation is unlikely to be sufficiently complete to support Trial Running in line with the approved DCS date. We have based our opinion upon the following information:

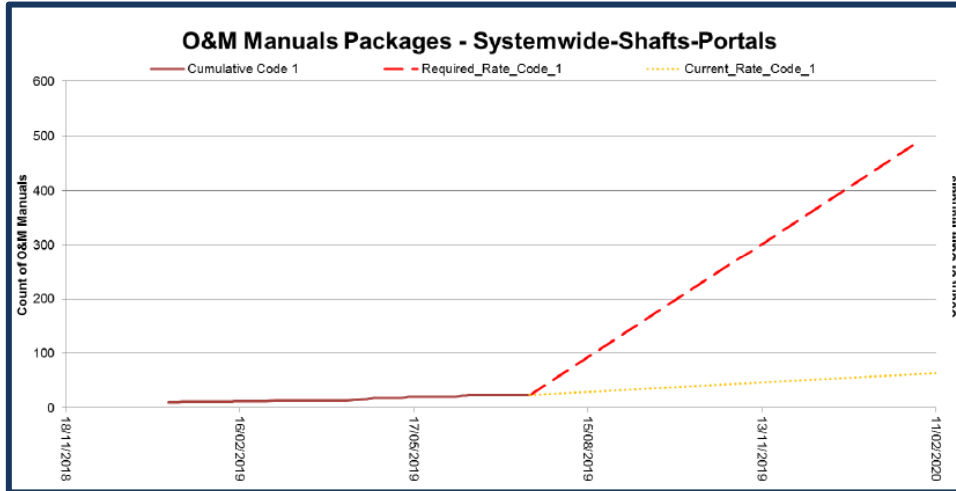


Figure 4 - 4 ~ O&M Manuals Packages – Systemwide-Shafts-Portals

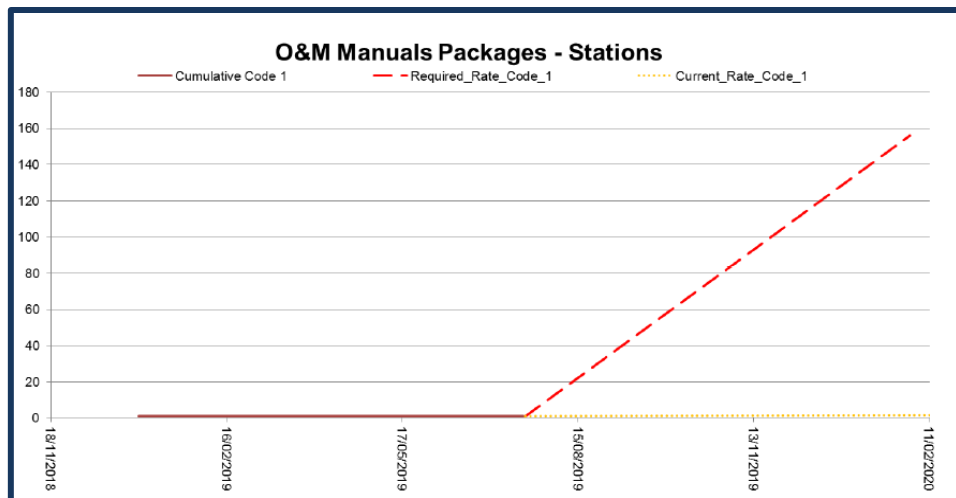


Figure 4 - 5 ~ O&M Manuals Packages – Stations

So far, of the 737¹² O&M Manuals expected, 27 are at Code 1 and 141 at Code 2. LU and RfL are now carrying out parallel reviews with CRL in order to increase the pace of acceptance, but it is evident that shortcomings with the current process are preventing material being delivered in time.

There is a lack of clarity concerning the status of Red-Line drawings. The IMs have confirmed the Red-Line drawing standard they are prepared to accept and are agreeing with CRL which assets they are required for. However, the contractors will still find this challenging because of the workload and time available. For the As-Built Drawings¹³, the IMs have accepted 3% of C600 contracts and 16% of MEPA equipment. (Change from P3: none and 3% respectively). This rate of acceptance is not fast enough for Trial Running.

¹² Excluding Whitechapel and Bond Street Stations.

¹³ CRL Period 4 Handover Report.

Stage 4 Summary

In our last report we described how the uncertainty of the Stage 3 opening date could affect CRL confidence in submitting a timetable bid. Related to that uncertainty will be the status of Stage 3 reliability. That is because Stage 3 will open with a 12 TPH service. Stage 4 is planned to double that service in the Central Section in one implementation¹⁴. To do that the Central Section will need to be performing at a very high level, in order to absorb the expected drop in performance from the lower performing NR routes. The RCC will also be managing a significant rise in complexity compared to Stage 3.

We believe there is value in CRL assessing the merits of a 'soft' start to Stage 4, as the performance of Stage 3 develops over the next 6 months.

Stage 5 Summary

CRL has given an overall rating of 'red' for Stage 5A Opening in its Period 4 PDB Dashboard. The completion by NR of the DOO CCTV project remains the key part of the programme. There has been no further slippage of those works in this period.

The software necessary for the FLUs to operate the December timetable is not forecast to be ready until close to the required date. However, the decision to implement the FLU to RLU conversion programme provides a clear mitigation.

We are now seeing the Stage B Opening as two distinct parts. The first is the building project of the inner West station enhancement works, which we have been reporting upon. The second is the railway reliability issue that we discussed as affecting Stage 4 in Section 5. We believe the issues discussed there could affect the current opening strategy for Stage 5B.

RLU – FLU Swap-Out

The first FLU began passenger operations in week commencing 29 July 2019. As operating experience grows, FLUs will begin to serve more of the paths currently being operated by RLUs.

As discussed in our last report, the software on the FLUs requires upgrading¹⁵ to obviate the RSSB derogation and increase reliability. This is forecast for late October 2019, with a late date of 22 November 2019. This was deemed too close to the December 2019 timetable change to give any degree of comfort, so RfL has implemented the FLU to RLU conversion programme.

Stage 5A Opening - NR

The delivery of the DOO CCTV remains the most critical element of Stage 5A. We reported delays within the programme in our last report, but there has been no further slippage in the programme since then. During Period 5 the first SATS¹⁶ are forecast to be submitted to RfL and NR jointly by the contractor. We will be closely following the acceptance progress, scheduled to take up to four weeks

Stage 5B Opening

There is little change from our Period 3 report. Stage 5B Opening is rated 'green' in the Period 4 PDB Dashboard, with a proposed opening date to be confirmed. We surmise that date to be

¹⁴ Excepting there will be a number of test trials.

¹⁵ With version Z 0.100.

¹⁶ Taplow 12/8/2019, West Drayton and Burnham both 16/8/2019.

best case December 2021, based on the assumption built into the EOP that it must occur 12 months after Stage 3 Opening. In that context, there are no workstreams that are on the critical path for that date, with all works remaining scheduled to be completed by December 2020¹⁷.

Key Areas of Concern in the Period

We recognise CRL has made great strides in resolving several key issues in recent months. However, in our opinion, CRL has yet to fully address the following: root cause of the optimism bias; the IM's detailed integration plan; risk management maturity plan, the mitigation plans for limiting the increasing AF CDC and the culture of 'planning to targets' in some areas of the programme

I would also like to take this opportunity to highlight the key issues from the Period Report that we consider require further action or explanation to Sponsors by the CRL Leadership Team:

- a. The current rate at which the safety and technical assurance documentation is being produced, reviewed and approved, does not align with the current ROGS dates contained within the DCS. CRL has made substantial interventions in addressing the 'handover documentation' risk. What plans does CRL have to address this assurance documentation risk, noting the flexibility to reduce the safety requirements is substantially less than the handover documentation?
- b. This period we have reviewed the phasing of CRL's risk register and believe the current assessment may not adequately cover the future phases of the programme (post-Stage 3). We have also observed that the 'post-ROGS' phase of the DCS has limited detail to support the approved opening dates. What are CRL's plans to ensure the future phases of the programme are robustly underpinned and there are suitable contingency plans in place to accommodate any unforeseen events.

¹⁷ Period 4 Stage 5B Dashboard.