Rail Baltica

RBDG-MAN-030-0106_BIM_EIR

Design guidelines

Building Information Management (BIM) Employer's Information Requirements

RBDG-MAN-030-0106

2022.11.28

Co-financed by the European Union
Connecting Europe Facility

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1. Introduction

- All the details and specifications about the BIM strategy, manuals and standards is covered in the "BIM Manual" document. "BIM Manual" and its supporting documents together with the Technical Specification must be used to understand and evaluate the BIM requirements and deliverables for this project. After the contract award the BEP prepared by the Consultant shall include all the details for the delivery, management and quality control processes of BIM models, data, documents and drawings prepared. Detailed requirements for BEP are described later in this document.

- This specification serves as a minimum requirements and basic information which can be a subject of change.

- It is mandatory that Consultants follow the BIM coordination and data collection principles laid down in the following standards listed in "2.2 Standards".

- Common Data Environment (CDE) to be used as specified by these standards. RB Rail will in due time implement a CDE for delivery of data from the Consultant's deliveries.

- These standards require delivery of 3D coordinated information models (federated models), related documentation and attribute data related to the objects the models describe. It is the intention of RB Rail and national implementing bodies to eventually require these three aspects as deliverables for the project.

- Consultants shall model in accordance with these requirements thus not only deliver 3D models but the supporting Functional and Specification attributes, data and documents for each component.

- The Consultant shall evaluate all the provided templates and fulfil the minimum requirements of each template. The Consultant shall propose improvements and additions to the provided templates if that brings additional clarification for the topic. RB Rail and Client shall approve these proposed additions.

2. References

2.1. Standards, norms and guidelines

The main standards relating to the Building Information Management aspects of the project and applicable in the European Union are listed below.

2.2. Standards

The mandatory technical standards are:

- ISO 19650-1:2018 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) -- Information management using building information modelling -- Part 1: Concepts and principles.
- ISO 19650-2:2018 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) -- Information management using building information modelling -- Part 2: Delivery phase of the assets
- PAS 1192-2:2013 Specification for information management for the capital/delivery phase of construction projects using building information modelling.
- PAS 1192-3:2014 Specification for information management for the operational phase of assets using building information modelling.
- PAS 1192-4:2014 Collaborative production of information.
- PAS 1192-5:2015 Specification for security-minded building information modelling, digital built environments and smart asset management.
- LVS 1052:2018 Building Information Modelling (BIM) terminology
- EVS 928:2016 Building Information Modelling (BIM) terminology
- LVS EN ISO 16739:2017 Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries (ISO 16739:2013)
- LVS EN ISO 29481-1:2018 Building information models - Information delivery manual - Part 1: Methodology and format (ISO 29481-1:2016)
- LVS EN ISO 29481-2:2017 Building information models - Information delivery manual - Part 2: Interaction framework (ISO 29481-2:2012)
- LVS EN ISO 12006-3:2017 Building construction - Organization of information about construction works - Part 3: Framework for object-oriented information (ISO 12006-3:2007)
- ISO/TS 12911:2012 Framework for building information modelling (BIM) guidance
- ISO 12006-2:2015 Building construction -- Organization of information about construction works -- Part 2: Framework for classification

- ISO 15686-4:2014 Building Construction -- Service Life Planning -- Part 4: Service Life Planning using Building Information Modelling

2.3. Supplementary Data

RBDG-MAN-033-0102_ BIMManual

RBDG-TPL-013-0102_BEPTemplate

RBDG-TPL-014-0102_TIDPTemplate

RBDG-TPL-015-0102_MIDPTemplate

RBGL-DMT-PRC-Z-00001 Document Numbering and File Naming Procedure

RBGL-DMT-LST-Z-00001 Document Numbering and Master Coding

RBDG-TPL-017-0102_QEXTemplate

RBDG-TPL-018-0102_QTOTemplate

RBDG-TPL-019-0103_BIM_Objects_Attributes_Matrix

RBDG-TPL-020-0101_BIMDeliveryReportTemplate

RBDG-TPL-021-0101_DataDropTemplate

RBDG-TPL-022-0101_QaQcBimCadTemplate

RBDG-TPL-023-0101_ClashCheckReportTemplate

RBDG-MAN-034-0101_CADStandards

3. Specific terminology and abbreviations

3.1. BIM

Building Information Management or Building Information Modelling, depending on the context.

3.2. BIM Execution Plan (BEP)

A formal document that defines how the project will be executed, monitored and controlled regarding BIM. A BEP is developed at project initiation to provide important information/data management plans and assignment of roles and responsibilities for model creation and data integration throughout the project.

3.3. CAD

Computer-Aided Design

3.4. Common Data Environment (CDE)

It is a central repository where construction project information is housed. The contents of the CDE are not limited to assets created in a "BIM environment" and it will therefore include data, documentation, graphical model and non-graphical assets.

3.5. Consultant

Service provider awarded with an Agreement to conduct the Services specified in the Technical Specification and Agreement and which has contractually binding responsibility against Rail Baltica Project Owner (Client) to implement Design and/or Construction of any part/project of Rail Baltica Global Project.

3.6. Level Of Definition (LOD)

Consists of Level of Geometric Detail (LoG) and Level of Information (LoI)

3.7. Level of Geometric Detail (LoG)

The description of graphical content of models at each of the stages

3.8. Level of Information (LoI)

The description of non-graphical content of models at each of the stages

3.9. 4D BIM

Construction sequencing – a dimension of information to a project information model in the form of scheduling data. This data is added to components which will build in detail as the project progresses. This information can be used to obtain accurate program information and visualisations showing how your project will develop sequentially.

3.10. 5D BIM

Cost sequencing – a dimension of information to a project information model in the form of costs.

3.11. 6D BIM

Project lifecycle information – all the information about the as-built assets that is used for maintenance and operations of the infrastructure and buildings during the whole lifecycle of it.

3.12. As-built information

A revised set of BIM models, data, information and drawings submitted by a Consultant upon completion of a project or a particular job. They reflect all changes made in the specifications, BIM models, data, information and working drawings during the construction process, and show the exact, quantities, attributes, dimensions, geometry, and location of all elements as required by the legislation and Contracting Authority (Client). Any element of a model is a field verified representation in terms of size, shape, location, quantity, and orientation after its final installation.

The Record Modelling (As-Built) is a mandatory Use Case for the Construction Stage. The Consultant during the Design Stage will develop a model that can be used / updated as a base for the As-Built models. The As-Built documentation will be also stored and used during the Operation stage.

The detailed description of As-Built information can be found in the “BIM Manual”.

4. BIM use cases

BIM information (both graphical models and non-graphical data) is initially created by the Supply Chain during the Design phases of the project. This information will be consumed by later functions where that data can input into their work processes. These "Use Cases" are summarized in the list below against each function. Some Use Cases are mandatory for any Rail Baltica project and the rest are optional. All the BIM Use Cases to be applied in each project shall be defined in the BIM Execution Plan.

The following table shows the mandatory and optional Use Cases for each design stage.

Mandatory (M) / Optional (O)	Site investigation (as input data)	Design Authoring (Collaboration)	Engineering Analysis	2D Drawing & Schedule Generation	Interference Management (Clash Checks)	Interactive Design Reviews	Structural Detailing	Quality Control	Visualisations	Phasing and Construction Sequencing Simulations (4D)	Field Progress Tracking	Quantity Take-Off (5D)	Vendor Equipment Submittals	Augmented and Virtual Reality	Digital Fabrication	As-Built documentation	Operations & Maintenance Information
Site Investigations (if required as contract deliverable)	M	M	-	M	O	M	-	M	O	-	O	-	-	O	-	M	-
Value Engineering	M	M	M	M	O	M	O	O	M	O	-	O	O	O	-	-	-
Master Design	M	M	M	M	M	M	M	M	M	M	-	M	O	O	-	-	-
Detailed Technical Design	M	M	M	M	M	M	M	M	O**	M	-	M	M*	O	-	-	O
Design for Administrative Approvals****	O	M	M	M	M	-	M	O	O	-	-	O	-	-	-	-	-
Construction	M	M	O***	M	M	M	M	M	O	M	M	M	M	O	O	-	-
As-Built	O	M	-	M	-	-	M	M	O	-	-	M	M	O	-	M	M
Operation	-	-	O	-	-	-	-	M	O	-	-	M	M	O	-	M	M

* - if the vendor can be specified in the project's documentation and alternatives are allowed

** - mandatory for heritage objects

*** - mandatory if project solutions are changed.

**** - mandatory if required by local legislation and law

The detailed description of all BIM use cases can be found in the "BIM Manual's' chapter 3.3.

5. Design Deliverables

The Project deliverables for each project stage and the descriptions of all project stages are defined in the respective Technical Specification and contract documentation of each design project. Each project stage may require interim deliverables and reports.

The main stages of each design project are:

- Site investigation *(depending on the requirements in Technical Specification)*
- Value Engineering *(depending on the requirements in Technical Specification)*
- Master Design
- Detailed Technical Design

If there are any country specific stages or deliverables requested by the local authorities, it is the Consultant's responsibility to fulfil them.

Contractor in the inception report shall provide a full BEP with described deliverables in it, including updated proposed BIM Object attribute matrix, and this must be done according to the requirements set in Design Guidelines.

The required sub-stage deliverables and frequency is described in the "BIM Manual's" chapter 8.5.2 "Sub-stages number and frequency" if not defined differently in Technical Specification or contract documents.

Chainage definitions for each design section shall be defined and agreed during the inception phase of the project if not otherwise described in the Technical Specification or Contract documents. The Contractor shall request the information about the chainage of the project from the Client.

Every design deliverables package shall be delivered together with the BIM Delivery Report Template: **RBDG-TPL-020-0101_BIMDeliveryReportTemplate**

6. Existing survey information

6.1. Geotechnical and geological survey

Geotechnical and geological survey material must be prepared using BIM-based methodology. Prepared information details must align with LOD requirements (Annex 2 and Annex 3). Prepared material must be compiled and submitted before design phase and supplemented during design phase if it will be necessary. Geotechnical investigation results for ever investigation points must be defined and described in 3D coordinated files (latitude, longitude, elevation) with descriptions and technical parameters of the soils as included attributes/layers.

The results of the investigations shall be presented in a form that will allow the use it in BIM models. This requires the data to be sufficient to build a 3D-subsoil model which maintains attribute information in it. The created solid soil blocks shall be able to be exported in formats that are specified in this chapter 7.1. All the results must collaborate with existing terrain model.

All prepared information must be in Open format (and original native format), also approved by local authority (if it requires local legislation). Consultant must demonstrate, in BEP document, how he will manage to deliver required information of survey data. Consultant must provide survey method, delivery format and survey origin information.

6.2. Geodetic and Topographical survey

Geodetic and Topographical survey material must be prepared using BIM-based methodology. Prepared information details must align with LOD requirements (Annex 2 and Annex 3). Prepared material must be compiled and submitted during design phase.

Stages and information of prepared material (orthophoto base map, point cloud, topographic plan, terrain model, etc.) formats are in chapter 7.1.

Along with a CAD standard and BIM manual requirements prepared information material must be provided in accordance with local laws and legislation (Lithuania, Latvia, Estonia).

All prepared information must be in Open format and original native format also approved by local authority (if it requires local legislation). Signed and approved topographical plans also must be scanned and delivered to RB RAIL CDE.

All design phases must be prepared based on geodetic and topographical survey. Existing utilities must be showed in topographical plans, depending on project phase the details of existing utilities must fulfill the LOD requirements (see Annex 2). Consultant must demonstrate, in BEP document, how he will manage to deliver required information of survey data. Consultant must provide survey method, delivery format and survey origin information.

7. Model types, content and file formats

The following table contains the provisional files formats for the deliverables.

All of the BIM models, data (including simulation and calculations models and data), documents, CAD files and drawings produced using the authoring tool/software, its plugins or addons shall be submitted to Client's CDE in their original native format and latest version containing all of the native elements, e.g. alignments, corridors, profiles, surfaces, blocks, components and all other attributes and proxies. An exported, attribute-less and proxy-less copy of CAD files also shall be delivered.

The complete and exact list of model types and submitted file formats shall be described and approved by the Client in the BEP.

7.1. Requirements for Existing conditions

Model type	Content	Format
Existing terrain	Based on laser scanning (aerial LIDAR) of existing terrain supplied/combined with detailed topology surveys. Laser scanning (aerial LIDAR) accuracy tolerance: +/- 10 cm Laser scanning accuracy tolerance regarding heritage objects must be agreed separately in BEP Photogrammetry and models created from this data might also be used, but it's accuracy and use cases shall be agreed separately in BEP.	Terrain models: 3D DWG/DGN/ DTM/LandXML Point cloud files: LAS/LAZ/XYZ/ PTS/PTX/E57/
Existing subsurface	Indicative model of existing geological layers based on information registered in geotechnical investigations. Geotechnical investigation results for each borehole shall be defined and described in 3D coordinated files with descriptions and technical parameters of the soils as included attributes/layers The results for the investigations shall be presented in a form that will allow the use of the results in B(uilding) I(nformation) M(odelling) (BIM).	DGN/DTM DWG/DXF/XML IFC2x3 (IFC4)

	This requires the data to be sufficient to build a 3D-subsoil model. It should be possible to build a surface for each defines soil layer. For this to be possible the top and bottom absolute height values must be available. The surface can then be able to be exported as a mesh. In case of soil lenses, those shall be able to be shown as a polygon.	
Existing track	Based on data from archive information (if available), laser scanning and surveying data Laser scanning accuracy tolerance: +/- 2 cm	DWG/DGN/ALG/ Point cloud files: LAS/LAZ/XYZ/ PTS/PTX/E57/
Existing structures which will be renovated or will not undergo any changes (incl. bridges, overpasses, viaducts, platforms, etc.)	Based on existing drawings from archive information, surveys, regulations and documentation. All existing structures which will undergo the renovation, need to achieve the same LOD as the newly designed structures. All existing structures which will not undergo renovation or demolition, but are required as reference structures for the project, need to achieve a basic LOD containing the geometrical and attribute information about the structure. Laser scanning accuracy tolerance: Existing structures which will be renovated: +/- 2 cm Existing structures which will not undergo any changes: +/- 10 cm Photogrammetry and models created from this data might also be used, but it's accuracy and use cases shall be agreed separately in BEP.	IFC2x3 (IFC4)/ DGN/DWG/I.DGN/ Point cloud files: LAS/LAZ/XYZ/ PTS/PTX/E57/
Existing structures (for complete demolishing)	Based on existing drawings from archive information, surveys, regulations and documentation. LOD shall be sufficient enough to calculate demolition quantities and schedules.	IFC2x3 (IFC4)/ DGN/DWG/I.DGN/ Point cloud files:

	Laser scanning accuracy tolerance: +/- 10 cm Photogrammetry and models created from this data might also be used, but it's accuracy and use cases shall be agreed separately in BEP.	LAS/LAZ/XYZ/ PTS/PTX/E57/
Existing utilities	Indicative model of existing utilities, based on information received from utility owners and surveying data (additionally with ground penetration radars in places where using other methods the precise information cannot be obtained) All indicative models of existing utilities shall be adjusted and implemented in 3D coordinates, with additional technical parameters and properties.	DGN/DTM/DWG/IFC

7.2. Requirements for Designed models (Railway and other infrastructure)

Model type	Content	Format
Alignment for tracks	3D alignments for designed tracks	DGN/ALG/ DWG/XML/ASCII
Embankment	3D model of embankment	DGN/DWG/ IFC2x3, (IFC4)
Alignment for roads and paths	3D alignments for designed roads and paths	DGN/ALG DWG/XML/ASCII
Corridor for railway	Corridor for the new track	DGN/DTM DWG/XML/ IFC2x3, (IFC4)
Platforms	Structures and fixtures for platforms at railway stations	IFC2x3, (IFC4)
Corridors for roads and paths	Corridors for designed or relocated roads and paths.	DGN/DTM DWG/XML/ IFC2x3, (IFC4)
Road geometry and equipment	Model containing road geometry and equipment, e.g. curbs, grating, crash barriers	DGN/DTM DWG/XML/ IFC2x3, (IFC4)
Clearance for railway	Clearance profile for railway	DGN/DTM DWG/XML

Clearance for crossing constructions	Clearance profile for crossing roads, paths and fauna passages	DGN/DTM DWG/XML IFC
Groundwater level	Model indicating maximum level of groundwater	DGN/DTM DWG/XML
Structures of over- & underpasses and associated works	Model of over- and underpasses, retaining walls and similar structures	DGN/DWG/ IFC2x3 (IFC4)
Excavations	Model containing excavations and backfill for constructions and structures.	DGN/DTM DWG/XML/ IFC2x3, (IFC4)
Technical installations	Model of e.g. signal control system, lighting masts and M&E.	DGN/DWG/ IFC2x3, (IFC4)
New and Relocated Utilities	As-built model of newly built and relocated utilities	LandInfra InfraGML/ DGN/DTM DWG/XML/ IFC2x3, (IFC4)
Rainwater basins	Model of rainwater basins incl. in- and outlets	DGN/DTM DWG/XML/ IFC2x3, (IFC4)
Drainage	Model of drainage pipes and manholes	LandInfra InfraGML/ DGN/DTM DWG/XML/ IFC2x3, (IFC4)
Spoil areas	Model of spoil areas	DGN/DTM DWG/XML
Terrain model	As-built model of the built terrain surface and objects for verification and clash detection Photogrammetry and models created from this data might also be used, but it's accuracy and use cases shall be agreed separately in BEP.	Terrain models: 3D DWG/DGN/ DTM/LandXML Point cloud files: LAS/LAZ/XYZ/ PTS/PTX/E57/

7.3. Requirements for Designed models (Railway stations)

Model type	Content	Format
Architectural model	Intelligent (with asset and attribute information) and detailed 3D models for the new station buildings, including all non-load bearing structures and other architectural details	IFC2x3, (IFC4)
Structural model	Intelligent (with asset and attribute information) 3D models for the new stations Shall include detailed (see LOD requirements): Foundation structures (incl. detailed reinforced concrete, embedded parts and systems, etc.); All load bearing structures (incl. detailed reinforced concrete and/or steel beams, columns, walls, slabs, roof structures, embedded parts and systems, etc.); etc.	IFC2x3, (IFC4)
Utilities models	Intelligent (with asset and attribute information) and detailed 3D models for the new stations Shall include detailed (see LOD requirements): Electrical, telecommunications, security and IT systems; Fire protection systems; HVAC systems; Water supply and sewerage systems; Plumbing and drainage systems; etc.	IFC2x3, (IFC4)
As-built models	As-built model of newly build structures and utilities	3D DWG/DGN/ DTM/LandXML/ LandInfra InfraGML/ IFC2x3, (IFC4) Point cloud files: LAS/LAZ/XYZ/ PTS/PTX/E57/

7.4. Requirements for Designed infrastructure models (Railway and Road Bridges, viaducts, overpasses, eco-ducts, culverts, etc.)

Model type	Content	Format
Architectural model	Intelligent (with asset and attribute information) and detailed 3D models for the Railway and Road Bridges, viaducts, overpasses, eco-ducts, culverts, etc.	IFC2x3, (IFC4)
Structural model	Intelligent (with asset and attribute information) and detailed 3D models for the Railway and Road Bridges, viaducts, overpasses, eco-ducts, culverts, etc. Shall include detailed (see LOD requirements): Foundation structures (incl. detailed reinforced concrete, embedded parts and systems, etc.); Span and deck structures (incl. detailed reinforced concrete and/or steel beams, columns, walls, slabs, roof structures, deck, embedded parts and systems, etc.); Retainers and railing; etc.	IFC2x3, (IFC4)
Utilities models	Intelligent (with asset and attribute information) and detailed 3D models for the Railway and Road Bridges, viaducts, overpasses, eco-ducts, culverts, etc. Shall include detailed (see LOD requirements): Electrical, telecommunications, security and IT systems; Fire protection systems; Drainage systems; etc.	IFC2x3, (IFC4)
As-built models	As-built model of newly build structures and utilities	3D DWG/DGN/ DTM/LandXML/ LandInfra InfraGML/ IFC2x3, (IFC4) Point cloud files: LAS/LAZ/XYZ/ PTS/PTX/E57/

8. BIM execution plan (BEP)

The complete BEP shall demonstrate the quality assurance and criteria of the Consultant throughout all of the project stages.

The Consultant after the signing of the contract during the mobilization period (in the inception report) shall provide a complete BEP based on the requirements set by the Client or in the "BIM Manual" and its supporting documents. In case there are changes, clarifications or amendments made during the performance of the Contract, it must be represented and updated in BEP. Any deviations or changes in the BEP, if those are recommended or necessary, shall be permitted only after Clients approval.

A template for BEP, TIDP and MIDP shall be used:

- **RBDG-TPL-013-0102_BEPTemplate** document.
- **RBDG-TPL-014-0102_TIDPTemplate** document.
- **RBDG-TPL-015-0102_MIDPTemplate** document.

As a minimum, but not limited to, BEP shall contain following information:

1. Organizational Roles and Staffing: Comprehensive list of involved parties and their responsibilities regarding design scope, BIM design managers and their contact information (email, phone number). The list shall reflect the design division and provide a clear understanding on responsibilities regarding any sub-model and equipment modelling. It is preferred, but not required, that the certified/lead specialist for each discipline has experience in project delivery in BIM. But for each discipline there shall be a person with knowledge and experience in BIM who will be/act as a BIM Manager for the Consultant company and project's discipline. As a minimum requirement, the specialists from all major disciplines (Architectural, Structural and Civil, MEP (HVAC, Electrical, Plumbing), other utilities and networks, Fire protection, Specialty disciplines - Railway, Viaducts/Overpasses) shall be listed.

   The Consultant in tabulation or diagrams/flowcharts must describe the organizational schemes for all discipline specialists and BIM related organizational roles (BIM Managers, BIM Coordinators, BIM technicians, etc.) and areas of responsibilities.

2. Modelling and clash test tolerances.
3. Coordinate system and models' alignment rules and procedures.
4. Model partitioning principles and interfaces.
5. Rules on nomenclature of file names.

6. Collaboration Plan and Quality Control:

- General description of collaboration process format for involved parties
- Quality Control and Collaboration Procedures in tabulation or diagrams/flowcharts which define the responsibility inside the organization and between sub-contractors (cross discipline workflows) for finding and resolving clashes or inconsistencies between the models and providing model quality according to the Contracting Authority's (Client's) requirements
- Model and other information access and exchange procedures.
- Co-location if planned
- Level of Definition detailed standard for trade models and central model at all project stages
- Comprehensive description of technological solutions to be used, including CDE and its folder structure.

7. All Quantity Takeoffs and Extractions, Product/quantity descriptions, product codes, volume/area/quantity calculation methods, measurement units and specifications shall be described in the BEP and agreed with the Client/RB Rail. Due to BIM models use in GIS platform, default settings units in all exported IFC models should be in meters.

8. Updated Objects Attribute Matrix is a part of BEP and must be handed in with suggested attributes for each respective element category in sufficient detail to fulfil BIM use cases for respective stages. Additionally, BEP for construction and as-built stage must be updated with requirements stipulated in BIM requirements for construction, including scanning schedules and exact tolerances.

9. BIM coordination meetings

BIM coordination meetings shall take place at according to the schedule set out in the respective Technical Specification and contract documentation and shall be agreed in the BEP and inception report (requirement, if not agreed separately – at least once a week during the design phase (responsibility of the Consultant to organize these meetings) and at least 2-4 times a month during the construction period (responsibility of the Consultant to organize these meetings)) of the project. The schedule can be changed only with an agreement from the Contracting Authority (Client). BIM specialists representing all of the project's disciplines and Consultants shall participate in these meetings.

Consultant shall ensure the space and technical equipment for hosting the meetings, but all of the Consultant's specialists, sub-contractors and representatives of Contracting Authority (Client) (if participating the meetings) shall be able to work during the meetings using their own portable hardware.

Consultant must organize BIM collaboration meetings with Contracting Authority (Client) monthly or as specified in the Technical Specification, or schedule can be agreed separately with Client.

Facilities and all the equipment shall provide functionality sufficient to carry out efficient BIM coordination process.

The facilities and equipment provided by Consultant shall include, but are not limited to:

- 2.4 or 5 GHz WiFi connection (WPA2 security enabled, password protected, 802.11 ac/n) with minimum 10 MB/s download/upload speed;
- 220V/50-60Hz electrical connection outlets (Power plug & outlet Type F); at least 1 for each member of the meeting located close to seat of participants (the outlet sockets should be placed not further than 1,5 m away from any participant);
- Furniture:
    - meeting room desk with enough space (min. 70 cm per each individual participant) to place laptop, mouse and notes;
    - office/meeting room chair for each individual participant of the meeting.
- Meeting room screens:
    - Projector and projector screen or LCD display (at least 55-inch diagonal);
    - min. resolution - FullHD (1920x1080 px);
    - at least 2 HDMI 1.4 connectors for the LCD screen or projector;

- 2 HDMI 1.4 cables with a minimum length to reach every participants laptop at their seats;

- Speakerphone with build in microphone for VoIP conference calls; with USB (Plug-and-play) cable connector;

A final interdisciplinary control must be carried out on model files, assured and documented upon completion of each phase or milestone.

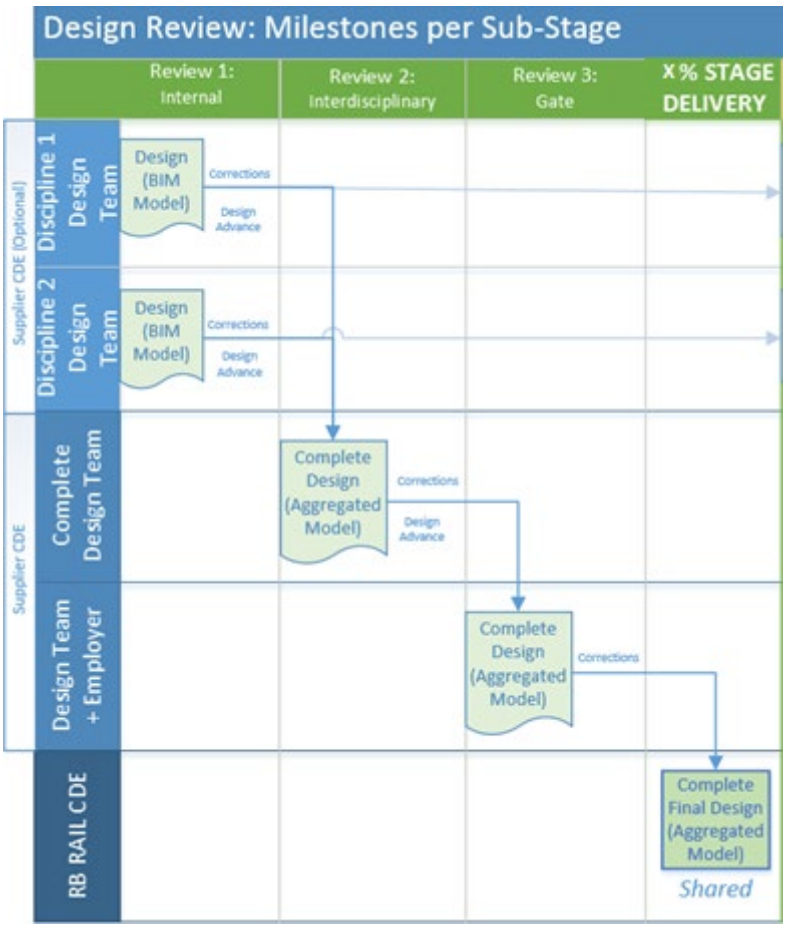
The Contracting Authority (Client) will follow up the consistency control process as well as evaluate conformity of delivered models with the requirements for the particular project stage.

Consultant should pay attention to the differences between structures (existing structures to remain, new building structures, structures to demolish or relocate, viaducts, overpasses, railway, embankment etc.) as well as the project division according to the needed construction permits. Based on these factors Consultant shall make their own assumptions on BIM coordination workflow to estimate the exact staff, resources and timing of coordination meetings needed. For each separate design project separate BIM coordination meetings shall be arranged if not otherwise agreed with the Contracting Authority (Client).

10. Data Delivery, Sharing and Naming

10.1. Data delivery and sharing principles

The Consultant shall follow the principles of data delivery and sharing principles set out in the "BIM Manual" chapter 8.



Updates of BIM models, data and documents for each discipline to Client's CDE shall be done according to the Technical Specifications and Contract documents. The detailed data deliverable information must be provided in BEP document.

Before each meeting federated model shall be updated with the latest data from each discipline – latest available up to date model and information shall be used during the meetings.

For legal requirements for construction permit application, the required documents shall be uploaded to Client's CDE in the following file formats:

- In Estonia according to the requirements set out in (in Estonian language):
    - Ehitusprojekti dokumentide vormistamise nõuded ehitusloa elektroonilisel taotlemisel – "Ehitusprojekti dokumentide vormistamise nõuded ehitusloa elektroonilisel taotlemisel" – Juhend

      https://www.mkm.ee/et/ehitus-ja-elamuvaldkonna-juhendmaterjalid
- In Latvia according to the requirements set out in (in Latvian language):
    - Currently no requirements for digital file formats
- In Lithuania according to the requirements set out in (in Lithuanian language):
    - LST 1516:2015
    - LIETUVOS RESPUBLIKOS APLINKOS MINISTRO ĮSAKYMAS Dėl statybos techninio reglamento STR 1.05.01:2017 „Statybą leidžiantys dokumentai. Statybos užbaigimas. Statybos sustabdymas. Savavališkos statybos padarinių šalinimas. Statybos pagal neteisėtai išduotą statybą leidžiantį dokumentą padarinių šalinimas" patvirtinimo

      2016 m. gruodžio 12 d. Nr. D1-878

      https://www.e-tar.lt/portal/en/legalAct/585f9850c05211e688d0ed775a2e782a/xjilXNtqau

10.2. Data approval process

The exact workflows of the data approval process will be described when a RB Rail CDE will be implemented. A Common Data Environment (CDE) is a single source of information for any given project or asset, used to collect, manage and disseminate all relevant approved project documents and data for multi-disciplinary teams in a managed process. The CDE must provide a secure, collaborative digital environment that all approved parties on a Rail Baltica project can access.

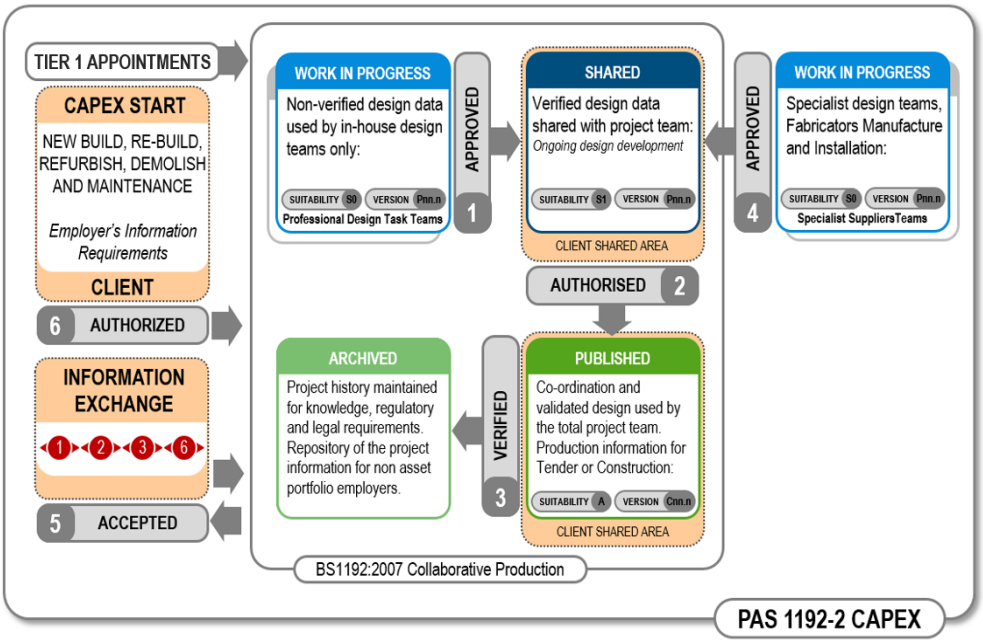
The CDE is core to the Rail Baltica Building Information Modelling [BIM] and information management processes and shall act as a means of providing a collaborative environment for sharing work in a consistent, managed and lean way for all project stakeholders.

The approval process described in the respective Technical Specification and contract documents must be followed.

The Rail Baltica CDE model has four principal phases, that are illustrated in the diagram below:

- **Work-in-Progress (WIP):** Used to hold unapproved information. [Consultant CDE]

- **Shared:** Used to hold information which has been approved for sharing with other organizations to use as a reference in design/construction development. [Consultant CDE]
- **Client Shared / RB Shared:** Used to release the information from the Consultant CDE to the Rail Baltica CDE, for sharing with RB Rail or the local implementing bodies. [Rail Baltica CDE]
- **Published:** Used to holds published information for use by the entire project team. (both design/construction team and Rail Baltica project team). [Rail Baltica CDE]
- **Archive:** used to store all progress as each project milestone is met. [Rail Baltica CDE]



CDE model four principal phases

[**Note:** The Clients (RB Rail) and the Consultants CDE are distinct entities. Each Consultant in the capital delivery phase shall be responsible for the creation of Work in Progress Information within their own CDE using their own procedures to control the creation and coordination of their own files and data. The Tier 1 contractor shall be responsible for the provision of a shared space. RB Rail shall be responsible for the client side CDE consisting of Shared, Published and Archive.]

The process in more detail is described in the "BIM Manual's" chapter 17 "Roles and Responsibilities" and 20 "Rail Baltica Common Data Environment (CDE)".

10.3. File naming conventions

All the delivered files that relate to Contracts started from 01.06.2022 must follow strict file naming conventions set out in:

RBGL-DMT-PRC-Z-00001 Document Numbering and File Naming Procedure

RBGL-DMT-LST-Z-00001 Document Numbering and Master Coding

All the delivered files that relate to Contracts started before 01.06.2022 must follow strict file naming conventions set out in the "BIM Manual" and its supporting documents according to below described logic.

This is the general unified coding file naming conventions for all projects for Rail Baltica Global Project:

RBR file name content																																	
Project name				_	Originator/ Supplier/ Contractor	_	Volume_System/Zone			_	Location	_	Document type	_	Discipline code			_	Project stage	_	Number	_	Revision No.										
EE file name relevant LT file name relevant		EE file name relevant LT file name relevant											EE file name relevant LT file name relevant			EE file name relevant LT file name relevant			EE file name relevant LT file name relevant		EE file name relevant		EE file name relevant									
PROJECT ID	-	SECTION ID	-	SUB-SECTION ID	Abbreviation of the originator of the document Predefined list ORIGINATOR_SUPPLIER Provided by RB Rail AS		VOLUME/SYSTEM	-	ZONE		Code of the location. Predefined list LOCATION Provided by RB Rail AS		Abbreviation of the document type. Predefined list DOCUMENT TYPE Provided by RB Rail AS		RBR CODE	-	LOCAL CODE		Abbreviation of the project stage. Predefined list PROJECT STAGE Provided by RB Rail AS		Unique ID number of each construction object 1-99999		Revision number 1-999									
Project name according to DTD TS Predefined list PROJECT ID Provided by RB Rail AS		Section name according to DTD TS Predefined list SECTION ID Provided by RB Rail AS		Sub-section name according to DTD TS Predefined list SUB-SECTION ID Provided by RB Rail AS			Code of the volume/ system. Predefined list VOLUME_SYSTEM Provided by RB Rail AS		Code of the zone. Predefined list ZONE Provided by RB Rail AS						RBR discipline code Predefined list Provided by RB Rail AS		Discipline code according to local legislation Predefined list															
RBDTD-EE	-	DS3	-	DPS3	_	RBR	_	B0001	-	ZZ	_	ZZZZ	_	IN	_	GP	-	AA	_	DTD	_	1	_	9									
RBDTD-LT	-	DS4	-	DPS1	_	EDZ	_	B0002	-	SB	_	0004	_	D1	_	GP	-	AA	_	DTD	_	15	_	1									

PROJECT NAME

PROJECT ID - Project name according to DTD TS, Predefined list provided by RB Rail AS

SECTION ID - Section name according to DTD TS, Predefined list provided by RB Rail AS

SUB-SECTION ID - Section name according to DTD TS, Predefined list provided by RB Rail AS

ORIGINATOR / CONSULTANT/ CONTRACTOR - Abbreviation of the originator of the document, Predefined list provided by RB Rail AS

VOLUME_SYSTEM / ZONE

VOLUME_SYSTEM - Code of the volume/ system, Predefined list provided by RB Rail AS

ZONE - Code of the zone, Predefined list provided by RB Rail AS

LOCATION - Code of the location, Predefined list provided by RB Rail AS

DOCUMENT TYPE - Abbreviation of the document type, Predefined list provided by RB Rail AS

DISCIPLINE CODE

RBR CODE - Abbreviation of unified RB Rail AS discipline code, Predefined list provided by RB Rail AS

LOCAL CODE - Discipline code according to local legislation, Predefined list

PROJECT STAGE - Abbreviation of the project stage, predefined list provided by RB Rail AS

NUMBER - Unique ID number of each construction object, 1-99999

REVISION NO. - Revision number of the document, 1-999"

Unified file name examples based on the table shown above:

RBDTD-EE-DS3-DPS3_RBR_B0001-ZZ_ZZZZ_IN_GP-AA_DTD_000001_009
RBDTD-LT-DS4-DPS1_EDZ_B0002-SB_0004_D1_GP-AA_DTD_000015_001

Due to the different requirements for file naming conventions in Lithuania and Estonia there are additional attributes required for these purposes:

Only EE and LT file name content				
Drawing name	_	Number of the buildings in the project	_	Document's running number within the project
EE file name relevant		LT file name relevant		LT file name relevant
Drawing name. No limitations.		Number of the buildings in the project. According to LST 1516:2015		Document's running number within the project According to LST 1516:2015
Notes_Drawing name	_	1	_	3
Notes2_Drawing name	_	2	_	4

Local file name examples based on the table shown above:

According to Estonian legislation: RBDTD-EE-DS3-DPS3_TP_AA-0-03_v09_Notes_Drawing name

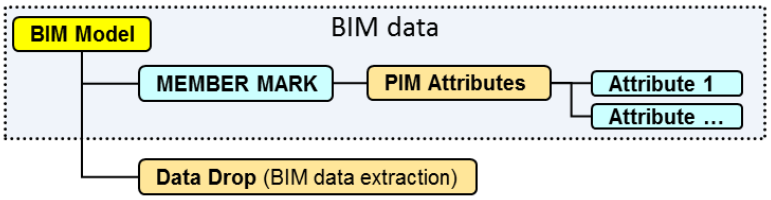
According to Lithuanian legislation: RBDTDLTDS4DPS1-02-DP-AA.B-04

All the required data and sheets for easier file naming will be provided by RB Rail AS and the Consultant shall request it.

All the data sharing, and naming conventions shall be described in detail in BEP during the mobilization phase after the contract reward.

10.4. Data storage and exchange

All data information stored within model objects and shared by means of Data Drops. Every BIM object has all the attributes populated with data. This way the Data Drops are 100% data extractions of the BIM models. This option makes the BIM models heavier but on the other hand the BIM models become the unique source of BIM data.



Data drop information from the models should be provided in English language and if required by local legislation in native Countries language.

All Data Drops shall be delivered using the Data Drop Template **RBDG-TPL-021-0101DataDropTemplate**

11. Level of Definition (LOD)

LOD consists of Level of Geometric Detail (LoG) and Level of Information (LoI). There can be different combinations of those based on project stage, phase and discipline.

Based on the information in PAS 1192-2:2013 section "Levels of model definition for building and infrastructure projects" and PAS 1192-5: 2015 "Specification for security-minded building information modelling, digital built environments and smart asset management":

Models in ***Value Engineering*** shall include the outer geometry for the front edge plate, foundations and major structures corresponding to "Stage number 2 – Concept/Stage number 3 - Definition". The LOD (LoG and LoI levels shall be defined for each discipline and system in the BEP).

Models in ***Master design*** shall include the outer geometry for the front edge plate, foundations and major structures corresponding to "Stage number 3 - Definition". Based on the model, data and documents, as a minimum requirement, it shall be possible to extract information according to the requirements of Master design in Technical Specification and other contract documents. The LOD (LoG and LoI levels shall be defined for each discipline and system in the BEP)

Models in ***Detailed technical design (DTD)*** must include all the objects corresponding to "Stage number 4 – Design". Based on the model, data and documents, as a minimum requirement, it shall be possible to extract information for the design phase according to the Technical Specification and other contract documents. LOD may differ depending on the discipline of the project. The LOD (LoG and LoI levels shall be defined for each discipline and system in the BEP)

The LOD (LoG and LoI levels), shall be defined for each discipline and system by phase in the BEP. Consultant is expected to update Object Attribute Matrix for this purpose and provide additional LOD table / information to the Annex 1 table if deemed necessary.

It must be considered that the LOD in design models shall follow the requirements in each Countries laws, standards and legislation. The models shall contain such level of detail, that all the required drawings can be produced directly from those.

As-built models must include objects corresponding to the same detailing level as detailed design, confirmed or revised by detailed surveys corresponding to "Stage number 6 – Handover and closeout".

RAIL BALTICA BIM DEVELOPMENT PLAN	RAIL BALTICA PROJECT PHASES				
	Value engineering (VE)	**Master Design (MD)**	**Detailed Technical Design (DTD)**	**Construction**	**Operation**
BIM Stage definition (reference: PAS 1192-2) **BIM object LoG** (reference: "BIM Manual" + BIM Forum) **BIM object LoI** (reference: "BIM Manual")	**Stage 2 - Concept / Stage 3 - Definition**	**Stage 3 - Definition / Stage 4 - Design**	**Stage 4 - Design / Stage 5 - Build and commission**	**Stage 5 - Build and commission / Stage 6 - Handover and Closeout**	**Stage 6 - Handover and Closeout / Stage 7 - Operation**
BIM MODELS (Geometry + Data)	**Project models within RB Rail scope**				
Level of Geometric Detail (LoG)	LoG 200*	LoG 300*	LoG 400*	LoG 400 / 500*	LoG 500*
Level of Information (LoI)	LoI 200*	LoI 300*	LoI 400*	LoI 400 / 500*	LoI 500*
3D MODELS (Geometry)	**Environment models / Existing Utilities models / Buildable & Non-buildable out-of-scope elements models**				
Level of Geometric Detail (LoG)	LoG 200*	LoG 300*	LoG 400*	LoG 400 / 500*	LoG 300*
Level of Information (LoI)	LoI 0	LoI 0	LoI 0	LoI 0 / Relocated utilities 300*	LoI 0
All	**BIM Models & 3D Models**				
Geo-reference	Yes	Yes	Yes	Yes	Yes
Construction scheduling / planning (4D)	**No**	Yes, briefly	Yes, approximate	Yes, accurate	No
Quantity Extraction (5D)	Partially, up to LoG detail	Yes	Yes	Yes	Asset Management related
Asset Management (6D)	No	No	Required according to LoI	Yes, detailed according to LoI	Yes, according to LoI
Analytical Calculations linked to BIM	Not a requirement	Recommended	Recommended	Recommended	Recommended

* - this is indicative target number and LoG and LoI for each discipline and system shall be agreed with the client separately in the BEP.

Minimum LoG and LoI requirements and descriptions for each discipline and system see in Annex 1, Annex 2 and Annex 3.

Consultant shall prepare BEP document according to required LOD of each stage of the project (Annex 1, 2 and 3).

12. For 2D CAD documents and drawing production

The intent of these CAD standards is to provide guidelines to ensure that all drawings are prepared to a standard and uniform appearance and reflect high quality workmanship, and that data created by CAD systems is correctly structured and classified to facilitate re-use and understanding by others.

Data used in drawing production shall derive directly from the 3D models and data supplied with necessary 2D information in all phases of the project as well as in the as-built documentation.

The CAD standards are not related to any Authoring Tool and it will be each Consultant who develops a specific practical standardization for the Authoring Tool to be used in their project, taking as a base this documentation.

The Consultant is obliged to deliver the drawings and CAD files according to the requirements in each Countries legislation, laws, rules, standards and requirements described in RB Rail “CAD Standard” document.

13. Simulations

Simulations can be performed based on both 2D and 3D models within one or more disciplines. For simulation purposes, each individual party can create its own simulation models, if necessary supplemented by input from other relevant disciplines. Each party is responsible for implementing amendments, demonstrated in simulation tests. Amendments outside the discipline of the party performing the simulation shall be coordinated with the relevant other discipline Consultants and parties and the General Consultant.

All intelligent 3D BIM models shall contain asset and attribute information to perform 4D (delivery schedules) and 5D (cost databases) modelling and providing asset information to operators at project completion (commonly known as 6D modelling).

Detailed and specific requirements for 4D and 5D modelling and workflows defined in the “BIM Manual” chapter 15 “Deliverables from BIM models”.

14. Consistency control

Consistency control shall ensure that the content of different model files agree with each other. Each party (discipline Consultant) shall carry out consistency control on an on-going basis between its own model files and in relation to other parties' model files. A final interdisciplinary consistency control shall be carried out on model files by completion of each phase or milestone. If a collision occurs, the relevant parties shall take action. The working procedure for consistency control means that: - Consistency control can advantageously be carried out on the principle of self-checking followed by interdisciplinary checks. - Each party checks that its own model files are consistent with each other and between different disciplines. - The parties jointly check that all model files across the project are consistent. - The Contracting Authority's (Client's) BIM and CAD coordinator makes consistency controls based on the delivered models. The responsibility for finding and resolving clashes or inconsistencies between the models is always placed at the Consultants.

QUALITY CONTROL CHECKS			
CHECKS	DEFINITION	RESPONSIBLE PARTY	FREQUENCY (recommended)
SELF-CHECK	General review: consistency, completeness and coherence of the design intent, graphic representation and inserted data	Modeler	Continuously
VISUAL CHECK	Ensure there are no unintended model components and the design intent has been followed	Contractor's project manager	Continuously
CLASH CHECK	Detect problems in the model where two components are clashing	Contractor's BIM Manager/Assigned BIM specialist	Weekly
MODEL DATA/INTEGRITY CHECK	Ensure that the project data has no undefined, incorrectly defined or duplicated elements.	Contractor's project manager	Continuously
STANDARDS CHECK	Ensure that the BIM and CAD STANDARD have been followed	Contractor's project manager	Continuously

More defined information is described in the "BIM Manual" chapter 19 "Quality Control".
All design deliverables shall be supplemented with QA/QC BIM CAD report using the **RBDG-TPL-022-0101_QaQcBimCadTemplate**

All design deliverables shall be supplemented with Clash Check reports using the **RBDG-TPL-023-0101_ClashCheckReportTemplate.**

Clash detection tolerance shall be presented and agreed in BEP document.

The following list of clash tolerance contains minimum required values and shall be upgraded by Consultant in BEP document. Presented clash tolerance list is for non-reasonable hard clashes according to BIM Manual subsection 19.1.3 defined clash interferences:

1. LOD 300:

1.1 Self-clash of elements according to systems of LOD:

- 1.1.1 Architecture – 0,02 m;
- 1.1.2 Drainage and flooding – 0,05 m;
- 1.1.3 Geotechnical – N/A;
- 1.1.4 MEP – 0,02 m;
- 1.1.5 Rail – 0,05 m (excavation earthworks – 0,1 m);
- 1.1.6 Roads – 0,05 m (excavation earthworks – 0,1 m);
- 1.1.7 Structures and bridges – 0,02 m (excavation earthworks – 0,1 m);
- 1.1.8 Tunnels – 0,02 m (excavation earthworks – 0,1 m);
- 1.1.9 Utilities – 0,05 m
- 1.1.10 Railway clearance under structures (gauge control) – 0,0 m.

1.2 Interdisciplinary clash of elements according to systems of LOG:

- 1.2.1 Architecture, Drainage and flooding, MEP, Rail, Roads, Structures and bridges, Tunnels – 0,05 m.
- 1.2.2 Geotechnical – N/A;
- 1.2.3 Utilities – soft clash evaluation/clearance (DG BIM Manual; BEP)

2. LOD 400:

2.1 Self-clash of elements according to systems of LOD:

- 2.1.1 Architecture – 0,01 m;
- 2.1.2 Drainage and flooding – 0,01 m;
- 2.1.3 Geotechnical – N/A;
- 2.1.4 MEP – 0,01 m;
- 2.1.5 Rail – 0,02 m;
- 2.1.6 Roads – 0,02 m;
- 2.1.7 Structures and bridges – 0,01 m (reinforcements – 0,01 m, excavation earthworks – 0,05 m);
- 2.1.8 Tunnels – 0,01 m (reinforcements - 0,01 m, excavation earthworks – 0,05 m);
- 2.1.9 Utilities – 0,01 m.
- 2.1.10 Railway clearance under structures (gauge control) – 0,0 m.

2.2 Interdisciplinary clash of elements according to systems of LOD:

- 2.2.1 Architecture, Drainage and flooding, MEP, Rail, Roads, Structures and bridges, Tunnels – 0,02 m;
- 2.2.2 Geotechnical – N/A;
- 2.2.3 Utilities – soft clash evaluation/clearance (DG BIM Manual; BEP)

Clash detection tolerance can be supplemented, if the information is missing. All modifications and additions must be approved by RB Rail team.

Indicative measurement tolerances for as-built verification scans could be found in BIM requirements for construction and as-built stages. Exact tolerances should be agreed in BEP.

15. Visualizations

Visualization is used in both technical and communicational contexts. Visualizations shall be prepared based on model files, or by producing special visualization models according to the purpose. Valid data for construction shall only be found in the models described by each type (terrain, utilities, track, structures, road, etc.) and in file formats stipulated in the table above. If new model files containing special or modified geometry must be created to perform the visualization (e.g. aesthetic modifications of 3D models), then it is not permitted to use these model files in other contexts.

General visual requirements and guidelines for the content and technical specifications of the video:

- The models and data used to create the videos, must represent the final design situation;
- The exact content for each video must be agreed with the Client;
- The video as minimum must contain and represent:
    - Overview of the planned alignment and landscape situation including orthophotos;
    - A flyover video of full design section shall be created showing the administrative municipality, town and city borders including a 360-degree flyover of most interesting and meaningful point-type construction objects;
    - Detailed and realistic render of 100 m wide corridor along the track alignment axis;
    - 500 m - 1 km on both sides of the track of simplified surrounding terrain including forest areas, buildings, bodies of water (e.g. rivers or lakes), high voltage lines and other meaningful landmarks;
    - Designed and existing bridges, viaducts, tunnels, eco-ducts, roads and other ecosystems;
    - Designed sound barriers, fences, electric cables, catenary posts, lighting equipment;
    - Designed underground utilities shall be represented by using a cross section cut at several places of the design section;
    - Moving passenger and freight (where applicable) train models;
    - Moving existing train and road vehicles, if applicable - In situations if the designed alignment corridor crosses or comes near (up to 3 km from alignment axis) to the existing train or road infrastructure;

- All the graphics, texts or numbers used in the video must align with visual identity of the project and must be agreed with Clients' PR team;
- Technical specifications of the video:
    - Resolution: 1920x1080px
    - File format: *.MP4 or *.MOV (encoded using H.264 codec for the best quality/file size ratio)
    - At least 25 fps

16. Classification system and Quantity Takeoffs

For the project needs there will be a Classification system implemented/adopted to achieve more fluent 4D and 5D simulation creation and delivery.

The Classification system shall define the attributes and properties for each asset and element in the BIM models to categorize and organize those. Guidance and templates to be used for information delivery can be found in chapter 17 “Asset Information”.

The Classification systems to be used is Uniclass 2015. For more details see the “BIM Manual’s” chapter 15.5.1 “Object Type Dictionary” and 20.5 “Classification”.

The Classification system should be created based on:

ISO 12006-2;

IEC/ISO 81346-1;

IEC 81346-2;

ISO 81346-12.

Quantity take-offs (QTO) and Quantity extraction (QEX) will be extracted from the BIM model and made available in the CDE in a standard format for the whole Rail Baltica project, which will align with the Rail Baltica Classification system for Bill of Quantities (BoQ) and Work Breakdown Structure (WBS) format.

		QUANTITIES							
Spec Code	RBR-OCC	UNICLASS 2015 Product Code(Pr_Code)	Type number	Product Description	No	Unit	Qty	% Con	Cont
N/A	N/A	Pr_20_85_16_15		Reinforced poured concrete; proportion normal weight concrete in accordance to EN1992-1-1 with compressive strength of 25 MPa at 28 days; according to Drawings and Specifications		M³	2.637		2.9007

BIM MODEL OBJECTS								SPECIFICATION		COSTING				
	MEMBER MARK					OBJECT LOD				QUANTITIES				
Native Unique ID	Discipline (Code)	VolSysZone	Location	Function	Object ID	LoG	LoI	Spec Code	RBR-OCC	UNICLASS 2015 Product Code(Pr_Code)	Type number	Product Description	Unit	Qty
12345678	RR	VVVVZZ	LLLL	FFF	123456	350	350	00	00000	Pr-00 00 00 00	XXXXX	Reinforced poured concrete; proportion normal weight concrete in accordance to ACI 211.1 and ACI 301 with compressive strength of 30 MPa at 28 days; according to Drawings and Specifications	M3	48.50
12345678	RR	VVVVZZ	LLLL	FFF	123456	350	350	00	00000	Pr-00 00 00 01	XXXXX	Reinforced poured concrete; proportion normal weight concrete in accordance to ACI 211.1 and ACI 301 with compressive strength of 30 MPa at 28 days; according to Drawings and Specifications	M3	48.50
12345678	RR	VVVVZZ	LLLL	FFF	123456	350	350	00	00000	Pr-00 00 00 02	XXXXX	Reinforced poured concrete; proportion normal weight concrete in accordance to ACI 211.1 and ACI 301 with compressive strength of 30 MPa at 28 days; according to Drawings and Specifications	M3	48.50

QTO template to be used:

- **RBDG-TPL-018-0101_QTOTemplate**

QEX template to be used:

- **RBDG-TPL-017-0101_QEXTemplate**

All Quantity Takeoffs and Extractions, Product/quantity descriptions, volume calculation methods, measurement units and specifications shall be described in the BEP and agreed with the Client/RB Rail.

17. Asset information

The minimum required attribute information for each asset is described in the "BIM Manual" and explicitly in chapters 9 "Information and Codification principles", 14.3.2 "Asset data", 15.6.2 "Asset Management for Operations & Maintenance" and 15.6.3. "Asset Management for Geographic Information System (GIS) integration".

- Based on the tables given in the:**RBDG-TPL-016-0101_CodificationTablestemplate**

and

- **RBDG-TPL-019-0101_BIM_Objects_Attributes_Matrix**

the minimum required asset attribute data are:

1. Global attributes
    - Member Mark
    - Common Asset Data
    - Location Asset Data
    - AIM Operation - Element Asset Data
    - LOD
    - Quantities and Cost Estimation
    - Time Liner
    - Clash Detection
    - Sustainability
    - Life and Safety
    - GIS
    - Operation / Facility management
    - Dimensions/constrains
    - Analytical
2. Discipline-Specific attributes – have to be suggested by consultant. Attributes have to fulfil BIM use cases.
3. Type-Specific attributes – have to be suggested by consultant. Attributes have to fulfil BIM use cases.

The detailed list of all asset attributes to be included in the BIM data models to be described in detail in the BEP in the form of Object Attribute Matrix during the mobilization phase after the contract award. It can be updated during the performance of the contract. All changes always shall be agreed with the Client.

18. Annex 1 – Level of Definition

The following tables show the minimum required Levels of Definition for each discipline and system for each project phase. For each system the LoG shall be agreed separately in the BEP.

18.1. Architecture

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Station	**Above ground or underground Station**	Above ground or underground stations in all locations	3D BIM models ● Conceptual Design and alignment 2D CAD drawings extracted from 3D BIM Models of: ● Conceptual Design and alignment	Detailed 3D Component models of: ● Walls ● Doors ● Windows ● Glazing ● Louvers and vents ● Roofs ● Ramps ● Exterior stairs ● Exterior escalators ● Exterior elevators ● Ladders and catwalks ● Façades ● Toilet fixtures ● Public furnishing ● Signage ● Communications shafts ● Defined model materials ● assembly elements (for steel and pre-cast concrete structures. In some cases, also for cast-in-place works – usually reffered to as Cast units)	All Component models of 300 (Master design) and in addition Detailed 3D Component models of: ● Louvers and vents ● Ceilings ● Floors ● Interior stairs ● Interior escalators ● Interior elevators ● Railings and handrails ● Interior and exterior lighting ● Fire protection specialties ● Defined model properties (color, texture, etc.) ●All assembly	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Streetscaping / Landscaping	**Site model**	Architectural elements for streetscape model in all locations	3D BIM models ● Conceptual Design and alignment 2D CAD drawings extracted from 3D BIM Models of: ● Conceptual Design and alignment ● Retaining Walls ● Noise barriers ● Bridges ● Corridor Fencing ● Environment and Cultural Heritage protection measures	Detailed 3D Component models of: ● Earthworks Surface ● Road/Street Surfaces ● Strings for setout ● Clearance envelopes (Space allowance for bridges, tunnels, channels, underpasses,...) ● Planting (for area quantification and visualization purposes) ● Street and road furniture ● Pavements (soft, hard, gravel, earthworks, slabs, stone pavement,…) ● Earthworks Formation incl Material Zones for embankments (base, sub base...), topping zones ● ● Defined model materials	All Component models of 300 (Master design) and in addition Detailed 3D Component models of: ● Specific Geometry according to Brand / model for supplied product (non Cast in Place) ● Defined model properties (color, texture, etc.) ●Signage	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)

18.2. Drainage and Flooding

COMPONENT			LEVEL OF DEFINITION			
Category	**System**	**Description**	**200**	**300**	**400**	**500**
Drainage	**Hydraulic Analysis**	Flood Modelling	2D CAD Models of: ● desktop flooding and hydraulic analysis ● Incremental afflux effects ● Mitigation treatments	3D Models of: ● Preliminary flooding and Hydraulic Analysis. Vertical Flooding Clearance Space (verification of bridges lower reference line) ● Incremental afflux effects ● Mitigation treatments	Detailed 3D Models of: ● Detailed flooding and Hydraulic Analysis. Vertical Flooding Clearance Space (verification of bridges lower reference line) ● Incremental afflux effects ● Mitigation treatments	As LoG 400
Building / Station	**Site model**	Drainage elements for streetscape model in all locations	2D CAD Models consisting of Approximate dimensions and layout	3D Models of: ● Accurate outline and RLs	Detailed 3D Component models of: ● Site infrastructure ● Street fire hydrant ● Surface drainage ● External drainage & underground drainage ● Hard landscaped areas ● Planter boxes including sub-soil drainage systems	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)

18.3. Geotechnical

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Geotechnical	**Ground Conditions**	Existing Ground Conditions	3D CAD Models of: ● Boring Locations ● Lab test results (DG soil classification) ● Test Pit Locations ● DCP locations- dynamic cone penetration test. Locations of alternative tests (e.g. CPT - cone penetration test) must also be modelled. ● Terrain model ● Ground Water Profile	incl. LOG 200 and additionally: ● Additional Boring Locations ● Additional Test Pit Locations ● Additional DCP/CPT locations ● Updated Terrain model Detailed 3D Interpreted Component Models of: ● Strata Profiles (including ground water level/profile and assessed Highest Water Level HWL by DTD) ● Embankment and cuttings subgrade (including soil/material QS classification according to DG)	As LoG 300 ● Updated overview of materials used in subgrade, embankment, sub-ballast, ballast layers	As LoG 300
Geotechnical	**Condition Monitoring**	Condition monitoring	2D GA of Monitoring locations	3D GA of Monitoring locations	As LoG 300 Detailed 3D component Models of: ● Sensors ● Monitoring Equipment	As LoG 400

18.4. MEP

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Station or Building	**Electrical, telecommunications, security and IT**		Diagrammatic or schematic model elements; conceptual and/or schematic layout/flow diagram	2D Models of: ● Schematic layout with approximate size, shape, and location of elements	Detailed 3D Component models of: ● High Tension Service & Dist. ● Low Tension Service & Dist. ● Cable trays (railway ducts) ● Lighting Equipment ● Communications equipment ● Security and Detection Systems ● Protection systems (Fire Alarm Systems) ● Lighting Equipment	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)
Station or Building	**Fire protection**		Diagrammatic or schematic model elements; conceptual and/or schematic layout/flow diagram	3D Models of: ● Schematic layout with approximate size, shape, and location of elements	Detailed 3D Component models of: ● Piping ● Sprinklers ● Valves ● Switches ● Sprinkle pumps ● Sprinkle tanks ● Hydrants and hose reels ● Fire extinguisher and hose reel cabinets ● Panels ● Sensors ● Heat/Smoke detectors ● Fire Extinguishers ● Shutters ● Smoke Curtains	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Station or Building	**HVAC**	Heating, Ventilation, and Air Conditioning	Diagrammatic or schematic model elements; conceptual and/or schematic layout/flow diagram	3D Models of: ● Schematic layout with approximate size, shape, and location of elements ● HVAC systems as Space allowances ● Mechanical ventilation equipment Space allowance (including maintenance access)	Detailed 3D Component models of: ● Piping ● Pumping ● Ducts (Distribution Systems) ● Energy Supply ● Heat Generating Systems ● Cooling Generating Systems ● Diffusers (Terminal Units) ● Controls & Instrumentation ● Filters ● Valves ● Heat storage ● Cooling storage ● Equipment ● Supplementary components	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)
Station or Building	**Water supply and sewerage**		Diagrammatic or schematic model elements; conceptual and/or schematic layout/flow diagram	3D Models of: ● Schematic layout with approximate size, shape, and location of elements ● Water systems as Space allowances (including, shafts and risers) ● Water equipment Space allowance (including maintenance access)	Detailed 3D Component models of: ● Piping ● Cold Water Service ● Hot Water Service ● Domestic Water Supply Equipment ● Tanks ● Equipment ● Plumbing Fixtures ● Valves ● Supplementary components ● Drains	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Station or Building	**Plumbing and drainage**		Diagrammatic or schematic model elements; conceptual and/or schematic layout/flow diagram	3D Models of: ● Schematic layout with approximate size, shape, and location of elements ● Water systems as Space allowances (including, shafts and risers) ● Water equipment Space allowance (including maintenance access)	Detailed 3D Component models of: ● Piping ● Sanitary Waste ● Rain Water Drainage ● Tanks ● Pumping ● Equipment ● Panels ● Plumbing Fixtures ● Valves ● Gas Distribution ● Supplementary components (Other Plumbing Systems) ● Drains	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)
Building / Station	**Site model**	MEP elements for streetscape model in all locations	2D CAD Models consisting of Approximate dimensions and layout	3D Models of: ● Schematic layout with approximate size, shape, and location of elements ● MEP systems as Space allowances (including, shafts and risers) ● MEP equipment Space allowance (including maintenance access)	Detailed 3D Component models of: ● Water Supply ● Sanitary Sewer ● Storm Sewer ● Fuel Distribution ● Industrial Waste Systems ● Electrical Distribution ● Site Lighting ● Site Communications & Security	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)

18.5. Rail

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Rail	**Superstructure**	Rail including all components to formation	3D Models of: ● 3D Track Alignment Geometry integrated to GIS ● 3D Railway superstructure and substructure realistic model (for visualisation purposes, alignment with adjoining sections and clearance checking) ● 3D Retaining walls and noise barriers (with volumes and length for calculation) integrated to GIS system. ● 3D Models of corridor fencing and utilities (with volumes and lengths for calculations). 2D CAD Models of: ● Schematic track layout for the railway ● Horizontal alignment, including turnouts, land plot boundaries ● Vertical alignment	Detailed 3D models of (integrated to GIS): ● Track Alignment Geometry, including turnouts, , cant ● Ballast layer (with volumes for calculations) ● Kinematic structural clearance, including overhead catenary ● Sidewalks and crossings (station areas) ● Slab Track ● 3D Railway superstructure realistic model (for visualisation purposes only) 2D CAD Models of: ● Schematic track layout for the railway ● Schematic layout of rail joints and weldings ● Horizontal alignment, including turnouts, land plot boundaries ● Vertical alignment ● Cross-sections ● Speed diagram	LoG 300 objects including: ● Specific Geometry and reinforcement according to Brand / model of sleepers, rails, fastening system, expansion joints, track slabs (if prefab) or any other supplied product (pre-cast). ● Layouts of turnouts with sleepers ● Any additional geometry required for the construction, installation and assembling works	LoG 400 geometry updated as built + further specific geometry detail needed to act as an Infrastructure manager for the LoI 500 (for Operation & Maintenance)

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Rail	**Substructure**		3D Models of: ● Substructure in 3D (Terrain model and design surfaces with volumes for calculations) integrated to GIS and length and lengths	● Necessary parts for coordination with nearby or attached elements. ● Drainage ditches Detailed 3D Component models with required calculations of: ● Earthworks Formation incl Material Zones for embankments (ballast, sub-ballast/blanket layer, prepared subgrade, subgrade, embankment fill, etc.), access track pavements. For every layer material property (QS-classification from DG) ● Excavation earthworks ● Technical blocks ● Soil improvement (CMC's, BMC's...) ● CESS Treatments / maintenance walkways ● Barrier Treatments ● Retaining Walls , Reinforced Earth Walls, etc. ● Noise Barriers ● Corridor Fencing ● Elements split according to construction division for retaining walls or similar in 3D (pour joints, dowels, expansion joints, water stops) ● Anchor rods, hangers, brackets (2D) ● Finishes (2D) Embankment layout and other 2D drawings/schemes	● Discrete elements as defined in LoG ● LoG 300 continuous elements split by 100m length divisions (LoI longitudinal division for asset management) ● Elements split according to construction division for retaining walls or similar in 3D (pour joints, dowels, expansion joints, water stops) ● Anchor rods, hangers, brackets (3D for geometrical coordination) ● Finishes	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance) ● Any continuous element split by 100m length divisions (LoI longitudinal division for asset management)

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Rail	**Systems**	System components and ancillary infrastructure for Rail Systems (Signaling, Telecommunications, Electric and Traction Power supply, etc.*)	2D CAD Models : ● Ducts and ULX locations ● Rail Systems equipment, structures and huts locations 3D Models : ● Duct and ULX layout ● Rail Systems equipment, structures and huts layout	2D CAD models : ● Schematic layout for the Signaling ● Breaking distance diagrams ● Rail Systems equipment and huts layout ● Cabling for Rail Systems ● Principle diagrams for Rail Systems Detailed 3D Component models : ● Ducts and ULX trenches and conduits, Duct Banks and Manholes (approximate geometry and layout), correct positioning ● Rail Systems equipment, structures and huts (approximate geometry and layout) with cabling, correct positioning	2D CAD models : ● Schematic layout for the Signaling ● Breaking distance diagrams ● Rail Systems equipment and huts layout ● Cabling and wiring for Rail Systems ● Principle and mounting diagrams for Rail Systems ● Layouts of indoor and outdoor Rail Systems equipment Detailed 3D Component models : ● Ducts and ULX trenches and conduits, Duct Banks and Manholes (geometry and layout), correct positioning ● Rail Systems equipment, structures and huts (geometry and layout) with cabling and wiring, correct positioning	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance) ● Any continuous element split by 100m length divisions (LoI longitudinal division for asset management)

18.6. Roads

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Road	Major/ Minor	Roads including all components	3D Models integrated to GIS: ● Terrain ● Earthworks Surface ● Road Surface ● Alignment Geometry ● Strings for setout ● Clearance envelopes (Space allowance for bridges, tunnels, channels, underpasses) 2D CAD Models of: ● Pavements ● Kerbs ● Retaining Walls ● Noise Walls ● Barriers ● Barrier Treatments ● Signage ● Road Lighting ● Traffic Signals ● Road Furniture ● Corridor Fencing ● Environment and Cultural Heritage protection measures ● Clearances	Detailed 3D Component models of: ● Earthworks Formation incl Material Zones for embankments (surface course, binder course, base, sub base, sub grade,, shoulder,...), topping zones ● Technical blocks ● Excavation earthworks ● Road Pavements ● Kerbs ● Retaining Walls ● Noise Walls ● Barriers ● Barrier treatments ● Signage (road traffic signs and vertical road marking) ● Road Lighting incl footings, pits, trenching and conduits ● Traffic Signals incl. footings, pits, trenching and conduits ● Drainage ditches ● Soil improvement (CMC's, BMC's...) ● Corridor Fencing ● Environment and Cultural Heritage protection measures ● Alignment Geometry ● Strings for setout ● Clearance envelopes allowance (Spaces as defined in LoG 300), no division ● LoG 300 continuous elements, no split. ● Proposed utilities associated with the roads (Storm water, Lighting, Electrical)	LoG 300 objects including: ● Specific Geometry according to Brand / model for supplied product (non Cast in Place) ● Split by 100m length divisions (LoI longitudinal division for asset management, if requested in the EIR for roads) ● Signage ● Road Furniture	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance) ● Any continuous element split by 100m length divisions (LoI longitudinal division for asset management) ● Only if requested in the EIRs

18.7. Structures and bridges

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Bridge	**Road and Rail Bridges**	Over and under bridges in all locations	3D Models of: ● Superstructure ● Substructure ● Foundation ● Accurate Reference Lines (clearances) Approximate geometry (e.g. depth) of structural elements Volumes for calculations 2D CAD Models consisting of Approximate dimensions and layout	Detailed 3D Component models of (integrated to GIS): ● Deck ● Barriers ● Girders ● Abutments ● Piers ● Piles ● Wingwalls ● Relieving Slabs ● Bearings ● Large penetrations (such as large utilities or MEP elements) ● Reinforcement ● Chamfer ● Pour joints and sequences to help identify reinforcing lap splice locations, scheduling, etc. ● Expansion Joints ● Lifting devices ● Embeds and anchor rods ● Post-tension profile and strands ● Any permanent forming or shoring components ● Stiffeners ● Other structural elements ● assembly elements Volumes for calculations Gridlines with headers All sloping surfaces included in model element with exception of elements affected by manufacturer selection	LoG 300 objects (in 3D) including necessary parts for coordination with nearby or attached elements (integrated to GIS): ● Elements split according to construction division (pour joints, dowels, expansion joints, water stops, splits between plate girders) ● Anchor rods, hangers, brackets ● Permanent forming, lifting devices ● Posttension anchors, deviators, penetrations, strand locations ● Connection details & main steel connection details (base plates, gusset plates...) ● All reinforcement ● All stiffeners ● Post tension elements ● Finishes, camber ● Chamber ● Welds, gratings, holes ● Copings ● Washers, nuts ● All assembly elements Alternative elements and products are allowed 2D drawings according to Country's national legislation	LoG 400 geometry updated as built + further specific geometry detail needed to act as Infrastructure manager for the LoI 500 (for Operation & Maintenance)

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Station	**Above Ground Station**	Above Ground station structure in all locations	3D Models of: ● Accurate Outline ● Accurate allowance space for clearance verification and for congested MEP areas ● Accurate Reference Lines (clearances) ● Structural elements related with global civil objects of the project ● Approximate wings ● Superstructure ● Substructure ● Foundation ● Accurate Reference Lines (clearances) Approximate geometry (e.g. depth) of structural elements Volumes for calculations 2D CAD Models consisting of Approximate dimensions and layout	Detailed 3D Component models of (integrated to GIS): ● Slabs ● Walls ● Structural Framing with specific sizes of main structural elements ● Structural connections ● Columns ● Foundations ● Floors ● Roofs & canopy ● Large penetrations (such as large utilities or MEP elements) ● Elements split according to construction division (pour joints, dowels, expansion joints, water stops, splits between plate girders) ● Anchor rods, hangers, brackets ● Permanent forming, lifting devices ● Posttension anchors, deviators, penetrations, strand locations ● Connection details & main steel connection details (base plates, gusset plates...) ● Large stiffeners Volumes for calculations 2D drawings according to Country's national legislation Specific sizes and locations of main structural members modeled per defined structural grid with correct orientation All sloping surfaces included in model element with exception of elements affected by manufacturer selection	LoG 300 objects including (in 3D) (integrated to GIS): ● All reinforcement ● All stiffeners ● Post tension elements ● Finishes, camber ● Chamber ● Welds, gratings, holes ● Copings ● Washers, nuts Alternative elements and products are allowed 2D drawings according to Country's national legislation	LoG 400 geometry updated as built + further specific geometry detail needed to act as Infrastructure manager for the LoI 500 (for Operation & Maintenance)

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Station	**Underground Station**	Underground station structure in all locations	3D Models of: ● Accurate Outline ● Accurate allowance space for clearance verification and for congested MEP areas ● Structural elements related with global civil objects of the project 2D CAD Models consisting of Approximate dimensions and layout	Detailed 3D Component models of: ● Slabs ● Walls & Retaining ● Tolerance of wall construction ● Structural Framing with specific sizes of main structural elements ● Structural connections when the size is larger than the structural elements ● Columns ● Foundations ● Floors ● Roofs & canopy ● Penetrations ● Elements split according to construction division (pour joints, dowels, expansion joints, water stops, splits between plate girders) ● Anchor rods, hangers, brackets ● Permanent forming, lifting devices ● Posttension anchors, deviators, penetrations, strand locations ● Connection details & main steel connection details (base plates, gusset plates...) ● Large stiffeners Volumes for calculations	LoG 300 objects including: ● All reinforcement ● Finishes, camber ● Chamber	LoG 400 geometry updated as built + further specific geometry detail needed to act as Infrastructure manager for the LoI 500 (for Operation & Maintenance)

COMPONENT			LEVEL OF DEFINITION			
Category	**System**	**Description**	**200**	**300**	**400**	**500**
Building / Station terminal buildings	**Site model**	Structural elements for streetscape model in all locations	3D Models of: ● Accurate Outline ● Accurate allowance space for clearance verification and for congested MEP areas Volumes for calculations 2D CAD Models consisting of Approximate dimensions and layout	Detailed 3D Component models of (integrated to GIS): ● Foundations ● Walls ● Stairs ● Structural Framing with specific sizes of main structural elements ● Structural connections when the size is larger than the structural elements ● Large penetrations (such as large utilities or MEP elements) ● Elements split according to construction division (pour joints, dowels, expansion joints, water stops, splits between plate girders) ● Anchor rods, hangers, brackets ● Permanent forming, lifting devices ● Posttension anchors, deviators, penetrations, strand locations ● Connection details & main steel connection details (base plates, gusset plates...) ● Large stiffeners	LoG 300 objects including (in 3D) (integrated to GIS): ● All reinforcement ● All stiffeners ● Post tension elements ● Finishes, camber ● Chamber ● Welds, gratings, holes ● Copings ● Washers, nuts	LoG 400 geometry updated as built + further specific geometry detail needed to act as Infrastructure manager for the LoI 500 (for Operation & Maintenance)

18.8. Tunnels

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Tunnels	**Rail Tunnels**	Bored, Mined, Drill & Blast, Cut and Cover	3D Models of: ● Geometry of railway track alignments ● Portals and other tunnel structural elements (on conceptional level) ● Tolerance Space allowance for Retaining Walls (cut & cover). 2D CAD models of: ● Tunnel on railway longitudinal profiles (height, length, portals) ● Associated structures (service tunnels, evacuation areas) ● Transition zones ● Necessary land plot borders	Detailed 3D Component models of: ● Geometry of railway track alignments ● Structural elements of tunnel and associated structures ● Extents ● Portals ● Transition zones ● Maintenance access and evacuation areas ● Main ventilation solutions ● Main lighting solutions ● Main Fire and Life Safety solutions ● Lining Treatments ● Emergency access associated solutions ● Cross Passages ● Anchor rods, hangers, brackets ● Permanent forming ● Posttension anchors, tie-back anchors ● Connection details & main steel connection details (base plates, gusset plates...) ● Ducts, Duct Banks ● Trays 2D CAD models of: ● Tunnel on railway longitudinal profiles (height, length, portals) ● Associated structures (service tunnels, evacuation areas) ● Transition zones ● Necessary land plot borders	LoG 300 objects including the brand/model specific detail for:● LoG 300 elements ● All structural element reinforcements (cast in place or precast segments) ● Post tension elements, anchors, tie-back anchors ● Finishes, camber ● Trays with brand/model definition ● Ducts and Duct Banks with brand/model definition ● Ventilation ● Lightning ● Fire and Life Safety ● Elements split according to construction division (pour joints, dowels, expansion joints, water stops, splits between plate girders), if continuous then split by 100m (LoI asset management)	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)

18.9. Utilities

COMPONENT			LEVEL OF DEFINITION			
Category	**System**	**Description**	**200**	**300**	**400**	**500**
Utilities (new / connection to existing)	**Public Utilities**	Public and private utilities within the Rail and or Road corridor	2D CAD Models of: ● New Utilities ● Proposed relocations or protection works	Detailed 3D Component models of: ● Location of Existing Utilities ● New Utilities ● Conflict Areas ● Protection Works ● Relocation Works	LoG 300 objects including necessary parts for coordination with nearby or attached elements. ● LoG 300 elements ● Elements split according to construction division (pour joints, dowels, joints, water stops,...) ● Anchor rods, hangers, brackets ● Lifting devices ● Connection details ● Trays ● Ducts & Duct Banks ● Specific detail from brand/model.	LoG 400 geometry updated as built + further specific geometry detail needed to act as placeholder for the LoI 500 (for Operation & Maintenance)
Existing Utilities	**Existing Public Utilities**	Public and private utilities within the Rail and or Road corridor	2D CAD Models of: ● Location of Existing Utilities 3D Models: • Existing utilities shall have 3D coordinates (X,Y,Z).	3D Models of: ● Existing Utilities (up to 20m away from the infrastructure boundaries; detailed geometry and position at connection points with new utilities)	LoG 300 objects including necessary parts/detail for coordination with new utilities. ● LoG 300 elements ● Hangers, joints, steps (within shafts),…	As LoG 300

18.10. Culverts

COMPONENT			LEVEL OF DEFINITION			
Category	System	Description	200	300	400	500
Culvert	**Large/ Small**	Major and Minor culverts in all locations	3D Models of: ● Accurate Outline ● Accurate Reference Lines (clearances) ● Structural elements related with global civil objects of the project ● Approximate wings Volumes for calculations 2D CAD Models consisting of Approximate dimensions (lengths, diameter) and layout	Detailed 3D Component models of (integrated to GIS): ● Crown units ● Pipe Units ● Headwalls ● Bedding Slabs ● Backfill (large culverts) ● Trench Support Zones ● Accurate shape, geometry, material and angle of wings ● Elements split according to construction division (pour joints, dowels, expansion joints, water stops) ● Anchor rods, hangers, brackets ● Permanent forming, lifting devices Volumes for calculations, exact slopes and inclinations 2D drawings according to Country's national legislation	LoG 300 objects including (in 3D) (integrated to GIS): ● All reinforcement ● Finishes ●Crown Units ●Backfill Alternative elements and products are allowed 2D drawings according to Country's national legislation	LoG 400 geometry updated as built + further specific geometry detail needed to act as Infrastructure manager for the LoI 500 (for Operation & Maintenance)

Note: New Utilities are those to be defined and designed as part of project's scope. New construction utilities out of RB RAIL project scope will be considered as Existing Utilities (in terms of LOD=LoG+LoI).

19. Annex 2 – Level of Geometric Detail

The following tables show the minimum required Levels of Geometric detail for each discipline and system for each project phase. For each system the LoG shall be agreed separately in the BEP. If minimum required data are BIM models, then 2D drawings will be extracted from BIM models.

The table of LoG matrix can be supplemented, if the information is missing. All modifications and additions must be approved by RB Rail team.

Symbols	Description
X	required
o	possible as an extra
BIM	3D+associated data of the object
2D	CAD model
SI	Site investigation (input data for design)
VE	Value engineering
MD	Master Design
DTD	Detailed Technical Design
CO	Construction/Operation

Systems	Description
AR	Architecture
GP	General part
MP	Master plan
LSC	Landscaping
LVS	Low voltage systems
HV	High voltage power distribution
FS	Fire safety
FDA	Fire Detection and Alarm Fire Suppression/extinguish
HVA	HVAC
WSS	Water supply and sewerage
WDR	Rain/Storm water drainage and land reclamation

GAS	Gas supply and networks
RW	Railway
AUS	Automation systems
RTI	Roads and transport infrastructure
BR	Bridges
STR	Structural

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
							LOG 200		LOG 300		LOG 400		LOG 500	
Discipline							2D	BIM	2D	BIM	2D	BIM	2D	BIM
X					AR	Walls	X	o	X	X		X		X
X						Doors	X	o	X	X		X		X
X						Windows	X	o	X	o		X		X
X						Glazing				X		X		X
X						Louvers and vents			X	o		X		X
X						Assembly elements				X		X		X
X	X					Roofs				X		X		X
X						Ramps				X		X		X
X						Exterior stairs				X		X		X
X						Exterior escalators				X		X		X
X	X		X			Exterior elevators				X		X		X
X						Ladders and catwalks				X		X		X
X						Façades				X		X		X
X						Toilet fixtures				X		X		X
X						Public furnishing				X		X		X
X						Signage				X		X		X
X	X					Communications shafts				X		X		X
X	X					Defined model materials				X		X		X
X	X					Ceilings			X	o		X		X
X	X					Floors			X	o		X		X
X	X					Interior stairs			X	o		X		X
X	X	X	X			Interior escalators			X	o		X		X
X	X	X	X			Interior elevators			X	o		X		X
X						Railings and handrails			X	o		X		X
X	X					Maintenance access and evacuation areas				X		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
Discipline							LOG 200		LOG 300		LOG 400		LOG 500	
							2D	BIM	2D	BIM	2D	BIM	2D	BIM
X						Interior and exterior lighting			X	o		X		X
X						Fire protection specialties			X	o		X		X
X						Defined model properties (color, texture, etc.)			X	o		X		X
X						Structural gridlines			X	X		X		X
X					GP	Retaining Walls	o	X		X		X		X
				X		Geodetic and Topographical survey	X	o	o	X		X		X
						Geodetic and Topographical survey (terrain model)	o	X	o	X		X		X
				X		Photos, laser scanning, photogrammetry (for existing structures)	X	o	o	X		X		X
				X		Geotechnical survey	X	X	o	X		X		X
X				X		Architectural artistic exploration (for existing structures)	X	o	o	X		X		X
X	X					Noise barriers	o	X		X		X		X
X						Corridor Fencing	o	X		X		X		X
X	X					Environment and Cultural Heritage protection measures	o	X		X		X		X
X				X		Road/Street Surfaces				X		X		X
			X	X		Existing utilities	X	X	X	X	X	X		X
			X	X		New Utilities	X	o	o	X		X		X
X						Clearance envelopes				X		X		X
X				X		Boring Locations	o	X*		X		X		X
				X		Lab test results (DG soil classification)	o	X*		X		X		X
				X		Test Pit Locations	o	X*		X		X		X
				X		DCP locations	o	X*		X		X		X
				X		Terrain model	o	X*		X		X		X
X				X		Necessary land plot borders	X		X	o		X		X
				X		Ground Water Profile	o	X*		X		X		X
				X		Strata Profiles	X	o		X		X		X
				X		Embankment	X	o		X		X		X
				X		Cutting Subgrade	X	o		X		X		X
				X		Sub-ballast	X	o		X		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
							LOG 200		LOG 300		LOG 400		LOG 500	
Discipline							2D	BIM	2D	BIM	2D	BIM	2D	BIM
				X		Ballast layers	X	o		X		X		X
				X		GA of Monitoring locations	X	o		X		X		X
			X	X		Sensors				X		X		X
			X	X		Monitoring Equipment				X		X		X
			X	X		Monitoring systems				X		X		X
				X	MP	Construction project master plan			X	o		X		X
			X	X		Protection Works	X	o		X		X		X
				X		Lifting devices			X	o		X		X
			X	X		Relocation Works				X		X		X
X				X	LSC	Earthworks Surface				X		X		X
X				X		Strings for setout landscape	X	o	o	X		X		X
X				X		Planting			o	o		X		X
X				X		Street and road furniture				X		X		X
X						Pavements				X		X		X
X				X		Earthworks Formation incl Material Zones for embankments, topping zones				X		X		X
X				X		Signage				o		X		X
X	X					Defined model materials			X	o		X		X
X	X			X		Defined model properties (color, texture, etc.)			X	o		X		X
				X	WDR	Desktop flooding	X	o	X	o		X		X
				X		Hydraulic analysis	X	o	X	o		X		X
				X		Incremental afflux	X	o	X	o		X		X
				X		Mitigation treatments	X	o	X	o		X		X
				X		Detailed flooding			X	o		X		X
				X		Detailed hydraulic analysis			X	o		X		X
				X		Vertical Flooding			X	o		X		X
X				X		Site infrastructure			X	o		X		X
				X		Street fire hydrant			X	o		X		X
				X		Surface drainage			X	o		X		X
				X		External drainage & underground drainage			X	o		X		X
				X		Hard landscaped areas			X	o		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
							LOG 200		LOG 300		LOG 400		LOG 500	
Discipline							2D	BIM	2D	BIM	2D	BIM	2D	BIM
				X		Planter boxes including sub-soil drainage systems			X	o		X		X
				X		geometry updated as built + further specific geometry detail						X		X
			X	X	LVS/HV	Schematic diagram	X			X		X		X
			X	X		Schematic Layout	X			X		X		X
			X	X		High Tension Service & Dist.				X		X		X
			X	X		Low Tension Service & Dist.				X		X		X
			X	X		Cable Trays (railway ducts)	X			X		X		X
			X	X		Communications Equipment	X			X		X		X
			X	X		Lighting Equipment	X			X		X		X
			X	X		Security and Detection Systems				X		X		X
			X	X		Protection Systems (Fire Alarm Systems)				X		X		X
				X	FS/FDA	Schematic diagram	X		X			X		X
				X		Schematic Layout	X		X			X		X
				X		Piping				X		X		X
				X		Sprinklers				X		X		X
				X		Valves				X		X		X
				X		Switches				X		X		X
				X		Sprinkle pumps				X		X		X
				X		Sprinkle tanks				X		X		X
				X		Hydrants and hose reels				X		X		X
				X		Fire extinguisher and hose reel cabinets				X		X		X
				X		Panels				X		X		X
				X		Sensors				X		X		X
				X		Heat/Smoke detectors				X		X		X
				X		Shutters				X		X		X
				X		Smoke Curtains				X		X		X
				X	HVA	Schematic diagram	o	X		X		X		X
				X		Schematic Layout	o	X		X		X		X
				X		HVAC system as Space allowances		X		X		X		X
				X		Mechanical ventilation equipment Space allowance		X		X		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
							LOG 200		LOG 300		LOG 400		LOG 500	
Discipline							2D	BIM	2D	BIM	2D	BIM	2D	BIM
				X		Piping				X		X		X
				X		Pumping				X		X		X
				X		Ducts (Distribution Systems)				X		X		X
				X		Energy Supply				X		X		X
				X		Heat Generating Systems				X		X		X
				X		Cooling Generating Systems				X		X		X
				X		Diffusers (Terminal Units)				X		X		X
				X		Control & Instrumentation				X		X		X
				X		Filters				X		X		X
				X		Valves				X		X		X
				X		Heat storage				X		X		X
				X		Cooling storage				X		X		X
				X		Equipment				X		X		X
				X		Supplementary components				X		X		X
				X	WSS	Schematic diagram	o	X		X		X		X
				X		Schematic Layout	o	X		X		X		X
						Water Supply				X		X		X
				X		Piping				X		X		X
				X		Cold Water Service				X		X		X
				X		Hot Water Service				X		X		X
				X		Domestic Water Supply Equipment				X		X		X
				X		Tanks				X		X		X
				X		Equipment				X		X		X
				X		Plumbing Fixtures				X		X		X
				X		Valves				X		X		X
				X		Supplementary components				X		X		X
				X		Drains				X		X		X
		X		X	WDR	Schematic diagram	o	X		X		X		X
		X		X		Schematic Layout	o	X		X		X		X
				X		Piping				X		X		X
				X		Sanitary Waste				X		X		X
				X		Rain Water Drainage				X		X		X
		X		X		Tanks				X		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
							LOG 200		LOG 300		LOG 400		LOG 500	
Discipline							2D	BIM	2D	BIM	2D	BIM	2D	BIM
				X		Pumping				X		X		X
		X				Equipment				X		X		X
		X		X		Panels				X		X		X
		X		X		Plumbing Fixtures				X		X		X
		X		X		Valves				X		X		X
X		X	X	X		Sanitary Sewer				X		X		X
X		X	X	X		Storm Sewer				X		X		X
		X		X		Supplementary components (Other Plumbing Systems)				X		X		X
				X		Drains				X		X		X
X		X	X	X	GAS	Sanitary Sewer				X		X		X
X		X	X	X		Conflict Areas	X	o		X		X		X
X		X	X	X		Existing utilities	X	o	X	o	X	o		X
X		X	X	X		New Utilities	X	o	o	X		X		X
X		X	X	X		Gas Distribution				X		X		X
X		X	X	X		Equipment				X		X		X
X		X	X	X		Supplementary components				X		X		X
X		X	X	X		Fuel Distribution				X		X		X
X		X	X	X		Site Communications & Security				X		X		X
				X	RW	Track Alignment Geometry		X		X		X		X
				X		Track Alignment turnouts		X		X		X		X
				X		Railway Superstructure and substructure (visualisation only)		X		X		X		X
				X		Schematic track layout for the railway	X	o	X	o		X		X
		X		X		Tunnel on railway longitudinal profiles	X		X	o		X		X
X				X		Emergency access associated elements				X		X		X
				X		Expansion joints				o		X		X
				X		Cant				X		X		X
				X		Ballast layer	X	o	o	X		X		X
				X		Crossing	X	o		X		X		X
				X		Sidewalks				X		X		X
				X		Slab Track				X		X		X
				X		Railway Superstructure		X		X		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
Discipline							LOG 200		LOG 300		LOG 400		LOG 500	
							2D	BIM	2D	BIM	2D	BIM	2D	BIM
				X		Schematic Layout	X		X		X	o		X
				X		Vertical alignment	X	o	X	o		X		X
				X		Horizontal alignment	X	o	X	o		X		X
				X		Cross-section	X		X	o		X		X
				X		Speed diagram	X		X		X			X
				X		Rails		X		X		X		X
						Cross Passages	X			X		X		X
				X		Sleepers	X	o		X		X		X
				X		Fastening system	X			o		X		X
				X		Turnouts	X			X		X		X
				X		Substructure		X		X		X		X
				X		Railroad corridor	X			X		X		X
	X			X		Retaining Walls		X		X		X		X
				X		Noise barriers		X		X		X		X
			X	X		Utilities	X			X		X		X
	X			X		Culverts	X			X		X		X
	X			X		Accurate Outline	o	X		X		X		X
	X			X		Structural elements related with global civil objects of the project	o	X		X		X		X
	X					Crown units				X		X		X
	X			X		Pipe Units				X		X		X
	X					Headwalls				X		X		X
	X					Bedding Slabs				X		X		X
	X			X		Backfill				X		X		X
	X			X		Trench Support Zones				X		X		X
	X					Material and angle of wings				X		X		X
	X			X		Elements split according to construction division				X		X		X
	X					Hangers				X		X		X
	X					Brackets				X		X		X
	X					Lifting devices				X		X		X
	X			X		Finishes			X	o		X		X
	X			X		Reinforcement			X	o		X		X
				X		Fencing		X		X		X		X
				X		Finishes	X			X		X		X
				X		Drainage, ditches	X	X		X		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
							LOG 200		LOG 300		LOG 400		LOG 500	
Discipline							2D	BIM	2D	BIM	2D	BIM	2D	BIM
				X		Sub-ballast/blanket layer	X	X		X		X		X
				X		Subgrade	X	X		X		X		X
				X		Embankment fill	X	X		X		X		X
				X		Excavation earthworks		o		X		X		X
				X		Soil improvement		o		X		X		X
				X		Technical blocks		o		X		X		X
				X		Access track pavements	X			X		X		X
				X		Hangers	X			X		X		X
				X		Brackets	X			X		X		X
		X	X	X	AUS	Ducts and ULX locations	X	o	o	X		X		X
				X		Rail Systems equipment's, structures and huts locations	X	o	X	o		X		X
				X		Ducts and ULX layout	X	o		X		X		X
				X		Rail Systems equipment's, structures and huts layout	X	o	X	o	X	o		X
				X		Breaking distance diagrams	X	o	X	o	X	o		X
				X		Schematic layout for the Signaling			X	o	X	o		X
		X	X	X		Caballing for Rail Systems			X	o	X	o		X
				X		Principle diagrams for Rail Systems			X	o	X	o		X
				X		Breaking distance diagrams			X	o	X	o		X
	X			X		Transition zones	X		X	o		X		X
			X	X		Telecommunications						X		X
			X	X		Electric supply						X		X
			X	X		Power supply						X		X
		X	X	X		Rail Systems equipment						X		X
				X		Rail System structure						X		X
	X			X		Rail System huts layout			X	o		X		X
			X	X		Cabling system			X	o		X		X
				X	RTI	Terrain model	o	X		X		X		X
				X		Earthworks Surface	o	X		X		X		X
				X		Earthworks formation material zones	o	X		X		X		X
				X		Excavation earthworks		o		X		X		X
				X		Soil improvement		o		X		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
							LOG 200		LOG 300		LOG 400		LOG 500	
Discipline							2D	BIM	2D	BIM	2D	BIM	2D	BIM
				X		Technical blocks		o		X		X		X
				X		Road Surface	o	X		X		X		X
				X		Alignment Geometry	o	X		X		X		X
				X		String for setout	o	X		X		X		X
				X		Clearance envelopes	o	X		X		X		X
				X		Pavements	X	o		X		X		X
				X		Kerbs	X			X		X		X
	X			X		Retaining Walls	X			X		X		X
	X			X		Noise Walls	X			X		X		X
	X			X		Barriers	X			X		X		X
	X			X		Barrier Treatments	X			X		X		X
				X		Drainage, ditches	X			X		X		X
			X	X		Signage	X			X		X		X
		X	X	X		Road Lighting	X			X		X		X
				X		Traffic Signals	X			X		X		X
				X		Road Furniture	X			o		X		X
				X		Corridor Fencing	X	X		X		X		X
	X			X		Culverts	X			X		X		X
	X			X		Accurate Outline	o	X		X		X		X
	X			X		Structural elements related with global civil objects of the project	o	X		X		X		X
	X					Crown units				X		X		X
	X			X		Pipe Units				X		X		X
	X					Headwalls				X		X		X
	X					Bedding Slabs				X		X		X
	X			X		Backfill				X		X		X
	X			X		Trench Support Zones				X		X		X
	X					Material and angle of wings				X		X		X
	X			X		Elements split according to construction division				X		X		X
	X					Hangers				X		X		X
	X					Brackets				X		X		X
	X					Lifting devices				X		X		X
	X			X		Finishes			X	o		X		X
	X			X		Reinforcement			X	o		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
Discipline							LOG 200		LOG 300		LOG 400		LOG 500	
							2D	BIM	2D	BIM	2D	BIM	2D	BIM
X				X		Environment and Cultural Heritage protection measures	X			X		X		X
				X	BR/STR	Superstructure	X	X	X	X		X		X
				X		Substructure	X	X	X	X		X		X
	X	X		X		Foundation	X	X	X	X		X		X
	X	X				Accurate Reference		X		X		X		X
	X					Deck		X		X		X		X
X						Structural gridlines			X	X		X		X
	X					Barriers				X		X		X
	X					Girders				X		X		X
	X					Abutments				X		X		X
	X					Piers		X		X		X		X
	X					Piles		X		X		X		X
	X					Wingwalls		X		X		X		X
	X					Relieving Slabs				X		X		X
	X					Bearings				X		X		X
	X					Large penetrations				X		X		X
	X					Chamfer				X		X		X
	X					Pour joints, sequences				X		X		X
	X					Expansion Joints				X		X		X
	X					Lifting devices				X		X		X
	X					Embeds				X		X		X
	X					Post-tension profile				X		X		X
	X					Any permanent forming or shoring components				X		X		X
	X					Stiffeners				X		X		X
	X					Other structural elements				X		X		X
	X				BR/STR	Dowels						X		X
	X			X		Water stops						X		X
	X					Splits between plate girders						X		X
	X					Washers, nuts						X		X
	X					Assembly elements				X		X		X
	X					Accurate Outline	o	X		X		X		X
	X					Structural elements related with global civil objects of the project	o	X		X		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
							LOG 200		LOG 300		LOG 400		LOG 500	
Discipline							2D	BIM	2D	BIM	2D	BIM	2D	BIM
	X					Crown units				X		X		X
	X			X		Pipe Units				X		X		X
	X					Headwalls				X		X		X
	X					Bedding Slabs				X		X		X
	X					Backfill				X		X		X
	X					Trench Support Zones				X		X		X
	X					Material and angle of wings				X		X		X
	X					Elements split according to construction division				X		X		X
	X					Hangers				X		X		X
	X					Brackets				X		X		X
	X					Lifting devices				X		X		X
	X					Finishes			X	o		X		X
	X					Reinforcement			X	o		X		X
	X					allowance space for clearance verification and for congested MEP areas	o	X		X		X		X
	X					Accurate Reference Lines	o	X		X		X		X
	X					Superstructure	o	X		X		X		X
	X					Substructure	o	X		X		X		X
	X					Foundation	o	X		X		X		X
	X					Slabs				X		X		X
	X					Walls				X		X		X
	X					Structural Framing				X		X		X
	X					Columns				X		X		X
	X					Floors				X		X		X
	X					Roofs & canopy				X		X		X
	X					Large penetrations				X		X		X
	X					Elements split according to construction division				X		X		X
	X					Hangers				X		X		X
	X				BR/STR	Brackets				X		X		X
	X					Large stiffeners						X		X
	X					Washers, nuts						X		X
	X					Chamber						X		X
	X					Coping						X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
							LOG 200		LOG 300		LOG 400		LOG 500	
Discipline							2D	BIM	2D	BIM	2D	BIM	2D	BIM
	X					Post-tension elements						X		X
	X					Portals		o		X		X		X
	X					Slabs		X		X		X		X
	X					Walls & Retaining		X		X		X		X
	X					Structural Framing with specific sizes of main structural elements		X		X		X		X
	X					Structural connections when the size is larger than the structural				X		X		X
	X					Slabs				X		X		X
	X					Wall & Retaining				X		X		X
	X					Columns				X		X		X
	X					Foundations				X		X		X
	X					Floors				X		X		X
	X					Roofs & canopy				X		X		X
	X					Penetrations				X		X		X
	X					Elements split according to construction division				X		X		X
	X					Anchor rods, hangers, brackets				o		X		X
	X					Posttension anchors, tie-back anchors				X		X		X
	X					Deviators				X		X		X
	X					Penetrations				X		X		X
	X					Strand				X		X		X
						Chamber			X	o		X		X
	X					Accurate Outline		X		X		X		X
X	X				BR/STR	Accurate allowance space for clearance verification and for congested MEP areas		X		X		X		X
						Foundations	X	o		X		X		X
	X					Walls	X	o		X		X		X
	X					Stairs	X	o		X		X		X
	X					Structural Framing with specific sizes of main structural elements	X	o		X		X		X
	X					Structural connections when the size is larger than the structural	X	o		X		X		X

Architecture	Structure	Mechanical	Electrical	Civil	System	Elements	VE		MD		DTD		CO	
							LOG 200		LOG 300		LOG 400		LOG 500	
Discipline							2D	BIM	2D	BIM	2D	BIM	2D	BIM
	X				BR/STR	Structural connections when the size is larger than the structural elements	X	o		X		X		X
	X					Large penetrations (such as large utilities or MEP elements)	X	o		X		X		X
	X					Elements split according to construction division	X	o		X		X		X
	X					Post-tension elements				X		X		X
	X					Strand				X		X		X
	X					Connection details & main steel connection details				X		X		X
	X					Stiffeners				X		X		X
	X					Copings			X	o		X		X
	X					Welds, gratings, holes			X	o		X		X
	X					Washers, nuts			X	o		X		X
						Associated structures	X		X	o		X		X
	X					Large stiffeners			X	o		X		X
	X			X		Tolerance Space allowance for Retaining Walls	o	X		X		X		X

* Delivered information in SI stage is covered by requirements in VE stage

20. Annex 3 – Level of Information (attributes)

The following tables show the minimum required Levels of Information object matrix. For each system the LoI shall be agreed separately in the BEP. The table of LoI can be supplemented, if the information is missing. All modifications and additions must be approved by RB Rail team.

NOTE: The elements with attribute "RBR-IsTemplate" value 1 are considered as template elements. Meaning attributes attached to these elements are applicable to all elements in the same model that have the same "RBR-Pr_Code" and "RBR-Type_number" combination. That will enable to keep the relevant attribute information in the model AND keep the file size under control.

RBR-Object_ID- data shall be extracted from BIM models to 2D detailed construction object drawings.

X: Mandatory O: Optional										Responsible	IFC Support (Optional)	Software Mapping
Type		Attribute Description				LOI						
Global attributes												
Group	Attribute	Data Type	Units	Description	Commentary	200	300	400	500			
Member Mark												
	RBR-Project_ID	Text		See Member Mark section	See codification tables	X	X	X	X	PIM		
	RBR-Section_ID	Text				X	X	X	X	PIM		
	RBR-SubSection_ID	Text				X	X	X	X	PIM		
	RBR-Originator	Text				X	X	X	X	PIM		
	RBR-Discipline_Code	Text				X	X	X	X	PIM		
	RBR-VolSysZone	Text				X	X	X	X	PIM		
	RBR-Location	Text				X	X	X	X	PIM		
	RBR-Functional_classification	Text			Classification code according with the functional hierarchy	X	X	X	X	PIM		
	RBR-Object_ID	Text			See codification tables	X	X	X	X	PIM		
Common Asset Data												
	RBR-Asset_ID	Text		Unique Asset ID		-	-	-	X	AIM		
	RBR-AR_ID	Text		Asset register identificator		-	-	-	X	AIM		
	RBR-Asset_Name_1	Text		Descriptive name (e.g. "Pump 01")	Operator defined, (Supplier defined if not by operator). Attributes used to relate components/sub-components hierarchically within assets.	-	-	-	X	PIM / AIM		

X: Mandatory O: Optional										Responsible	IFC Support (Optional)	Software Mapping
Type		Attribute Description				LOI						
Global attributes												
Group	Attribute	Data Type	Units	Description	Commentary	200	300	400	500			
	RBR-Asset_Name_2	Text		Descriptive name (e.g. "Pump 01")	According to the WGS in use, refer to BIM models' Geo-reference in the BIM Manual for units and precision	-	-	-	X	PIM / AIM		
	RBR-Easting	Number			Point object	X	X	X	X	PIM		
	RBR-Northing	Number				X	X	X	X	PIM		
	RBR-Elevation	Number				O	O	O	O	PIM		
	RBR-Easting_Start	Number			Line object	X	X	X	X	PIM		
	RBR-Northing_Start	Number				X	X	X	X	PIM		
	RBR-Elevation_Start	Number				O	O	O	O	PIM		
	RBR-Easting_End	Number			Line object	X	X	X	X	PIM		
	RBR-Northing_End	Number				X	X	X	X	PIM		
	RBR-Elevation_End	Number				O	O	O	O	PIM		
	RBR-Design_life	Integer			Design whole life, in years	-	X	X	X	PIM		
Location Asset Data												
	RBR-Route_code	Text		Specific code for Route	Specific code for Route	-	X	X	X	PIM		
	RBR-Start_Kilometre	Number		Start Kilometre of a linear asset	Start Kilometer of a linear asset	-	X	X	X	PIM		
	RBR-End_Kilometre	Number		End Kilometre of a linear asset	End Kilometer of a linear asset	-	X	X	X	PIM		
	RBR-Track_ID	Text		For Instances where the bridge does not span all	For Instances where the bridge does not span all	-	O	O	O	PIM		
	RBR-Room_Name	Text		Room Name	The room name where the Item is located (MEP&Arch elements), if it is a Room its own Name	X	X	X	X	PIM		
AIM Operation - Element Asset Data												
	attribute1				Operator defined, attributes to be defined by the Operator by means of AD4	-	-	O	X			
	attribute2					-	-	O	X			
	attribute3					-	-	O	X			
	….					-	-	O	X			
LOD												
	RBR-LoG	Integer		See Level of Definition Section	This attribute indicates the level of Accuracy of the element	X	X	X	X	PIM		
	RBR-LoI	Integer		See Level of Definition Section	This attribute indicates the level of Accuracy of the element	X	X	X	X	PIM		
Specifications												
	RBR-Spec_Code	Text		Specification code	Specifications codes used to relate BIM objects to spec documents. Defined by	-	O	X	X	PIM		
	RBR-Spec_Name	Text		Specification name		-	O	X	X	PIM		

X: Mandatory O: Optional										Responsible	IFC Support (Optional)	Software Mapping
Type		Attribute Description				LOI						
Global attributes												
Group	Attribute	Data Type	Units	Description	Commentary	200	300	400	500			
	RBR-Spec_Division	Text		Specification division	Supply Chain during PIM.	-	O	X	X	PIM		
	RBR-OCC	Text		Object Category Code	See codification tables	X	X	X	X	PIM		
	RBR-IsTemplate	Integer		Is Template Object	In current model all required attributes for this RBR-Type number are attached to this element	X	X	X	X	PIM		
Quantities and Cost Estimation												
	RBR-Material_Designation	Text		Element Material designation according to the European Standard (EN, Eurocodes…) whenever there is an European standard.		-	X	X	X	PIM		
	RBR-Material_Description	Text		Material description		-	X	X	X	PIM		
	RBR-Product_Name	Text		Name of the product		-	X	X	X	PIM		
	RBR-Product_Description	Text		Product description		-	X	X	X	PIM		
	RBR-Pr_Code	Text		Uniclass 2015 Product table	As defined in UniClass 2015 tables.	-	X	X	X	PIM		
	RBR-Type_number	Text		For unique type identification	To distinguish different types with identical "Uniclass Pr codes"	-	X	X	X	PIM		
	RBR-Units	Text		Measurement units	Indicates the measurement units of the element	X	X	X	X	PIM		
	RBR-Unit_Cost	Number				-	O	O	O	PIM		
	RBR-Element_Cost	Number				-	O	O	O	PIM		
Time Liner												
	RBR-Phase_Created	Date		Phase where the element is created		-	O	O	O	PIM		
	RBR-Phase_Demolished	Date		Phase where the element is demolished		-	O	O	O	PIM		
Clash Detection												
	RBR-TOClashCheck	Yes/No		Should be considered for clash check?	This attribute can be used to ignore the element in a clash test	-	O	O	O	PIM		
Sustainability												
	RBR-Recycled_Content	Integer				-	O	O	O	PIM		
	RBR-Carbon_Footprint	Integer				-	O	O	O	PIM		

X: Mandatory O: Optional										Responsible	IFC Support (Optional)	Software Mapping
Type		Attribute Description				LOI						
Global attributes												
Group	Attribute	Data Type	Units	Description	Commentary	200	300	400	500			
	RBR-LEED_Compliant	Integer		List of LEED attributes that complies with (i.e. 15-A, 17-B, 20-A)		-	O	O	O	PIM		
	RBR-LEED_Comment	Text		Extra information regarding LEED attributes compliance		-	O	O	O	PIM		
Life and Safety												
					To be defined by the supply chain if needed	-	-	-	-			
GIS												
	RBR-GISattribute1			To be filled in if the LOI200 model is expected to be loaded to GIS	Attributes to be defined according to the attribute structure of the GIS environment where BIM models will be inserted. (if the Use Case exists)	X*	X	X	X	PIM		
	RBR-GISattribute2			To be filled in if the LOI200 model is expected to be loaded to GIS		X*	X	X	X	PIM		
Operation / Facility management												
	RBR-Manufacturer_Name	Text				-	-	-	X	PIM / AIM		
	RBR-Material_reference	Text				-	-	-	X	PIM / AIM		
	RBR-Manufacturer_URL	URL				-	-	O	X	PIM / AIM		
	RBR-Maintenance_Sheet	Text / URL				-	-	O	X	PIM / AIM		
	RBR-Installed	Yes/No				-	-	O	X	PIM / AIM		
	RBR-Installation_date	Date				-	-	O	X	PIM / AIM		
	RBR-Maintenance_Frequency	Integer		in years		-	-	O	X	PIM / AIM		
	RBR-Warranty_Start	Date				-	-	O	X	PIM / AIM		
	RBR-Warranty_End	Date				-	-	O	X	PIM / AIM		
	RBR-SerialNumber	Text		Element serial number		-	-	X	X	PIM		
	RBR-ModelReference	Text		Model reference		-	-	X	X	PIM		
Dimension/constrains												
					To be defined by the supply chain if needed	-	-	-	-			
Analytical												

X: Mandatory O: Optional										Responsible	IFC Support (Optional)	Software Mapping
Type		Attribute Description				LOI						
Global attributes												
Group	Attribute	Data Type	Units	Description	Commentary	200	300	400	500			
					To be defined by the supply chain if needed	-	-	-	-			
Others												
	RBR-Local_Code	Text		Discipline code according to local legislation	See Codification and Data Management Document and tables	X	X	X	X	PIM		
	RBR-Project_Stage	Text		Abbreviation of the project Stage		X	X	X	X	PIM		
	RBR-Revision	Integer		Revision Number		X	X	X	X	PIM		