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**Wales and Borders Rail Service and
South Wales Metro**

Invitation to Submit Final Tender

Volume 8: Core Valley Lines
Infrastructure

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I. Introduction

- I.1 The ODP and its supply chain partners are expected to have the skills, capacity and technical capability to deliver a successful CVL Transformation to meet the timescales as defined in Volume I. The CVL Transformation must be delivered in a safe manner with minimum impact to existing passengers, stakeholders and affected third parties.
- I.2 The Authority will also be separately appointing IDPs to deliver infrastructure works developed by the ODP as part of its Solution.
- I.3 The railway environment is complex. In developing your CVL Concept Design, you will need to consider all the system interfaces to ensure the Authority's aspirations for the CVL Transformation are delivered.
- I.4 As part of the new Rail Service, the ODP is expected to transform the CVL Rail Services into a faster, more frequent railway service. This will require extensive modifications to the existing railway infrastructure. It is likely that new infrastructure elements will be added to the rail network as part of the CVL Transformation. These works, combined with new and improved Train Fleet, will deliver a high frequency, faster service with the capacity to meet increasing demand.
- I.5 The ODP must ensure that construction works can be delivered within the overall Budget Envelope described in Volume I. You will be required to provide visibility of the assumed cost elements of your Solution and how the budget is made up, including Optimism Bias, Inflation and VAT.
- I.6 The ODP must comply with the contents of the document in Volume I, Appendix I.D "Final Tender CVL Engineering Requirements".
- I.7 The Authority is seeking to appoint an Infrastructure Manager ("IM") as an integrated part of the ODP to maintain the CVL network. You must ensure that the CVL Transformation is integrated with the Infrastructure Manager Services and CVL Rail Services to safeguard CVL Rail Services and maximise efficiencies through the design, delivery and commissioning of your Solution.
- I.8 You should minimise the impact of the CVL Transformation on current railway users. In doing so, the Authority expects you to develop a construction methodology for the CVL Transformation that complies with the draft Code of Construction Practice Part I, which has been developed by the Authority and updated to reflect feedback from the Welsh Government, Local Authorities and the Bidders, (see Appendix I.E Draft Code of Construction – Part I ("CoCPI")); The ODP will be expected to develop Part 2 of the Code of Construction Practice.

CVL Concept Design

- I.9 Each Bidder has provided a CVL Concept Design which describes the proposed CVL Transformation at a level appropriate to the current, relatively early stage of the development process. During the Preliminary Design and Discovery Phase, and then subsequent stages of the CVL Transformation, the design products in the CVL Concept Design will evolve and develop into

detailed, living documents. This Volume 8 should be considered in this context - it is important that the Authority has a complete picture not only of the CVL Concept Design but also the plan, organisation and principles behind it.

- 1.10 Where you propose particular working methods or make commitments, the Authority may incorporate these into the ODP Grant Agreement before signature. However, where you are describing plans, these are expected to be at a level of maturity which is consistent with the maturity of the CVL Concept Design, and the Authority understands that they will evolve as the CVL Concept Design evolves into Preliminary Design and Detailed Design as detailed in Appendix I.B of Volume I and TfW Plan of Works, dated 3rd May 2017. It is still important that the Authority can see evidence that the plans are deliverable in the specific context of the CVL and that they are consistent with the remainder of your Solution.
- 1.11 The works and solution described in your CVL Concept Design and funded within the Budget Envelope are termed “CVL Phase 2” in this document.
- 1.12 It is the Authority’s intention to align many of the products described in the appendices to this Volume 8 to products within the ODP Grant Agreement. For instance, the ‘Engineering Implementation Plan’ submitted will be converted into the plan referenced in Schedule 3B to the ODP Grant Agreement. You will be contractually obliged according to your Responses to this Volume.

2. Engineering Implementation Plan

- 2.1 The Engineering Implementation Plan (“EIP”) sets out how you will manage the implementation of the CVL Transformation. It will give the Authority the confidence that your planned schedule of activities will be controlled in line with the Authority’s requirements and the Outline Target Price.
- 2.2 Your response should detail, making use of your best industry knowledge and your railway sector construction experience of building new railway infrastructure within a live railway operating environment your approach to the engineering delivery of the Solution. You are encouraged to refer to your own successful industry experience and draw out the challenges and opportunities that your Solution provides and how you will manage these in a manner that provides the best outcome for the Authority.
- 2.3 The Authority requires the ODP to prepare an EIP with sufficiently specific information to provide confidence that, in the specific environment of the CVL:
 - a) Your CVL Concept Design will be delivered to quality, time and budget
 - b) That the Authority requirements will be met in the required timescales.

- R8.1** Provide an Initial EIP as described in Appendix 8.A.
- R8.2** Provide:
- A high-level summary of your EIP and the objectives of your EIP; and
 - Confirmation that your Solution meets or exceeds the Authority's requirements, including ERDF timescales and requirements.
- R8.3** Describe your proposed structure for the IDP work packages, ODP Infrastructure Works work packages and how this structure will ensure best value for the Authority.
- R8.4** Explain how your plan provides confidence that the CVL Transformation can be delivered within the timescales required to secure ERDF funding.
- R8.5** Describe key Authority dependencies and state if they are part of the critical path for the implementation of your Solution. Within your response you should identify, where they exist, any proposed mitigation plans for these Authority dependencies.
- R8.6** Confirm, by reference to Volume II, that you have scheduled sufficient resource to achieve the timescales and activities to an acceptable quality as described in your Initial EIP.

3. Commercial mitigation of the CVL transformation risks

- 3.1 The Preliminary Design and Discovery Phase may result in a number of risks which, if they materialise, could have a significant impact on costs, timescales and the overall design for the CVL Transformation. Ideally, designs will minimise risk, but for those that remain, the Authority wishes to see how you propose to manage them effectively and your plans to deal with them if they do occur. The ODP will be responsible for taking all reasonable steps to ensure that these risks are mitigated.
- 3.2 Your Response should set out how you will minimise the risks to the Authority of a change in the CVL Transformation plans rendering CVL Train Fleet or other long lead-time items redundant, leading to high costs of change in Train Fleet specification/quantity or wasted maintenance/lease/finance payments for Train Fleet which is delivered too early to be used on the CVL, or other consequential costs for long-lead time items.
- 3.3 You should be specific, including dates and include figures for key risks. Design decisions for the CVL Transformation should be taken in an order which minimises risk to the CVL Train Fleet and other long lead time components, and sub-contracts including the CVL Train Fleet orders have effective protection aligned to these decision points.
- 3.4 Your Response should set out how risks associated with the CVL Transformation design decisions which affect the CVL Train Fleet specifications are backed off to sub-contractors including Train Fleet suppliers and how sub-contracts allow for delay in completion of CVL Transformation. The Authority wishes to minimise the risk of high costs of change in Train

Fleet specification/quantity or wasted maintenance/lease/finance payments for the Train Fleet which is delivered too early to be used on the CVL, or other consequential costs for long-lead time items.

- 3.5 As a minimum, the Authority requires that there is flexibility in any contract between the ODP and manufacturer/financier for a time period of three months after the date of execution of the ODP Grant Agreement during which the order for the CVL Train Fleet can be amended at little or no penalty, but risks of change should be mitigated as fully as possible for as long as possible.
- R8.7** Describe the top 10 impacts of risks outside your direct control which could affect feasibility, timescales and/or costs of the CVL Transformation, with consequential impact on train operations, revenues and costs. Include consideration of the impacts of significant cost overrun, regulatory approvals failure, reshaping of the CVL Concept Design, and a three month, six month and twelve month delay in the delivery of the CVL Transformation. For each, impact describe
- The key risks which could lead to the impact (including the cause, the effect and the proposed mitigation);
 - How you have prioritised work and structured decision making to identify risks as soon as possible and minimise the impact to the Authority, for instance by ensuring the largest-scale decisions can be taken early providing maximum flexibility to resolve;
 - Your approach (in addition to the Authority's Requirements set out in Volume I, Appendix I.D "Final Tender CVL Engineering Requirements") to minimising any exposure for Train Fleet costs, revenue and the delivery of benefits from initiatives; and
 - Any other ways in which you can minimise the impact.

4. Public Impact of Implementation Plan

- 4.1 The Public Impact of Implementation Plan ("PIIP") provides an insight into how you propose to manage the impact of the CVL Transformation on passengers, communities and affected third parties.
- 4.2 The Authority wishes to limit this disruption to an absolute minimum, but recognises that there is a balance between this and cost.
- 4.3 You should reference examples of where your approach has been successful in similar areas, ideally within the railway environment.
- R8.8** Submit a PIIP that includes, as a minimum:
- An identified owner of the PIIP within the ODP;
 - An outline mapping of public stakeholders and citizens affected, how you consider they will be affected, and how you propose to engage with them as individuals, organisations, influencers, collaborators and/or controllers of the delivery of your Solution;

- c. A description of your possession strategy, which should describe how you will minimise disruption and provide a summary of the total annual requirements for disruptive possessions and blockades, including details about how these will be managed in accordance with your response on this topic included in your Responses to Questions R9.6, R9.21 and R9.22 within Volume 9 and the EIP, during the CVL Transformation, whilst meeting the Requirements defined in the document in Volume I, Appendix I.D "Final Tender CVL Engineering Requirements";
- d. An outline of the alternative transport arrangements you will put in place during possessions and blockades, including details about how these will complement existing transport services to provide an integrated transport service Solution;
- e. Details about how you will consult and engage with affected third parties and the local community prior to, during, and after works; and
- f. A description of measures you will take to ensure passenger numbers are not reduced in the long term due to the disruption caused by the CVL Transformation.

5. Railway control system

- 5.1 Your railway control system will be a key element of the successful delivery of a faster, more frequent service.
- 5.2 Operation and asset management for railway control systems is described in Volume 9. This section describes the requirement for the CVL Transformation from current railway control systems to your proposed Solution. Questions are focused on design and implementation rather than operation and maintenance.
- 5.3 The Authority expects you to provide a signalling system with sufficient capacity, functionality and control to meet passenger expectations and safety for all Rail Services. Where any legacy signalling equipment is used this must be replaced during CVL Transformation or you must demonstrate it will have a life of at least 10 years.
- 5.4 Your signalling system must be deliverable within the constraints of key project milestones, including ERDF as set out in Volume I ITSFT, Section 11.
- 5.5 Your Solution will need to accommodate the timetable operations for Special Events.
- 5.6 The Authority will undertake a review of your Solution using operational models such as Railsys against TSR2.
- 5.7 The Authority will look for evidence that your Solution delivers additional capacity, supports a turn-up and go philosophy, can, in the future, support the ambition for on-street running, and safe control of train movements using efficient, modern technology.
- 5.8 You are encouraged to refer to your successful industry experience both in the UK and overseas, draw out the challenges and opportunities that your

Solution provides and how you will manage these in a timely manner that provides the best outcome for the Authority.

- 5.9 The Authority will, in evaluating the response to Questions R8.9 to R8.16 inclusive, assess the ability of your Solution to deliver the Requirements as detailed within Volume 1, Appendix 1.A.
- R8.9** Provide an Initial Railway Control System Definition as described in Appendix 8.B.
- R8.10** Provide an Initial Railway Control System Implementation Plan as described in Appendix 8.C.
- R8.11** Summarise your Solution for signalling on the CVL and the proposed changes that would be made to the current system, including timescales.
- R8.12** Provide the Operational Model Input Parameters or an Operational Model Export File detailed in the CVL Concept Design Documentation. Note that where this information has been provided as part of the CVL Concept Design, it need not be resubmitted, and your Response to this Question should indicate this.
- R8.13** Describe how your proposed signalling system will maximise quality of service including details on:
- a. Headway management, (details of signal spacing and any traffic management systems);
 - b. Perturbation management / service reformation; ¹
 - c. Degraded mode facilities; and
 - d. Management of service appropriate variations i.e. Special Events.
- R8.14** Explain the benefits and risks that your signalling Solution has on the legacy infrastructure including neighbouring infrastructure outside of the scope of this project, and key considerations and assumptions for commissioning, approvals and route acceptance.
- R8.15** Provide details of any known on-going third party commercial dependencies and liabilities that will arise due to any changes proposed in your signalling control system and confirm that these commercial liabilities have been included within your ongoing Infrastructure Manager Model Templates as contained in Volume 12.
- R8.16** Describe, by reference to your Initial Railway Control Definition, how you will ensure your signalling Solution is resilient and flexible, and how it will deliver high levels of performance and reliability. Clearly define the signalling resilience, flexibility, performance and reliability philosophy, broken down into three discrete sections:

¹ To assist with considering the impact of perturbations the Authority will be using the data provided by Network Rail relating to today's level of perturbation. This will be applied to the Authority's Railsys model of your Version 5 CVL Concept Design (built using the model provided by you or a model constructed using your Concept Design information) to determine the level of average delay the CVL services experience.

- a. Reliability and performance:
 - i. A description of how reliability and performance will be built into your Solution and how reliability will be monitored and effective action taken to resolve issues;
 - ii. Details on how you will enhance performance during the ODP Grant Agreement Term, describing the monitoring systems that will be deployed, and how such systems will help reduce whole-life costs, and provide proactive and reactive feedback on performance issues.
- b. Disaster Recovery:
 - i. Details of your disaster recovery plans, where the command and control centre was unavailable due to incident.
- c. Legacy:

An explanation of how your signalling Solution is future-proofed for the design life of the CVL asset, including:

 - i. Original Equipment Manufacturer (“OEM”) support, spares management;
 - ii. Obsolescence management of new, legacy assets, 3rd party dependencies including areas expected to be updated in line with future requirements and design to enable this;
 - iii. Any areas where significant expenditure is anticipated to sustain level of service of a CVL asset; and
 - iv. Life extension plans, identifying whether these have been included in costings.

6. Train power systems and electric power and plant

- 6.1 A key element to the successful delivery of a faster, more frequent railway service after the CVL Transformation is your Solution for the train power systems and electric power and plant.
- 6.2 Your proposed train power system must:
 - a) Have reliability and performance at the heart of your Solution. It should provide a high level of resilience (at least N-1, as detailed in the Volume 1, Appendix I.D “Final Tender CVL Engineering Requirements” and flexibility whilst meeting service level demands and minimising unavailability of key systems;
 - b) Deliver a CVL Concept Design that can deliver the additional capacity, the ERDF requirements as set out in Volume 1, ITSFT, Section 11, and the future ambition for on-street running;
 - c) Provide safe power supply for train movements using efficient modern technology.

- d) Deliver a new power system that will provide resilience and a lasting legacy for the CVL, minimising the impact on third parties and sensitive receptors.
 - e) Deliver an energy efficient Solution by detailing the potential for energy storage, total energy usage and efficiency.
- 6.3 You are encouraged to refer to your successful industry experience both in the UK and overseas, draw out the challenges and opportunities that your Solution provides and how you will manage these in a timely manner that provides the best outcome for the Authority.
- 6.4 The Authority expects that you will have conducted a Traction Power Simulation to evidence your Solution. If you have not, the Authority will undertake such a simulation, and will use the results to assess your Solution's viability.
- 6.5 The Authority will, in evaluating the response to Questions R8.17 to R8.26 inclusive, assess the ability of your Solution to deliver the Requirements as detailed within Volume I, Appendix I.A.

Train Power Systems

- R8.17** Provide an Initial Train Power System Definition as described in Appendix 8.D.
- R8.18** Provide the inputs described in Appendix 8.E to enable the Authority to run a Traction Power Simulation. Where a Traction Power Simulation has been undertaken, outputs are expected to be provided in accordance with Appendix 8.E. Note that where this information has been provided as part of the CVL Concept Design it need not be resubmitted, and your Response to this Question should indicate this.
- R8.19** Summarise your Solution for the Train Power System on the CVL including the key aspects of your Solution.
- R8.20** Provide an Initial Traction Power System Implementation Plan as described in Appendix 8.F.
- R8.21** Explain how the manufacturing, installation, testing and commissioning of the electric power system and MV distribution system (if applicable) will be delivered through implementation of key construction stages and milestones.
- R8.22** Provide a summary of your reliability, availability and maintainability (“RAM”) targets e.g. Mean Time Between Failures (“MTBF”) and Mean Time to Repair (“MTTR”) for the major items of equipment proposed for the new traction power system and MV distribution system (if applicable).
- R8.23** By reference to your Initial Train Power System Definition, Traction Power Simulation and Initial Traction Power System Implementation Plan, summarise how your power systems:
- a. Are sufficient to power your Solutions in a range of future scenarios;
 - b. Are resilient to at least meet the Authority's N-I standard; and
 - c. Are flexible and extendible.

R8.24 Describe your train operating timetable in the event of an N-1 (Authority Requirement) power failure referring to both daily operational and Special Events timetables and describe the same in the event of an N-2 (Not an Authority Requirement) power failure

Electric Power and Plant

R8.25 Provide an Initial Electric Power and Plant Plan as described in Appendix 8.G.

R8.26 Provide a summary of your Electric Power and Plant Solution and explain how your Solution is deliverable within the timescales required.

7. Systems Integration Plan and Telecommunications System

- 7.1 The Systems Integration Plan (“SIP”) provides the Authority with details of how you will manage and implement the systems integration element of the CVL Transformation. It should provide confidence that your schedule of activities will be controlled in line with the Authority Requirements.
- 7.2 Railway technology and systems serve an extensive range of functionality, the combination and interaction of which will allow the ODP to meet key performance requirements and achieve the required business outputs. The systems integration ensures that the railway systems, infrastructure and Train Fleet, combined with the maintenance and operational aspects, provide an ability to deliver a robust and resilient railway to meet the Authority Requirements.
- 7.3 Your response should demonstrate your expertise in mapping all the system interfaces and how they relate to each other within the operating railway environment.

R8.27 Submit your Systems Integration Plan, which should include, as a minimum:

- a. An introduction that defines the importance your SIP holds within the delivery of your Solution. This should identify the person within your organisation with overall responsibility for the SIP and your lead engineer on systems integration. It should explain how your lead engineer proposes to manage and control the continued development and implementation of systems integration throughout the delivery of your Solution.
- b. Details for how you propose to control and manage the requirements management of systems integration. This should include the mechanisms/processes you plan to implement during the CVL Transformation and how they will assist in the final handover of the asset to your CVL Infrastructure Manager Services team.
- c. Details of all the systems included in the SIP, their key attributes, an explanation for why they are included in the SIP, and what you consider is key to the successful delivery of the systems integration for the CVL Transformation. There are a range of system components set out in the Response Template within Volume 13 that you may consider appropriate. You may add further sub-sections as required or appropriate.

- d. A definition of the standards associated with the key components of the sub-systems that inform the development of a comprehensive systems approach.
- e. A systems integration matrix that highlights key interfaces, at a system level, and describes the highest risk system interfaces that require careful consideration as part of your overall Solution and approach.
- f. Details of your approach to the development of the hazard log and an indication of how this will be managed, both from a process and data management perspective, throughout the CVL Transformation. You should outline how you propose to deal with the content of the hazard log at operational handover of assets to your CVL Infrastructure Services Manager team and your CVL Rail Services team during CVL Transformation.
- g. An outline of your proposed management system for system integration and provide an organisational structure that details the key roles and responsibilities, including the CV of the person within your organisation identified as the "Independent Competent Person", as well as details about who will have access and control of relevant data.
- h. Details on the proposed tools and methods you will use to control and implement the Systems Integration during the CVL Transformation.
- i. Key interfaces that will require specific attention and how these will be managed within your organisation's structure.
- j. Details on your proposed approach to provide resilience on key sub-systems, including during the CVL Transformation.

R8.28 Provide your Initial Telecommunications Plan as described in Appendix 8H.

8. CVL Depot and Stabling

- 8.1 Depots will form an important component of a resilient, high performing and efficient service. Access to the depot and stabling locations is key, not only from an operational service perspective but also for staff access, visitors and deliveries. You will be expected to provide a CVL Concept Design that has considered these needs to ensure all types of access required is possible; not only at the depot or stabling locations but also the roadways leading to them.
- 8.2 Your response should reference examples from similar areas. Draw out the opportunities for operational efficiencies and potential to support a growing network in the future. You should indicate the key components that you consider are essential to support the CVL Train Fleet and Rail Services.

R8.29 Summarise your depot and stabling strategy for CVL for Phase 2 and beyond.

R8.30 Describe the proposed depot and stabling locations for your Solution. This should include, as a minimum:

- a. Individual location descriptions, including:
 - i. An aerial map of the chosen locations;

- ii. A description of the land ownership for each location;
 - iii. A description of the purpose of the proposed site, i.e. Train Fleet, Maintenance, Renewals etc.;
 - iv. A summary of the key benefits and limitations of each site;
 - v. A general arrangement of the proposed layout of each site with vehicle positions shown and connections to the mainline;
 - vi. An indication on the general arrangement drawing of the extent of overhead electrification within the depot site;
 - vii. A location for operational waste storage and collection within each site; and
 - viii. A description of the security that would be implemented.
- b. A summary of:
- i. Road Vehicle Access:
 - A description of how road accessibility will be addressed at each depot and stabling location, including
 - Road vehicle access to the site and within the site including for deliveries of materials and emergency services vehicles;
 - Car parking provision for each site, for staff and visitors, to be shown on a general arrangement layout;
 - Any interfaces between road and rail vehicles;
 - Rail vehicle delivery by road, including the accessibility leading up to the depot or stabling site. This should highlight the preferred location for this activity.
 - ii. Rail Vehicle Access:
 - A description of how rail vehicle access will be provided to and from the main line at each depot and stabling location.
- c. A summary of how the maintenance facilities will be designed to cater for the proposed Train Fleet and Rail Services, including:
- i. Details of the maintenance workshops to be proposed for each depot and stabling location;
 - ii. Details of storage facilities to be provided for maintenance spares;
 - iii. General arrangement layout plans for each maintenance facility highlighting the key functions such as office and welfare space, maintenance berth types and storage space. This is to be a block representation only and not detailed architectural plans to demonstrate that all facilities required have been considered;
 - iv. The key parameters used in determining the size of maintenance facilities; and

- v. The locations of key plant and equipment.
 - d. The level to which your proposed Solution has been future proofed, including:
 - i. The maximum number of rail vehicles that could be maintained within the facilities without further expansion; and
 - ii. Possible future extensions to maintenance facilities that could be completed should the Train Fleet size be expanded in the future and the potential capacity. If additional private land is needed to deliver this expansion, then this should be clearly noted in your response with the extent of additional land required, clearly identified.
 - e. You shall provide a list of key plant and equipment to be supplied at each depot and stabling location, that support the details contained within the CVL Cost Templates, including:
 - i. Location general arrangement plans highlighting the positions of any external plant per depot and stabling location;
 - ii. A list of plant and equipment per depot and stabling location;
 - iii. A list of infrastructure plant and where this is to be stored;
 - iv. Means of road access to the depot and
 - v. Means of access to the rail network.
 - f. Information on the flow of rail vehicles, indicating the level of operational flexibility your Solution provides, including a table demonstrating the flow of rail vehicles on site and highlighting where any reverse moves are required. This should be completed for each depot and stabling location.
- 8.3 You may cross reference between your Responses to R6.10, R8.29 and R8.30 and vice versa.

9. Extendability

- 9.1 The South Wales Metro will integrate rail and bus-based public transport services and systems in South East Wales around the hub of Cardiff Central. The CVL Transformation represents Phase 2 of the scheme, with the ambition of subsequent phases to extend service provision.
- 9.2 Your Solution must therefore facilitate the expansion of future phases of South Wales Metro. The Authority wishes to see your vision for extension and growth of the South Wales Metro, and, through your Final Tender, evidence of how your Solution can be extended in the future to meet requirements, illustrated with four specific schemes. To enable you to illustrate additional extension options, this section provides you the opportunity to describe additional schemes that you feel are appropriate to illustrate your vision.
- 9.3 The Authority recognises that some extensions may not need to be served by the same technical solution as the remainder of the CVL – in some

circumstances, it may be acceptable to have interchange from the CVL to extensions. You should consider, however, the inconvenience of interchange to passengers and explain how this is outweighed by other benefits which the interchange enables.

- 9.4 The Authority will, in evaluating the response to Questions R8.31 to R8.32 inclusive, assess the ability of your vision and strategy and proposed extensions to deliver the Requirements as detailed within Volume I, Appendix I.A.
- 9.5 It is also acceptable for extensions to be contingent on statutory/regulatory approvals, third party land, new technology or on other engineering, but the Authority will consider the risks which innovation may introduce and form a view on overall feasibility, and implications for cost and timescales.
- 9.6 Overall, the Authority wishes to see evidence that you have understood the importance of flexible and incremental extendibility, that your strategy and vision are well-developed and that the Authority can be confident that your proposals are deliverable and will meet passenger expectations. Your Solution should be designed to anticipate extensions, and your Solution should therefore minimise any step change in costs or cost-blockers to change which would prevent expansion.
- 9.7 A Solution which does not show clearly how the extensions set out below can be delivered, including meeting the requirement for on-street running, will be deemed materially non-compliant.
- 9.8 The four specific sample extensions that the Authority has selected are:
 - a) Direct Rail Services from Cardiff Central or Cardiff Queen Street to the Flourish via on-street running from Cardiff Bay station. Further context is provided below:
 - i) Between Cardiff and the current Cardiff Bay station an additional station in the vicinity of Loudon Square is required and there is flexibility to relocate the existing Cardiff Bay stop noting the original station building is listed;
 - ii) Accords with local plans to redevelop the area immediately to the west of the Flourish and developments around the east side of Cardiff Bay;
 - iii) Must be capable of further extension beyond the Flourish station and therefore should be able to operate a minimum of 8 tph in each direction; and
 - iv) Much of the route and further extensions will lie within primarily pedestrian/shared space areas and pass close to major administrative, cultural and historic buildings and this must be reflected in the design proposals.
 - b) Aberdare to Hirwaun, including any proposed new stations, through conversion of the freight line branch which once served Tower Colliery. Further context is provided below:

- i) Accords with redevelopment of the Tower Colliery site (200 acres of developable land for housing, commercial and light industrial use);
 - ii) Potential additional stations to serve existing communities north of Aberdare; and
 - iii) Ability to operate a minimum of 4 tph in each direction.
- c) Extension of the Coryton Line from Coryton Station to Longwood Drive close to Junction 32 of the M4 Motorway using the former railway corridor and via the new Velindre Hospital with two new stations at Velindre Hospital and Longwood Drive. Further context is provided below:
- i) Accords with hospital development planned around a high public transport mode share for staff, patients and visitors;
 - ii) Ability for further extensions possibly serving a Park & Ride site intercepting commuting journeys from M4;
 - iii) Ability to operate a minimum of 4 tph in each direction; and
 - iv) Preference to maintain retain/relocate recreational footway/cycle route along the existing corridor.
- d) Link south from the vicinity of Cathays station operating on-street along Park Place to terminate south of A4161 in the vicinity of Park Place/Greyfriars Road with an intermediate station at the National Museum, wider context is detailed below;
- i) Accords with Cardiff University plan to redevelop area around Student Union including demolition of the retail units immediately south-west of Cathays station;
 - ii) Accords with the local plan of Cardiff Council to close Park Place to all except public transport and access together with shared space use of the existing highway;
 - iii) Could reduce capacity constraint at Queen Street north junction by terminating some Rail Services at Greyfriars Road rather than Cardiff Central;
 - iv) Could form the first stage of on-street network around the west side of the city centre to Central Station and therefore must be capable of future extension beyond Park Place/Greyfriars. It is accepted that this might involve some 'abortive' construction around the southern end of Park Place and Greyfriars station;
 - v) Potential to use new station during Special Events to ease pressure on Cardiff Queen Street and Cardiff Central stations, and
 - vi) Infrastructure to support a minimum of 8 tph in each direction.
- 9.9 Three of the four schemes are illustrative and are expected to be costed at an outline level only. The fourth: Cardiff Central/Cardiff Queen Street to the Flourish extension, is expected to be designed and priced to the same level as

the CVL Concept Design (using the document “CVL Cost Templates Conformed” and based upon developing the technical Solution to no further than indicated within the TfW Plan of Works slides v2.0 dated May 2017). You may exclude the costs of utility diversions and any Public Inquiry under the Transport and Works Act Orders from your estimates. The costs provided for ‘The Flourish’ will be treated in the same way as the CVL Concept Design during the Preliminary Design and Discovery Phase following the Start Date. Question R12.4 in Volume 12 sets out the cost requirements.

- 9.10 In preparing your responses you should assume an initial minimum train service level for each of the extension options of 4tph in both directions, and you are able to propose pathing to match your Solution.

R8.31 Summarise your vision and strategy for the expansion of the South Wales Metro, incorporating the four outline schemes above and any other potential schemes that your Solution offers (up to a maximum of seven extensions). Within your response you should include reference to sequencing of extension construction, train operations, Train Fleet maintenance and outline implementation timescales and any other key aspects that you consider relevant for each of the four schemes above and any further schemes that your Solution could bring to your vision for the South Wales Metro. You do not need to provide the level of detail required for the four Authority extensions for your own proposals.

R8.32 For each of the extensions outlined in paragraph 9.8, provide:

- a. A high level design for the option and timescales for implementation from commitment by the Authority;
- b. A TSR level description of new train services and impact on wider CVL TSRs.
- c. An assessment of the impact of each extension on the passenger journey experience (e.g. interchange requirements, frequency etc.);
- d. A description of how your design maximises the benefits of your chosen Solution to passengers
- e. An assessment of the impact of each extension on rail capacity (loop positions and junction capacities);
- f. An assessment of the impact of each extension on Train Fleet (compatibility, upgrades and procurement);
- g. An assessment of the impact of each extension on infrastructure requirements (compatibility, upgrades & integration). This shall consider the following:
 - i. The wheel - rail interface;
 - ii. Platform levels and local access;
 - iii. How your signalling Solution supports system expansion and scalability;

- iv. The suitability of the signalling Solution for either segregated Rail Services and/or on-street systems;
 - v. Operating enhanced Rail Services (you should identify the appropriateness of the Solution in relation to system expansion);
 - vi. Strategic location of substations and/or switch-rooms;
 - vii. Space provision for future power equipment;
 - viii. Spare power equipment capacity provision;
 - ix. Assurance as to the suitability of your power Solution to the extension, including a list of the main challenges associated with any power interface issues;
 - x. Identification of problems from an electrical perspective and an outline of your proposed Solution and details of the working principles. This could include relevant examples from other projects you have delivered; and
 - xi. A high-level assessment on the main stray current issues associated with the potential power interfaces and any future on-street extensions. Highlight the technical arrangements envisaged, and provide details of feasible solutions to address any potential stray current issues from the future system to the CVL.
- h. An assessment of the impact of each extension on urban realm & land requirements (stations, depot & interchange facilities);
 - i. Dependencies for your chosen Solution, including approvals or other schemes, and how these will be managed to achieve a positive outcome;
 - j. Indicative activity durations based upon the TfW plan of work stages, the details of which is included within Appendix A within Volume I, Appendix I.C "CVL Concept Design".
 - k. A proposed delivery Programme.

10. Interchange

- 10.1 Cardiff Central and Cardiff Queen Street are the principal gateway stations for rail passengers travelling to and from the centre of Cardiff. They also serve as important rail hubs enabling passengers to interchange between different rail service routes.
- 10.2 Development of the CVL will serve as a key step in the CVL Transformation of Rail Services and towards the creation of a new transport system in South East Wales centred around Cardiff. Your Solution should help deliver this vision with the opportunity to re-configure Rail Services and create a range of new journey opportunities. The Authority requires that in developing your proposals you give sufficient consideration to the passenger movements that will result, particularly within the key interchange hubs of Cardiff Central and Cardiff Queen Street.

- 10.3 Your response should focus on the experience of the passengers changing Rail Services or wider transport services and what facilities are being offered as part of the CVL Transformation and how your Solution will enhance the interchange experience.
- R8.33** Describe how your proposed timetable Solutions will affect the level and pattern of pedestrian movements at Cardiff Central and Cardiff Queen Street. Your response should include:
- A summary of the projected number of passenger movements during Peak Periods at each Station throughout the ODP Grant Agreement Term, including a summary of the impact of planned timetable changes on the number of passengers interchanging and entering/exiting the station;
 - An assessment of the critical capacity constraints at each station and the ability of the projected passenger movements during Peak Periods to be safely accommodated;
 - Details of any mitigation measures to ensure that the projected passenger movements during Peak Periods can be safely accommodated, including:
 - Any proposed modifications to the station layout or facilities; and
 - Any proposed station management strategies.
- R8.34** Complete the [redacted] separately attached which describes the Weekday Peak, Weekday Off-Peak and Saturday service pattern for a range of key station-to-station flows served by South Wales Metro services across Cardiff Central and Cardiff Queen Street in the post CVL Transformation timetable.
- 10.4 The Authority's ambitions for an integrated multi-modal public transport metro network within South Wales includes the provision of cross-valley connectivity. Recognising that the existing CVL Rail Services generally run north/south up and down the valleys, the Authority is keen to explore cross-valley transport using bus routes and particularly the development of bus rapid transit (BRT) solutions on key routes. This is likely to come forward as part of Metro Phase 3 and beyond, possibly using City Deal funding (and will be procured outside the ODP Grant Agreement). A key route which will attract initial attention will be Cwmbran to Pontypridd via Pontypool, Newbridge, Ystrad Mynach and Abercynon. The strategy is to expand the catchment of the rail service network to achieve modal shift without extracting passengers from bus services, but reducing traffic on strategic highways and connecting communities which are poorly served by existing public transport.
- R8.35** Detail how your CVL Solution will support cross-valley connectivity using the key route given in paragraph 10.4 above and describe, by example, how you will enhance interchanges at the key stations in support of integrated multi-modal public transport. What benefits will passengers gain from your contributions?

II. Statutory approvals and third party dependencies

II.I The Authority needs to be assured that you have considered the statutory approvals and third party dependencies in developing your Solution and bringing the CVL Transformation into operation. This section focuses on how you will achieve applicable regulatory consents and other approvals for your Solution and how you will successfully mobilise as the Infrastructure Manager for the CVL. **Note:** This section does not require further description of your proposed Solution.

R8.36 Detail your process and detailed plan for transferring responsibility for the Infrastructure Manager role from Network Rail, including proposed timing of transfer, whilst still recognising that this plan will not be fully populated until after completion of the Preliminary Design and Discovery Phase. Your response should include;

- a. An outline plan for mobilisation for the IM role;
- b. The regulatory consents and exemptions that are required, as requested in the ORR questionnaire;
- c. Where exemptions are required to the standards or other policies that will be implemented as part of the ODP organisation and any further consents not detailed in your response to this Question that you may consider are required as part of implementing your Solution;
- d. Establishment of an Interconnect Agreement with Network Rail, including details of any Infrastructure Manager Services that your Solution requires to be continued to be provided by Network Rail (including a statement confirming the stage of discussions with Network Rail);
- e. Establishment of Access Agreement(s) with Network Rail (including a statement confirming the stage of discussions with Network Rail);
- f. Any risks and proposed mitigations should consents or exemptions not be obtained including potential alternative approaches for the delivery of your Solution, and
- g. Any other requirements that you consider key to the successful transfer of the IM role from Network Rail (including a statement confirming the stage of discussions with Network Rail).

R8.37 Identify which of the items below will be applicable or relevant to the CVL for the transfer of the Infrastructure Manager Services. Where you consider items not to apply or be relevant please provide a brief explanation why they will not apply or be relevant. Where you consider items applicable or relevant please explain how you will progress the item including details of outputs, timetable and mitigation/contingency plans;

- a. Network Statement in accordance with Regulation 13 of the Railways (Access Management and Licensing of Railway Undertakings) Regulation (“AMR”);
- b. Claims Allocation and Handling Agreement (“CAHA”);

- c. Standard Access Agreements;
- d. Station Access Agreements;
- e. Track Access Agreements
- f. Depot Access Agreements
- g. Network Rail Connection Agreement(s);
- h. Network Code and Access Dispute Resolution Rules (ADRR);
- i. Charging policies and allocation policies;
- j. Business Plan in accordance with AML Regulation 12;
- k. Network Licence;
- l. Station Licences;
- m. Safety Authorisation and Certification;
- n. Safety Management System (“SMS”);
- o. Emergency Response Plan;
- p. Safety critical work plans;
- q. The Railways and Other Guided Transport Systems (Safety) Regulations (“ROGS”) Inspections;
- r. Health and Safety at Work Act (“HSWA”) Policy;
- s. Licensing for signalling staff Institution of Railway Signalling Engineers (“IRSE”);
- t. Membership of the Rail Safety and Standards Board (“RSSB”) which includes and is subject to Rail Accident Investigation Branch (“RAIB”), and
- u. Any other elements that are not listed above but are key components in the delivery, management and operation of your Solution.

R8.38 Describe the following elements of your Solution in the context of regulatory and Network Rail approvals;

- a. Through running between CVL Rail Services and WCB Services and any changes (transitional and/or permanent) that will occur as a result of the CVL Transformation, and
- b. How your Solution supports freight traffic and any changes (transitional and/or permanent) that will occur as a result of the CVL Transformation.

R8.39 Detail any third party approvals (other than planning/TWAO) associated with the delivery of your Solution of the CVL Transformation. This section should include:

- a. The dependency of your Solution on the third parties and or landowners and where procured, provide evidence that you have the required support or approval; and

- b. What the contingency plans are if any of these agreements are not achieved within the required programme timescales.

R8.40 Describe planning and/or TWAO approvals required. This section should include:

- a. The dependency of your Solution on any planning or TWAO approvals
- b. Evidence that this has the required support or approval from the respective bodies. Where evidence does not exist, describe what activities the ODP will undertake in the management of securing the required planning or TWAO approvals; and
- c. What the contingency plans are if any of these approvals are not achieved within the required programme timescales.

12. Appendix 8.A - Initial Engineering Implementation Plan

12.1 This appendix sets out key items which the Authority expects to see in your EIP. You do not need to respond to this list exhaustively, and the precise content is expected to vary depending on the nature of the engineering Solution proposed. This list is therefore a guide only, and you should use your professional judgment to assess the content required to provide clarity and evidence of deliverability to the Authority.

Key items:

- 12.2 A description of the relevant standards your proposed Solution will adhere to, and any proposed derogations and variations to these standards;
- 12.3 Details of any locations where your Solution is reliant on statutory approvals, regulatory approvals, planning approvals, building regulations approvals and/or listed building consents (especially where these fall on the critical path of your delivery programme) and indicate how you propose to achieve a positive outcome;
- 12.4 Details of any additional requirements associated with the draft Code of Construction Practice Part 1, as provided by the Authority;
- 12.5 A description of your approach to the development and preparation of the Code of Construction Practice (Part 2);
- 12.6 A delivery organisation structure, including proposed:
 - 1. Annual resource levels;
 - 2. Key roles and key responsibilities, including a RACI chart;
 - 3. Details of proposed location/co-location of the team and any space requirements at Pontypridd during the following phases:
 - a. Preliminary Design and Discovery Phase;
 - b. Detailed Design and Discovery Phase;
 - c. CVL Transformation, and
 - d. Post CVL Transformation
 - 4. Specialist outside suppliers;
 - 5. Key relationships with interfacing organisations, in particular Network Rail; and
 - 6. Key relationships with stakeholders and approvers;

You may cross refer to the Resource Plan included within Volume 11 as required.
- 12.7 Details of the constraints to the implementation of your Solution, referring to items including, but not limited to:
 - 1. Working hours;
 - 2. Land; and
 - 3. Safeguarding

- 12.8 Your cost breakdown structure and work breakdown structure;
- 12.9 Delivery Programme (DP), as detailed within Clauses 31-32 Appendix 5 Part A of Schedule 3B to the ODP Grant Agreement, which should also include the following items (and utilises your work breakdown structure) and for each activity, a statement of how the scope will be delivered identifying the principal resources which will be deployed:
1. Starting dates and completion dates for key activities;
 2. All items, where not included below as per the High Level Programme requirements detailed in Section 3.1 b) of the document entitled Volume I, Appendix I.C "CVL Concept Design";
 3. Key milestones including but not limited to:
 - a. Contract award;
 - b. Commencement of Rail Services;
 - c. Infrastructure management / Asset management ("IM/AM") commencement; and
 - d. Target completion dates;
 4. Identification of critical path activities, float, time risk allowances;
 5. Detailed Design activities;
 6. Other procedures set out in the contract;
 7. The dates when plant, equipment, materials and others items are to be provided by the Authority and key third parties;
 8. Access dates and key dates for activities;
 9. Third party dependencies; including:
 - a. Local Authority approvals;
 - b. Transport and Works Act Order key activities;
 - c. Building regulations activities; and
 - d. Other third party approvals, in particular NR and ORR;

Note these are expected to be managed by the ODP unless agreed by the Authority;
 10. Regular reporting activities;
 11. Design and discovery activities;
 12. Key asset surveys / investigations;
 13. Design freeze dates and project reviews;
 14. Key IT activities;
 15. Health Safety Quality & Environment ("HSQ&E") activities;
 16. System integration;
 17. Mobilisation;
 18. Preparatory works;

- 19. Risk management;
 - 20. Enabling works;
 - 21. Construction;
 - 22. Transition activities;
 - 23. Testing and commissioning activities associated with Infrastructure works;
 - 24. Train Fleet testing & operational approvals; and
 - 25. Other activities that the Bidder considers key to the successful delivery of their Solution.
- 12.10 Drawings showing proposed construction sites and the access points to the CVL network needed to implement the CVL Transformation (including details of the timings, the purposes of each site, the mode of access which can be achieved and any secondary alternative access locations, if required);
- 12.11 Detail any required preparatory works and enabling works associated with the delivery of your Solution, including the timing and duration of such works;
- 12.12 Detail your approach to the management of new data and the integration of existing asset data within the ODP and what the key attributes are in the implementation of your BIM Execution Plan (BEP), this shall include a description of the BEP for the CVL Transformation and how this document links to the asset information models that you are proposing as part of the delivery of the Infrastructure Manager Services. It should cover an overview of your approach to managing high quality, structured data for the Authority (e.g. Safety, Asset performance and criticality, Regulatory, Commercial, Technical and Environmental etc.). Bidders shall explain how they will work with Authority, post Award, to refine its Organisational Information Requirements (OIRs), Asset Information Requirements (AIRs) and from these the detailed Employers Information Requirements (EIRs). Bidders are encouraged to draw on their best industry knowledge and experience of creating and managing asset information for large infrastructure clients;
- 12.13 Definitions of the programme controls you will implement to ensure the appropriate level of control will be established and maintained throughout the CVL Transformation (including defining the proposed governance structure);
- 12.14 Details of how you propose to implement the regular reporting requirements, to include specific reporting and retention of records to comply with the requirements for ERDF payment requests
- 12.15 Provide a list of assumptions and exclusions associated with the delivery of your Solution.
- 12.16 An outline (at a high level) of your approach to managing HSQ&E risk assessments, security risk assessments and information security risk assessments (including details about how project safety reviews will be implemented and how sustainability and environmental risk assessments will be completed and managed within the ODP);
- 12.17 Details of any specific site based surveys that are required for the Preliminary Design and Discovery Phase and as identified via a detailed gap analysis of the data already provided by the Authority;
- 12.18 A summary of key environmental impacts associated with your proposed Solution and the key mitigation plans for minimising these impacts;
- 12.19 An outline of your proposed approach to the implementation of Common Safety Method Risk Evaluation and Assessment (CSM RA).

13. Appendix 8.B - Initial Railway Control System Definition

13.1 This appendix sets out key items which the Authority expects to see in your Railway Control System Definition. You do not need to respond to this list exhaustively, and the precise content is expected to vary depending on the nature of the engineering Solution proposed. This list is therefore a guide only, and you should use your professional judgment to assess the content required to provide clarity and evidence of deliverability to the Authority.

Signalling Technologies

13.2 Information about the signalling systems that will form part of your Solution for the CVL and Rail Services depot(s);

1. A description of the supervisory, trackside and on-board systems;
2. An explanation of how you plan to retain, re-deploy or dispose of legacy assets;
3. Photographic evidence of the key components indicative of the signalling type(s) and control systems;
4. A summary of the key attributes and benefits of the signalling type(s) proposed;
5. A populated [redacted], which is provided in the Response Template within Volume 13; and
6. An explanation of how your proposed system will interface with the rest of the rail network and Network Rail's "Digital Railway" initiative.

Supervision

13.3 A description of how the control of train movements is to be achieved, including;

1. A description of the command and control centre, including the location, number of desks available at project inception and extendibility capability, centralised or distributed control centres;
2. Exclusive areas of CVL Rail Services:

Areas of the CVL where for nominated periods of time, the section of route is dedicated to a single mode of Rail Service i.e. Light Rail, Tramway or Heavy Rail services.

3. Semi-exclusive areas of CVL Rail Services:

Areas of CVL where different modes of Rail Services either cross, interlace or merge for a short distance but then return to being 'Exclusive'.

4. Non-exclusive areas of CVL Rail Services:

Shared running where different modes of Rail Services are interspersed on a common section of route.

5. Degraded Modes of CVL Rail Services:

A description of any areas of design or operation that is foreseen to require a derogation of Network Rail standards or type approval to provide your Solution;

6. A description of the train protection systems to be provided and the limits/location of such provision;

7. Details about where the control of movement proposal requires transfer of control between Infrastructure Managers; and
8. A description of how your system will provide safe management of level crossings.

Support contracts

- I3.4 A summary of the signalling support contracts you plan to establish and the supply chain services you plan to use, by signalling asset class area over the ODP Grant Term:
1. 3rd party asset lease including the ability to provide continuous service to the CVL throughout and confidence to support CVL beyond the ODP Grant Agreement Term;
 2. Signalling maintenance and spares contracts and how you will work in alliance with suppliers to safely support the overall goals and objectives.

14. Appendix 8.C - Initial Railway Control System Implementation Plan

14.1 This appendix sets out key items which the Authority expects to see in your Railway Control System Implementation Plan. You do not need to respond to this list exhaustively, and the precise content is expected to vary depending on the nature of the engineering Solution proposed. This list is therefore a guide only, and you should use your professional judgment to assess the content required to provide clarity and evidence of deliverability to the Authority.

Systems Integration

14.2 You may cross reference your Systems Integration Plan described in Section 7 of this Volume 8:

1. A description of the key interfaces and dependencies required to provide control of train movement within your Solution, including key interfaces with Network Rail, Network Rail Telecom (NRT), train depots, and private sidings;
2. A description of your systems integration strategy and systems migration strategy during the CVL Transformation phase of the project and the project operations phase(s); and
3. A summary of the systems integration risks, and proposed mitigation measures associated with your Solution.

Capacity

14.3 A description of your Solution on a line by line basis (e.g. Treherbert, Aberdare, Merthyr etc.), including:

1. The performance figures for CVL Rail Services from your operational modelling on a station by station and junction by junction basis;
2. The allowance for existing freight services;
3. The infrastructure provision made to manage perturbations i.e. degraded modes of operation, holding bays, passing loops etc., and
4. The maximum capacity and length of trains that can be provided for Special Event.

Signalling Solution deliverability plan

14.4 Details of your plans to introduce your signalling Solution, including:

1. A clear and specific plan that details how the new signalling will be introduced into service, including refurbishment plans and the timely purchase of new signalling equipment (this should include a description of how the current and future signalling will interface and be delivered);
2. Details of the organisation you are contracting to provide the signalling and the maturity of this arrangement, where works are proposed not to be undertaken by the ODP;
3. Details of the key supply chain and evidence that there is sufficient capacity to meet the committed timescales, where works are proposed not to be undertaken by the ODP; and
4. Contingency plans to support late delivery of new or refurbished signalling, including any liquidated damages arrangements.

Engineering diagram

- 14.5 A system engineering diagram/configuration plan, including if available staging plans, that illustrates the signalling system during resignalling/upgrade/ migration phase and the final signalling system presentation (including signalling type, control including key interfaces and functionality e.g. GSM-R, train management system).

Safety and Assurance

- 14.6 An outline of the steps you will take and the processes you will put in place to achieve safety assurance (focusing on key points including any complex or innovative solutions), including:

1. Approval processes, especially for novel solutions, including any key risks;
2. Method employed when determining safety assurance and approvals;
3. Infrastructure limitations; and
4. Statutory and Third Party Approvals.

15. Appendix 8.D - Initial Train Power System Definition

15.1 This appendix sets out key items which the Authority expects to see in your Train Power System Definition. You do not need to respond to this list exhaustively, and the precise content is expected to vary depending on the nature of the engineering Solution proposed. This list is therefore a guide only, and you should use your professional judgment to assess the content required to provide clarity and evidence of deliverability to the Authority.

Summary of your proposed power supply Solution

15.2 Summary of your proposed power supply Solution:

1. The type of traction system proposed and its nominal voltage;
2. The supporting medium voltage (“MV”) distribution system (if applicable);
3. The proposed number and rating of substations, track paralleling huts and MV switch-rooms (if applicable);
4. The proposed number and rating of feeder stations and track sectioning cabins (if applicable); and
5. The principles for remote control and indications from the high, medium, low voltage systems and ancillary systems e.g. fire & security should be outlined as part of your Solution.

Proposed power system and performance

Overview

15.3 Provide an overview of your Solution.

Incoming Source of Power Supply

15.4 Details about the following traction power related information:

1. A list of Bulk Supply Points (and associated ratings) where an MV AC system is proposed with DC traction power supply system;
2. The list and ratings of Distribution Network Operator (“DNO”) intakes at substations where no dedicated MV AC system is proposed with a DC traction power supply system; and
3. A list and rating of Grid Supply Points, for each of the Feeder Stations where a 25kV AC traction power supply system is proposed.

15.5 Details of the locations, ratings and voltage levels at the power supply intakes;

15.6 Assurance that the power supply intakes are viable, including evidence, information or data obtained from the Distribution Network Operator.

Power Supply System Configuration

15.7 Diagrams that illustrate your proposed traction power system and MV distribution system (if applicable), including:

1. The Major Feeding Diagram of the proposed traction power system and MV distribution system (if applicable) accompanied by an explanation of the system configuration and operation;

2. Single Line Diagrams of typical DC substations, Track Paralleling Huts (“TPH”) and MV AC switch-room arrangements (if applicable)
3. Single Line Diagrams of typical 25kV AC feeder stations and Track Side Cabins (“TSC”) (if applicable); and
4. These diagrams shall be provided separately in A3 format.

Rating and Design Life of Major Equipment

- 15.8 A summary of the rating and design life of the major items of equipment including transformers, switchgears, rectifiers, cables, and energy storage devices (if applicable), compliant with our minimum requirements.

Protection Strategy

- 15.9 A description of your proposed protection strategy for your new traction power system and MV distribution system (if applicable), which is needed to enable the safe detection and isolation of electrical faults.

16. Appendix 8.E - Traction Power Simulation

Simulation package

- 16.1 The Authority expects to see details of the simulation package you used to conduct your traction power system simulation studies (i.e. provider, version number, capabilities, validation). This should include a statement detailing the accuracy of the simulation package used to validate the power simulation as well as details of all input data used to conduct the power system simulations, including:
1. Train timetable for normal operations and Special Event operations;
 2. Train Fleet characteristics (including current vs speed, tractive effort vs speed and rolling resistance curves);
 3. Infrastructure data (chainage, alignment, gradients, speed limits, etc.);
 4. Overhead Line data and configuration;
 5. Substation electrical data;
 6. Substation, track paralleling hut/track sectioning cabin, switch-room locations;
 7. Energy storage system data (if applicable);
 8. If you have not undertaken your own power system simulations, you will still need to respond to this part of the Response Template;
 9. A list of the assumptions and exclusions that you have applied to the design of the CVL Transformation, including justifications;
 10. An outline of the scenarios you have simulated for this study, including:
 - a. Peak Period time normal operational conditions;
 - b. Off-peak normal operational conditions;
 - c. Peak Period degraded operational conditions;
 - d. Off-peak degraded operational conditions; and
 - e. Special Event operations (if applicable);
 11. A summary of the simulation results for this study, including:
 - a. Bulk Supply Point loading on the MV AC system supplying the DC system (where a DC traction power supply system is proposed);
 - b. Grid Supply Point loading (where a 25kV AC traction power supply system is proposed);
 - c. Traction power substation loading (for DC traction power system);
 - d. Overhead line voltage (max and min);
 - e. Catenary current (max);
 - f. Track feeder current (max);
 - g. Rail voltage (max);
 - h. Feeder cable current for MV distribution system (max), if applicable; and

- i. Busbar voltage for MV distribution system (max), if applicable:
- 12. This is to be delivered as a standalone document to cover the items above and no page limits have been set.

17. Appendix 8.F - Initial Traction Power System Implementation Plan

17.1 This appendix sets out key items which the Authority expects to see in your Traction Power System Implementation Plan. You do not need to respond to this list exhaustively, and the precise content is expected to vary depending on the nature of the engineering Solution proposed. This list is therefore a guide only, and you should use your professional judgment to assess the content required to provide clarity and evidence of deliverability to the Authority.

Delivery design and coordination

17.2 The Authority expects to see a description for how your designs will be delivered either by yourself or the IDPs and coordinated by you.

Overview

17.3 A summary of your approach to delivering and coordinating your Solution.

Design

17.4 A description of how your design for the power system will be delivered through implementation of:

1. Key design stages and milestones;
2. British and European standards;
3. System assurance process;
4. Design for safety and constructability requirements;
5. Project delivery risk management;

- a. A list of key design submissions, calculations and system studies that will be carried out for the power system and MV distribution system (if applicable);
- b. An organisation chart showing the resources to be employed to manage and produce the design works;

Coordination

17.5 A description of how you will achieve coordination among disciplines throughout design to construction stages including IDP work packages including:

1. A coordination process;
2. How you will manage drawings / design documentation to ensure all disciplines are considered;
3. An organisation chart showing the resources to be employed to coordinate with interfacing parties. You can cross refer to your organisational chart in the EIP to avoid duplication of organisational charts.

Power Solution

17.6 The items below indicate content which the Authority expects to see in order to demonstrate how you will deliver your power Solution.

Procurement, Sub-Contractors and Manufacturers:

- 17.7 You should confirm your approach to procuring the traction power system confirming the split of ODP and IDP delivered works. For both ODP and IDP delivered works you should indicate your approach to sub-contractors and manufacturers for the major items of plant/equipment/material in the new system. For IDP delivered work, you should provide details of how you will manage the process including the suitability of the major items of plant/equipment/material. You can cross refer to your Engineering Implementation Plan to avoid duplication of organisational charts.

Testing

- 17.8 You shall indicate how your procurement approach will ensure successful integration of the traction power system's design and functional requirements. The acceptance criteria and testing strategy for major items of equipment/plant, shall be provided along with confirmation of how quality can be assured.

Asset Operations Management and Day to Day Asset Management approach

- 17.9 The items below indicate the content which the Authority expects to see in your description of your approach as to how Asset Operations Management and Day to Day Asset Management, as detailed with Volume 9 and Schedule 3A of the ODP Grant Agreement, aspects within your CVL Concept Design have been considered.

Overview

- 17.10 A summary of your approach to Asset Operations Management and your Day to Day Asset Management.

CVL Asset Life Consideration:

- 17.11 Evidence that you have considered the principle of total life cycle costs and applied it to your Solution.

Modification of Existing Plant/System:

- 17.12 A description of any proposed modification works to existing items of plant/systems for the traction power infrastructure, including evidence these have been included in the costings.

18. Appendix 8.G - Initial Electric Power and Plant Plan

Earthing, bonding and lightning protection strategy

Bonding

18.1 Information relating to the earthing and bonding strategy that will form part of your Solution, including:

1. Main principles of the proposed earthing and bonding scheme, which could involve separation of earthing systems (LV and DC for DC solution) or cross-bonding of line side systems to the traction earth (for AC solution);
2. Measures for equipotential bonding. You should summarise relevant standards and practices that are proposed to be employed to ensure the safety of personnel and protection of equipment;
3. Measures for compliance to touch voltages and step potential limits, including relevant standards and practices that are proposed to be employed to ensure the safety of personnel and protection of equipment;
4. Interfaces with other infrastructure (e.g. bridges, viaducts);
5. Key standards that are proposed for earthing and bonding; and
6. Earthing system testing.

Lightning Protection Strategy

18.2 Identification of the principal parts of the infrastructure that will be vulnerable to lightning strikes and would require a lightning risk assessment. These components could include Overhead Line masts, over-ground buildings, telecommunications equipment, etc. Your response shall detail the general principles considered and provide high-level options for the design of the lighting protection system for the areas at risk.

AC/DC Interface with Great Western Main Line (if a DC system is proposed only):

18.3 A description of the design considerations and challenges related to the earthing and bonding arrangements in the AC/DC interface on the Great Western Main Line, which is currently being electrified with a 2x25kV AC system. This could include relevant examples from other projects you have delivered.

Electro-Magnetic Compatibility Management Plan²

EMC Issues

18.4 Include:

1. Identification of EMC Issues related to railway infrastructure (internal), including:
2. Identification of the project requirements and key EMC standards that must be considered.

² EMC is the ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

3. Identification of the risks posed to existing lineside equipment from the new traction system. You should highlight the main challenges and propose mitigation measures where required.
4. Compatibility issues associated with the signalling systems.

EMC Influence on External Infrastructure

- 18.5 A description of how you plan to address issues arising from any large magnetic fields arising from the traction system which can severely affect neighbouring facilities with sensitive equipment (such as electron beam microscopes) found in hospitals, universities, and research establishments. Your Response should include solutions for minimising the Electromagnetic Interference (“EMI”) to third parties.

Inductive Coupling (if an AC System is proposed)³

- 18.6 An outline of potential options for the return system and provide adequate mitigation measures to manage inductive coupling issues.

EMC Evidence and Assurance Process

- 18.7 A description of the basic steps and structures you will implement to deliver the EMC evidence and assurance management process. You will need to consider Network Rail's EMC management process in this context, which is outlined in documents NR/L1/RSE/30040 and NR/L2/RSE/30041 for a novel installation. Include a brief description of the documentation you will produce and the processes you will follow.

Approach to managing stray currents⁴

General (if a DC System is proposed)

- 18.8 A description of your approach for the management of stray current, including:

1. A description of the main earthing and bonding arrangements (e.g. floating return) to ensure that an appropriate code of practice is adopted;
2. Identification of stray current issues in existing permanent way infrastructure (i.e. steel sleepers) and proposal of design options and monitoring methods;
3. Proposed methods for provision of adequate rail to earth resistance and minimisation of longitudinal resistance of the return path;
4. Proposed methods for stray current collection (if required);
5. Establishment of monitoring and testing regimes (if required);
6. Hazard identification and risk assessment; and
7. Identification of key standards that shall be considered.

³ The traction supply and return systems (conductor layout and current distribution) will have an impact to the induced currents on lineside cables (within the railway corridor or not).

⁴ When DC return currents utilises alternative paths other than the running rails, the electrolytic properties of DC current may cause corrosive damage to the adjacent metallic infrastructure. These effects can be severe, even over relatively short periods of time. You shall produce an outline strategy document to accommodate the management of stray current particularly regarding the retention of steel sleepers prevalent on the CVL system.

AC-DC Interface with GWML (if a DC System is proposed):

1. A summary of the issues associated with the DC stray current propagation in the interface between CVL and Great Western Mainline; and
2. A summary of the issues that can arise from accidental transfer of DC stray current to the steel intersection bridge, to ensure adequate mitigation measures are proposed in the design.

19. Appendix 8.H - Initial Telecommunications Plan

- 19.1 This appendix sets out key items which the Authority expects to see in your Initial Telecommunications Plan. You do not need to respond to this list exhaustively, and the precise content is expected to vary depending on the nature of the engineering solution proposed. This list is therefore a guide only, and you should use your professional judgment to assess the content required to provide clarity and evidence of deliverability to the Authority.
- 19.2 Your response should detail how you will meet the Authority requirement that all the works needed to deliver your Transformation Solution for your CVL Rail Services over the full Grant Agreement Term are to be delivered as part of your Transformation Solution during the Transformation Stage, with the exception of the following categories of renewals:
1. Renewals needed to address obsolescence issues that arise during Steady State Stage for new assets installed as part of the Transformation Stage provided that, the ODP meets good industry practice to minimise obsolescence as set out below; and
 2. Renewals needed to replace existing assets during the steady stage as result of expected decline in condition.
- 19.3 Good industry practice to minimise obsolescence includes:
1. ODP performing all necessary updates of hardware, software and firmware in line with the system integrator or OEM / support providers recommendations; and
 2. Development and implementation of an annual obsolescence management plan, as part of the IM Annual Asset Management Planning process, that complies with BS EN 62402:2007, Obsolescence management - Application guide.
- 19.4 For clarity, the following existing assets are to be renewed as part of your Telecoms Solution:
1. Those that are obsolete or may be expected to become obsolete during the Transformation Stage; and
 2. Those assets that are expected to become life expired during the Transformation.

Introduction

- 19.5 A description of your Initial Telecommunications Plan with an overview of your proposed Solution.

Scope

- 19.6 You should describe the scope of your telecommunications solution and how you plan to deliver the proposed works associated with your Solution.

Competence

- 19.7 Detail the expected competence of the team that will develop the design of your Solution and how you will ensure that the required competence will be delivered and maintained during asset transfer from implementation into operation and then maintained during day to day asset management.

Design management

- 19.8 Outline your approach to the design of your Solution and what processes you will implement to control the design development of your Solution, you should provide details of how the systems integration will be managed, you may cross reference other elements of your submission.

Approvals

- 19.9 Detail the approvals that you will require as part of the implementation of your telecommunications solution.

System Overview

- 19.10 Provide a summary overview of your telecommunications solution and provide details as appropriate on;
1. System Administration;
 2. System Architecture;
 3. Network Supervision and Management Subsystems;
 4. Telecommunication Networks;
 5. Dependability; and
 6. Network Security.

Supervision and Control

- 19.11 Detail your proposed approach to supervision and control of the operation of your telecommunications solution. You should provide details as appropriate on;
1. Operations Control Centre;
 2. Control Room Layout;
 3. Control Room Human Machine Interface (HMI);
 4. Central Equipment Room;
 5. Event Recording (Ancillary SCADA);
 6. Automatic Vehicle Location System/ Traffic Management Systems interface; and
 7. Signalling interface.

Supervision of Traction Power and Remote Equipment

- 19.12 Detail your proposed approach to supervision of traction power and remote equipment associated with the operation of your telecommunications Solution. You should provide details as appropriate on;
1. Operator Interface; and
 2. SCADA System.

Station Information and Security Systems

- 19.13 Outline your proposed approach to station information and security systems of the operation associated with your telecommunications Solution. Bidders are encouraged to cross reference other parts of your submission and should provide details as appropriate on;
1. Public Address;
 2. Passenger Information;
 3. Wi-Fi communications;
 4. CCTV Surveillance;
 5. CCTV surveillance Monitor Matrix;
 6. CCTV System Characteristics;
 7. CCTV surveillance Cameras;
 8. CCTV Surveillance System Architecture;
 9. CCTV Recording; and
 10. Image Display and Playback.

Operational Telecommunications

- 19.14 Detail your proposed approach to operational telecommunications associated with the operation of your telecommunications Solution. You should provide details as appropriate on;
1. Operational Radio Network (ORN);
 2. Mobile Voice Communications;
 3. Fixed Telephony Network (TEL); and
 4. Uninterruptible Power Supply (UPS).

Equipment Cubicles and Housings

- 19.15 Outline the details/approach of your proposed equipment cubicles and housings associated with your telecommunications Solution.

Surface Concrete Troughing (SCT) route and cable ducting

- 19.16 Outline the details/approach associated with the routing and cable ducting associated with your delivery of your telecommunications Solution and how this utilises any existing surface concrete troughing.

Migration from existing telecommunication system

- 19.17 Detail your proposed approach to the migration of your telecommunications Solution from the existing telecommunications system. You should provide details, as appropriate on;
1. Control Room Migration;
 2. Interim Arrangements; and

3. Final Arrangements.