



Wales and Borders Rail Service and South Wales Metro

Final Tender CVL Engineering
Requirements

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Document History

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Document Review

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Document Sign-off

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I. General Requirements

I.1 Introduction

Purpose of the Engineering Requirements Document

- I.1 This document sets out the Authority's Engineering Requirements for the CVL Infrastructure. The document is split into key discipline areas that are aligned with the CVL Cost Template, which is based upon the Railway Method of Measurement.
- I.2 The Final Tender must be compliant with the standards and minimum requirements set out in this document unless otherwise accepted by the Authority.
- I.3 Bidders may apply for a derogation from this Engineering Requirements document but such derogation would need to be sought prior to Final Tender as not meeting these criteria may result in a change to the CVL Concept Design RAG Status assessments of the Final Tender evaluation. It is at the discretion of the Authority as to whether a derogation will be acceptable.
- I.4 The ODP will be responsible for the design, construction, installation and commissioning of all ODP Works in accordance with this Engineering Requirements document. The ODP will also be responsible for ensuring all IDP works are specified and successfully commissioned in accordance with this Engineering Requirements document.

Development of the Engineering Design Standards Document

- I.5 This document presents a range of technical standards and requirements which are referenced within Schedule 3B of the ODP Grant Agreement. Some elements – those shown as 'to be informed by bidder solution' – will be incorporated into the ODP Grant Agreement once the ODP has been appointed.
- I.6 This document is a live document and provides a benchmark for Final ITSFT to allow Bidders to identify the key standards (or derogations) they will use in developing their solutions. The document is expected to be evolved and developed post appointment to reflect the ODP's solution, details of which will be included within the ODP Grant Agreement. A review and change control process for the management of the content of this document will be required as part of the Design and Discovery Phase post award of the ODP Grant Agreement where Bidders will be able to propose derogations or changes to standards.

Definitions & Abbreviations

- 1.7 Table I provides a list of abbreviations and defined terms for CVL.
- 1.8 [Note: definitions for terms defined in the ODP Grant Agreement take precedence over these. Lists to be merged in final version]

Term	Definition
AC	Alternating Current.
Active Travel	As defined in the Active Travel (Wales) Act 2013 and the Well-being of Future Generations (Wales) Act 2015.
[Asset Transfer]	As defined in the ODP Grant Agreement.
Authority	the party termed the Authority within the ODP Grant Agreement dated [XXXX.]
AWS	Automatic Warning System.
BS	British Standards.
BIM	Building Information Modelling.
Branding Guidelines	As defined in the ODP Grant Agreement.
BSP	Bulk Supply Point.
BTN	Backbone Transmission.
BTP	British Transport Police.
CCTV	Closed Circuit Television.
Chainage	A method of measurement along a railway track (Bidders to decide whether the Network Rail system of chains and yards is retained or if a metric system is used).
Contractor	The ODP or IDP contractor being managed by the ODP constructing the Works.
Control Room	Core functional entity, and its associated physical structure, where operators are stationed to carry out centralised control, monitoring and administration of routine operations and Train movements across the CVL network. (Reference ISO 11064-3:1999).

Term	Definition
CSM-REA	Common Safety Method on Risk Evaluation and Assessment.
CVL	Core Valley Lines. The assets forming the Core Valley Lines that transfer from Network Rail ownership to become assets owned by the Welsh Government assets.
CVL Extensions	The future extensions to CVL as identified in the ITSFT.
CVL Rolling Stock	The Rolling Stock to be used in passenger service on CVL (including future extensions).
DC	Direct Current.
DKE	Developed Kinematic Envelope (DKE) as defined by RSP2.
DDA	Disability Discrimination Act.
Degraded Operating Condition	State of continuing railway operations with significant equipment failures (such as track related failures and communications system failures).
Design Life (also referred to as the equipment service life)	The design life of equipment, which can sometimes be referred to as the equipment service life, is defined as the period of time for which the equipment is expected to work within the parameters of its design and Mission Profile, without any failures in its performance or operation, so long as the maintenance activities prescribed by the equipment manufacturer are followed rigorously. This parameter is a fixed number, usually expressed in years, and is subject to a maintenance regime defined by the manufacturer.
DMRB	Design Manual for Roads and Bridges.
DNO	Distribution Network Operator.
DPA	Data Protection Act 1998.
Earthing and Bonding Strategy.	The Earthing and Bonding Strategy prepared by the ODP and accepted by the Authority.
EN	European Standards.

Term	Definition
EU	European Union.
[Event Day Services]	As defined in the ODP Grant Agreement.
[Final Tender]	As defined in the ODP Grant Agreement.
Grant Agreement	The ODP Grant Agreement.
HSE	Health and Safety Executive (HSE).
IDP	Infrastructure Delivery Partner.
IRJ	Insulated Rail Joints.
ITSFT	Invitation To Submit Final Tender.
LED	Light Emitting Diode.
Level Boarding	Level access to Rolling Stock for persons with reduced mobility along the whole length of a CVL train formation at all door thresholds.
LHA	Local Highway Authority.
LV	Low Voltage.
Mission Profile	A representation of all relevant conditions (temperature, humidity, dust, altitude, etc.) a product will be exposed to in all of its intended applications throughout its entire life cycle.
MVAC	Medium-Voltage Alternating-Current.
N-I	Traction power resilience (or traction power security) is the ability of a traction power system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements (e.g. failure of traction power equipment). N-I traction power resilience means that any single failure of Traction Power Equipment should not cause a Train Service Affecting Failure. 'Traction Power Equipment' is any equipment located between the point of connection to the DNO and the point of connection to the tracks / overhead line equipment (OLE). Therefore, traction power infrastructure includes (but is not

Term	Definition
	limited to): Cabling; Switchgears; Rectifiers; and Transformers.
Normal Operating Condition	State of normal running of the railway incorporating minor disturbance and delays to the service in traffic hours and operations during non-traffic hours.
NR	Network Rail.
NRSWA	The New Roads & Streetworks Act 1991.
OCS	Operations Control Systems - The technical systems and facilities required for the ODP to provide efficient running of the CVL Network and Train operations.
ODP	Operator and Development Partner.
[Operational Hours]	As defined in the ODP Grant Agreement.
ORR	Office of Rail & Road.
PRM	Technical Specification for Interoperability - Persons with Reduced Mobility (PRM TSI).
RCM	Remote Condition Monitoring. A system that provides the ability to monitor key assets with real time information that will support: diagnostics right time; interventions; changes in the existing maintenance regimes; and re-design of an asset.
RSP2	Railway Safety Publication 2, Guidance on Tramways, published by the ORR.
RSSB	Rail Safety and Standards Board.
RVAR	Rail Vehicle Accessibility (Non-Interoperable Rail System) Regulations 2010.
S&C	Switches & Crossings.
Special Trackwork Designs	Any special trackwork required for CVL including but not limited to switches, crossings, slabtrack, transition rail, expansion joints, embedded track, grass track, derailment containment, overrun

Term	Definition
	measures and noise & vibration mitigation measures.
Stray Current Management Plan	The Stray Current Management Plan prepared by the ODP and accepted by the Authority.
Street Furniture	Street Furniture is any equipment located above ground level (including below ground foundations) that provides a function in the urban realm in terms of highway infrastructure, safety, wayfinding, hygiene, public transport, providing information to the public and advertisement.
TfW	Transport for Wales.
TPWS	Train Protection Warning System.
Traffic Regulation Order	An order issued by a Local Highway Authority to control the traffic in their area in some way using powers within the Road Traffic Regulation Act 1984.
Trains	All rail-based vehicles to be used on CVL for the carriage of passengers (Rolling Stock), the carriage of Freight from Cwmbargoed and Infrastructure Maintenance trains.
[Train Service]	As defined in the ODP Grant Agreement.
Train Service Affecting Failure	A Train Service that is running with a delay of 3 minutes or greater compared to the scheduled time for the 'affected' service.
TSI	Technical Specifications for Interoperability.
TSRGD	Traffic Signs Regulations and General Directions 2016.
V	Volts.
VSS	Video Surveillance System.
Works	Any works associated with the design and construction of CVL either now or in the future during the lifetime of the Grant Agreement.

Standards & Derogations

- 1.9 All design, manufacture, construction and commissioning will be carried out in accordance with the following hierarchy of legislation and standards:
- Statutory documents (Acts and Statutory Instruments).
 - Building Regulations.
 - Highway Authority Standards (public highway infrastructure only).
 - Network Rail Standards (network rail infrastructure only).
 - British Standards (BS and BS EN).
 - European Standards (EN).
 - Industry Standards.
- 1.10 The hierarchy of documents will be as noted above in all cases. Where there is a conflict or variance between standards, the order of precedence noted above will prevail unless otherwise instructed by the Authority.
- 1.11 Any specific standards and legislation referred to in this document should not be considered as exhaustive, and it is the responsibility of the ODP to ensure that applicable legislation, codes and standards are applied as appropriate.
- 1.12 The Works will comply with any specific requirements of the Health and Safety Executive (HSE), Office of Rail & Road (ORR) and all undertakings given by the Authority to the extent they are known or stated.
- 1.13 Upon the [Asset Transfer] the ODP will be responsible for CVL. It is assumed that all Works will comply with Network Rail (NR) Railway Group Standards unless a derogation has been notified by the ODP and accepted by the [Authority or ORR as appropriate].
- 1.14 NOTE: It is expected that the ODP will look to introduce its own standards as it implements its solution. Any new standards proposed will need to be notified by the ODP and accepted by the Authority or ORR as appropriate.
- [TO BE FURTHER INFORMED BY BIDDER SOLUTION]
- 1.15 Design, manufacture and construction undertaken outside of the United Kingdom which meets the national standards of any European Union (EU) Member State or an International Standard recognised in another EU Member State will be acceptable provided that the Standard or Code of Practice offers equivalent levels of safety, reliability and fitness for purpose as the British Standard and Code of Practice. The ODP will provide all necessary evidence to satisfy the Authority that the standard or code of practice used is equivalent to the relevant British Standard.
- 1.16 Standards to be adopted will be those current at the date of design acceptance of the Works. Where standards are revised subsequent to this date prior to

construction, the ODP shall raise a technical query to the Authority who will instruct the standard to be adopted.

- I.17 The International System of Units (SI) will be used.

Design Acceptance

- I.18 The ODP will not commit to the purchase of any plant, equipment materials or services or the commencement of any associated construction prior to the consent of the Authority to the relevant design package. This requirement applies to all design packages. All design documents submitted to the Authority Project Manager accompanied by the following certificates:
- Design Certificates in respect of all design packages other than for retaining structures or for earthworks signed by the Designer and set out in a form agreed with the Authority Project Manager;
 - Separate Design Certificates in respect of individual retaining or building structures signed by the Designer and set out in a form agreed with the Authority Project Manager;
 - Separate Design Certificates (Geotechnical) in respect of the geotechnical elements of the works signed by the Designer and set out in a form agreed with the Authority Project Manager.
- I.19 Design certificates will be signed by a relevant discipline based chartered engineer and counter-signed by a Company Director, Partner or equivalent within the relevant Design organisation responsible for the design package. The Contractor will ensure the compatibility of inter-related, interdisciplinary design reviews have been completed prior to the submission of the above design certificates.
- I.20 Structural elements and building works will follow an Approval in Principle (AIP) procedure prior to detailed design. AIP documents will be submitted to the Authority Project Manager, who will be given two weeks to review the AIP or any subsequent submissions prior to submission by the Contractor to the approval authority. AIP submissions will follow the procedures identified in the Design Manual for Roads and Bridges BD2/05, or, where affecting Network Rail operation or infrastructure, Network Rail Procedure NR/L2/CIV/003.
- I.21 The Design Certificates will confirm that the Design meets the minimum requirements of the Authority and will identify any respects in which the design does not meet requirements with an explanation of the non-compliance.
- I.22 Design information provided for review should use the following industry standard design packages, or have output files that can be imported into the these design packages:
- • Alignments (MX / Microstation)
 - • Drainage Windes

- • Microsoft Office 365
 - • Drawings (AutoCad / Civils 3D)
 - • Structures (Revit)
- I.23 The Project Manager will be given four weeks to review detailed design submissions and will respond with a status number in the following way:
- 1. Acceptance of proposals.
 - 2. Minor comments to be addressed by ODP without need for re-submission of design.
 - 3. Minor comments with the need for resubmission by ODP (Two weeks to be given to the Authority Project Manager to review subsequent re-submissions from the date of receipt).
 - 4. Non- acceptance – non-compliant with the Authority’s minimum requirements (Four weeks to be given to the Project Manager to review subsequent re-submissions from the date of receipt).
- I.24 Formal consents and approvals from external bodies will not be sought until the Authority has accepted the proposals.
- I.25 The ODP may, at their discretion, provide the Authority Project Manager with preliminary or draft proposals for comment prior to formal submission of a design package. The Authority Project Manager will be given four weeks to
- I.26 respond to preliminary or draft submissions. Comments provided by the Authority Project Manager on preliminary or draft submissions will not constitute any form of consent to or approval of any element of the design.

Infrastructure Interfaces

- I.27 The CVL infrastructure shall be compatible with all Trains.
- I.28 [TO BE INFORMED BY BIDDER SOLUTION]

Rolling Stock Interfaces

- I.29 [TO BE INFORMED BY BIDDER SOLUTION]

Collaboration

Data Management

- I.30 TO BE INFORMED BY THE AUTHORITY’S [EMPLOYER’S INFORMATION REQUIREMENTS], JOINTLY PREPARED WITH THE ODP POST AWARD
- I.31 The Authority will be provided with access to the Common Data Environment at all times.
- I.32 Data held within the common data environment is owned by the Authority.

BIM

- I.33 The Works shall be produced in accordance with the ODP's BIM Execution Plan and comply with the Authority's [Employer's Information Requirements].

Site Accommodation

- I.34 The Contractor will provide suitable site accommodation and welfare facilities for the Authority throughout the transformation Works within the Contractors main site offices.

Safety

Safety Management

- I.35 [TO BE INFORMED BY BIDDER SOLUTION]. THIS IS EXPECTED TO INCLUDE:

- Common Safety Method on Risk Evaluation and Assessment (CSM-REA)
- Safety Verification

Blockades & Schedules

- I.36 The ODP shall comply with the requirements of the Authority with respect to the duration and location of all Blockades and Possessions as detailed below;
- TfW/ODP will be responsible for the CVL safety case for lineside working and gain ORR approval prior to asset transfer.
 - No Disruptive Possessions south of Pontypridd and Caerphilly when Special Events are on in Cardiff.
 - Blockades for up to 6 months on single track sections, provided new services and rolling stock are introduced immediately afterwards. A maximum of two shorter duration blockades between Interchange Stations, each of up to a maximum of 60 days duration, would be considered acceptable by the Authority provided that after completion of the 2nd blockade the affected line between the two Interchanges has been transformed and new services and rolling stock have been introduced.
 - Where possessions/ blockades extend beyond a few days the replacement bus service should match the future TSR rather than the existing service level (e.g. Merthyr currently 2tph, future is 4tph, therefore bus replacement should be 4 per hour, combined with existing bus services).
 - Blockades not to occur on adjacent branches at the same time, to allow passengers an option to use nearby rail services as an alternative to bus replacement services. The Authority may consider simultaneous blockades on two branches north of Pontypridd (i.e. Merthyr Tydfil and Aberdare but not Treherbert: Treherbert and Aberdare but not Merthyr Tydfil etc.,

subject to through railway services being provided between Pontypridd and Cardiff Central, Queen Street or Cathays.

- The Authority will not allow any all-line blockades of tracks between Raydr and Pontypridd to occur within the same 12-month period as any blockades north of Pontypridd.
- There shall be a primary and alternative construction traffic route to each works site agreed in advance with the affected local authority
- Your works shall comply with the Code of Construction Practice Parts 1 & 2.

1.37 [TO BE FURTHER INFORMED BY BIDDER SOLUTION].

Transport & Works Act Order (TWAO)

Assumptions

1.38 The types of provisions which are anticipated to be relevant for the purposes of the TWAO include (but are not limited to) those which:

- powers to construct, maintain, alter and repair the CVL;
- operational powers in relation to the CVL;
- powers to require those engaged in development close to the railway to protect the railway's operations and assets in accordance with the Authority's and ODP's requirements;
- make the Authority (with ODP support) a statutory consultee for all developments close to the railway; and
- place any constraints on the Authority's powers in relation to the CVL.

1.39 This TWAO application will also exclude the proposed Depot at Taffs Well, which is subject to a separate Local Authority Planning Application being pursued by TfW.

1.40 The ODP will be responsible for the preparation of any TWAO applications and support through statutory processes required by the Works and the associated timescales of the process from initial preparation through to the decision note.

Taffs Well Site

1.41 The ODP shall be responsible for all Works associated with development of the Taffs Well site for CVL.

1.42 Once the ODP Grant Agreement is signed the ODP shall become responsible for security at the Taffs Well location.

- 1.43 Bidders are advised that no demolition or site clearance work will be undertaken prior to the handover of the site to the ODP. The ODP will be responsible for all site clearance and ground remediation including the removal of any remaining plant and equipment on the site.
- 1.44 Bidders shall make an allowance within their costings for this location to relocate the Western Power Sub-station to a location that does not affect their railway operations.

Site Clearance / Redundancy

- 1.45 The ODP shall recover all redundant / obsolete assets from CVL unless it is unreasonable to undertake such activity. Any redundant / obsolete assets that remain need to have the prior acceptance of the Authority. The ODP is responsible for maintaining accurate records of such assets and for ensuring adequate maintenance is undertaken to ensure that these redundant assets do not pose a safety risk.

2. Railway Control Systems (1.01)

General Signalling and Control

- 2.1 The ODP shall maintain and upgrade the signalling system, as required, to manage the safe and efficient running of Trains along the CVL throughout the Grant Agreement Term.
- 2.2 Signalling systems shall be provided where movement authorities and additional information needs to be provided to Train drivers to:
- a) Ensure safety of routes to be set.
 - b) Ensure safe separation between Trains.
 - c) Provide movement instructions to Trains.
 - d) Provide movement instructions to Trains in on-street running areas, where signalling is required for operational needs and where movement instructions differ from those which are provided by road signalling systems. Signalling shall also provide warning information to general road and pedestrian traffic or prevent conflicting use of the CVL route where public roads or walkways cross partially segregated sections of CVL, as far as they are not covered by the road signalling provision. Reference shall also be made to the requirements of RSP2.
 - e) Safeguard road traffic, farm traffic, non-motorised users and Active Travel modes from rail traffic at level crossings.
- 2.3 Operations Control Systems (OCS) shall be provided to supervise and manage Train operations.

- 2.4 Due consideration shall take place assessing the impact of the Works. The condition of signalling systems and its dependencies shall be assessed before undertaking design alterations, so that the integrity of the system is not compromised during the Works and that the safety of the railway is assured.
- 2.5 The signalling system provided by the ODP shall be flexible, efficient and scalable by design to accommodate the CVL Extensions.
- 2.6 All signalling systems supplied as part of the Works shall be proven by design with references readily available to describe the successful and reliable deployment on other systems of equivalent type.
- 2.7 The ODP shall provide all necessary signalling tie in works and modifications to the current signalling at NR interfaces to seamlessly integrate CVL with NR signalling controlled areas, where required by the Works, including the operation of freight trains from Cwm Bargoed through to the NR network at Cardiff Central.
- 2.8 The ODP shall furnish all hardware, software, and all related equipment necessary to provide a complete signalling solution for CVL.
- 2.9 The project will ensure compliance with both the detailed application of BS EN 50126:1999 process and the Authority's railway performance requirements as defined within the ITSFT and the ODP Grant Agreement.
- 2.10 [The ODP shall be responsible for all signalling recoveries and renewals (including any undertaken by the IDP) associated with the CVL Works]. Where assets of third parties are impacted by the Works, then the ODP are responsible for agreeing the extent of works and costs associated with the third party recoveries and renewals.

Signals

- 2.11 Where provided, signals shall be spaced to optimise service performance whilst maintaining the safety of the system.
- 2.12 The control of movement within on-street running areas will be compliant with RSP2.
- 2.13 The ODP shall select signals appropriate to the mode of operation, line speed, and reading times.
- 2.14 Low voltage LED signal heads are to be provided, where practical, to reduce environmental impact, minimise maintenance obligations and improve safety and reliability.
- 2.15 Signal types shall be consistent, where practical, to avoid driver confusion.
- 2.16 The ODP shall be responsible for the siting of signals, points indicators, speed boards and other equipment, so that the network operates safely.

- 2.17 The signal sighting process shall be commensurate with the type of signal to be provided.
- 2.18 Signal sighting shall take place accordance to NR/L2/SIG/10157, where such standards cover the signal type provided.
- 2.19 Where, on-street signals are to be provided, these signals shall comply with the Traffic Signs Regulations and General Directions 2016 and RSP2 guidance.
- 2.20 Train driver visibility to signals shall not be obscured with visibility appropriate to the Works and Train operation being provided at all times.
- 2.21 It is essential that the revised locations of the CVL signals in no way affect the sighting of any of the Network Rail existing signals or operational indicators in such a way as to render drivers' viewing less effective than it is now. A joint Network Rail / ODP review of the CVL design should be undertaken to satisfy both parties that no problems of misreading exist.

Train Protection System

- 2.22 The ODP shall retain / enhance / replace the train protection system (TPWS, AWS) system, as necessary, commensurate with the speed and mode of operation.
- 2.23 Where segregated signalling is to be provided, automated systems shall be provided to restrict the movement of Trains by technical means in the case of hazardous deviations from permitted movements.
- 2.24 A highly reliable fault tolerant system of radio communication between the Control Room and Trains should be provided suitable for safety critical communications.
- 2.25 Radio system availability and network coverage should be provided for the entire CVL operational network.
- 2.26 Where freight services are to be retained, GSM-R shall be provided.
- 2.27 GSM-R shall be provided where NR is the movement authority or movement on NR infrastructure is required.
- 2.28 Where more than one radio system is provided, train cab radio communications shall be restricted to use of the radio system pertinent to the Control Room responsible for control of train movements within the specific area.

Supervisory System

- 2.29 The signalling equipment provided for CVL shall be monitored by and integrated into the Control Room supervisory system to allow the signalling status to be continuously monitored and logged.
- 2.30 Workload assessment shall be carried out by the ODP to determine the number of signaller workstations required to operate CVL.

- 2.31 Extendibility is a key requirement of the Grant Agreement, passive provision for additional workstations should be provided by the ODP for foreseeable extensions (i.e. those stated within the ITSFT).
- 2.32 The ODP shall provide where reasonably practical condition monitoring systems, and asset performance trending facilities.
- 2.33 The ODP shall be able to identify the location of all Trains on the CVL network (including but not limited to depots, freight lines and sidings) but excluding private sidings. The ODP shall provide suitable traffic management tools to optimise the management of Trains, train timetabling, performance reporting, rolling stock allocation, stabling and train crew deployment.

Points (Switches & Crossings)

- 2.34 Switches and Crossings shall reliably operate in all weather conditions.
- 2.35 To minimise environmental impact of the electrical point heating system, attention should be paid to economic and efficient design of heating systems and appropriate level of control. Energy-efficient control methods and thermal insulation of the rails should be realised where practical.
- 2.36 Remote Condition Monitoring (RCM) of powered point machines and switch heating systems is required.
- 2.37 Switches, crossings, and points heaters shall be remotely monitored from the signalling Control Room for signaller indications, fault monitoring, incident investigation, and trending failures.

Signalling Cabinets and Equipment

- 2.38 Signalling cabinets and doors shall be positioned such that track operatives and members of the public are not at risk of injury during maintenance works.
- 2.39 Signalling power installations shall conform with The Electricity at Work Regulations 1989 and BS7671.
- 2.40 Signalling shall benefit from an Uninterruptible Power Supply (UPS) backed LV power source.

Cabling, Containment and Ducting

- 2.41 All new or replacement cable routes shall employ security measures such as lockable lids to reduce the threat of vandalism.
- 2.42 All cable routes (surface concrete troughing, ducting etc.) shall include at least 25% spare capacity for maintenance purposes.
- 2.43 Tail cables fitted with plug couplers are to be used for all lineside signalling equipment where practical.

Control Room

- 2.44 The ODP shall have a disaster recovery plan and facility, whereby if the usual Control Room was unavailable due to a major incident, a backup system should be available such that Trains can still be safely managed with a reasonable service frequency and capacity on all routes.
- 2.45 The Control Room shall be of sufficient size to accommodate the CVL Extensions.
- 2.46 The Control Room shall be ergonomically designed, the ODP shall consider ISO 11064 all parts.

Reliability

- 2.47 The Works shall enable the ODP to monitor reliability figures, using metrics, and demonstrating year on year performance improvements.
- 2.48 The system must be able to recover from perturbations and to run the required train service without delays and cancellations affecting Train Services for the remainder of the day (unless it is the last service of the day that is affected).

Level Crossings

General Requirements

- 2.49 The ODP shall retain / enhance / replace the level crossing facilities, as necessary, commensurate with the speed and mode of operation.
- 2.50 No existing level crossing (of any type) will be closed either temporarily or permanently without the permission of the Authority and where appropriate for publicly accessible level crossings, the Local Highway Authority.
- 2.51 New vehicle level crossings across the CVL formation within an off-street area are prohibited, unless otherwise accepted by the Authority and the Local Highway Authority.
- 2.52 New vehicle level crossings are allowed for on-street where they can be introduced using the appropriate crossing technology to support the CVL Rolling Stock and the necessary risk assessment and approvals are in place .

3. Train Power Systems (1.02) & Electric Power and Plant (1.03)

Electrification & Power

Design Life

- 3.1 Major plant equipment shall typically have a design life of typically 30-35 years.
- 3.2 Consumable items and auxiliary equipment shall typically have a lower design life of 15-20 years.
- 3.3 The minimum Design Life of key traction power equipment will be as detailed in Table 2.

Table 2: Minimum design life

Equipment	Recommended minimum design life
1. Traction Transformers	30 years
2. Traction Rectifiers	30 years
3. Autotransformers	40 years
4. Booster Transformers	35 years
5. AC Switchgears	30 years
6. DC Switchgears	30 years
7. Auxiliary Transformers	25 years
8. Feeder Cables	30 years
9. Battery Chargers	30 years
10. Batteries	10 years
11. RTU	20 years
12. SCADA and Telecoms	15 years
13. Electronic equipment	15 years
14. Auxiliary supplies equipment	20 years
15. Ancillary wiring	30 years

Equipment	Recommended minimum design life
16.Overhead Line Equipment (OLE) Catenary Structures & Foundations	60 years

Resilience

- 3.4 The CVL traction power system and equipment shall provide a resilience level of N-1.

Alternating Current (AC) Traction Power System

- 3.5 The requirement for a AC traction power system is that a single failure of either a transformer, AC cable, AC switchgear or DNO infeed should not cause a [Train Service Affecting Failure].
- 3.6 Any two faults happening simultaneously in the AC traction power systems could result in a train service affecting failure [which shall be mitigated by operating a degraded service pattern].

Direct Current (DC) Traction Power System and Supporting MVAC System

- 3.7 The requirement for a DC traction power system is that a single failure of either a transformer, rectifier, DC cable, DC switchgear or DNO infeed should not cause a Train Service Affecting Failure.
- 3.8 The requirement for a Medium-Voltage Alternating-Current (MVAC) system (either owned by rail infrastructure manager or DNO) supporting DC traction power system is that a single failure of either a Bulk Supply Point (BSP) transformer, AC cable, AC switchgear or DNO infeed should not cause a train service affecting failure.
- 3.9 Any two faults happening simultaneously in the DC traction power systems and/or MVAC system could result in a Train Service Affecting Failure [which shall be mitigated by operating a degraded service pattern].
- 3.10 The CVL traction power system and equipment shall support the [(August 2016 TSR)] requirements and Event Day Services.

Substations

- 3.11 Substations shall have a naming convention that is unique but adaptable as the system matures (i.e. if gaps need to be filled in due to an increase in the frequency of services or the addition of new extensions e.g. CVL Extensions).
- 3.12 Substations shall have a suitable road access and a suitable space for maintenance vehicles to park for routine maintenance.

Overhead Line Equipment (OLE)

General Requirements

- 3.13 The acceptable methods of overhead electrification for CVL are:
- Alternating Current (AC) at 25kV.
 - Direct Current (DC) at 750V.
 - Direct Current (DC) at 1500V.
- 3.14 Datum plates shall be provided on all structures and OLE poles that note the design level of the track with a benchmark, the offsets from the structure to the running rails and where appropriate, indicate the clearance from the design level of the top of rail to the OLE contact wire and the minimum electrical clearance from the underside of overhead structures.
- 3.15 Overhead electrification required for on-street extensions will be in accordance with Railway Safety Publication 2 (RSP2) published by the Office of Rail and Road (ORR).

Contact Wire Heights

- 3.16 The contact wire shall allow the safe passage of Trains.
- 3.17 [TO BE FURTHER INFORMED BY BIDDER SOLUTION. THIS IS EXPECTED TO INCLUDE:]
- Maximum wire height.
 - Minimum wire height (segregated).
 - Minimum wire height (public areas).
 - Minimum wire height (on-street).
 - Clearances (including structures and station canopies).

Electrical Ratings

- 3.18 [TO BE INFORMED BY BIDDER SOLUTION]. THIS IS EXPECTED TO INCLUDE:
- Nominal voltage.
 - Peak voltage.
 - Overhead line resistance per track (off street and on-street).
 - Current rating (off street and on-street).

Environmental Requirements

3.19 [TO BE INFORMED BY BIDDER SOLUTION]. THIS IS EXPECTED TO INCLUDE:

- Design maximum temperature.
- Design minimum temperature.
- Maximum relative humidity.
- Rainfall average annual (mm).
- Wind maximum operational speed (m/s).
- Maximum gust speed (m/s).
- Ice loading (maximum radial thickness considering wind).
- Tensioning systems.

Poles & Fixings

3.20 Each fixing point (OLE pole or structural fixing will be provided with a plate noting a unique alpha numeric reference that assist track maintenance teams with identifying the route and Chainage of the OLE infrastructure to assist with infrastructure maintenance. The only exception is for on-street building fixings where a location reference should be attached to the non-live parts of the Catenary.

Wire Gradients and Stagger

3.21 Wire gradients and stagger shall be compatible with the pantograph of the CVL Rolling Stock. The ODP shall consider the requirements of the CVL extensions when specifying the CVL Rolling Stock pantograph.

3.22 The stagger on the OLE shall minimise the wear of consumables on the vehicle (e.g. carbon rods).

OLE Clearance Requirements

3.23 [TO BE INFORMED BY BIDDER SOLUTION]

Dynamic Kinetic Envelope Clearance Requirements

3.24 [TO BE INFORMED BY BIDDER SOLUTION]

Electrical Clearance Requirements

3.25 [TO BE INFORMED BY BIDDER SOLUTION]

OLE Material Requirements

3.26 [TO BE INFORMED BY BIDDER SOLUTION]. THIS IS EXPECTED TO INCLUDE:

- Overhead Contact Wires
- Feeder Connection Cables
- Poles
- Building Fixings
- Cantilevers
- OLE Fittings
- Insulators
- Sectioning Equipment
- Isolators
- Section Insulators
- Span Wires
- Jumpers and Cross-connections
- Tensioning Equipment
- Small Part Steelwork

OLE Interfaces

3.27 [TO BE INFORMED BY BIDDER SOLUTION]. THIS IS EXPECTED TO INCLUDE:

- Traction Power Cables
- Feeder Cables
- Earth Connections
- Trackwork
- Telecoms
- Signalling System
- Signal Sighting
- Sectioning
- Civils
- Foundations
- Ducting
- Trackside Cabinets

- Rolling Stock
- Pantograph
- Regenerative Braking
- Network Rail

Earthing and Bonding

3.28 Works to be in accordance with the ODP's Earthing And Bonding Strategy.

Stray Current Mitigation

3.29 Works to be in accordance with the ODP's Stray Current Management Plan.

Lightning Protection

3.30 Works to be in accordance with the ODP's Lightening Protection Strategy.

EMC

General Requirements

3.31 The Works shall be in accordance with the ODP's EMC Management Plan.

3.32 The separation between traction power and communication cables running in parallel will be sufficient to avoid EMC compatibility issues and be in accordance with the EMC Management Plan.

Hazard Identification

3.33 [TO BE INFORMED BY BIDDER SOLUTION]

4. Permanent Way (1.04)

Track & Formation

Gauge

- 4.1 The gauge of the track shall be 1435mm.
- 4.2 The track width (effective gauge/wheel contact gauge) shall be 1502mm.
- 4.3 The alignment leading up to a station shall prevent a Train fouling the platform.
- 4.4 The spacing between sleepers / rail fixings will provide adequate support and reliably maintain gauge in straight and curved sections.

Derailment Containment

- 4.5 All new or amended structures will safely contain Trains in the event of a derailment.

Wheel-Rail Interface

- 4.6 The wheel profile for the CVL Rolling Stock and Trains (including rail maintenance vehicles) will be compatible with the CVL rail profile without the need for infrastructure maintenance staff to modify check rails in-between the passage of each vehicle type.
- 4.7 The CVL wheel-rail interface shall facilitate the CVL Extensions. The selected rail profile and CVL Rolling Stock wheel profile will be compatible for complex urban environments including shared use on the public highway with pedestrians, cyclists and vehicles using the same lane around tight corners (minimum track radius 25m). The solution will keep the width of the open groove within the street to a minimum.
- 4.8 The ODP will carry out a comprehensive wheel-rail interface study on all Special Trackwork Designs and trackwork prior to installation. The study will demonstrate that the designs permit the safe passage of Trains over all switches and crossings. The study will be undertaken based on the following assumptions:
 - new track and new CVL Rolling Stock wheel.
 - new track and CVL Rolling Stock wheel maximum wear limits.
 - track maximum wear limits and new CVL Rolling Stock wheel.
 - track maximum wear limits and CVL Rolling Stock wheel maximum wear limits.
 - Existing rail based freight movements on the Cwm Bargoed freight branch and the associated section of the Rhymney line.

- Assessing and minimising the risk to motorists, particularly cars and motorcycles, from installing rails with low skid resistance in the public highway.
 - Assessing and minimising the risk to pedestrians and cyclists from grooved track and openings in the public highway.
- 4.9 For each new Special Trackwork Designs installation the ODP will confirm to the Authority, prior to installation, the following:
- Operational speeds in all directions.
 - protection measures to be used.
 - maximum safe speed for any spring-operated points.
 - maximum safe speed for any hand operated points.
 - maximum safe speed for points that can be trailed.

Design Life

- 4.10 Design life for track structures will be a minimum of 50 years.
- 4.11 The design life of all rail sections will be in excess of 40 years except where:
- a) horizontal radii of less than 100 metres (on the centreline of the track) exists, in which case, rail sections with a design life in excess of 20 years will be provided; and
 - b) the switch blades will have a design life in excess of 10 years. This is the lifespan of the rail before total replacement of the rail.
- NOTE: Rail recharge/build up is permissible throughout the lifetime of the rail.
- 4.12 All rail pads and/or base plate pads used on track systems will have a proven in service life of at least 15 years.
- 4.13 The ODP's design submission will clearly demonstrate the details of the life expectancy of each component within the track form systems including but not limited to; rail, rail fastening systems, base plates, base pads, any acoustic attenuation systems, track slabs, sleepers, ballast materials, sub-ballast mats and any specialist formation treatments. For each track system the ODP will identify clearly the anticipated first point of failure giving both the load and expected time period to failure of that component.

Corrosion Prevention

- 4.14 All track components which have direct contact with electrically powered CVL Rolling Stock will be isolated electrically from the ground. Track components will be protected from corrosion by providing barriers to electrical currents

and moisture. Measures for specific components will be in accordance with the ODPs Stray Current Management Plan and will include:

- Embedded track - rail to earth resistance and stray current collection system (SCCS) to be provided in accordance with the ODP's Stray Current Management Plan.
- Slab track - rail to earth resistance and stray current collection system (SCCS) to be provided in accordance with the ODP's Stray Current Management Plan.
- Ballast track - rail to earth resistance to be provided in accordance with the ODP's Stray Current Management Plan.

Electrical Continuity

- 4.15 Electrical continuity of the track is essential to ensure negative return of traction power to the substation (if appropriate) and to ensure that stray current is minimised.
- 4.16 Where rail bonding is required within embedded track, such bonds will be protected to separate it from the infill concrete.
- 4.17 Jumper bonds will be provided at rail expansion joints. The bond wires will be placed in such manner that they can accommodate movement created by the thermal expansion and contraction of the rail / structure.

Ballasted Track (off-street)

- 4.18 Ballast underneath the sleepers will be at least 250mm in depth.
- 4.19 Ballast will be kept minimum 50mm below foot of rail.
- 4.20 The sleeper spacing shall be:
 - a) to limit rail sag to less than 1mm during construction, or
 - b) be a maximum of 750mm.

Slab Track (off-street & segregated)

- [TO BE FURTHER INFORMED BY BIDDER SOLUTION].

Embedded Track (on-street)

- 4.21 Embedded Track will be surfaced to meet the requirements of the Local Highway Authority and where appropriate be approved by the Planning Authority and landowner (if a CVL Extension is not on the public highway).
- 4.22 Embedded Track will take full account of the geotechnical and environmental conditions including resistance to sulphate or highway de-icing agents, where applicable.

- 4.23 The ODP will ensure that the rail, any insulating material and adjacent paving materials provide each other with adequate lateral and vertical restraint against movement or fatigue action likely to result in premature failure of either the components of the slab or track.
- 4.24 The minimum skid resistance for all surface materials in a public highway where CVL Rolling Stock and other road vehicles operate will be 65 when tested in accordance with one of the methods set out in BS EN 13036 Part 4 Pendulum Test, unless otherwise agreed with the Local Highway Authority.
- 4.25 The sleeper spacing shall:
- a) limit rail sag to less than 1mm during construction; or
 - b) be a maximum of 1.5m.

Green Track

- 4.26 Top soil will be provided at a depth between the top of the rail element/surround to the top of the track slab formation. Areas outside of the track slab envelope but within the proposed green track area will have a free draining subbase material provided below the top soil formation down to the sub surface drainage system. The finished surface (e.g. surfgrass seed mix, sedum etc.) requires the prior acceptance of the Authority, or where appropriate the Local Highway Authority.
- 4.27 The green track will be maintained (watered, cut etc.), where required, to enable establishment of the vegetation as per the supplier's requirements. A barrier (e.g. geotextile) will be provided between the topsoil and sub base track formation layers to prevent migration of fines.
- 4.28 The sleeper spacing shall be:
- a) to limit rail sag to less than 1mm during construction, or
 - b) be a maximum of 750mm.

Transition Tracks

- 4.29 A gradual change in track stiffness will be made where two types of track construction abut one another. This will be accomplished by introducing a transition section between the two types of track construction and will include one of the following:
- variation in spacing of rail fixings.
 - variation in stiffness of rail support pads.
 - transition slab (in particular where change from ballast to concrete track bed and between supporting interfaces of varying stiffnesses).

Subbase and Sub-grade Layers

- 4.30 Formation stiffness will be appropriate for the proposed trackform and to prevent subsequent settlement (soft areas will be treated adequately to obtain the required stiffness).
- 4.31 Sand Blankets and geotextiles will be provided at locations where there is a risk of formation flooding or poor ground formation conditions.

Structural concrete for track bed

- 4.32 [TO BE INFORMED BY BIDDER SOLUTION]. THIS IS EXPECTED TO INCLUDE:
- Concrete Performance Requirements
 - Reinforcement
 - Separation Membranes

Track Drainage

General

- 4.33 The ODP will design and construct all aspects of the drainage system necessary for the effective drainage of track, adjacent paved areas and all other locations where track is installed and tested.
- 4.34 The track system shall provide for free drainage of all surfaces, track work, rail grooves and ancillary equipment such as electrical and mechanical equipment associated with switches and turnouts, expansion joints, points heaters etc. The works will be designed and constructed so as to ensure no standing water at the surface, on track work, in rail grooves or ancillary equipment.
- 4.35 All new drains shall have a self-cleansing velocity.
- 4.36 All new exposed surfaces of drainage equipment will be appropriate for the location, pedestrian friendly wherever it is reasonable to expect surface use by pedestrians and with secure fixings to ensure surface covers, gratings and frames remain in place in all surcharge conditions. All surface drainage access covers, gratings and frames will as a minimum comply with the requirements of BS EN 124.
- 4.37 All new slot drains shall have a 'heelproof' lid with a maximum clear opening or 8mm or less.
- 4.38 Open dish drainage channels are prohibited for new drains due to the risk of ice in inclement conditions.
- 4.39 It is the responsibility of the ODP to agree and secure connection and discharge consents with the appropriate body for any new drainage outfalls to third party systems and watercourses This includes the need for any mitigations such as silt traps, flow control devices, oil interceptors etc.).

Ballast

- 4.40 All ballasted track will be drained in accordance with the requirements of Network Rail Standard NR/L3/CIV/005.

On-Street

- 4.41 Drainage in the public highway shall be provided to meet the Local Highway Authority requirements.
- 4.42 All grooved rail will be drained at regular intervals not exceeding 30 metres. The interval may be increased up to 50m with the acceptance of the Authority, where 30m of straight rail is not achievable. The outlet formed in the grooved rail will be free from burrs or rough edges and will be large enough to provide for the required drainage but will not reduce the overall structural performance of the rail section locally to the drainage opening. Openings shall be formed such that no fractures are induced in the rail section or associated flangeway which could subsequent result in premature failure after installation. Drainage slots on curved track will be avoided. Continuity of the grooved rail keeper flange will be maintained throughout drain points.
- 4.43 Pipe work and drainage boxes attached to the rail will be capable of dealing with the maximum theoretical flow of water through the prescribed waterway without surcharge into the rail groove. Such system will consist of an auxiliary drainage box with removable lockable cover, silt trap, outlet pipe and be securely attached to the rail. The provision of drainage collection boxes will be compatible with the electrical system requirements and ODP's Stray Current Management Plan and Earthing and Bonding Strategy including any insulation requirements. In all cases, drainage boxes, their fixing to the rail and associated supporting material will be capable of taking the loads likely to be imposed on the rail at any location including where appropriate regular cyclic loading from highway vehicles.
- 4.44 All rail drainage will be connected to a carrier drain eventually leading to a highway drain or sewer. Wherever practical in Embedded Track arrangements, the rail drainage connection will be treated in the same way as a highway gulley connection and will comply fully with the requirements of the Design Manual for Roads and Bridges and the Specification for Highway Works as though it were a gulley connection.

Slab-track

- 4.45 Slab track will drain passively to the outer edge of the track by creating a minimum fall of 1.5% in the slab.

Rail

General Requirements

- 4.46 All rails will satisfy the electrical conductivity requirements regarding the ODP Stray Current Management Plan and Earthing and Bonding Strategy.

- 4.47 Rail material shall be selected to ensure track brake efficiency is maintained in all conditions.
- 4.48 All new rails for use by CVL Rolling Stock in passenger service will be continuously welded unless otherwise accepted by the Authority.
- 4.49 There will be no holes created in the rails other than those required for the permanent Works.
- 4.50 The desirable minimum length of rail between any joints, mechanical or welded will be 18m with a minimum of 4.5m. The minimum rail length may be reduced to an absolute minimum of 3m with the acceptance of the Authority.

Head profile (off-street)

- 4.51 [TO BE INFORMED BY BIDDER SOLUTION]

Head profile (on-street)

- 4.52 The surface material for a distance of 150mm on the outside of any 'on-street' rail in a road will be 0mm above the rail. If a rail section is used with a profile where the top of the keep is lower than the top of the rail head, the adjacent surface on the inside of each rail will be not more than 3mm above the keep and will not be below the level of the keep.
- 4.53 The rail will be installed and maintained such that the CVL rolling stock wheel profile does not run on the surface of or cause damage to the surrounding highway construction surface throughout the lifetime of the rail (e.g. bitumen, concrete etc.).

Rail Inclination

- 4.54 [TO BE INFORMED BY BIDDER SOLUTION]

Rail Treatments (Bending, Cutting, Drilling & Grinding)

- 4.55 All rails regardless of whether they are pre-curved in the factory or bent on site will achieve the required installation tolerances. Rails for curved trackwork with radius less than 100 metres will be pre-bent prior to installation. Rails for curved trackwork will be pre-bent at the ends of the rail prior to installation, where required to ease installation between adjacent rails.
- 4.56 Where rolled sections are longer than 18 metres and need to be cut for transportation by road vehicle, the minimum number of cuts should be used for radii of 100 metres or less. For radii over 100 metres, cutting of sections should be determined by the most economic use of the rail.
- 4.57 Prior to the movement of Trains but after completion of all track and associated Works, the ODP will use suitable means to remove all millscale, pitting and other irregularities from the rail (e.g. rail grinding).

4.58 [TO BE INFORMED BY BIDDER SOLUTION] THIS IS EXPECTED TO INCLUDE:

- rail end condition (cutting),
- proximity of welds (minimum closure lengths),
- head matching (joint alignment)
- requirement for square or staggered joints (position of joints).
- Rails cutting (without impacting on structural performance requirements of the rail)
- Rail drilling (without impacting on structural performance requirements of the rail)
- Post rail treatment finishing.

Interface / Transition Rails

- 4.59 Where there is a change in rail from one type of section to another, a factory made transition rail section will be used unless otherwise accepted by the Authority. The transition rail section will provide for a smooth safe transition from one rail section to the other. Where appropriate, the flangeway of any grooved sections should be designed to mitigate the derailment risk.
- 4.60 Transition rails will only be located on straight sections of track.
- 4.61 New track should have transition curves when changing from straight to laterally curved track unless otherwise accepted by the Authority.

Fasteners & Fixings

- 4.62 All rail pads and/or base plate pads used on track systems will have a proven in-service life of at least 15 years. If rail pads or base plates meeting the 15 years proven in service life are not available, the ODP will submit details of proven in service lives to the Authority for acceptance
- 4.63 The Contractor will ensure that the components of the rail fastening system are mutually compatible in terms of geometry, resilience, elasticity and manufacturing tolerances with the track systems.
- 4.64 In the case of track systems with concrete base slabs or where rails are directly fixed to structural slabs or decks, the ODP will design and construct the fastening system to ensure that the system provides the correct degree of resilience in relation to noise and vibration attenuation and to ensure a proper durable fixing of the rail in all operational loading conditions that are likely to occur.
- 4.65 The ODP will ensure that the fastening systems used are compatible with the design clamping loads in all track forms whilst ensuring the correct degree of resilience within the fastening system.

- 4.66 Where practical, the rail fastening systems used for all track types will utilise the same components and minimise the number of those components.
- 4.67 A resilient base plate pad will be installed directly beneath the rail in all circumstances. It should have characteristics which reduce noise and vibration transmission and provide the necessary electrical insulation.

Encapsulation

- 4.68 Where electrical insulation is required, rail sections will be encapsulated by means of a continually elastic rail mounting system. The rail will be factory pre-coated in clean dry conditions.
- 4.69 The resilient encapsulation system must comply with the OPD's Stray Current Management Plan and provide the following :
- high electrical resistance and insulation.
 - low water absorption of the profiles and water tightness with excellent resistance to dilute acids, alkalis and salt solutions. It shall prevent water seepage paths that would allow surface water to penetrate either between the encapsulation and the rail, or between the encapsulation and the track structure.
 - adequate provision for the encapsulation of turnouts, crossings rail welds, bonds, tie bars, drain boxes and other apparatus / works, without elaborate on-site cutting and fitting, .
 - ability to flex with the natural flex of the rail capability and to sustain cyclic loading while limiting maximum vertical deflections to safe level under all loading conditions.
 - high resistance to abrasion and tear and capable of withstanding robust rail fastening without damage to its electrical insulating properties.
 - proven long term adhesion to itself and steel.
 - proven to facilitate the repair, extraction and replacement of rails, turnouts, crossings, tie bars and other apparatus without major damage to the track slab. This includes withstanding rail welding (including pre-heating) and railhead grinding.
 - capable of withstanding site handling without damage.

Joints

- 4.70 All raised rail sections will be stressed to the correct stress free temperature and where necessary be provided with expansion joints and or lateral restraint mechanisms to prevent adverse movement. The following requirements also apply:

- Welded joints in plain line track will not be staggered but will be pairs of welds across the track which are not out of square by more than 75mm.
 - All weld trimming and head profiling will be undertaken with fully track mounted purpose built grinding plant that grinds both rails simultaneously. Hand grinding of final head profile will not be acceptable.
 - The ODP will test completed welds for defects prior to re-opening to passenger services and maintain a record of all welding, inspection, testing, welding methodology and operator qualifications which could be provided to the Authority upon request.
- 4.71 Fishplate joints will not be used on new lengths of rail without the prior acceptance of the Authority.

Insulated / Isolation Joints

- 4.72 Insulated Rail Joints (IRJ's) should only be used where necessary for the safe operation of the system.
- 4.73 The electrical resistance across the joints will be compatible with the CVL signalling, telecommunications and control system and the power supply systems.
- 4.74 All insulated joints and their filler material will be of a proprietary product of either the glued or fully encapsulated types.

Special Trackwork

Off-Street Switches (Points)

- 4.75 Off-Street and segregated switches and crossings will be in accordance with Railway Group Standard GC/RT5021 Part 4.
- 4.76 The points operating machines shall be selected in conjunction with the design of the track elements of the point layouts to ensure safe and reliable operation.
- 4.77 All switches will meet the following requirements:
- When adjacent to the stock rail, the switch blade will be in contact with it for the full length of the planed section;
 - The switch rail will have a sufficient number of distance blocks to prevent lateral movement and adequate support will be provided to prevent vertical movement under trafficked load;
 - The switch heel blocks will be of adequate design and number to prevent differential movement between the switch and the stock rail;
 - An adequate number of stretcher bars will be provided to operate the switches and to move the entire flexible length of the switch blades firmly against the distance blocks for the design life of the switch unit;

- The opening at the switch toe will meet the requirements of the switch operating mechanism and the minimum flangeway between the stock rail and an open switch rail will be sufficient to prevent the backs of the Train wheels striking the switch rail in all wear states;
- All rail joints in a switch assembly will be welded unless insulated joints are required for signalling purposes;
- Switches will be designed to withstand forces from stressed continuously welded rail or be protected by expansion joints;
- Switch blades should be selected and have identifying marks so that they are readily replaceable; and
- Switches will be compatible with the wheel profile and wheel set geometry of Trains.

4.78 [TO BE FURTHER INFORMED BY BIDDER SOLUTION]

On-Street Switches (Points)

- 4.79 The points operating machines shall be selected in conjunction with the design of the track elements of the point layouts to ensure safe and reliable operation.
- 4.80 All switches will meet the following requirements:
- When adjacent to the stock rail, the switch blade will be in contact with it for the full length of the planed section;
 - The switch rail will prevent lateral movement and adequate support will be provided to prevent vertical movement under trafficked load (including that from highway vehicles where applicable);
 - The opening at the switch toe will meet the requirements of the switch operating mechanism and the minimum flangeway between the stock rail and an open switch rail will be sufficient to prevent the backs of the CVL Rolling Stock wheels striking the switch rail in all wear states;
 - All rail joints in a switch assembly will be welded; and
 - Switch blades should be selected and have identifying marks so that they are readily replaceable.
- 4.81 Operational facing points shall include tongue detection and dedicated detection rods connected at the switch toes. There shall be visual indication of the tongue detection to the driver to confirm the points position (e.g. Points Position Indicator (PPI)) at:
- all operational facing points; and
 - trailing powered points with an integral lock mechanism.

- 4.82 The points operating machines shall be selected in conjunction with the design of the track elements of the point layouts to ensure safe and reliable operation.
- 4.83 The supervisory system shall be interfaced with the street points to provide the facility to monitor point detection where provided.
- 4.84 Switches shall:
- A be capable of being hand operated by a single person, if necessary under equipment failure conditions following the manufacturers guidelines.
 - be compatible with the wheel profile and wheel set geometry of CVL Rolling Stock.
 - be flush with the surrounding finished surface levels and provide a safe means of access for pedestrians to walk across (except for the grooves, flangeways and nosings);
 - be located such that any moving parts are away from pedestrian ‘desire lines’ of movement across the street to protect the public from injuries resulting from a sudden movement of the switch blades
 - be positioned, where practical, to minimise the passage of light and heavy goods vehicles across the switch blades.
 - be either manually or power operated;
 - trailable; and
 - equipped with efficient switch heating systems at facing points or at trailing points where a risk of derailment during wintery conditions or operational risks is identified.
- 4.85 Manual switch point machine configurations shall be either:
- Sprung return; or
 - Throw over.
- 4.86 Manual switch machines shall include a mechanism to reduce noise created during its operation.
- 4.87 Sprung return manual switch machines should be selectable sprung enabling easy reconfiguration to the non-biased end position and reversal back to sprung return mode when necessary (e.g. using a points bar or similar action).
- 4.88 Powered switch point machines shall:
- be provided with an integral locking mechanism to positively lock the switch rails in the closed position when CVL Rolling Stock operating speeds are 15kph or greater;
 - have an operating time of no more than 2 seconds at the minimum supply voltage;

- be managed via a points controller and associated equipment achieving an overall safety rating relevant to the project risks (It is envisaged for street points SIL level 3 according to EN61508 will be required); and.
- be trailable (where fitted with an integral lock) in order to prevent damage to the mechanism and to reduce the risk of derailment.

Rail Expansion Devices

4.89 All Rail Expansion Devices will meet the following requirements:

- Rail Expansion Devices will be designed to accommodate the full range of potential movement of the rail to ensure it accommodates the movement of the structure beneath.
- Rail Expansion Devices will be designed to accommodate free movement of the movable rail.
- Rail Expansion Devices will not be placed within areas where surrounding material will interfere with the mechanism of the device.
- Electrical continuity of the rails will be provided at the Rail Expansion Devices and will be in accordance with the ODP's Stray Current Management Plan.

Trackside Equipment

Lubricators

- 4.90 The ODP will make provision for track lubrication at the locations which have been deemed necessary by the ODP's wheel rail interface study. This can be achieved via trackside lubrication with remote monitoring via the Control Room or on intelligent on vehicle solutions monitored by the on-board computer (e.g. location tags, GPS etc.).
- 4.91 Lubrication may be required at other locations where noise or rail wear is deemed to be an issue.
- 4.92 The lubricant supply will be environmental friendly and will be used economically considering the ambient temperature and avoiding as much as practicable soiling of the track bed and vehicles.
- 4.93 Trackside lubrication systems and lubricant will be compatible with any CVL Rolling Stock wheel / flange lubrication systems preventing blockage of either system or any chemical reaction.
- 4.94 New trackside lubrication systems will meet the following requirements:
- Lubricators located at the start of a horizontal curve at the point of first full wheel flange - rail contact.

- Gauge side of the high rail and the contact face of the restraining rail will be lubricated. Under no circumstances should the high rail be lubricated with the restraining rail dry.
- Lubricator cabinet and electricity supply to accommodate the installation core comprising lubricator compressor, pump, drums and ancillary apparatus will be located close to the applicator head to keep the length of pipe between pump and applicator head to a minimum.
- Lubricant pipes will be protected from impact damage. (in embedded track sections the pipe work will be embedded in the concrete; at slab track sections the pipe work will be encased in a rigid conduit).

Point Heaters

- 4.95 Point heaters will be installed at all new points. The heaters will be thermostatically controlled such that in normal operation they automatically switch on and off at predetermined temperatures to be agreed by the Authority. An override facility will also be provided to allow the remote control of the operation of the heaters from the Control Room.

Track Geometry

General

- 4.96 The Developed Kinematic Envelope (DKE) of the CVL Rolling Stock (working in multiple) will be compatible with the CVL track geometry.
- 4.97 The vertical track geometry will comprise grades (straight elements) and vertical curves. Horizontal geometry will consist of straights, transitions, circular curves and cant
- 4.98 [TO BE FURTHER INFORMED BY BIDDER SOLUTION]

Track Geometry (off-street)

Interfaces

- 4.99 [TO BE INFORMED BY BIDDER SOLUTION]

Minimum Radius of Circular Curves

- 4.100 Ballast Track Desirable Minimum Radius = 500m
- 4.101 Ballast Track Absolute Minimum Radius = 100m

Horizontal Geometry

- 4.102 [TO BE INFORMED BY BIDDER SOLUTION]

Vertical Geometry

- 4.103 [TO BE INFORMED BY BIDDER SOLUTION]

Platform Interface

4.104 [TO BE INFORMED BY BIDDER SOLUTION]

Track Geometry (on-street CVL Extensions)

Interfaces

- 4.105 Off-set running shall be provided for on-street extensions where the highway width allows. The ODP can provide justification for acceptance by the Authority of not using off-set running when local constraints dictate an alternative solution.
- 4.106 Safe alternative cycle facilities shall be provided for cyclists that avoid the need to cross the tramway at angles more acute than 60 degrees.
- 4.107 Crossings shall be perpendicular to the rails or at an angle which will minimise the trip hazard to pedestrians
- 4.108 Sufficient space is to be provided between junctions to safely accommodate CVL Rolling Stock without obstructing the highway

Minimum Radius of Circular Curves

- 4.109 Slab Track / Embedded Track Desirable Minimum Radius = 50m
- 4.110 Slab Track / Embedded Track Absolute Minimum Radius = 25m

Length of Circular Curves and Tangents

- 4.111 The designed geometry can be negotiated by the CVL Rolling Stock both when operated as single units and when working in multiple and when coupled for the recovery of a broken down vehicle (i.e. considering issues associated with reverse horizontal curvature, passenger ride comfort and the limits on the rotation of the connection between coupled vehicles).
- 4.112 FURTHER DETAILS TO BE DEVELOPED BASED ON BIDDERS SOLUTION BUT WILL INCLUDE THE FOLLOWING:
- Length of Circular Curves with Applied Cant
 - Length of Circular Curves without Applied Cant
 - Tangents between Reverse Circular Curves
 - Tangents between Reverse Transition Curves

Type of Transition Curve

- 4.113 Transition curves shall be Clothoid spiral types.

Transition Length

4.114 [TO BE INFORMED BY BIDDER SOLUTION] CONSIDERING:

- Cant Gradient
- Rate of Change of Cant Deficiency
- Rate of Change of Cant
- Design Twist
- Desirable and minimum transition lengths considering constraints that may be imposed by track maintenance vehicles (e.g. tampers)
- Situations where a transition curve may not be required, such as where the operating speed is low and/or where the track radius is relatively large. The concept of virtual transitions shall be applied to calculate the rate of change of non-compensated lateral acceleration at the change in horizontal curvature.

Horizontal Geometry through Switches and Crossings

- 4.115 The horizontal geometry of turnouts will, where possible, be based on standard units of the same geometry as those used on the existing system in order to minimise the need for additional spares.
- 4.116 Curves will have the largest possible radius in order to minimise wear and enable higher operating speeds and/or improved passenger comfort to be achieved. A turnout radius of less than 50m should not normally be introduced on a regular passenger service route.
- 4.117 If it is necessary to introduce non-standard turnouts, the geometry will, so far as is reasonably practical, be based on the use of a standard switch panel as this will enable some spares (such as switch blades) to be shared with other turnouts on the system. The use of non-standard turnouts will be subject to acceptance from the Authority.
- 4.118 Complex layouts, such as those containing horizontal transition curves or diamond crossing with slips, will be avoided due to high cost of manufacture and maintenance.
- 4.119 Consideration will be given to the phasing of opposite crossing gaps when designing diamond crossings: the proposed geometry will facilitate the provision of adequate guidance of the wheels as they negotiate the crossing.

Type of Vertical Curve

- 4.120 Vertical curves shall be parabolic.

Maximum Vertical Radii

- 4.121 Crest (convex) curves for on-street extension

- Desirable minimum crest curve radius (excluding areas of horizontal curvature and cant gradients) = 1000 m
- Absolute minimum crest curve radius (excluding areas of horizontal curvature and cant gradients) = 250 m
- Desirable minimum crest curve radius = 625 m

4.122 Sag (concave) curves for on-street extension

- Desirable minimum sag curve radius (excluding areas of horizontal curvature and cant gradients) = 1000 m
- Absolute minimum sag curve radius (excluding areas of horizontal curvature and cant gradients) = 250 m
- Desirable minimum sag curve radius = 625 m

4.123 Curves coincident with cant gradients for on-street extension

- Desirable minimum vertical curve in areas of cant gradients = 2000 m

Length of Vertical Curves and Grades

- 4.124 Desirable minimum length of vertical curves and grades = Greater of $0.25V$ and 15 m, where V = design speed (Km/h)
- 4.125 Absolute minimum length of grade between circular curves = 0 m (subject to the use of desirable minimum curve radii)

Maximum Vertical Acceleration

- 4.126 Desirable maximum vertical acceleration = 0.1 m/s^2
- 4.127 Absolute maximum vertical acceleration = 0.3 m/s^2

Maximum Longitudinal Gradients

- 4.128 Desirable maximum longitudinal gradient = 5 % (This limit is based on the desirable maximum longitudinal gradient for footways contained within HD 39/01 (Design Manual for Roads and Bridges).
- 4.129 Absolute maximum longitudinal gradient (excluding areas with coexistent horizontal curvature) = 8 %

Cant

- 4.130 The desirable applied cant adjacent to Stations is 0 mm.
- 4.131 The absolute maximum applied cant on curved track within segregated sections (e.g. ballasted track) excluding Switches & Crossings (S&C) and Stations is 50 mm.

- 4.132 It is desirable for the magnitude of the applied cant in off-street areas (e.g. segregated central reserve) is to be between $\frac{2}{3}$ and $\frac{3}{4}$ of the equilibrium cant for the operating speed – subject to the limiting design values specified above.
- 4.133 The magnitude of the applied cant in on-street areas should ideally comply with the off-street rule. However, it is acknowledged that this will not be achieved in many areas due to constraints on the applied cant resulting from the need to accommodate the coincident highway geometry. The magnitude of the applied cant will therefore often be insignificant. In these areas operating speeds should be calculated on the basis of the cant deficiency value and cant will be dictated by the needs of all road users.
- 4.134 Cant will be introduced uniformly at the chosen cant gradient and will, so far as is reasonably practicable, be applied in multiples of 5 mm.
- 4.135 Cant will be introduced uniformly at the chosen cant gradient and will, so far as is reasonably practicable, be applied in multiples of 5 mm.
- 4.136 FURTHER DETAILS TO BE DEVELOPED BASED ON BIDDERS SOLUTION BUT WILL INCLUDE THE FOLLOWING:
- Positive Cant
 - Negative Cant
 - Method of Application
 - Cant Deficiency (also see below)
 - Cant Gradient
 - Rate of Change of Cant
 - Rate of Change of Cant Deficiency

Cant Deficiency

- 4.137 Desirable maximum cant deficiency (excluding S&C) = 100mm
- 4.138 Absolute maximum cant deficiency (excluding S&C) = 150mm

Combinations of Horizontal and Vertical Geometry

- 4.139 Combinations of horizontal and vertical curvature should be avoided wherever practicable. However, it is recognised that this can often not be achieved, particularly in constrained urban areas. Where it is necessary to combine horizontal and vertical curvature, it is desirable for vertical curvature to be limited to areas of circular horizontal curves, rather than transition curves. If this cannot be achieved, the magnitude of vertical curvature in combination with a transition curve should normally be limited to that specified in item 4.123.

- 4.140 Consideration must be given to the practicality of constructing areas of combined horizontal and vertical curvature. As a general 'rule-of-thumb' it is desirable for the product of the horizontal and vertical radius (in m) to be equal to or greater than 25000. Where combinations of horizontal and vertical radius (in m) are less than 25000, acceptance will be required from the Authority.
- 4.141 Consideration must also be given to the impact of combining horizontal curvature with longitudinal gradients as this will result in the introduction of design twist, limiting values for which are specified below. In addition, the rolling resistance associated with the CVL Rolling Stock negotiating the horizontal curvature is likely to result in the vehicle not being able to negotiate a coexistent gradient equal to the absolute maximum specified value for the vehicle. This gradient will need to be reduced or 'compensated'.
- 4.142 GRADIENT COMPENSATION [TO BE INFORMED BY BIDDER SOLUTION]

Phasing of Alignment Elements

- 4.143 Design Horizontal and vertical alignment elements should generally be phased such that short lengths of track with constant horizontal and vertical curvature are avoided, due to potential construction problems and the impact on ride quality. An exception is when the proposed horizontal or vertical radii are so large that construction and ride quality issues will be insignificant.

Twist

- 4.144 Design twist is defined as 'the change in cross level along a track measured over the axle and bogie spacing of the CVL Rolling Stock to be procured by the ODP for the extended South Wales Metro network.
- Slab Track Desirable maximum design twist (slab track) = 1 in 500
 - Slab Track Absolute maximum design twist (slab track) = 1 in 400
 - Ballasted Track Absolute maximum design twist (ballasted track) = 1 in 400

Visibility

Safe Stopping Distance (SSD)

- 4.145 [TO BE INFORMED BY BIDDER SOLUTION]

Clearances

- 4.146 FURTHER DETAILS TO BE DEVELOPED BASED ON BIDDERS SOLUTION BUT WILL INCLUDE THE FOLLOWING:
- Clearances between DKEs
 - Clearances between tram DKEs
 - Clearances to platform faces

DKE

4.147 FURTHER DETAILS TO BE DEVELOPED BASED ON BIDDERS SOLUTION BUT WILL INCLUDE THE FOLLOWING:

- The effect of track tolerances on the gauge and DKE.
- Clearance to structures
- Clearance to trackside equipment
- Interface with platform edges.

5. Operational Telecommunications System (1.05)

Backbone Transmission (BTN) System

General Requirements

- 5.1 A modern fault tolerant high bandwidth scalable BTN is required for supporting the communication requirements of the business-critical systems employed along the CVL alignment.
- 5.2 The BTN must meet the business needs in terms of reliability, availability, maintainability, and extendibility
- 5.3 Where legacy systems are to be reemployed, the ODP must clearly demonstrate the methods and processes and investment strategy for providing the necessary level of service and assurance throughout the concession period including any handback criteria.
- 5.4 The ODP shall perform all necessary updates of hardware, software and firmware in line with the system integrator or OEM / support providers recommendations; and
- 5.5 The ODP will develop and implement 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.
- 5.6 The following existing assets are to be renewed as part of the ODP's CVL Transformation of the Telecoms Systems:
 - Those that are obsolete or may be expected to become obsolete during the Transformation Stage; and
 - Those are expected to become life expired during the Transformation.

CCTV

- 5.7 [TO BE INFORMED BY BIDDER SOLUTION]

Station Lifts

- 5.8 [TO BE INFORMED BY BIDDER SOLUTION]

Station Uninterruptible Power Supply (UPS)

- 5.9 [TO BE INFORMED BY BIDDER SOLUTION]

Traction Power and Overhead Line Equipment

- 5.10 [TO BE INFORMED BY BIDDER SOLUTION]

Cabling, Containment and Ducting

5.11 [TO BE INFORMED BY BIDDER SOLUTION]

Operational Data Network

5.12 [TO BE INFORMED BY BIDDER SOLUTION]

Public Address (PA)

5.13 [TO BE INFORMED BY BIDDER SOLUTION]

Emergency Help Point (EHP)

5.14 [TO BE INFORMED BY BIDDER SOLUTION]

Passenger Information Display (PID)

5.15 New PIDs as a minimum will provide a 3 line display allowing next train information, following train information, disruption information and the time to be shown.

5.16 [TO BE INFORMED BY BIDDER SOLUTION]

Ticket Vending Machines (TVM)

5.17 [TO BE INFORMED BY BIDDER SOLUTION]

Smartcard Validators

5.18 [TO BE INFORMED BY BIDDER SOLUTION]

Station Barriers

5.19 [TO BE INFORMED BY BIDDER SOLUTION]

Network Security

5.20 [TO BE INFORMED BY BIDDER SOLUTION]

Environmental Conditions

General Requirements

5.21 The Works shall include wind speed measurement instruments located and spaced, such that the ODP can monitor, understand and respond to the different wind speeds across the CVL. The measurement instruments are to have data connections to the CVL operational control room so this monitoring and response is real time and is integrated with other control functions.

6. Buildings & Property (1.06)

Stations

General Requirements

- 6.1 All current CVL stations are to remain open unless agreed otherwise by the Authority following provision of a compelling case for closure.
- 6.2 All new stations facilities are to be fully accessible to mobility impaired passengers.
- 6.3 As a minimum, all stations must have facilities at least equivalent to those in place at the end of the current franchise agreement including:
- a) A public address and/or a public information display and/or a Freephone link/emergency help point communication system. Such communication links shall be maintained in working order and shall be used effectively by the ODP's staff to provide next train information, service announcements and in the event of a delay or cancellation, details of the delay or cancellation and any alternative journey arrangements (and any other relevant information);
 - b) Weather proof covered waiting accommodation or other adequate shelter which offers reasonable protection from the weather. Adequate alternative shelter shall be available when such waiting accommodation is temporarily out of use. Seating shall also be provided, where reasonably practicable, in such waiting accommodation and shelter and on station platforms;
 - c) adequate lighting, which shall be switched on throughout the hours of darkness during which Rolling Stock are scheduled to call at the relevant Station (including for a reasonable period of time before and after the first and last scheduled train in order to allow passengers to await the first scheduled train at the Station or depart from the Station following the departure of the last scheduled train).
- 6.4 Each Station must also have information displays and/or signing which provide the following information:
- a) the name, address and telephone number of the customer services manager (or his equivalent) under whose control the Station rests;
 - b) the location of the nearest public telephone or "freephone" if provided (unless such telephone or "freephone" is located within the Station and is adequately signed);
 - c) the telephone number/s and URL of the CVL Control Room and National Rail Enquiries (or successor facility), including the telephone number that provides information on rail services for passengers with special needs;

- d) the telephone number's and URL of an alternative location from which current train running information can be obtained if the public address facility is not working at the Station;
 - e) the telephone number and text number of Traveline, or such other enquiry line as the Authority may accept for this purpose, to facilitate the ability of passengers to transfer easily to other modes of transport;
 - f) wherever appropriate, the location and telephone number of the nearest taxi rank or operator, other public transport services;
 - g) for Stations which are not staffed at all times of the day at which Rolling Stock are scheduled to call, the nearest person authorised to sell tickets for use on the Passenger Services if no tickets can be bought on the Station or CVL Rolling Stock;
 - h) a list of tickets which may be purchased on CVL Rolling Stock calling at that Station at times at which such Station is not staffed (if at all);
 - i) for Stations which have two or more platforms, customer information displays or directional signs indicating the destinations served by trains calling at each platform;
 - j) The location of bicycle storage facilities at the Station;
 - k) arrangements for the purchase of any tickets when they are not available for purchase from the Station. This shall include arrangements for the issue of season tickets, railcards and other facilities relating to Rolling Stock calling at such Station which are not normally available for purchase at that station;
 - l) if no access for mobility impaired customers is provided at the Station, a telephone hotline number for such passengers and/or information as to the nearest station with such access; and
 - m) a map of the locality served by that Station.
- 6.5 The ODP will not reduce the amount of any bicycle storage facilities provided at any Station without the Authority's prior written consent. The ODP will maintain all such bicycle storage facilities to a reasonable standard.
- 6.6 The Authority requires that free Wi-Fi access shall be available for station users. As a minimum, a data rate of 2 Mbps per passenger should be provided and at a rate appropriate to meet reasonable user expectations, even at peak times, and should provide for increasing the data rate as user demands increase. The Authority will only allow non-provision of Wi-Fi at stations on an exceptional basis where the ODP have provided a justifiable rationale with supporting evidence and this has been accepted by the Authority.
- 6.7 New stations are required to meet BTP Safer Station Criteria while upgrade works should meet this criteria wherever possible in regard to the items being upgraded.

Station Categories

- 6.8 TfW have defined 4 types of stations by which the Authority's Engineering Design Standards will be set:
- **Hub** (Cardiff Central & Cardiff Queen Street)
 - **Interchange** (stations where people change between either rail services, rail and bus at public transport interchanges or where rail services terminate e.g. Caerphilly, Cardiff Bay, Heads of Valleys, Radyr, Pontypridd etc.)
 - **Standard** (stations not fitting into the categories above that typically have a high footfall greater than 100,000 and are likely to be in an urban environment e.g. Cathays, Taffs Well, Treforest etc.)
 - **Standard (low use)** (stations not fitting into the categories above that typically have a low footfall less than 100,000 and are likely to be in a rural environment e.g. Gilfach Fargoed, Ynyswen etc.)

New Station Requirements

- 6.9 The following are the Engineering Design Standards for new Stations in addition to those already detailed under General Requirements in Section 6 and shall also be considered to be the desirable requirements for Station refurbishments at existing stations:

Hub

- 6.10 THE STATION DESIGN WILL BE IN ACCORDANCE WITH THE [TFW SOUTH WALES METRO PLACEMAKING STUDY]. TYPE OF INFORMATION TO BE COVERED FOR ALL STATION CATEGORIES:
- Station signs (Size, frequency, position from ends on platform, font etc.)
 - Information boards (Route Maps / Timetables / Local Information Boards)
 - Waiting Rooms and Shelters
 - Seating
 - Glazing hallmark
 - Lighting
 - Commercial advertising
 - Bins
 - Cycle Racks
 - Platform numbering (should there be consistency across CVL where possible e.g. Platform No. 1 towards Cardiff and No. 2 towards the Heads of the Valleys etc.)

- security considerations (BTP/ Transport Security & Contingencies Directorate (TRANSEC))

Interchange

- 6.11 THE STATION DESIGN WILL BE IN ACCORDANCE WITH THE [TFW SOUTH WALES METRO PLACEMAKING STUDY] AND BRANDING GUIDELINES

Standard

- 6.12 THE STATION DESIGN WILL BE IN ACCORDANCE WITH THE [TFW SOUTH WALES METRO PLACEMAKING STUDY] AND BRANDING GUIDELINES

Standard (low use)

- 6.13 THE STATION DESIGN WILL BE IN ACCORDANCE WITH THE [TFW SOUTH WALES METRO PLACEMAKING STUDY] AND BRANDING GUIDELINES

Branding

- 6.14 THE BRANDING WILL BE IN ACCORDANCE WITH AUTHORITY'S BRANDING GUIDELINES

Toilets

- 6.15 Toilets are required such that access toilets at stations to ensure that passengers on any rail service are never any more than 20 minutes away from a toilet. This should be measured from the time the passenger first boards a train to when they can next access a toilet, assuming the train runs to schedule.
- 6.16 If toilets are not provided on the CVL Rolling Stock then the toilets should be open throughout [Operational Hours].

Ticketing & Revenue Protection

TO BE INFORMED BY BIDDER SOLUTION BUT EXPECTED TO INCLUDE:

- TVM requirements (e.g. in-built facial recognition. multi-lingual machines etc.)
- Smart Card requirements
- Validators (on or off vehicle, multi-modal or CVL only?)
- [Will CVL times be integrated into National Rail screens at Cardiff Central or on separate screens? Integration of information needs to be considered.]
- Through Ticketing

Communications

- 6.17 Emergency help points should be in a prominent and consistent position on the station platform to enable these to be found by passengers.
- 6.18 New CCTV cameras on stations shall enable the Control Room to monitor the Service Pattern and the safety of passengers in relation to their journey across the CVL station environment including the facility to zoom.
- 6.19 For new stations a CCTV camera should provide coverage of the emergency help point when the button is pressed by a passenger.
- 6.20 TO BE FURTHER INFORMED BY BIDDERS SOLUTION

Lighting

- 6.21 All stations shall be illuminated throughout the hours of darkness during [Operational Hours].
- 6.22 TO BE FURTHER INFORMED BY BIDDERS SOLUTION BUT EXPECTED TO INCLUDE:
 - LED requirements
 - Photometric control
 - Minimum lighting requirements (platform edge, shelter, TVM, EHP etc.)

CCTV

- 6.23 CCTV shall be provided at all stations, buildings and level crossings along the CVL route by the end of Transformation.
- 6.24 The Control Room shall have a user configurable overview screen that will provide images from the CVL CCTV cameras for routine operations and incident management.
- 6.25 An incident suite shall be included at the back of the Control Room where senior managers can view the operations floor without causing disturbance and plan incident response strategies.
- 6.26 CCTV provision shall be consistent with the rail industry best practice, Railway Safety and Standards Board (RSSB) / British Transport Police (BTP) guidelines and the BS EN 62676 series of standards.
- 6.27 The ODP shall provide a Video Surveillance System (VSS) to provide surveillance and recording off CCTV images.
- 6.28 The VSS system(s) shall be easily controlled and monitored by the Control Room operator(s).
- 6.29 All CCTV images and recordings should be available to view by authorised personnel within the Control Room. Attention is drawn to the Data Protection Act 1998 (DPA).

- 6.30 New CCTV housings, poles brackets should be in keeping with the station design.
- 6.31 The environmental conditions under which equipment will be expected to operate within shall be considered and environmental housings affording appropriate levels of ingress protection shall be provided.
- 6.32 CCTV recordings should be stored for a minimum 30 days and suitable for prosecution purposes.
- 6.33 VSS and CCTV system(s) shall as a minimum benefit from system security measures described in EN 62676-1-1:2014 Video surveillance systems for use in security applications - Part 1-1: System requirements - General.
- 6.34 CCTV shall interface with help points, security systems and fire systems as required to provide necessary system security.

Station Lifts

- 6.35 FURTHER DETAILS TO BE DEVELOPED BASED ON BIDDERS SOLUTION BUT WILL INCLUDE THE FOLLOWING:
 - Design Life
 - Warranty
 - Machine Room Equipment
 - Lift Shaft Equipment
 - Lift Car/Equipment
 - Landing Entrance Equipment
 - Electrical Works

Platforms

General

- 6.36 TO BE FURTHER INFORMED BY BIDDERS SOLUTION

Accessibility

- 6.37 Platforms will enable the CVL rolling stock to meet RVAR/PRM requirements
- 6.38 There shall be a suitable fully accessible means of access between adjacent platforms at all Hubs and Interchanges.
- 6.39 There shall be a DDA compliant means of access between adjacent platforms for all new or modified stations.
- 6.40 At new and refurbished stations, measures shall be built into the design of the station to facilitate the train driver in stopping the CVL Rolling Stock in a

position such that the doors closest to the on-board wheelchair spaces are accessible to those with a mobility impairment. The location that such a passenger should wait to gain access to the doors intended for use by the mobility impaired shall also be clearly marked on the platform, unless all doors on the vehicle provide access to wheelchair accessible spaces (e.g. a colour contrasting engraved tactile paving symbol).

Platform Length

- 6.41 All platforms on the CVL network are to be long enough to accommodate Rolling Stock operating in multiple (2 or more CVL Rolling Stock units) unless otherwise accepted by the Authority (Derogations may be accepted at Standard (low use) Stations where this requirement does not offer value for money and appropriate safety systems are in operation).
- 6.42 All platforms are to be fully accessible to mobility impaired users with level boarding and compliant stepping distances for the CVL Rolling Stock.

Platform Height

- 6.43 Platforms Heights from top of rail to platform shall be:
 - Desirable maximum height 915mm
 - Absolute maximum height of 1150mm
- 6.44 Level Boarding shall be provided for each of the Station Categories as follows:
Hub

Hub

- 6.45 Level Boarding Mandatory

Interchange

- 6.46 Level Boarding Mandatory

Standard / Standard (low use)

- 6.47 Level Boarding Desirable (level boarding is to be provided at a minimum of 50% of the CVL stations within this category with it being provided at the busiest stations based upon current published footfall).
- 6.48 Platform Humps (e.g. Harrington Hump) is an absolute minimum requirement at all stations that do not provide Level Boarding.
- 6.49 Level Boarding shall have a tolerance from the platform to vehicle door threshold of -0mm to +50mm at all loading capacities.
- 6.50 All new and modified platforms edges shall have colour contrasting tactile paving with the tactile design appropriate to the South Wales Metro Phase 2 solution (as defined in Inclusive Mobility <https://www.gov.uk/government/publications/inclusive-mobility>).

- 6.51 Coping stones shall have a white platform edge marking (new copings should have a 50mm minimum width white line preferably i within a shallow recessed groove to assist long term durability of the marking).
- 6.52 The platforms edges are to be laid with a cross fall away from the tracks.

7. Civil Engineering (1.07)

Structures

General

- 7.1 Highway structures shall be in accordance with the Design Manual for Roads & Bridges.
- 7.2 FURTHER DETAILS TO BE DEVELOPED BASED ON BIDDERS SOLUTION BUT WILL INCLUDE THE FOLLOWING:
- Materials and Workmanship Specification
 - Design Life
 - Demolition

Highways

General

- 7.3 Bidders are to work to the standards required by the Local Highway Authority affected by the CVL transformation works.
- 7.4 No public highways, public rights of way or privately owned accesses shall be closed either permanently or temporarily without having been approved by the Authority and having received the appropriate consent and approval (e.g. Traffic Regulation Order, Transport & Works Act Order etc.).
- 7.5 The Contractor will be responsible for agreeing and implementing detailed traffic management proposals with the Local Highway Authority, obtaining all permanent and temporary Traffic Regulation Order and for issuing all relevant notices in accordance with the NRSWA Act 1991 and Traffic Management Act 2004.
- 7.6 The Works shall be in accordance with the Local Highway Authority's standard details for highway works.
- 7.7 FURTHER DETAILS TO BE DEVELOPED BASED ON BIDDERS SOLUTION

Design Life

- 7.8 Pavement design shall be in accordance with HD 24/06 Traffic Assessment (DMRB Volume 7) for a minimum design life of 40 years.

Site Clearance

- 7.9 The Contractor will be responsible for the site clearance of 3rd party assets and apparatus affected by the Works.
- 7.10 All existing non-prescribed signage within the public highway will be retained and where required to be relocated by the Works, will be repositioned as

close to its existing location as possible on an appropriate piece of street furniture or new pole.

- 7.11 Any items that are earmarked for re-use in a new location need the prior acceptance of the Authority or Local Highway Authority as appropriate to confirm that they are in a suitable condition. If such items are damaged during relocation or storage then the Contractor will replace these items with new items to the same specification.

Geometry

- 7.12 Highway alignments will be designed generally in accordance with the Design Manual for Roads and Bridges Volume 6: Geometry, and to the requirements of the Local Highway Authority. Where agreed in writing with both the Authority and Local Highway Authority, DMRB standards can be replaced with more appropriate guidance documents such as Manual for Streets 2, Traffic Advisory Notes (TA), Local Transport Notes (LTN), Interim Advice Notes (IAN) etc.
- 7.13 Where physical constraints mean that these standards cannot be achieved, the Contractor will be responsible for gaining approval from the Authority Local Highway Authority to any Relaxations or Departures from Standard.
- 7.14 TO BE FURTHER INFORMED BY BIDDER SOLUTION

Highway Pavements

- 7.15 New flexible bituminous pavements will be designed in accordance with HD 26/06: Pavement Design (DMRB Volume 7).
- 7.16 Carriageways and will have a minimum surface course thickness of 40mm unless otherwise agreed with the Local Highway Authority.
- 7.17 Pavement foundations will be designed in accordance with IAN 73/06 Rev 1, Design Guidance for Road Pavement Foundations.
- 7.18 Where there is a change of surface or upstand kerb over which the CVL Rolling Stock travels then the ODP will carry out an assessment of the interfaces allowing for maximum load and wear conditions (of the track and CVL Rolling Stock tyres) and alignment to provide sufficient clearance to the CVL Rolling Stock.
- 7.19 TO BE FURTHER INFORMED BY BIDDER SOLUTION

Footways

- 7.20 Bituminous construction will be in accordance with HD 39/01, Footway Design (DMRB Volume 7).
- 7.21 Block, sett and flag paved areas will be designed and constructed in accordance with the relevant parts of BS 7533. Construction will be rigid unless otherwise accepted by the Authority and Local Highway Authority as appropriate. The

surface material shall be laid to avoid colour banding unless this forms part of the urban design palette approved by the Local Highway Authority.

- 7.22 Desirable crossfall for pedestrian areas and footways will be 2.5% and with a minimum longitudinal gradient of 0.5%. Paving levels will have regular even falls and no sudden change in gradient. In constrained areas where track geometry requirements and/or tie-ins to existing thresholds do not permit these gradients, pavements will be designed to be free draining with no ponding or excessive run-off.
- 7.23 Footways and paved areas which are susceptible to overrun by service or delivery vehicles will be designed for occasional overrun by commercial vehicles in areas agreed by the Local Highway Authority and in accordance with the relevant sections of BS7533. Where the footway is designed for occasional overrun any associated chamber covers within this area will also be designed for occasional vehicle overrun.
- 7.24 All footways/hard landscaping areas will tie into existing levels at the site boundary and fall away from building frontages unless otherwise accepted by the Authority and Local Highway Authority as appropriate.
- 7.25 Where existing surface levels are altered to incorporate the Works existing surface materials will be retained and re-laid to the same construction and level of workmanship as existing. Any pavers damaged during this process will need to be replaced by new pavers matching the same specification.
- 7.26 The Light Reflectance Value (LRV) of paving material / finishes and furniture should be guided by BS8300 and in accordance with Building Regulations Approved Document M 2015 to give a greater than 30 points between these two elements. The Work will provide a minimum of 30 points contrast between any tactile warning paving and adjacent surfaces, step risers, nosing details etc. The contrast between adjacent surfaces shall also consider the change in colour of the surfaces in all weather conditions (e.g. wet, dry and sunny etc.) which could make the contrast become less prominent.
- 7.27 Surfaces finishes will offer a level of slip resistance to meet BSEN 1338 that provides a firm foothold and good wheel grip under normal conditions of use. Adjacent floor surfaces should have similar levels of slip resistance. Pendulum testing values are to be obtained in line with BS7976-2 and surface micro-roughness measurement in line with BS 1134-1.
- 7.28 Surface finish slip resistance values will be sufficient to mitigate against slips when the surface may become wet, snow covered, especially on sloping surfaces and ramps and will be appropriate for the proposed surface gradients.
- 7.29 All vehicular accesses from the carriageway will have dropped kerbs with a maximum upstand of 25mm and pedestrian crossings will have dropped kerbs with a maximum upstand of 6mm. No ponding of water will be permitted to occur at pedestrian crossing locations, and gullies / surface channels will not be

positioned within the crossing width as defined by the extent of the dropped kerbs without the approval of the Local Highway Authority.

- 7.30 Footways will generally be a minimum of 3m wide and tie-in to existing building entrance thresholds without the use of stepped or ramped sections. Where footways are provided on both sides of the carriageway these will be of similar width where practicable. In some constrained locations, the minimum 3m footway width may not be achievable. All Footway widths will be subject to the acceptance of the Local Highway Authority.
- 7.31 [TO BE INFORMED BY BIDDER SOLUTION]

Cycle Routes

- 7.32 Cycle infrastructure will be designed in accordance with Local Transport Note 2/08.
- 7.33 No cyclists to be directed to ride across the CVL rails at an angle, to the rail, of 60 degrees or less. Alternative cycle routes should be provided such that cyclist are not adversely affected by the Works.
- 7.34 TO BE FURTHER INFORMED BY BIDDER SOLUTION

Highway Signage & Road Markings

- 7.35 Signs and road marking on the public highway will be in accordance with the Traffic Signs Regulations and General Directions 2016 (TSRGD).
- 7.36 Where the Works require the approval of the DfT to nonprescribed signs, the Contractor will agree the proposals with the Local Highway Authority and undertake all necessary discussions with the DfT to obtain agreement in principle to the non-prescribed signs. The Contractor will make all necessary information available for the Local Highway Authority to make the non-prescribed sign application.
- 7.37 Signs mounted over footways and cycleways will have a minimum of 2.3 metres clearance to the underside of the sign. The siting of new traffic signs and the requirement for a contrasting band for visually impaired pedestrians shall be agreed with the Local Highway Authority.
- 7.38 Sign Posts will comply with BS 729.
- 7.39 TO BE FURTHER INFORMED BY BIDDER SOLUTION

Ducting Provision

- 7.40 All ducting in the Public Highway will be in accordance with Specification for Highways Works.
- 7.41 Ducting depth and surround in the Public Highway will be in accordance with Volume I NJUG Guidelines on the Positioning and Colour Coding of underground utilities' Apparatus. Each end of the ducting will be connected to a drawpit / chamber. All ducts will be provided with a draw rope tied to a fixing

point within each chamber. Drawpits will be located outside of the highway carriageway and other trafficked areas.

7.42 TO BE FURTHER INFORMED BY BIDDER SOLUTION

Street Furniture

7.43 The ODP is responsible for agreements with third parties in regard to the removal and relocation of any Street Furniture affected by the Works and any associated costs.

7.44 All street furniture greater than 1.5m high and accessible to the public will have a colour contrasting band for visually impaired pedestrians to meet Local Highway Authority requirements.

7.45 TO BE FURTHER INFORMED BY BIDDER SOLUTION BUT EXPECTED TO INCLUDE

- Bollards
- Guard Rails
- Bins
- Seats
- Boundary Treatments
- Cabinets

Landscape

7.46 Landscaping will be in accordance with Planning Application conditions.

7.47 Tree pits and surfacing will be located flush within the streetscape surface to avoid trip hazards and to meet requirements of Equality Act and Building Regulations Part M for general accessibility and slot size opening requirements to prevent trip hazards or wheel, walking stick trap.

7.48 TO BE FURTHER INFORMED BY BIDDER SOLUTION

Utilities

Public Utilities

7.49 The ODP is responsible for the diversion of statutory undertakers plant and apparatus considered to be affected by the CVL Works.

7.50 The ODP will be responsible for taking any necessary measures to ensure that no damage occurs to Statutory Undertakers Apparatus during the construction and operation of the works.

7.51 Bidders are responsible for maintaining a database of utilities crossing or affected by the CVL Assets on behalf of the Authority.

7.52 TO BE FURTHER INFORMED BY BIDDER SOLUTION

Low Voltage Electrical Supplies

7.53 DETAILS TO BE DEVELOPED BASED ON BIDDERS SOLUTION BUT WILL INCLUDE THE FOLLOWING:

- Stations and associated ancillary equipment
- Station Lifts
- Overhead Line Equipment
- Cabinets, Feeder Pillars and Equipment
- LV Cable Ducting and Access Chambers
- Trenching and Ducting
- Low Voltage Cabling Drainage

Drainage

Design Return Periods

7.54 [TO BE INFORMED BY BIDDER SOLUTION]

Sustainable Drainage System Design

7.55 [TO BE INFORMED BY BIDDER SOLUTION]

Design Life

7.56 [TO BE INFORMED BY BIDDER SOLUTION]

Connections to Existing Drains

7.57 [TO BE INFORMED BY BIDDER SOLUTION]

Drainage Chambers & Surface Channels

7.58 [TO BE INFORMED BY BIDDER SOLUTION]

Highway Drainage

7.59 Highway drainage will meet the requirements of the Local Highway Authority.

7.60 [TO BE FURTHER INFORMED BY BIDDER SOLUTION]

Oil Interceptor

7.61 [TO BE INFORMED BY BIDDER SOLUTION] (IF REQUIRED)

Lighting

General

7.62 [TO BE INFORMED BY BIDDER SOLUTION]

Station Lighting

7.63 [TO BE INFORMED BY BIDDER SOLUTION]

Street Lighting

7.64 Street lighting will meet the requirements of the Local Highway Authority.

7.65 DETAILS TO BE DEVELOPED BASED ON BIDDERS SOLUTION BUT WILL INCLUDE THE FOLLOWING:

- Electricity Supply Requirements
- Photo Electronic control unit for lighting
- Street Lighting Control Boxes

8. Depot & Stabling

Heavy Maintenance Rolling Stock Depot

General Requirements

- 8.1 The facility will be secure.
- 8.2 Walkways are to be provided throughout the site with appropriate lighting and surfacing.
- 8.3 The facility will be designed and operated to minimise the environmental impact on neighbours, particularly during the hours of darkness.

Operational Flow

- 8.4 On entry to the depot from the mainline (tracks used for regular CVL passenger services), CVL Rolling Stock shall be able to pass through the sanding and wash facilities before proceeding to the stabling sidings without a reversing move.
- 8.5 The depot shall have a bypass road to allow CVL Rolling Stock leaving service to pass the maintenance building and the sanding and wash facilities should there be an issue with the sand or wash, or should there be a queue of vehicles. The queue of vehicles waiting to enter the depot facilities shall not foul the mainline.
- 8.6 The reception track on to the depot shall allow for standage of at least one CVL Rolling Stock vehicle awaiting sanding and washing.
- 8.7 It is desirable for stabling sidings shall be double ended to limit the possibility of trapping CVL Rolling Stock.
- 8.8 The depot maintenance workshop shall be accessible directly from the main line or from the majority of sidings without the need for reverse moves.
- 8.9 Entry and exit to the depot site for CVL Rolling Stock finishing or starting service shall be possible without a reversing move on the mainline .
- 8.10 Exit from the depot shall be possible to both directions on the mainline without having to travel a significant distance in the opposite direction to the intended destination.
- 8.11 The workshop and depot layout shall ensure that no CVL Rolling Stock vehicles become trapped by other CVL Rolling Stock vehicles in the workshop following completion of maintenance.
- 8.12 There shall be more than one entry/exit point from the depot to the mainline so CVL Rolling Stock vehicles can leave for service in the event of a failed connection onto the main line.

Road Vehicle Requirements

- 8.13 Road access shall be provided to the workshop building and stores along with access to the sand and wash plants.
- 8.14 Parking shall be provided on site for the total number of staff required to operate at the site at any one time.
- 8.15 CVL Rolling Stock shall be able to be delivered to site via low loader with suitable facilities for loading and unloading. The facility should allow the safe turning of road hauliers vehicles and consider how the vehicles will be delivered (i.e. not invalidating any manufacturer warranties in terms of the ability to sub-divide and re-connect vehicles at the articulation).

Substation

- 8.16 A suitable location for a depot substation shall be provided on site with road access that can support all CVL Rolling Stock maintenance and stabling requirements.
- 8.17 The depot substation shall have an Uninterruptable Power Supply (UPS) of a minimum of 2 hours to allow all depot activities to continue in the event of a power failure.

Stabling

General Requirements

- 8.18 The facility will be secure.
- 8.19 Walkways are to be provided throughout the site with appropriate lighting and surfacing.
- 8.20 The facility will be designed and operated to minimise the environmental impact on neighbours, particularly during the hours of darkness.

Infrastructure Maintenance Depot

General Requirements

- 8.21 The facility will be secure.
- 8.22 Walkways are to be provided throughout the site with appropriate lighting and surfacing.
- 8.23 The facility will be designed and operated to minimise the environmental impact on neighbours, particularly during the hours of darkness.

Road Vehicle Requirements

- 8.24 There shall be suitable HGV road access for all materials that need to be delivered by road.

Taffs Well

Passive Provision

- 8.25 Facilities at Taffs Well shall be designed to allow for a possible overbuild park & ride development of up to two storeys in the future and suitable access ramps on to the existing public highway.