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BUILDING INFORMATION MODELLING REQUIREMENTS

Version 2.0.

Contents

1. Introduction

1.1. Purpose and application

This document has been prepared with the aim of establishing clear and comprehensible conditions and procedures for the ordering, development and delivery of BIM within the framework of a real estate development project, as well as formulating the quality, capacity and information exchange requirements.

These BIM requirements are intended for use in the design and construction process and foresee an approach where the design team that has created the BIM retains responsibility for updating and supplementing the BIM during the construction phase. Accordingly, BIM requirements can be used both within a joint design and construction contract (the design-build principle) and where the design development and construction works are undertaken by different suppliers under different contracts (the design-bid-build principle). Where the design-bid-build principle is used, the BIM requirements apply to the designer. At the same time, if necessary, BIM requirements can also be used in the design phase only.

BIM requirements are to be used as employer's information requirements (including information exchange requirements) within the context of BIM and can be included in procurement contracts as an annex. BIM requirements do not replace the technical specification of a particular service, but rather serve as a part of the work assignment.

At the same time, BIM requirements do not waive the need to develop and coordinate the construction intention documentation in compliance with laws and regulations. The BIM requirements establish the conditions for information exchange and cooperation processes, as well as define the technical requirements for BIM deliverables.

The BIM requirements are to be adapted to the needs and specifics of a given project. The use of the BIM requirements' documentation or a part thereof remains at the discretion of the customer. For convenience of use, a template with special requirements of the Project has been annexed to the requirements, which can be used to determine the BIM deliverables, deadlines, and other conditions applicable to a specific project.

BIM requirements are also suited for internal use by the customer, as descriptive and explanatory guidelines for BIM processes and requirements.

It is worth noting that, in order to ensure a comprehensive BIM process, the customer also needs to ensure the presence of their own BIM staff or a BIM consultant (in the case of outsourcing). Firstly, it is necessary to be able to meet the customer's obligations regarding the use of the CDE and BIM workflows. Secondly, in order to enhance the BIM quality, it is recommended to provide not only the BIM information management function, but also the BIM quality control function, by coordinating the models and checking compliance with BIM requirements from the customer's side as well. The mandatory and recommended roles of the customer's specialists are described in the relevant section of the BIM requirements. Moreover, the availability of competent BIM staff will not only allow one to fully utilise all possibilities and advantages offered by BIM, but also to correctly define the needs and methods of application of BIM when delivering real estate development projects.

This is the second version of BIM requirements, version 2.0, which has been updated and supplemented based on the practical experience gained in the projects and the development of BIM technologies. In the future, it is planned to continually update the BIM requirements and release updated versions of the document.

1.2. Document structure

The BIM requirements consist of four chapters as well as a set of annexes.

The introduction contains information about the goals and contents of the document, as well as instructions on how to use the document. In addition, there are references and definitions of the terms and abbreviations used.

The "Business Requirements" chapter provides a general overview of the overall life cycle of the building in the context of basic BIM procedures, procurement processes and BIM application types. The key information included in the "Business Requirements" chapter consists of well-defined project stages and control points that are binding to suppliers.

The "Information Exchange Requirements" chapter contains the organisational matters of the BIM process regarding the cooperation of the parties involved, information exchange, management and operations processes, including the requirements for the BIM execution plan, the Common Data Environment and quality checks. Where there is a choice of approach to be used (for example, providing a CDE or the design-build or design-bid-build principle), Chapter Three also describes the process alternatives. The information exchange requirements and principles apply to all projects.

The "Technical Requirements" chapter provides guidance on the information created within BIM, such as level of development requirements, modelling requirements, descriptions of BIM deliverables. The requirements of Chapter Four apply to a specific project to the extent that the specific deliverables required in the Project special requirements are applicable to the project.

Annexes to the BIM requirements can be divided into two groups:

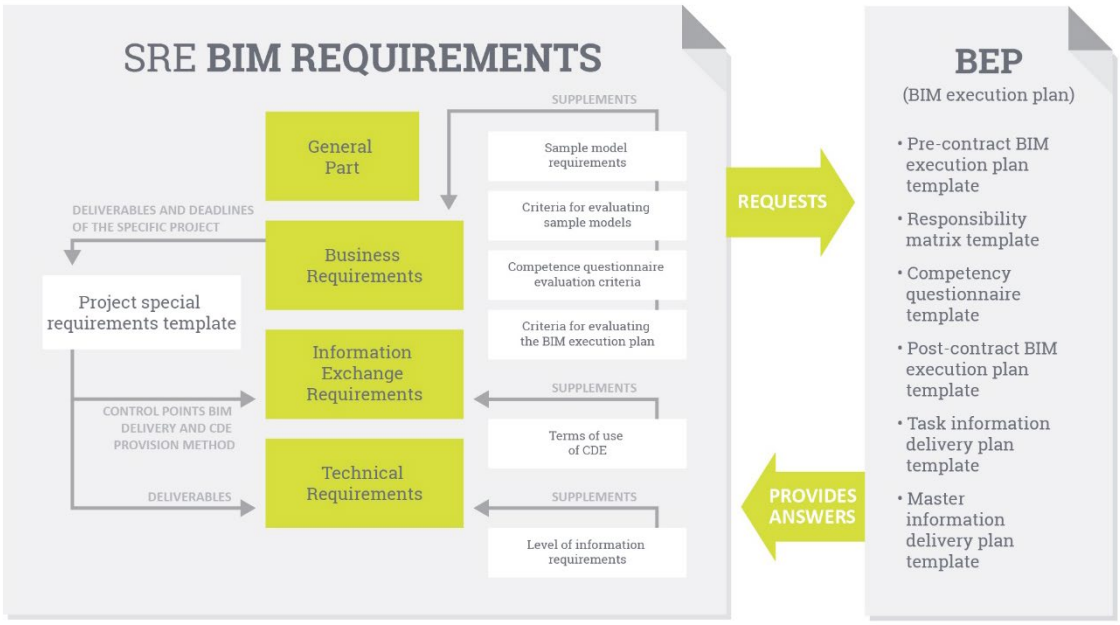
Annexes supplementing BIM requirements:

- Project special requirements template (a template used by the customer to determine the requirements of a given project)
- Level of information requirements (requirements for information to be added to engineering systems and construction elements)
- Sample model requirements
- Criteria for evaluating sample models
- Competence questionnaire evaluation criteria
- Criteria for evaluating the pre-contract BIM execution plan
- Terms of use of CDE

Annexes to be used by the supplier to provide answers to BIM requirements:

- Competency questionnaire template
- Pre-contract BIM execution plan template
- Responsibility matrix template
- Post-contract BIM execution plan template
- Task information delivery plan template
- Master information delivery plan template

Below is a schematic representation of the structure of SRE BIM requirements and the application matrix.



1.3. References

- LVS EN ISO 19650-1:2019 “Organisation and digitisation of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 1: Concepts and principles”
- LVS EN ISO 19650-2:2019 “Organisation and digitisation 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”
- LVS 1052:2018 “Building Information Modelling (BIM) Terminology”
- BS 1192:2007 “Collaborative production of architectural, engineering and construction information – Code of practice”
- BSI PAS 1192-2:2013 “Specification for information management for the capital/delivery phase of construction projects using building information modelling”
- BSI PAS 91:2010 “Construction related procurement. Prequalification questionnaires”
- BIM Forum “Level of Development Specification” 2021
- COBIM 2012 “Common BIM Requirements” manuals

1.4. Terms and abbreviations used

BIM Requirements – Building Information Modelling Requirements, this document.

Customer – the customer specified in a given procurement tender and procurement contract.

Supplier – the tenderer specified in the bid for a given procurement or the contractor specified in a given procurement contract.

Project – the customer's real estate development project in the planning or execution phase.

CDE – common data environment.

Note: definitions for terms used in accordance with the standard LVS 1052:2018 are not given in this document.

2. Business Requirements

2.1. Project Life Cycle

The BIM information delivery cycle and procedures within a project are part of the general real estate life cycle.

The real estate life cycle can be divided into three major phases: Project Idea, Project Execution, Facility management and Operations.

The project idea development phase includes project planning and preparation work, for example, identifying client's needs, selecting the best-suited real estate, carrying out a preliminary technical study, estimating the preliminary budget and identifying the funding source. This establishes the overall framework of the project and leads to the project execution phase, which includes detailed research, design and construction work.

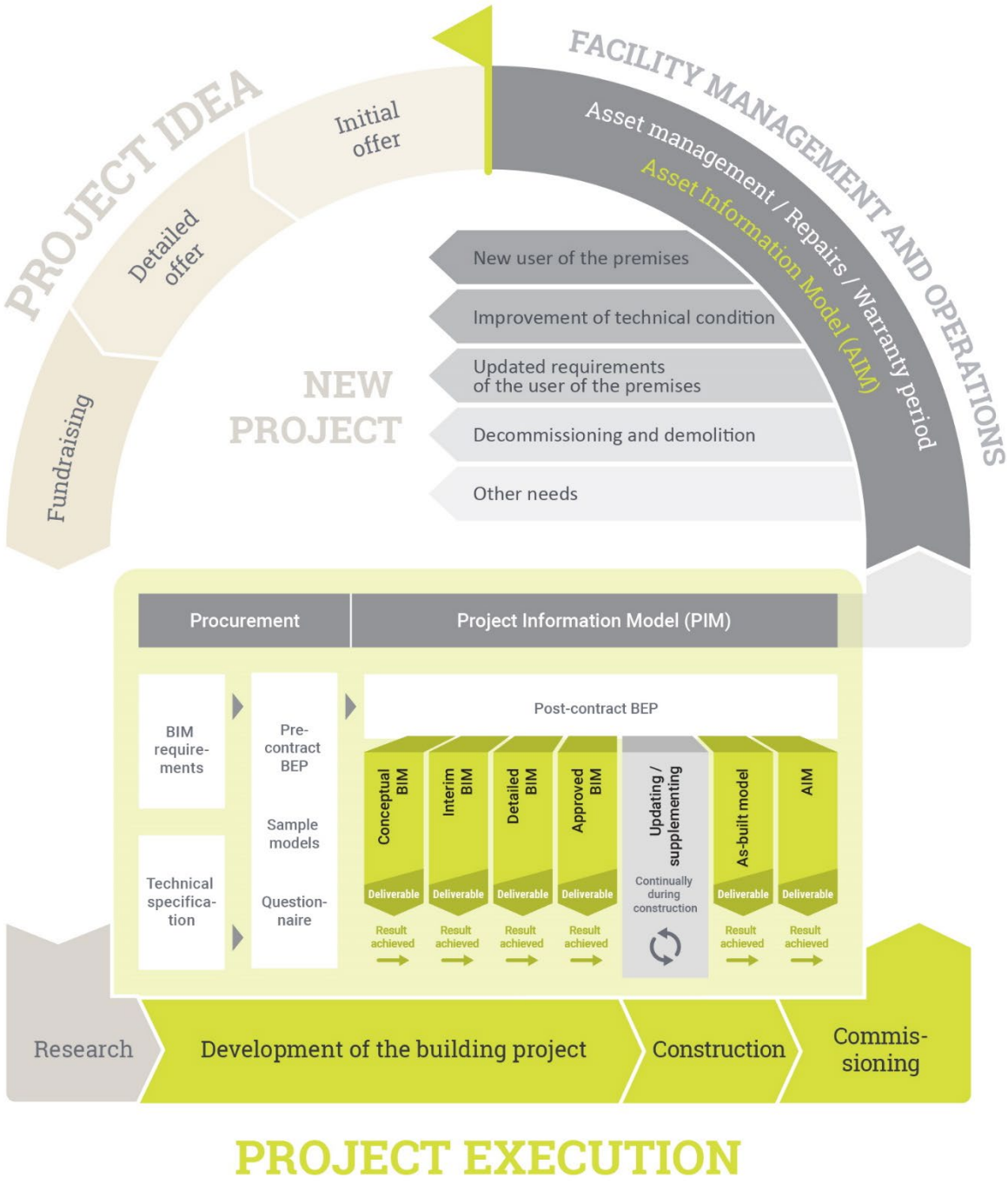
The starting point of use of BIM is determined individually in each specific case depending on the specifics of the project. In general, it is expected to use BIM simultaneously with the initiation of the design phase. The BIM control points must align with the results to be achieved under the respective activities of the project life cycle.

Upon completion of the project execution, the real estate transitions into the facility management and operations phase which is the longest phase in terms of duration. In practice, all three phases of a given real estate property may overlap or occur simultaneously.

The use of BIM does not end with the completion of the project. The BIM developed during the execution of the project, which reflects the work actually carried out, the technical solutions selected and the assets delivered and installed, offers wide possibilities of application in the real estate facility management and operations phase.

For example, BIM can be used both for the planning of new project development ideas and the execution of new projects, and for creating asset information models by cross-referencing information with other databases. Paragraph 2.5 of the Business Requirements provides a descriptive insight into the possible applications of BIM for asset management and building operations during the facility management process.

Below is a schematic representation of the project life cycle and basic BIM procedures in the context of the overall building life cycle.



2.2. Supplier's competence

The customer is responsible for verifying the supplier's ability to execute the project in the BIM environment and to meet the BIM requirements. The assessment of the supplier's competence takes place during the procurement procedure.

Indicators of the supplier's ability to execute a BIM project are the level of knowledge and skills, previous experience, as well as information technology and personnel resources.

To verify the supplier's compliance with the BIM requirements, the customer may request submission of the following materials of the procurement procedure:

Materials to be submitted	
Name	Purpose
Sample models	Factual and tangible proof of the supplier's ability to meet the customer's technical requirements.
Competence questionnaire	Provides an overview of the basic BIM competencies and capacity of the supplier.
Pre-contract BIM execution plan	Ensures that the customer’s requirements are understood and the commitment to provide a specific service in full, according to a certain level of quality and within deadlines. Provides information on the supplier's approach to project execution in the BIM environment (including resources and methods).

Both the requirements and the evaluation criteria for all of the deliverables mentioned above are annexed to the BIM requirements.

As regards sample models, it is recommended to avoid having the same requirements in different procurement tenders and to vary the technical parameters of the sample models. Items that preferably should be changed for each subsequent tender are highlighted in grey and underlined in Annex 3 “Requirements for Sample Models” and Annex 4 “Criteria for Evaluating Sample Models” to the BIM requirements. When setting the requirements for sample models, the customer should also ensure a proper inspection of the submitted sample models on their part.

The BIM requirements do not govern all the requirements of the specific procurement regulations, which depend on the content and specifics of a given project, but rather establish the minimum recommended requirements for BIM competence. The scope of general tender qualification requirements or other requirements remains at the discretion of the customer.

2.3. Control points and results to be achieved

Control points and results to be achieved are specified to precisely define the conditions under which the next set of BIM deliverables are approved and the transition to the next BIM development phase occurs.

Deadlines for the execution of control points are determined individually using the Project special requirements template.

The following BIM control points and results to be achieved are planned in the project:

Project phase	Control point	Result to be achieved
Project planning	*N/A*	*N/A*
Research	N/A or Conceptual BIM	■ The models (and other deliverables, if applicable) have been fully developed, checked and approved by the customer. ■ The included solutions are coordinated with the user of the building.
Design	Conceptual BIM	■ The models (and other deliverables, if applicable) have been developed to the level of development specified in the project special requirements sample, checked and approved by the customer. ■ A design developed to the minimum scope and approved with the customer, the user of the building and the building board. ■ A conditional building permit has been received.
	Interim BIM	■ BIM models have been developed to the level of development specified in the project special requirements template, checked and approved by the customer. ■ The federated model contains no clashes that are not listed in the clash report.
	Detailed BIM	■ BIM development has been completed.

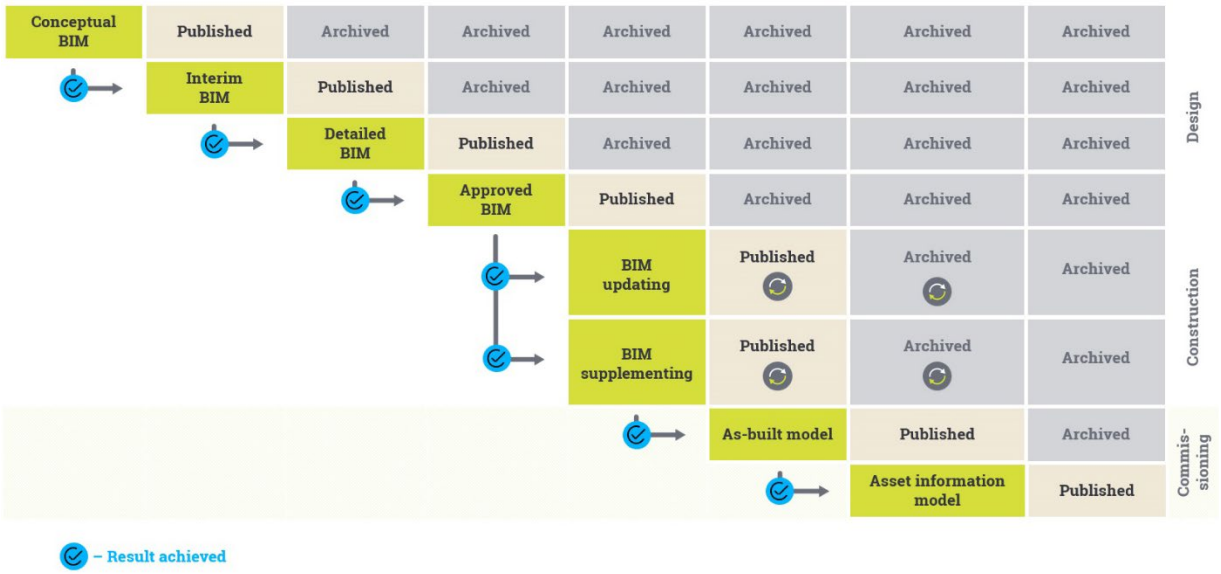
		■ The models (and other deliverables, if applicable) have been fully developed, checked and approved by the customer. ■ Material volume specifications derived from BIM models have been submitted. ■ The design has been coordinated with the user of the building. ■ The design is ready for submission for expert evaluation.
	Approved BIM	■ The updated models (and other deliverables, if applicable) have been checked and approved by the customer. ■ Material volume specifications derived from BIM models have been submitted. ■ A positive expert opinion has been received. ■ The design has been coordinated with the user of the building and the customer. ■ The design has been approved by the building board.
Construction	BIM updates (amendments to and deviations from the design): *continually*	■ The models (and other deliverables, if applicable), with changes during the construction works and/or deviations from the design have been fully developed, checked and approved by the customer.* ■ Changes, including changes in the quantities of construction works have been approved according to the procedure specified in the procurement contract (i.e., legally approved, for example, by signing a respective statement of changes or a contractual agreement).**
	Updating BIM addition (information about equipment and elements):	■ The models have been supplemented with information obtained during the construction works after the installation of the equipment/elements, checked and approved by the customer.

	within 10 days from receiving the information	
Transfer for management	As-built model (as-built model)	■ The models (and other deliverables, if applicable) have been fully developed, checked and approved by the customer. ■ The facility has been commissioned.
	Asset information model	■ The models (and other deliverables, if applicable) have been modified according to the requirements. The asset information model has been checked and approved by the customer. ■ The works and/or the facility have been handed over to the customer.

** where the "design-bid-build", approach is used, the deadline for fulfilling this condition may be established in the technical specification of a given service.*

** where the "design-bid-build", approach is used, this condition applies to the construction work contract.*

Below is a basic process diagram:



2.4. BIM deliverables

The following BIM deliverables may be requested as part of the project:

Type	Name
Capturing of the current situation	■ Photogrammetry ■ Laser scanning
Development of models	■ Architectural models ■ Building structure models ■ Mechanical, electrical and plumbing models ■ Other models (such as road or area) ■ Federated model
Analysis and simulations	■ 4D: simulation of the construction process ■ 4D: logistics, waste management, intensity analysis by zone ■ 4D: updating and status management ■ 4D: constructability analysis ■ Environmental accessibility analysis ■ Acoustic analysis ■ Analysis of flow of people and escape route options ■ Fire simulation ■ Lighting simulation ■ Security analysis ■ Location analysis ■ Analysis of exposure to sunlight ■ Construction site risk analysis ■ Energy efficiency analysis ■ Sustainability analysis ■ 5D
Visual reference materials	■ Visualisations ■ Virtual reality ■ Augmented reality
Other deliveries	■ Cost management

Descriptions and requirements of the deliverables can be found in Chapter 4 “Technical Requirements”.

A unique list of deliverables is requested in each project, which depends on the specifics, content and goals of the given project.

The minimum list of BIM deliverables when executing a project in the BIM environment may be limited to the development of 3D BIM models and non-graphical information supplementing the 3D BIM models.

The list of deliverables of the specific project is based on Annex 1 “Project special requirements template”.

Below is a completed sample of the Project special requirements template:

Special requirements of the project “...”							
Control points	Conceptual BIM	Interim BIM	Detailed BIM	Approved BIM	Construction	As-built	Asset information model
Deadline in months	3	6	9	12	Continually	Until commissioning the facility	Until handing over the works and/or the facility to the customer
Deliverables: 3D BIM models							
3D BIM models/Level of development							
Architectural solutions (Interior, Equipment location, Building acoustics)*	LOD 200	LOD 300	LOD 300	LOD 350	LOD 350	LOD 350	LOD 350
General plan, landscape	*N/A*	LOD 200	LOD 300	LOD 300	LOD 300	LOD 300	LOD 300
Building structures	*N/A*	LOD 200	LOD 300	LOD 300	LOD 300	LOD 300	LOD 300
HVAC (heating, ventilation,	*N/A*	LOD 200	LOD 300	LOD 300	LOD 300	LOD 300	LOD 300

climate control)*							
Internal water supply and sewerage*, external water supply and sewerage, rainwater drainage networks	*N/A*	LOD 200	LOD 300	LOD 300	LOD 300	LOD 300	LOD 300
Internal and external power supply	*N/A*	LOD 200	LOD 300	LOD 300	LOD 300	LOD 300	LOD 300
Electronic communication systems (Access control, Security alarm, Electronic communication networks, Control and automation systems, Video surveillance)*, External electronic communication systems	*N/A*	LOD 200	LOD 300	LOD 300	LOD 300	LOD 300	LOD 300
Thermal mechanics	*N/A*	LOD 200	LOD 300	LOD 300	LOD 300	LOD 300	LOD 300
Fire detection and emergency alarm systems	*N/A*	LOD 200	LOD 300	LOD 300	LOD 300	LOD 300	LOD 300
Federated model	*N/A*	●	●	●	●	●	●
Others...	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

Other deliverables:							
Control points	Conceptual BIM	Interim BIM	Detailed BIM	Approved BIM	Construction	As-built	Asset information model
Laser	●						
4D Simulation			●	●			
4D updating and status management					●		
Environmental accessibility analysis	●						
Visualisations	●	●	●	●			

Design and CDE solutions:		Level of information requirements for the design:	
		Data group	Yes/No
BIM delivery type	design-build	MAS	*Yes*
		Architectural solutions, Windows and doors	*Yes*
CDE provision type	Full-cycle CDE	Architectural solutions, Finishing	*Yes*
		Architectural solutions, space ID	*Yes*
		Architectural solutions, construction elements	*Yes*
		Building structures	*Yes*
Person in charge for the provision of CDE (in case of full-cycle CDE)	Supplier	internal power supply, VS, Electronic communication systems, Cable ladders	*Yes*
		Mechanical, electrical and plumbing	*Yes*
		Asset information	*No*
Person in charge for the provision of laser scanning	Supplier	Technical parameters (if laser scanning is provided by the Customer)	
		Distance accuracy error [1]	*N/A*
		3D point accuracy[1]	*N/A*
		Registration deviations[2]	*N/A*
		Point cloud density[2]	*N/A*

[1] - Laser scanner parameters [2] - Point cloud parameters

2.5. BIM application during facility management

Once the projects are completed, the following potential BIM applications are planned:

Application	Description
Maintenance of assets	Using models to maintain asset information by linking objects/elements to external databases using special middleware. Maintenance of assets is part of the asset management process.
Procurement of assets	Using models as part of the asset procurement process (for example, procurement of furniture, spare parts or equipment). The process also includes updating/supplementing the models with information about replaced, new or disposed assets.
Tracking of assets	Using models to track the locations of static or movable assets. Tracking of assets is part of the asset management process and may include the use of radio frequency identification (RFID) or other tracking/tagging technologies.
Inspection of the building	The models are used for the purpose of inspection and reporting of the technical condition of the building, compliance with the legal requirements, standards, etc.
Transfer of assets	Using models to plan and manage the transfer of movable property (assets) within the facility.
Room management	Using models to plan and manage the loading/occupancy of rooms.
Building automation	Using models for monitoring and control of the facility by means of a building management and automation system (BMS).
Real-time information	Using models to represent information received in real time from sensors located in the building or at the facility. The information may include room occupancy, temperature, humidity, energy consumption, etc. The process also applies to Building Management and Automation System (BMS) and Internet of Things (IoT).

2.6. Responsibility for subsequent use of BIM

Considering that BIM can be used throughout the entire life cycle of the building, the BIM deliverables created within the project can also be used in the subsequent stages of the building life cycle. Any BIM deliverables created as part of the project are subject to copyright and the copyright provisions set forth in the contract for the development of the design or the joint "design-build" contract.

Purposes of BIM deliverables include:

- Building facility management and operations.
- Building and asset management (including linking with other information systems).
- Carrying out design and construction works during use.
- Execution of new projects (including reconstruction or renovation of the building, identification of technical and spatial requirements, development of the concept of the planned or existing building).
- Demolition of the building.

The list is non-exhaustive and the purposes may differ in each individual case.

If the BIM deliverables created within the Project contain patent-protected inventions, including technical solutions or methods, the Supplier is required to inform the customer about the existence of such inventions and to present the patent.

When engaging other suppliers in the subsequent stages of the building life cycle, and if the BIM deliverables created within the Project are usable for the provision of the service, the following condition shall be included in the work order:

- "3D BIM models and other BIM deliverables must only be used for performing the work included in the contract and in the technical specification. It is prohibited to use the BIM materials and files provided by the customer for purposes unrelated to the contract."

The customer shall not be held responsible for non-compliance with the above condition on the part of other suppliers.

The work order also includes information on inventions protected by a patent, if the customer has received such information from the Supplier.

3. Information Exchange Requirements

3.1. Roles and responsibilities

This chapter defines the minimum requirements for the distribution of roles of the parties involved in the BIM process. Roles cannot be combined, except for in the cases presented in the table.

Role		Responsibilities
Customer	Project manager *(can be combined with any role)*	■ Representing the customer; ■ Ensuring the verification of results to be achieved and conditions of control points.
	Information manager	■ Checking the BIM execution plan; ■ Checking the BIM deliverables for compliance with the Employer's information requirements and the BIM execution plan; ■ Attending meetings related to the BIM process; ■ Checking and monitoring compliance with BIM processes and procedures; ■ Publishing and archiving BIM deliverables.
	BIM coordinator *(Recommended. (can be combined with information manager)*	■ Performing model quality control, including model coordination and compatibility checks, clash checks (using both visual and automated methods), documenting it and following up on the resolution of these problem areas; ■ Attending meetings related to the BIM process.
	CDE manager *(Applicable if the customer provides a CDE.* *Can be combined with any role.)*	■ Managing CDE, which includes providing access to the involved parties, ensuring the correct arrangement and structuring of data.

Supplier	Project manager *(can be combined with any role)*	▪ Representing the supplier. The responsibilities are based on the conditions of the particular contract and technical specification; ▪ Organising and/or attending (if the responsibility to organise is delegated to the Information Manager) meetings related to BIM processes;
	Information manager	▪ Developing the Post-contract BIM execution plan; ▪ Developing the Master Information Delivery Plan from the Task Information Delivery Plans delivered by the design team and updating it in the case of changes; ▪ Attending and/or organising (if the responsibility to organise is delegated to the Information Manager) meetings related to BIM processes. ▪ Defining responsibility for providing information and its level of development for each stage of the project (based on the customer's BIM requirements); ▪ Delivering the information specified in the Employer's information requirements within the specified deadlines and with the appropriate level of development.
	BIM coordinator *(can be combined with the role of information manager)*	▪ Providing information required to compile the BIM execution plan to the Information Manager; ▪ Performing model quality control, including model coordination and compatibility checks, clash checks (using both visual and automated methods), documenting it and following up on the resolution of these problem areas (this includes preparing clash reports and protocols of coordination meetings); ▪ Hosting project coordination meetings, as well as attending other meetings related to BIM (if required or if attendance is requested by the customer); ▪ Providing support to involved parties related to BIM processes within the project.
	Lead Architectural Part Designer* *(can be combined with the role of information manager, if the information manager has not been combined with the BIM coordinator role)*	▪ Providing information required to compile the BIM execution plan to the Information Manager; ▪ Developing the task information delivery plan and updating it in the case of changes; ▪ Ensuring the creation of the building information model in the agreed coordinate system and location, which must then be delivered to all parties involved in the project; ▪ Ensuring the development of architectural BIM model(s);

	▪ Ensuring self-testing of models; ▪ Attending meetings related to BIM processes; ▪ Ensuring that all information meets the required level of development (LOD, non-graphic information); ▪ Ensuring that models are uploaded in the common data environment according to the schedule established in the BIM execution plan; ▪ Ensuring the elimination of problem areas discovered during coordination as part of the Architectural Solutions part.
Lead Designer (Structural, MEP, etc.) *(can be combined with the role of information manager, if the information manager has not been combined with the BIM coordinator role)*	▪ Providing information required to compile the BIM execution plan to the Information Manager; ▪ Developing the task information delivery plan and updating it in the case of changes; ▪ Ensuring the development of BIM model(s) for engineering solutions; ▪ Ensuring self-testing of models; ▪ Attending meetings related to BIM processes; ▪ Ensuring that all information meets the required level of development (LOD, non-graphic information); ▪ Ensuring that models are uploaded in the common data environment according to the schedule established in the BIM execution plan; ▪ Ensuring the elimination of problem areas discovered during coordination within their part.
CDE manager *(Applicable if the Supplier provides a CDE. Can be combined with any role.)*	▪ Managing CDE, which includes providing access to the involved parties, ensuring the correct arrangement and structuring of data.
Cost consultant *(recommended)*	▪ Provide information and data to the design team about the budget and costs for the design and related changes.

** Responsibilities of these BIM process participants within a part of a design can be specified in more detail by the supplier (for example, the lead designer, BIM technician/modeler, etc.).*

3.2. BIM execution plan

The supplier develops a BIM execution plan in response to the BIM requirements. The BIM execution plan shall describe the supplier's approach to project execution and meeting the customer's requirements. During the procurement procedure, the supplier submits a Pre-Contract BIM execution plan with the supplier responsibility matrix attached. Once the contract has been concluded, the supplier shall develop a Post-Contract BIM execution plan along with the Master Information Delivery Plan and Task Information Delivery Plans.

3.2.1. Pre-contract BIM execution plan

The Pre-Contract BIM Execution plan template contains the requirements and explanations for preparing a Pre-Contract BIM Execution plan.

The supplier responsibility matrix defines the responsibility of the parties involved in the project for parts of the design and other BIM deliverables. According to the BIM development phase, it is also necessary to indicate the level of development of graphic information (if applicable to the information to be delivered).

3.2.2. Post-contract BIM execution plan

Once the contract has been concluded, the supplier shall develop a Post-Contract BIM Execution Plan along with the Master Information Delivery Plan and Task Information Delivery Plans. The Post-Contract BIM execution plan must include information from the Pre-Contract BIM Execution Plan with changes approved by all parties involved in the execution of the project (if there have been changes), as well as be supplemented with information as specified in the Post-Contract BIM Execution Plan template. The supplier has the right to describe the BIM processes in more scope and detail than is required in the Post-Contract BIM Execution Plan.

The Post-Contract BIM Execution Plan must be submitted to the customer within 4 weeks after the conclusion of the contract. The customer shall review and approve it within 2 weeks from the submission of the BIM Execution Plan. Depending on the project specifics, the above-mentioned deadlines may be altered in the special requirements of the Project.

In the design stage, the Post-Contract BIM Execution Plan has to be updated and approved with the customer by the end of the duration of the respective next control point. The Post-Contract BIM execution plan, along with the updated Task Information Delivery Plans and the Master Information Delivery plan, shall be submitted simultaneously with the deliverables of each control point.

The BIM Execution Plan can also be updated more often, as well during construction works, if such a need arises during project execution. The updated Post-Contract BIM Execution Plan can only be used after being approved by the customer.

The Post-Contract BIM Execution Plan is approved by being signed by both parties. The Post-Contract BIM Execution Plan is only considered to be approved once signed by the customer and the supplier.

The tasks and information stated in the Post-Contract BIM Execution Plan must not contradict the BIM requirements and technical specifications, as well as the law. The approval of the BIM Execution Plan by the customer cannot create additional obligations for the customer or change or amend the terms of the contract; by approving it, the customer does not undertake any obligations other than those provided for the customer in the contract.

3.2.2.1. Task information delivery plan

Once the contract has been concluded, the Lead Designer of each Design part or the author of another BIM deliverable, is required to describe what files are planned to be delivered during each of the project stages and control points by developing the Task Information Delivery Plan.

The Task Information Delivery Plan must specify exact information about the files (BIM deliverables, 2D documentation, etc.) to be submitted at the next (subsequent) control point and approximate information about the files to be submitted at the remaining control points.

3.2.2.2. Master Information Delivery Plan

The Master Information Delivery Plan (MIDP) is compiled from individual Task Information Delivery Plans (TIDPs). This plan serves as an information delivery schedule during the execution of the project.

At each control point, it is required to submit the updated Master Information Delivery Plan, which is based on each individually updated Task Information Delivery Plan.

3.3. Organising the flow of information

The flow of information is organised in the following stages:

Stage	CDE	Shared with
Work-in-progress	N/A	None
Shared	See the Special Requirements template	For project participants*
Published	See the Special Requirements template	For project participants*
Archived	See the Special Requirements template	For project participants*

** for more details, see Section 3.6.*

Work in progress

Information developed by the person in charge of each part of the design and this information is not visible or accessible to anyone else. During this stage, information is formed and developed. Depending on the stage of the project, this information needs to be transferred to the sharing stage at certain intervals.

Shared

Information that has been approved for exchange with the parties involved in the execution of the project. The information at this stage is used for project coordination purposes and to enable cooperation between the parties involved in the project.

Published

Information that has been approved for further detailing of the project, construction or asset management. The project information must be submitted for approval within certain deadlines according to project control points. Information is approved at the Published stage, if all the requirements set for it at the relevant stage of the project and at the project control point have been met.

Archived

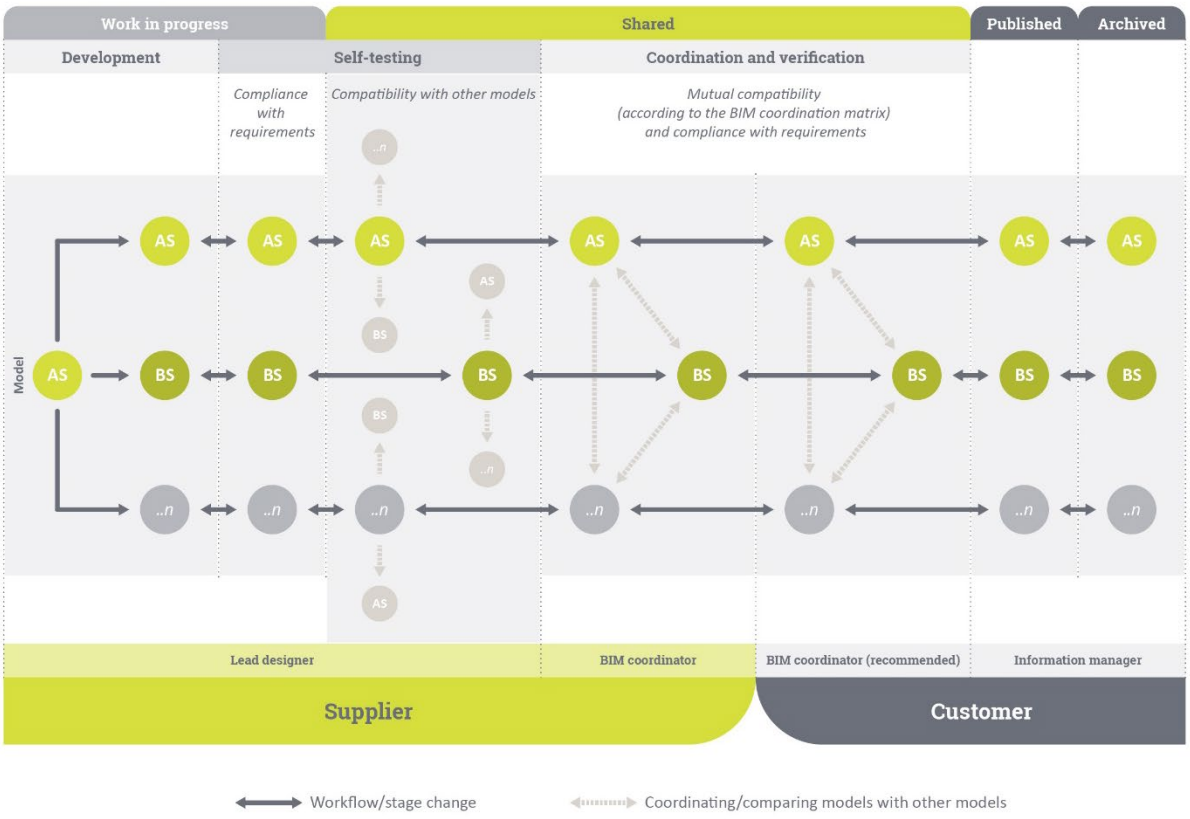
An information development log that enables tracing of the information development cycle. This contains the entire project development history that has been approved at the Published stage.

3.4. Workflow during design work

This chapter describes the minimum requirements and rules for the BIM workflow for the creation of BIM and the use of CDE in design work. The requirements apply to design works (including changes to the designed solutions) both in the design development phase and in the construction phase.

- Each model developer has to regularly coordinate their activities with other model developers, including sharing of models and making model comparisons with current versions of other models. Self-testing of the models is also required to check consistency, completeness, coherence and compliance with the customer's information requirements.
- The supplier should determine the frequency of information exchange depending on the design stage. Information exchange means uploading the information developed during the Project to the CDE (in the “Shared” stage). Starting from completion of the “Interim BIM” control point, the minimum information exchange frequency and the frequency of coordination meetings is once every two weeks.
- BIM deliverables must be submitted to the customer in a timely manner according to the respective control points.
- BIM deliverables shall be submitted to the customer by the supplier's information manager. The information manager of the supplier is required to immediately notify the customer’s information manager about the submission of the deliverables.
- The customer's information manager will approve or reject the supplied information within 10 working days, providing comments on any deficiencies or shortcomings identified in the supplied information.
- The supplier is obliged to eliminate the identified deficiencies or shortcomings within 10 working days and to submit the rejected information for re-examination.
- The approved BIM deliverables according to the respective control point shall be published for future use by all parties involved in the project. Only approved information will be included in the Published stage, which will be made available to all parties involved in the project.
- BIM deliverables shall only be published after all results for the respective control point have been achieved.
- After the publication of the next approved BIM version, the previous approved BIM version is transferred to the CDE archive stage.

Below is a basic process diagram.



3.5. BIM process during construction

During the construction works, 3D BIM models have to be constantly updated and supplemented, taking into account any changes made and the resulting information about the building elements and assets, so that after the completion of the project, the BIM would be fully consistent with the actually constructed building (object) and ready for the facility management process and the creation of the Asset Information Model.

The information exchange process during construction works is dependent on the BIM delivery method chosen or the procurement principle, that is, when the development of the design and the construction work takes place under a single contract or where the design development and construction works are undertaken by different suppliers under different contracts.

Procedure for making changes (general instructions):

- The supplier shall implement the proposed changes in 3D BIM models (while maintaining the specified level of development) and submit them to the customer for inspection and approval.

- 3D BIM models must be submitted in a timely manner, along with changes during the construction and with deviations from the design, including the drawings for implementing the changes.
- All changes to and deviations from the design must be included in the 3D BIM models and must reflect the actually planned construction work solutions.
- Changes to 3D BIM models should be made while complying with the CDE workflow description, as well as all relevant sections of BIM requirements, such as modelling requirements, coordination and quality control requirements, etc.
- The customer carries out an examination according to the conditions of the control point, and rejects or publishes the proposed changes accordingly.
- Once the proposed changes have been published, they are considered to have been handed over for the respective construction works.
- BIM requirements do not regulate the financial and legal responsibility for proposed changes under the procurement contract, as they are a matter of specific technical specifications, the procurement contract or the law.

Preparation of BIM for facility management (general instructions):

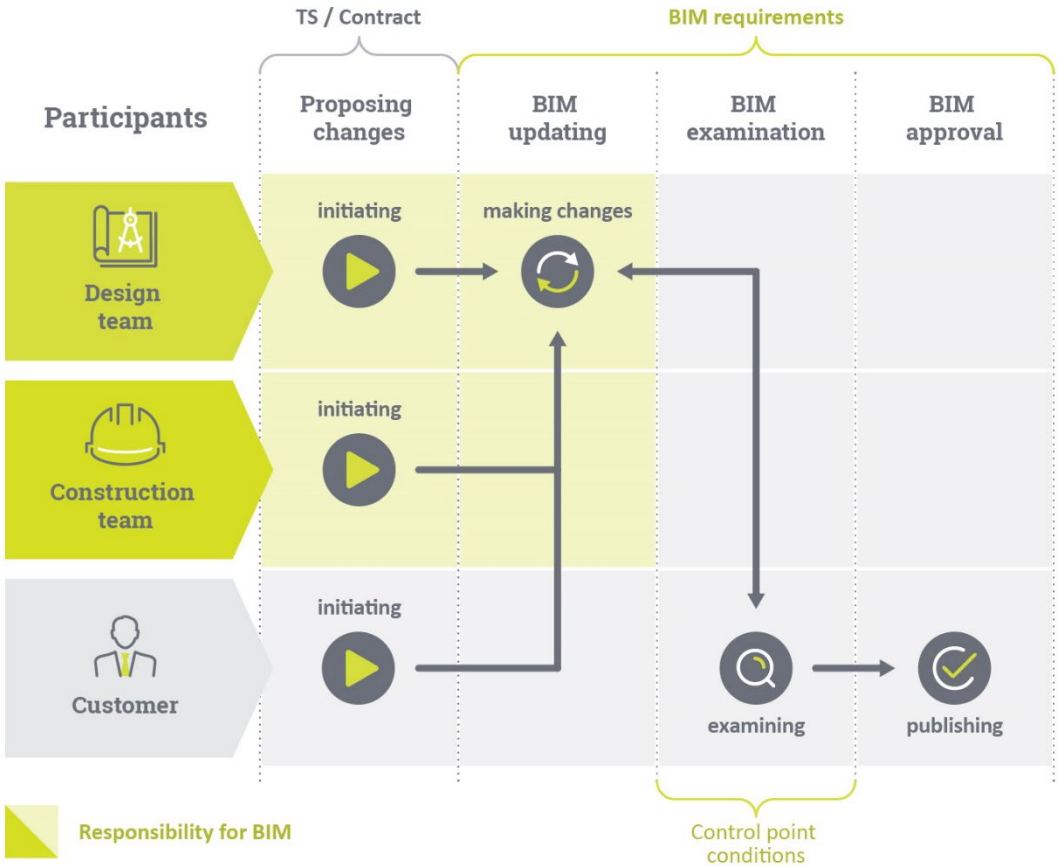
- During the construction works, the 3D BIM models have to be supplemented with information obtained during the construction works after the installation of the equipment/elements. 3D BIM models have to be updated within 10 days from receiving the information.
- The information to be added to 3D BIM models is described in the section Level of Information Requirements section.
- The supplier ensures the keeping of records of BIM additions and updates during construction.

3.5.1. Information exchange using the “design-build” principle

Under the “design-build” principle, the supplier assumes full responsibility for receiving information from the construction site for updating and supplementing the 3D BIM models during construction.

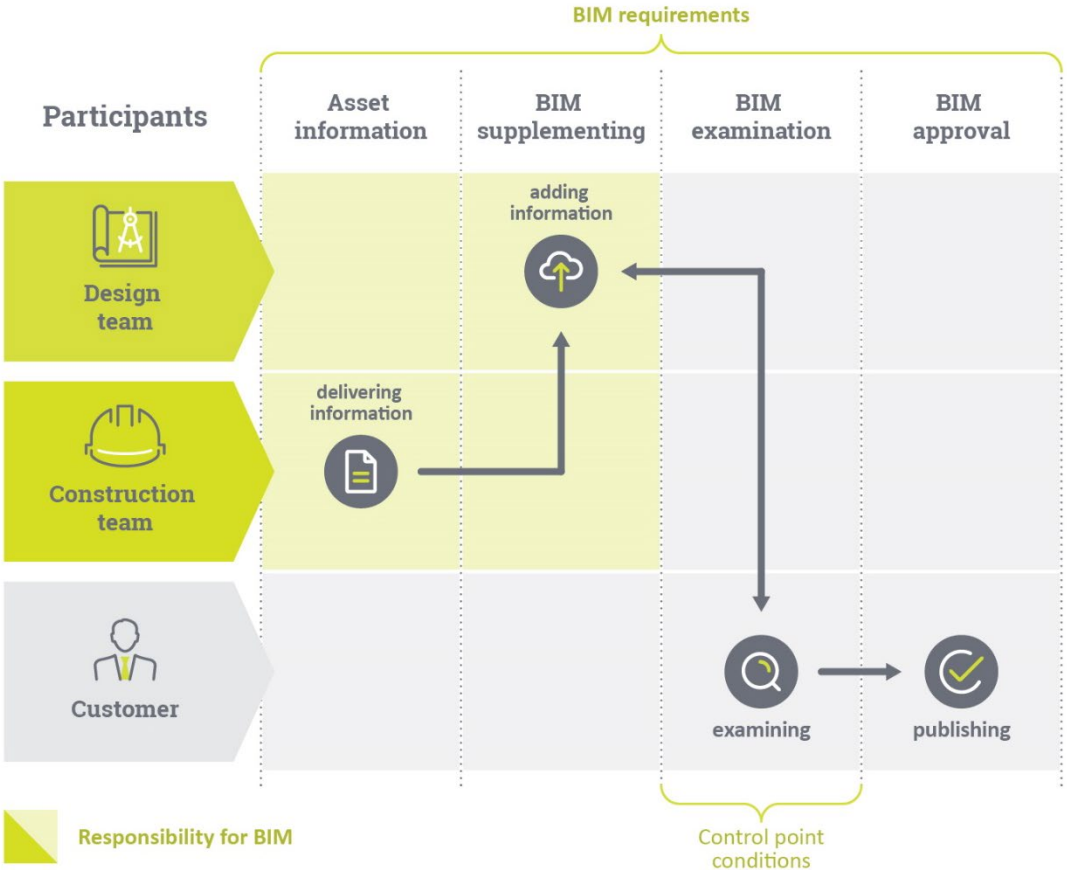
Making changes:

- The supplier shall ensure the timely exchange of information on proposed changes between the contractor and the design team.
- Below is a schematic representation of the change workflow.



Adding information:

- The installer of the equipment/elements is required to deliver this information to the BIM manager of the respective part of the project after installing the equipment.
- BIM models shall be uploaded to the Common Data Environment at least once a month.
- The diagram below shows how BIM is supplemented with information on assets.

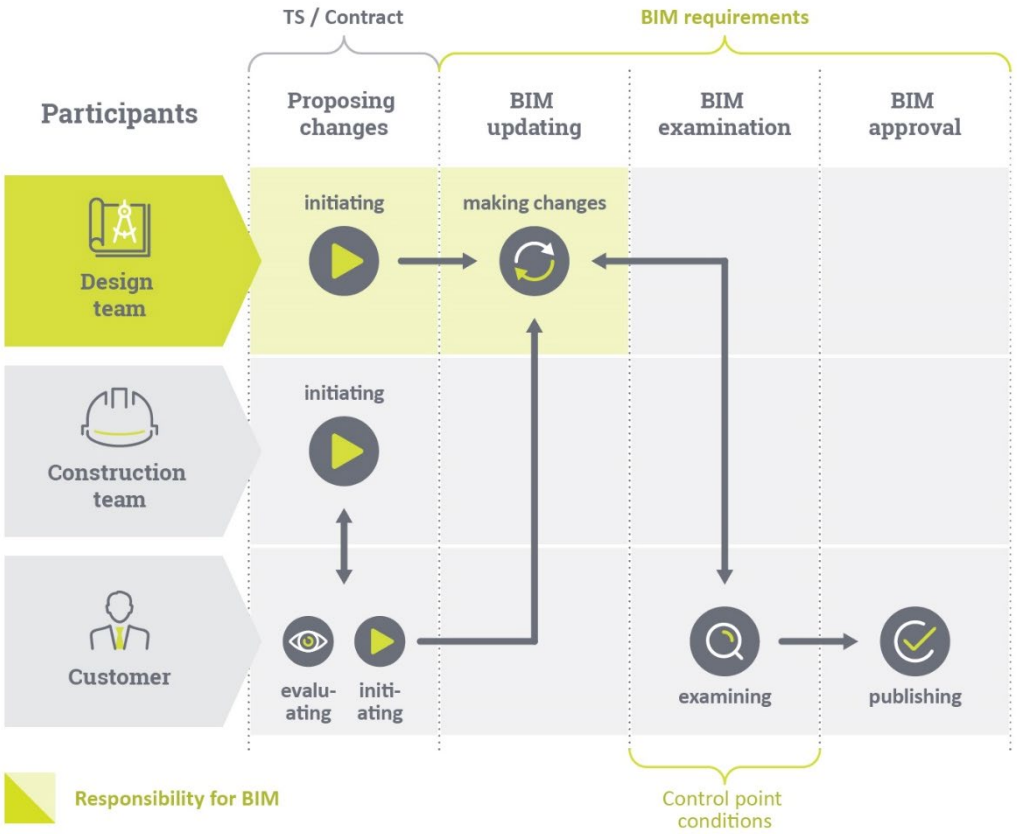


3.5.2. Information exchange using the “design-bid-build” principle

Under the “design-bid-build” principle, both the supplier and the customer can be responsible for receiving information from the construction site for updating and supplementing the 3D BIM models during construction.

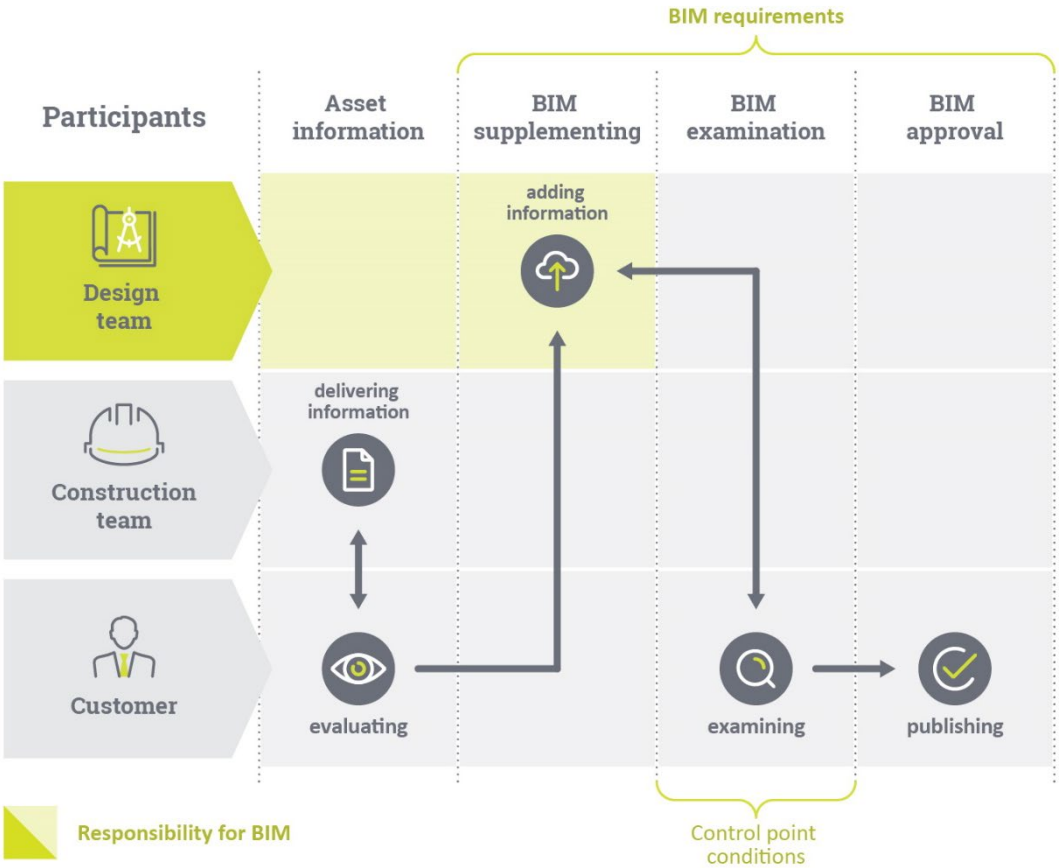
Making changes:

- The supplier receives information about the changes proposed by the contractor from the customer. The changes proposed by the contractor are first submitted to the customer for evaluation. If the customer agrees with the changes proposed by the contractor, they are considered to be proposed changes that should be included in the 3D BIM models.
- Below is a schematic representation of the change workflow.



Adding information:

- After installing the equipment, the customer shall provide the supplier with the necessary information about the equipment/elements for supplementing the 3D BIM models.
- At the time of handing over the information to the Supplier for supplementing or updating the BIM during construction works, the Contractor is required to verify the completeness of the information and its compliance with the Level of information requirements. Should the information be incomplete or incompliant with the level of information requirements, the contractor shall report this to the customer within 5 days.
- BIM models shall be uploaded to the Common Data Environment at least once a month.
- The diagram below shows how BIM is supplemented with information on assets.



If applying the “design-bid-build” principle, the customer has to ensure that the contractor is informed about the BIM requirements and processes during construction, including the procedure for making changes and adding information. The customer must ensure that the contractor is obliged to submit all the necessary information in a timely manner and according to the scope and format specified in the BIM requirements.

3.6. Common Data Environment

This chapter contains the minimum requirements for CDE functionality and also describes the methods of providing the CDE.

The CDE provision method chosen for the specific project is based on Annex 1 “Project special requirements template”.

The party that maintains and manages the CDE as part of the project has to ensure that CDE terms of use are present, and it is also recommended to develop CDE use instructions. Annex 10 of the BIM requirements contains a sample of CDE terms of use.

Regardless of the CDE provision method, the Supplier is required to define and describe in the BIM implementation plan how information will be structured within the project, what information will be shared with all parties involved in project execution, as well as set file size limits for project information, if deemed necessary.

3.6.1. Requirements for the Common Data Environment

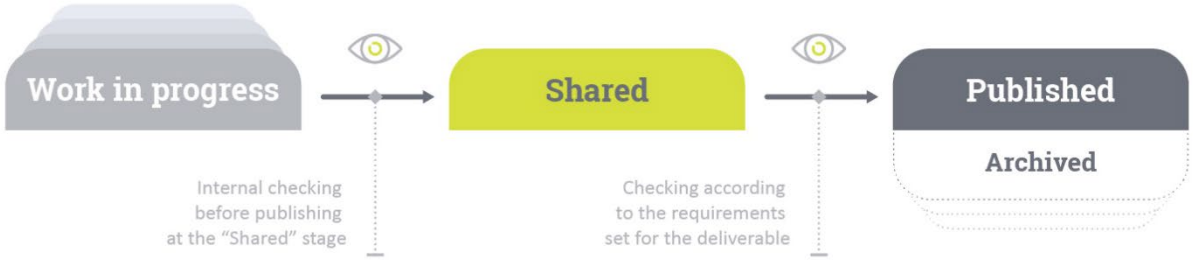
CDE is a file management solution that enables the storage, sharing and exchange of information developed during the project. The main purpose of the Common Data Environment is to maintain a centralised information source that serves to distribute all project-related information to relevant teams and project participants.

CDE stores and manages information referred to as information containers. The information containers are 3D BIM models, databases, documents and other files that contain information. Once an information container is created/inserted in CDE, the following information has to be stored for it to enable the tracking of the information container development:

- Information on the author who created/inserted this information container;
- Information on who updated this information container, while maintaining the option to view older versions.

Information containers are organised by stages according to the readiness of information. The information containers must enable transitioning from one stage to another depending on the readiness of the information, the respective stage of the project, as well as the expected deliverables. Stages of information containers can be changed by creating a request or submitting a deliverable at the respective stage, which is then checked and approved or rejected by the relevant person specified in the roles and responsibilities.

Schematic representation of the Common Data Environment workflow:



Common Data Environment security and access solutions:

- The CDE must enable the assignment of usage rights (view, download and change) at the stage and information container level;
- enable defining of the rights of CDE users to submit and approve the transition of information containers from one stage to another based on the roles and responsibilities of the parties involved, recording the time of these actions and the person who performs them.

Naming of information containers should be done according to the requirements of Paragraph 4.3 of the BIM requirements section "File naming".

In addition, it is recommended to ensure the following information container attribute requirements in the CDE (optional):

- Information container audit. One of the methods of assigning audits to information containers would be the following: unconfirmed information with the prefix "P" and confirmed information with the prefix "C" followed by an audit number consisting of two digits and a version number consisting of two digits. The version number is available for work in progress only and is not carried over when transitioning to "Shared".
- Example:

Information container audit	Description	CDE stage
P[nn].[nn]; P01.01	Information container audit and version	Work in progress
P[nn]; P01	Information container audit	Shared
C[nn]; C01	Information container audit	Published

- The status of information containers to enable the identification of the allowed purpose of use of the information:

Information container status	Description	CDE stage
S0	Unconfirmed	Work in progress
S1	Confirmed for coordination purposes	Shared
S2	Confirmed for information	Shared
S3	Confirmed for checking	Shared
S4	Confirmed for submitting deliverable	Shared
A1	Confirmed at Conceptual BIM stage	Published
A2	Confirmed at Interim BIM stage	Published
A3	Confirmed at Detailed BIM stage	Published
A4	Confirmed at Approved BIM stage	Published

- Classification. All information containers in CDE must be classified according to the information contained in them, and the classification should be assigned to the container as an attribute. The classification should take place according to the classification system described in Paragraph 4.5.3 of the BIM requirements. “Classification”.

3.6.2. Split-cycle Common Data Environment

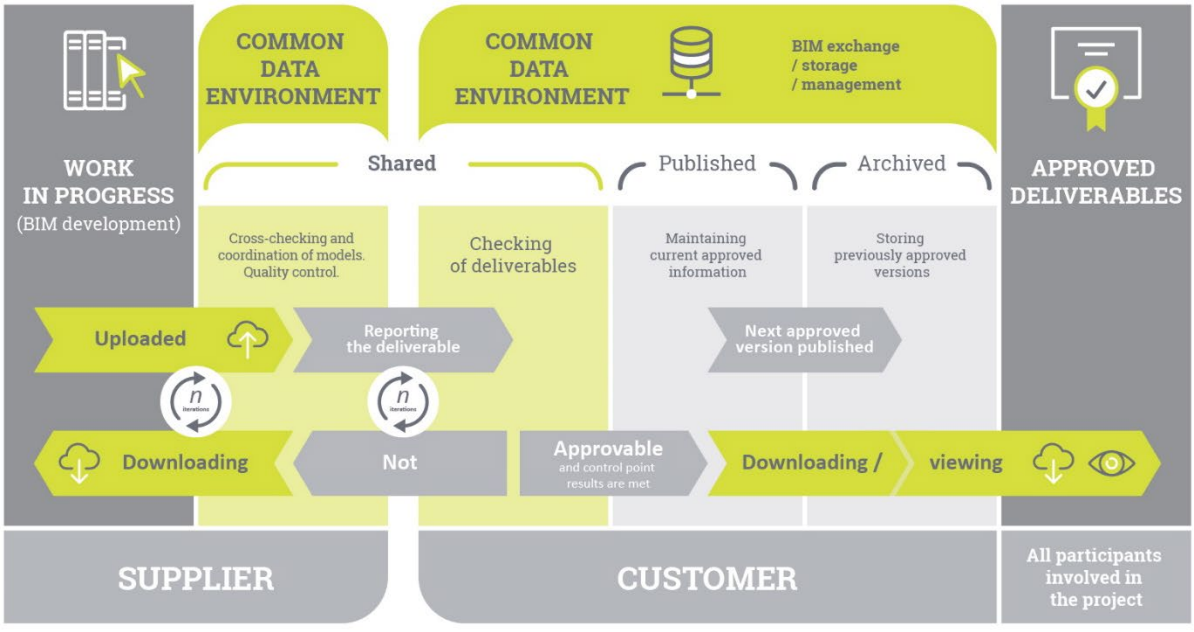
The approach of the split-cycle CDE is that at the “Shared” stage the technical CDE solution for sharing models, other deliverables and information among the supplier participants is ensured by the supplier, whereas the technical CDE solution for submitting deliverables to the customer at the “Shared” stage, as well as all actions at the “Published” and “Archived” stages is ensured by the customer.

A split-cycle CDE approach can be used in cases where the customer wants to remain in charge of the provision and maintenance of CDE under the project, but has no sufficient IT or administrative resources available to ensure full-cycle CDE, that is, maintenance of the CDE at its most active phase of use, when models and other deliverables are shared and coordinated multiple times among supplier team members.

Split CDE can also be used in cases where the customer does not need to track the actions of the contractor at the “Shared” stage before the models or other deliverables are forwarded for approval by the customer (for example, in the execution of particularly large-scale projects involving several supplier teams).

Within the split-cycle BIM approach, the BIM created by the customer is the only reliable source of BIM within the project.

Below is a schematic representation of the split-cycle CDE workflow.



The following management and access rights are provided under split-cycle CDE according to the distribution of roles of the parties involved:

Supplier's CDE:

- **CDE manager** – manages the Common Data Environment, assigns access rights to project participants;
- **Supplier's information manager** – can manage all shared project deliverables and view/download published and archived deliverables, as well as submit deliverables to the customer's information manager;
- **Supplier's BIM coordinator** – can manage model quality control information at the "Shared" stage and can also view/download other shared, published and archived deliverables;
- **Architect, engineering solutions designer (author)** – can manage information within the respective design part at the "Shared" stage and can also view/download other shared, published and archived deliverables;
- **Customer's information manager** – the right to view/download shared deliverables is assigned upon the customer's request.

Customer's CDE:

- **CDE manager** – manages the Common Data Environment, assigns access rights to project participants;
- **Customer's information manager** – can view/download shared, published and archived deliverables. Publishes, archives or rejects project deliverables;
- **Customer's BIM coordinator** – can view/download shared, published and archived deliverables;
- **Project manager** – can view/download shared, published and archived deliverables;
- **Supplier's information manager** – submits (uploads) deliverables to the customer's information manager at the "Shared" stage, can view/download published and archived deliverables;
- **Supplier's BIM coordinator** – can view/download published and archived deliverables;
- **Architect, engineering solutions designer** – can view/download published and archived deliverables;
- **Other participants involved in the execution of the project** – can only see/download published and archived deliverables (rights may be amended during the execution of the project).

Where a split-cycle CDE solution is chosen, this is specified in the Project Special Requirements template.

Both the supplier's and the customer's CDE has to meet the requirements specified in Paragraph 3.6.1.

3.6.3. Full-cycle Common Data Environment

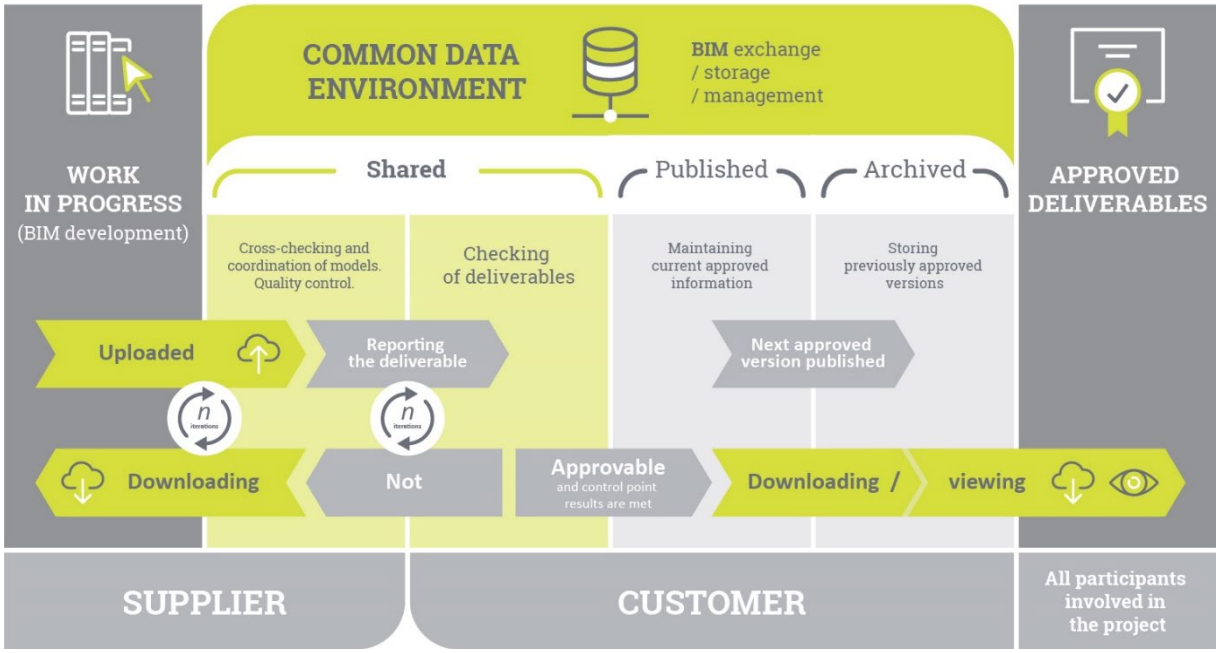
The approach of full-cycle CDE is that the only technical CDE solution for all project activities in the “Shared”, “Published” and “Archived” stages is fully provided by one of the parties – the customer or the supplier.

CDE created and maintained by the customer or supplier only is used for exchanging, managing and collecting information in the “Shared”, “Published” and “Archived” stages.

CDE is the only reliable source of BIM within the project.

All participants involved in the project from the supplier's side are required to use the CDE for sharing models, deliverables and information both among themselves and when submitting deliverables to the customer according to the respective control point.

Below is a schematic representation of the full-cycle CDE workflow.



The following management and access rights are provided under full-cycle CDE according to the distribution of roles of the parties involved:

- **CDE manager** – manages the Common Data Environment, assigns access rights to project participants;
- **Customer’s information manager** – can view/download shared deliverables (submitted for approval to the customer according to control points), as well as published and archived deliverables; The right to also view/download shared deliverables among supplier participants is assigned upon the customer’s request. Publishes, archives or rejects project deliverables;

- **Customer's BIM coordinator** – can view/download shared, published and archived deliverables;
- **Customer's project manager** – can view/download shared, published and archived deliverables;
- **Supplier's information manager** – can manage all shared project deliverables and view/download published and archived deliverables, as well as submit deliverables to the customer's information manager;
- **Supplier's BIM coordinator** – can manage model quality control information at the "Shared" stage and can also view/download other shared, published and archived deliverables;
- **Architect, engineering solutions designer (author)** – can manage information within the respective design part at the "Shared" stage and can also view/download other shared, published and archived deliverables;
- **Other participants involved in the execution of the project** – can only see/download published and archived deliverables (rights may be amended during the execution of the project).

Where a full-cycle CDE solution is chosen, this is specified in the Project Special Requirements template, adding a note on which party is responsible for providing full-cycle CDE under the project.

If the CDE during the construction works stage is provided by the supplier, the operability of CDE has to be ensured until the completion of the construction works, that is, until the design and/or construction service is commissioned and accepted. In certain cases, the provision of CDE by the supplier can also be extended for the warranty period; this has to be separately stipulated in the technical specification of the respective service.

Regardless of who is responsible for providing full-cycle CDE, the CDE has to meet the requirements specified in Paragraph 3.6.1.

3.7. Collaborative process

It is the duty of all parties involved in project execution to exchange and share project information. Sharing of 3D BIM models and other deliverables and information should take place in CDE. This should promote information exchange among the parties involved in the execution of the project.

The BIM execution plan should describe the frequency of information exchange, as well as establish joint meetings as part of the project. As a minimum, the Supplier is required to organise the following meetings:

Type of meeting	Activities and goals	Frequency of meetings (recommended)	Frequency of meetings (minimum)
BIM launch meeting	BIM launch meeting/s has to be organised during the development of the Post-Contract BIM Execution Plan. The main objectives of the meeting are to define the resources and methods required for project execution, to detail the duties and responsibilities of the parties involved, as well as the procedure of achieving the customer's goals and meeting the set requirements.	Once a week	At least once
Model review meeting	Model review meetings should be organised during the design phase. Topics to be discussed at the meeting include: compliance of the models and design with the goals and requirements of the project, including the level of development and completeness according to the project stage, suitability of applied solutions, compliance with standards and guidelines.	Once every two weeks	Once a month
Coordination meeting	Starting from the control point "Interim BIM", coordination meetings have to be organised during the design phase and, if changes are made to the geometry of the models during construction, also during the construction phase. The goal of the meetings is to identify and eliminate design errors before they become apparent during construction.	Once a week	Once every two weeks
Constructability analysis meeting*	Constructability analysis meetings have to be organised at the design phase in order to be able to identify and change potentially complex and inconvenient solutions that could negatively affect the construction process. The goal of the meetings is	Three times*	At least once*

	to identify risks that could arise during construction, to help plan construction works more efficiently, as well as to evaluate cost-saving opportunities by proposing alternative solutions.*		

**Applicable if a constructability analysis deliverable is requested in the Project special requirements template.*

3.7.1. Customer's participation in BIM meetings

At the customer's request, the Supplier is required to include the customer's representatives (for example, project manager, information manager, BIM coordinator) in meetings related to BIM. The customer's representatives participate in these meetings with the aim of verifying the compliance with the BIM requirements, including the procedures, workflows and quality control processes defined in the BIM requirements. The customer's representatives have the right to point out non-compliances with BIM requirements, and the Supplier is also required to eliminate the deficiencies identified by the customer.

3.8. Coordination and quality control

Project quality and risk reduction by using 3D BIM models and information coordination is one of the key goals and requirements of the customer during project execution. The parties involved in the execution of the project need to agree on how the 3D BIM models of the respective sections will be coordinated and how quality control will be ensured.

3.8.1. Types of testing

In order for the project to meet the geometric and information requirements set for it, as well as to ensure the general quality of the design and its compliance with standards, continuous quality control must take place during the design development. Quality control must be ensured by arranging the following tests:

Type of testing	Purpose	Frequency of testing	Party in charge
Self-testing	Ensuring that the model meets the design intention and technical requirements, contains the necessary information according to the phase/stage of the project, and that the graphical representation of the model meets the level of development requirements.	Not less frequently than prior to uploading the models in CDE during the "Shared" stage	Lead Architectural Part Designer, Lead Designer (Structural, MEP, etc.)
Visual examination	Ensuring that the model does not contain redundant elements and that the information corresponds to the part of the project. Complying with the spatial requirements of the facilities (for example, the areas required for opening doors or windows).	Not less frequently than project coordination meeting interval	BIM coordinator
Checking for clashes	Identifying unwanted clashes of two or more model elements. Checking for clashes can be carried out using both automated and manual methods.	Not less frequently than project coordination meeting interval	BIM coordinator
Model date/integrity check	Checking whether the model elements meet the level of development and information requirements set for it.	Before submitting the deliverable to the customer	BIM coordinator

3.8.2. Coordination and scheduling of clash checks

A clash report has to be uploaded to CDE no later than one day before the Coordination Meeting and must contain the following information:

- an image of the identified clash of the problem area;
- an indication of the parts of the projectin which the elements are clashing or conflicting (it is not permissible to indicate all or other parts of the project that do not create a clash or a conflict);
- location;
- the date when the clash or problem area was identified.

A coordination meeting report has to be uploaded to CDE no later than two days after the Coordination Meeting. It must be based on the clash report and supplemented with the following information :

- the party responsible for eliminating the clash or the problem area;
- the expected timeframe for resolving the clash or problem area;
- date of resolution of clashes identified in prior meetings (if applicable).

The clash report can be uploaded to the CDE in .bcf format. The coordination meeting minutes must be uploaded to CDE in .xls or .pdf file format:

Note: Clashes that are deliberate and do not affect the constructability of the elements are permitted during the clash checks. These clashes can be left unresolved. Such clashes may include:

- perpendicular clashes of engineering solutions model pipes, ventilation ducts and cable ladders not larger than d150 mm, against non-bearing structures;
- perpendicular clashes of engineering solutions model pipes, ventilation ducts and cable not larger than d50 mm, against non-bearing structures;
- perpendicular clash of pipelines, if the diameter of both pipelines is less than 18 mm;
- clash of elements with the insulation of pipelines and ducts that is less than 1/2 of insulation thickness;
- clashes of light fixtures, mechanical, electrical and plumbing outlets and inlets with suspended ceiling;
- other minor clashes, subject to approval by the parties involved in project execution.

In the BIM implementation plan, the supplier has to describe the coordination and clash checking processes, including the following information:

- coordination and clash identification process;
- software;
- creation of a clash report;
- coordination meetings;
- drafting minutes of the coordination meeting;
- clash elimination process.

To enable the tracking of quality control carried out by the Supplier, the results of the performed clash checks shall be uploaded in CDE according to the meeting schedule specified in the BIM execution plan.

3.8.3. Clash detection matrix

The clash detection matrix has to be included in the BIM execution plan. The clash detection matrix should present the distribution of priorities among all sections of the design for which BIM models are developed. The purpose of the clash detection matrix is to determine the priorities of the procedure for the prevention of clashes and problem areas in the parts of the project , based on which the parties responsible for the prevention of the identified clashes or problem areas are appointed. The clash detection matrix should be designed as a table in which the parts of the design are listed in priority order, starting from the highest priority to the lowest priority.

Note: The clash matrix serves as a general principle for determining the party responsible for the prevention of clashes and problem areas; however, exceptions are allowed when a lower-priority design part clash or problem area is resolved by making changes or corrections in a higher-priority design part.

4. Technical Requirements

4.1. Software

The supplier is required to specify the software used during the design, its version, as well as file formats. Unapproved changes of software versions is not permitted during the design process to avoid compatibility issues. Change of versions is only permitted subject to approval by the customer and all parties involved in the design process; test models should be used to prevent information loss and inaccuracies during the transition process. BUILDING SMART-certified software should be used for the development of BIM models (https://www.buildingsmart.org/compliance/certified-software/).

4.1.1. Software for creating 2D drawings

The same authoring tool that is used for the development of BIM models should be used for design drawings and layout.

This requirement does not apply to the following exceptions:

- for displaying assemblies, schematics and high level of development elements with a scale greater than M1:20. In certain cases, subject to approval by the customer, it is permissible to reduce the scale to M1:50;
- tables, specifications, if this information is not available or readable in BIM models;
- development of geotechnical, topographic and general plan part drawings;
- if the chosen BIM development authoring tool does not provide the functionality of creating drawings.

Drawings (or their parts, if applicable) developed in the BIM authoring tool must not be modified or supplemented in other authoring tools.

The contractor is required to inform the customer about all drawings that are to be developed outside BIM authoring tools. The information must be provided before the drawings are prepared.

The proof of design drawings being created and laid out in the BIM authoring tool are the drawings in the original file format of the BIM authoring tool.

4.2. Data exchange formats

File formats used for project information exchange:

Type of deliverable	Deliverable file format
3D BIM models	*.ifc and authoring tool original format
Bills of materials	*.xlsx or *.csv
2D drawings	*.dwg and *.pdf
Information on managed assets	*.csv or *.xlsx
4D simulation	*.mpeg or *.avi and authoring tool original format
Other documentation	*.pdf and *.docx, if applicable

The formats of the other deliverables shall be specified in the BIM execution plan.

4.2.1. Original format files

Original format files are those authoring tool files that contain graphical and/or non-graphical information about the relevant building or facility. Files used for export from the original format of authoring tools to the *.IFC file format are also considered original format files. The size of submitted original authoring tool format files must allow repeated export to *.IFC file format again without losing graphic and non-graphical information.

4.3. File naming

Files within the project should be named according to a uniform structure. The file name consists of 8 separate groups separated by a dash:

[Project code] - [design part] - [File type]- [Building part or zone]- [Information content]- [Floor or level] - [Number] - [Name]

Name group	Description
Project code	Project identification code. The recommended length of the project code designation is 3 characters. The project code is determined by the customer.
Design part	Part name according to LBN 202-18 “Execution of the Construction Intention Documentation”. Where one part is divided into several parts, it is necessary to reflect this in the name of the section by placing an underscore after the name and adding the separate part. Example – AVK_V (ventilation systems).
File type	The file type is used to describe the contents of the file. File type length – 2 characters. See table below for applicable file type designations.
Building part or zone	Part or zone of the building according to the specifics of the project. The recommended length of the building part or zone designation is 2 characters.
Information content	Content of the information displayed in the file. See table below for applicable designations.
Floor or level	Designation of the building floor or level. See table below for applicable floor or level designations.
Number	The sequence number can be used if there are several files from the same series and they cannot be distinguished by any other part of the file name. It is recommended to use sequence numbers consisting of three digits starting with 001.
Name	The file name can be used as required, for 2D documentation only.

If a certain name group is not applicable to a specific file, the designation ZZ should be used (except for the name group “Name”).

File type designations

File types for models or drawings	
Designation	Description
M3	3D model
M2	2D model
RA	Drawing
VZ	Visualisations
File types for documents	
Designation	Description
MS	Bills of material quantities
SP	Specifications
TD	Text document

Information content designations

Designation	Description
00	General information (also applicable to 3D models)
01	Plans
02	Cross-sections
03	Facades
04	Diagrams
05	Assemblies

Floor or level designations

Designation	Description
00	Not applicable to a specific floor or applies to the entire volume
S01	First floor
S02	Second floor
P1	Basement or underground floor

If additional file types, information content designations and floor or level designations are required, they need to be approved by all participants involved in project execution and specified in the post-contract BIM execution plan.

If necessary, upon agreement of the parties, another file naming procedure may be specified in the BIM implementation plan.

4.4. Capturing of the current situation

4.4.1. Photogrammetry

Automatic or semi-automatic process of creating 3D models using photographs and image analysis.

The photogrammetric processing of the obtained images should result in a dense point cloud with a minimum distance between points of not more than 10 mm and an accuracy not lower than 50 mm in the Latvian geodetic reference system. Accuracy may be adjusted for specific projects. The customer has to submit the data processing quality report along with the survey results.

In addition, the customer has to submit all captured aerial photographs along with their capture locations and orientations in the Latvian geodetic reference system.

The technical specification of the respective project may describe the requirements for the work to be performed and its specifics in more detail.

4.4.2. Laser scanning

Laser scanning and the creation of point cloud using a stationary or mobile laser scanner within the project can be provided by both the customer and the supplier. The laser scanning provision method chosen for the specific project is based on Annex 1 “Project special requirements template”.

4.4.2.1. General instructions:

- The point cloud can be used as input data for modelling and design development.
- The point cloud is considered a priority in comparison to the inventory case.
- The accuracy of the 3D BIM models developed by the supplier will be checked against the point cloud.
- Maximum permissible deviations of models from the point cloud:
- 10 mm from the corner points of the elements;
- 25 mm from planes (walls, floors);

- 50 mm from unevenly shaped elements and parts (decorative elements, roof).
- Upon agreement of the parties, accuracy requirements may be adjusted or exceptions added in the post-contract BIM execution plan, if it is impossible to achieve certain accuracy indicators due to objective reasons.

4.4.2.2. Instructions if laser scanning is provided by the Customer:

- The technical parameters of the laser scanner and point cloud used are specified in Annex 1 “Project special requirements template”:
    - technical parameters of the laser scanner: ranging error, 3D point accuracy;
    - technical parameters of the point cloud: registration deviations, point cloud density (distance between the measured adjacent points).
- If required, the customer may provide more detailed information about the point cloud as part of the procurement process.
- The customer provides a merged, common point cloud.
- The customer shall provide the point cloud in a format compatible with the proprietary authoring tools used by the supplier (.E57, .RCP, or another format).
- The customer hands over the point cloud to the supplier within 10 days after concluding the contract.
- The supplier has to carry out a topographic survey of the marks (checkerboard targets) located in the building and submit coordinates in the LKS-92 and LAS-2000.5 coordinate systems to the customer.
- Once the coordinates are received, the customer attaches the point cloud to the coordinate systems.
- The point cloud attached to coordinate systems shall be resubmitted to the Supplier within 10 days after receiving the coordinates.
- Upon agreement of the parties, if required (for example, to ensure compatibility with the software used by the supplier), the customer shall divide the point cloud and/or reduce its density.
- Upon agreement of the parties, during the design or construction process, in the case of objective necessity (for example, after exposing structures during the technical survey), the point cloud may be supplemented and/or updated by the customer with the contractor’s invitation.

4.4.2.3. Instructions if laser scanning is provided by the Supplier:

- The 3D laser scanner used for 3D scanning must meet the following accuracy criteria:
    - ranging error: less than 2 mm at 25 m or less than 3 mm at 100 m;
    - 3D point accuracy: less than 3.0 mm at 10 m.
- The contractor must ensure the following minimum technical parameters of the point cloud:
    - registration deviations must not exceed 15 mm, which must appear in the merging report, which must be submitted along with the 3D point cloud.
    - point cloud density (distance between the measured adjacent points): not exceeding 10 mm.
- The data obtained by 3D laser scanning must be merged in a common coordinate system (the data must correspond to the Latvian geodetic reference system – LKS-92 and LAS - 2000.5 (which is the implementation of the European Vertical Reference System (EVRS) in Latvia).
- Laser scanning and creation of a point cloud should be done prior to the development of construction intention documentation solutions.
- The supplier provides a merged, common point cloud.
- The supplier shall provide the point cloud in a format compatible with the proprietary authoring tools used by the customer (.E57, .RCP, or another format).
- In addition to the merged and processed point clouds, it is also necessary to submit the source data used to prepare them – individual raw point clouds in their original file formats obtained from the scanning equipment.
- The contractor has to ensure that the 360-degree images taken by the 3D laser scanner at each of the scanning stations are available for viewing or handing over to the customer.
- The technical specification of the respective project may describe the requirements for the work to be performed and its specifics in more detail.

4.5. Development of models

4.5.1. Level of development

The level of development requirements set for the project can be divided into two parts – the graphical level of development (LOD) of models and the level of information (LOI). The graphical level of development only represents the level of geometric accuracy and detail of the elements. The level of information represents the amount of information that is added to the elements.

4.5.1.1. Level of development

Brief description of graphical levels of detail of models:

LOD 100

- A model element is represented by a symbol or other general designation with the purpose of indicating the element's existence, but not its shape, size, or exact location.
- Any information obtained from LOD 100 elements should be considered approximate.

LOD 200

- A model element is graphically represented as a general object or system with approximate quantities, size, shape, location and orientation. A model element can be recognisable with respect to the object it represents or serve as a space highlighting or reserving volume. Non-graphical information can also be added to a model element.
- The model must be sufficiently accurate to ensure that the design meets the specified constraints (for example, regulatory requirements for the minimum scope of the design) before detailing the design.
- Any information obtained from LOD 200 elements should be considered approximate.

LOD 300

- A model element is graphically represented as a specific and accurate object or system according to a specific quantity, size, shape, location and orientation. The quantity, size, shape, location, and orientation of a designed element can be measured directly from the model without using non-modelled information (such as notes). Non-graphical information can also be added to a model element.
- The model can be used to verify all regulatory requirements (such as regulatory requirements applicable to the design), unless they are brand-, model- or material-specific (this also applies to subsequent LOD levels).

LOD 350

- A model element is graphically represented as a specific and accurate object or system according to a specific quantity, size, shape, location, orientation and interfaces with other building systems. Details required to coordinate the element with nearby or attached elements are modelled (modelling of supports and connections, for example).
- The quantity, size, shape, location, and orientation of a designed element can be measured directly from the model without using non-modelled information (such as notes). Non-graphical information can also be added to a model element.

LOD 400

- A model element is graphically represented as a specific and accurate object or system according to a specific quantity, size, shape, location and orientation, with level of development, manufacturing, assembly and installation information. The quantity, size, shape, location, and orientation of a designed element can be measured directly from the model without using non-modelled information (such as notes). Non-graphical information can also be added to a model element.
- A model element is modelled with a level of development and accuracy sufficient to manufacture and install the depicted component. This is the highest graphical level of development.
- If LOD 400 is requested at the design stage, the manufacturer or model may not be specified; therefore, the construction stage information must be supplemented with the make or model eventually chosen.

LOD 500

- A model element is checked on site according to a specific quantity, size, shape, location and orientation.
- LOD 500 refers to on-site checks and is not associated with an even higher graphical or non-graphical level of detail.

Detailed description of the levels of detail of models can be found in the document developed by BIM Forum “Level of Development Specification 2021 (Part I)” (available at https://bimforum.org/lod/).

All the elements specified in the design have to be modelled in BIM models, except for in the cases when the document “Level of Development Specification 2021 (Part I)” specifies a lower amount of elements to be modelled according to the level of development of the deliverable.

Certain exceptions are allowed for elements to be modelled in BIM models:

Level of development(LOD)	Description
LOD200/300	Electrical and low current cables and wires do not need to be modelled

The list of exceptions can be supplemented during project execution upon agreement between the customer and the supplier and each specific exception shall be described in the Post-contract BIM Execution plan.

4.5.1.2. Level of information

To meet the building construction and facility management needs, specific information has to be specified in 3D BIM models.

Requirements for information added to the model elements can be found in Annex 2 “Level of information requirements”. The information to be added is divided into data groups (e.g., “Architectural solutions, Finishing”) and data sets (e.g., “Wall finish”).

The data group name is given on the left side of each table. The data set name and its brief description is given at the top of the table.

Data groups “Architectural solutions, Windows and doors”, “Architectural Solutions, Finish”, “Architectural solutions, Space ID”; “Architectural solutions, Building structures”, “Building constructions”, “Internal power supply, VS, Electronic communication systems, Cable ladders” refer to specific parts of the project , while data groups “MAS” refer to all parts of theproject. The data groups “Mechanical, electrical and plumbing” and “Asset information” refer to the mechanical, electrical and plumbing of all parts of the design and, in some cases, also to the Architecture part.

Data groups “Architectural solutions, Windows and doors”, “Architectural Solutions, Finish”, “Architectural solutions, Space ID”; “Architectural solutions, Building structures”, “Building constructions”, “Internal power supply, VS, Electronic communication systems, Cable ladders” require information that can be used both during the construction and during building facility management and operations.

The creation of the “MAS” data set ensures that information is added to all elements of the model, including those that do not have the requirement to add information in other data sets, thus optimising the process of preparing the bill of materials.

The data group “Asset information” requires more specific information, which is primarily intended for data export in specialised building facility management and management IT systems, as well as in accounting IT systems.

Depending on the needs and purposes of use of information, the customer defines the amount of non-graphical information to be added for the respective project, using Annex 1 “Project special requirements template”.

Instructions for adding information:

- It is necessary to follow the structure indicated in the tables, and it is not permitted to combine, swap or edit attribute names.
- Data set information fields should be added immediately after creating model elements, while attribute information should be added as soon as it is available.
- In some authoring tools, it is permissible to not specify the data set name for technical reasons; however, it must appear when exporting the model in *.IFC file format.
- When adding information to the attribute “01_Name” *(description)*, the element name must be clearly defined, specific for the intended element. A generic or ambiguous name is not allowed.
- If an element consisting of several layers is modelled with one model element, all layers and their thicknesses have to be stated at the “02_Material” attribute.
- When adding information to the “03_Type” *(type mark)* attribute, it is necessary to specify the element type as presented in theproject. If the specific element has not been assigned a specific type, it needs to be assigned separately in BIM models. Identical type names for different elements are not allowed.
- Attribute names must appear in the exact order in which they appear in the level of informationtables, and all attribute names must be created, even if it is known that some of the attributes will not be completed.
- Attribute information must be completed in Latvian. Exceptions are only allowed in cases where this information cannot be described in Latvian.
- The “Project phase” column indicates the control point at which the required information must be presented for the model elements. Information at the respective control point may only be lacking when this information is not available; it is required to provide it as soon as this information becomes available.
- Attributes requiring a link to an external document must not contain links to an internet website. An exception can be made if a copy of this website is saved in .HTML format and then a link to such saved version is provided.
- Files attached to BIM models should be saved in a separate folder and submitted along with BIM models so that the relative link between the models and the attached files is not lost.
- The Post-Contract BIM Execution Plan should contain a detailed description on the procedure for adding non-graphical information in the original authoring tool file format (description of the compliance of the attributes of Annex 2 “Level of information

requirements" with the built-in attributes and newly created attributes of the authoring tool, their naming procedure), as well as the export of such information to *.IFC file format (describe the actions to be carried out, the auxiliary files used, as well as enclose such auxiliary files as an attachment).

Explanation of abbreviations control point:

Abbreviation	Meaning
KC	Conceptual BIM
ST	Interim BIM
DT	Detailed BIM
AP	Approved BIM
BV	Construction (BIM updating, BIM supplementing)
IM	As-built model
AIM	Asset information model

4.5.2. Coordinates

Each 3D BIM model must be located in a unified coordinate system that corresponds to the true coordinates of the building according to the coordinate system LKS-92 and LAS-2000.5. The models must be correctly orientated towards the north of the project.

Guidelines for ensuring unified coordinates when starting the design process:

- The architect will share a model containing the axes and levels of the project as early as possible. This model should be used to achieve unified project coordinates.
- Each party involved in the design process will use this model to ensure that the project is at an exact location without modification.
- If the facility is divided into several parts (for example, buildings or wings) and, accordingly, into models, the zero point needs to be defined for each model.

4.5.3. Classification

The elements of the 3D BIM models developed as part of the project must be classified according to the ISO 12006-2:2015 “Organisation of information about construction works - Part 2: Framework for classification of information” standard.

UniClass 2015 classification has to be used, using Products, Systems and Spaces tables (information available on the NBS website https://www.thenbs.com/our-tools/uniclass-2015#classificationtables). The Products and Systems tables can be used simultaneously for each specific element or object of the building.

The classification has to be presented in models under a separate data set. The data set name as well as the attribute names must be identical in all models. Both the *description* and *number* attributes have to be presented for each specific classification table.

Model elements must be classified with LOD300 graphical level of development.

4.5.4. Modelling

The following minimum requirements are established for the modelling process:

- The elements of the model must meet the level of development requirements set for the particular stage of the project, they must be clearly understandable and contain information about the required parameters and attributes.
- It is essential to ensure that model element data can be transferred to IFC format.
- Model coordinate systems must be consistent between all design parts. The BIM models of each part of the project , as well as the exported IFC models, must be located at the same coordinates. When importing IFC models from other parts into BIM authoring tools, they must overlap with the BIM model developed in the given authoring tool without manual position corrections. If an authoring tool by one developer is used in several parts of the design, when merging the authoring tool files, they must also overlap at the correct coordinates without manual corrections of the position of the models.
- Conflicts of elements (crossing, overlapping or clashes) are not permitted in the model (except for in the cases provided for in Section 3.8.2. “Coordination and scheduling of clash checks”. It is the responsibility of the BIM coordinator and the authors of 3D BIM models (architects, designers of engineering solutions) to ensure that the models of different parts of the projectare consistent, the height of the elements is correctly placed and they do not conflict with the models of other parts.
- All three geometric indicators (3D) of the model elements are equally important. The accuracy and required reliability of location of elements in space is equal in three directions.

- Model elements have to be modelled floor by floor. Division by floors allows for better management of the model design, and also facilitates the preparation of construction estimates and planning based on the model.
- Model elements have to be modelled according to their phases – demolished, existing or designed. All volumes to be demolished have to be modelled for the Architectural solutions and Building structure parts.
- Redundant types of model elements, the so-called sets that are uploaded to the project, have to be eliminated from the models. The model should form a whole and the elements of the model should be modelled as a connected and independent system. It is necessary to model all elements that are required for the system to work according to the project solution.
- All elements must be modelled with a tool (function) intended for this in the chosen BIM software. If, however, different tools are used or new elements are created using general modelling tools, then, when exporting to IFC, it is important to monitor that they are correctly associated with IFC classes and types and that they are correctly represented.
- When changing model elements, the existing model elements should be edited first, rather than deleting them and creating new ones. In this way, elements retain a single GUID identifier and actions related to them can be tracked.
- Space elements (IfcSpace) have to be modelled at all stages of the construction life cycle. Spaces must adjoin their boundaries and there must be no conflicts between them. All floor surfaces of the building must be covered with space elements.
- 2D drawings must be derived from 3D BIM models. Inconsistency of information between 2D drawings and 3D BIM models is not permitted.
- If there are changes to the design solution, they must be first implemented in the model, and then the drawings updated with the changes are to be sent out.
- Annotations (references, indications, elevation marks, dimension lines) that are attached to drawings and rendered in 2D drawings must be based on models (must correspond to the model), i.e., the parameters must be linked to model elements.
- Correct graphical information about materials (colour, pattern, etc.) must be added to the finish and interior elements. It is not allowed to use generic materials as a finish for these elements. It is necessary to ensure that the material information in the model matches the specification of the design.
- If the technical specification specifies a status of limited access for a part (or parts) of the design, a visually visible designation “Limited access information” has to be added to the model of the respective part of the design. The designation should be agreed upon during the project launch meeting and described in the Post-Contract BIM Execution Plan.

If it is requested in the Project Special Requirements template to add non-graphical information to the models in the data group “Architectural solutions, Finishing”, the finishing elements must be created in accordance with the following principles:

- To ensure compliance with the exterior finish level of development requirements in Architectural Solutions models, it is permissible to create a separate finish model in which all individual interior and exterior finish elements are modelled with the information attached to them, or, alternatively, it is possible to model the finish in the main architectural model by separating the finish into separate elements and adding the necessary information, while maintaining the intended indoor and outdoor geometry. Clashes of finishing elements with construction elements of the model are not permitted. The thickness of the finishing layer must be subtracted from the thickness of the building element, modelling it so that it adjoins the construction elements.
- Floor and ceiling finishing layers need to be created for each space separately. Using the same finishing element for several spaces that are separated by boundary structures is not permitted.

4.5.5. Unique identification number

If the special requirements of the project require the addition of a non-graphical information data set “Asset information”, it is necessary to add a unique identification number to the respective model elements, which must not be shared with any other element within the project. The assignment methodology of the unique identification code consists of the following:

- Enumeration of LBN 501-17, Annex 2 “Types of construction works and structural elements”;
- Attachment of the element to the floor;
- Attachment of the element to the space;
- Ordinal number of the element.

Example:

- Unique identification number: **20.3_02_213_001**
- Meaning: Lighting fixture, on the 2nd floor of the building, in space 213, first in its UID group.

The classification of LBN 501-17, Annex 2 enables searching for objects within the building according to a common standard adopted in the country. For example, the presence of fire alarm objects in the project can be ascertained by searching for No. 26.3. The classification of

LBN 510-17, Annex 2 can be further detailed, subject to approval by the customer, and the adopted detailed names can be described in the Post-Contract BIM Execution Plan.

4.5.6. Federated model

The individual *.IFC format 3D BIM models by all authors have to be combined into one federated model. The federated model must enable the viewing of each model separately.

When combining 3D BIM models, the supplier must ensure that the location of the 3D BIM models is correct, i.e., the models imported into the model federation software appear at the respective coordinates as defined in the Post-Contract BIM Execution Plan. Manual correction of model location in the software used for 3D BIM model federation is not permitted.

Graphical and non-graphical information added to 3D BIM models must appear in the federated model in accordance with the criteria set forth in the BIM requirements.

4.6. Analysis and simulations

4.6.1. 4D simulation

4D simulation involves visualisation and analysis of the construction process using 3D models and adding a time dimension.

When developing a 4D simulation or linking construction activities and timelines with model components, it is necessary to provide a sufficient level of detail for clarity of the simulation. The minimum level of detail for model components is as follows: models, floors, types of work (volume to be demolished, volume to be retained, new volume), zones, essential equipment. Time level of detail in the 4D simulation is 1 calendar day. For certain types of work, subject to agreement between the parties, it is possible to reduce the level of detail to 1 week.

Technical requirements for 4D video:

- Video resolution: 1920x1080 pixels;
- Video format: *.mpeg or *.avi;
- At least 30 frames per second.

4D simulations are delivered in video file format and in the original format of the 4D simulation authoring tool.

By making a note in the Project special requirements, additional information and analyses may also be requested within the project along with the 4D simulation of the planned construction process, such as an extension of the 4D simulation, updating the 4D simulation during the construction work and constructability analysis.

4.6.1.1. 4D extension

Construction logistics:

- Construction site organisation planning and creating simulation, including the planning of location/movement of the workforce, equipment, heavy machinery, planning of location/relocation of temporary structures, planning of supply, location and storage of construction materials, etc. This also includes checking the availability of resources.

Construction Waste management:

- Planning and creation of a simulation/model of construction debris and other waste generated during construction works, which includes the planning of storage and transportation of construction debris, identification of potential construction debris and its volume, identification of factors, technology and materials influencing the generation of construction debris and reduction of their use, as well as the identification of reusable materials.

Construction intensity analysis by zone:

- Analysis of whether several types of construction work overlap in the respective areas at the same time, possibly interfering or hindering each other.

A 4D extension can be requested, provided that the development of a basic 4D simulation is envisaged within the project.

4.6.1.2. 4D updating and status management:

Constant updating of the 4D simulation during the construction works according to the actual work performed at the construction site, as well as the planned changes in the original construction work schedule (if any).

The completed and planned construction works should be clearly separated in the updated 4D simulation.

Construction work status reports and 4D simulation updates should be done once a month.

The 4D simulation updating requirements apply to both the basic 4D simulation and the 4D extended simulation (if requested in the Project special requirements).

4D updating and status management can be requested provided that the development of a basic 4D simulation is envisaged within the project.

4.6.1.3. Constructability analysis

Constructability analysis includes creating specific operations and assembly simulations to verify the feasibility of the work envisaged in the project before construction and to prevent or reduce risks. Constructability analysis is performed for specific stages of construction, where detailed information on the activities to be performed at the specific stage, the

materials and equipment used is presented. Listed below are the main principles that should be followed when preparing constructability analysis:

- Installation of large and/or heavy equipment or elements (length exceeding 5 m/weight exceeding 200 kg/volume exceeding 1 m^3) at the facility. When preparing the constructability analysis, it is necessary to specify the storage location of the elements at the facility before installation, the methods and machinery used for installation of the element, as well as the planned installation.
- Note: In certain cases, subject to agreement with the customer, it is possible to reduce the scope of the constructability analysis, for example, by not analysing the construction of cast ceiling/floor in the case of a new construction, etc.
- Installation of equipment or elements in a limited space or area, for example utility shafts, room ceilings, if utilities occupy more than 75% of the intended area surface, etc.
- Note: When preparing the constructability analysis, pay attention to the fastening elements.
- A detailed representation of pedestrian and traffic restrictions, including solutions for redirecting these flows, planned areas, technical solutions and instructions for organising the flow.

Constructability analysis may also be requested in cases where 4D simulation is not planned.

4.6.2. Environmental accessibility analysis

When planning or re-planning spaces during the design process, it is necessary to comply with the public buildings' environmental accessibility requirements for people with movement, vision and hearing impairments. Sufficient free space for movement in public spaces and adapted sanitary facilities must be provided for physically handicapped people.

Purpose:

- Verifying environmental accessibility in accordance with applicable laws and regulations.
- Providing sufficient free manoeuvring areas during the development of the interior part (IN).
- Requirements:
- Transparent spatial zones modelled in a 3D environment, where free movement must be ensured.
- Environmental accessibility areas have been checked for clashes against the Interior part (IN) or, if no Interior part is planned, against the Architecture part (AR).
- The spatial zones have been developed in accordance with applicable laws and regulations and the technical specification.

Environmental accessibility analysis has to be developed as an independent IFC model. The model includes spatial volumes of free movement, areas that enable the movement of people and room for moving in a wheelchair. This model is merged with the interior model and checked against it, thus pointing out areas where the placement of interior objects is not permitted.

Deliverable	Description	Prepared by
IFC file	Environmental accessibility zone for the flow of people and free movement marked with transparent spatial volumes (including in the direction of the z axis). Transparent zones are located in spaces where it is necessary to ensure compliance with environmental accessibility requirements, including toilets, changing rooms, lifts and shower rooms.	Author responsible for the environmental accessibility part

4.6.3. Other simulations

If a certain deliverable is required in the Project special requirements, it has to be applied to present alternative technical and other solutions to the customer and user of the building, and to choose and develop the most optimal technical solutions during design and/or construction works. All simulations are developed in the BIM environment using 3D models.

Deliverable	Description
Acoustic analysis	Simulation and analysis which includes research and simulations related to sound, for example, sound insulation tests and material selection tests, sound equipment location tests.
Analysis of flow of people and escape route options	Simulation and analysis of the behaviour of individuals or crowds of people using 3D models in normal use and emergency situations. The simulation helps identify and improve access, movement and exit routes.
Fire simulation	Fire and smoke propagation simulation and analysis for designing the building ventilation systems, automatic fire detection and suppression systems, etc.
Lighting simulation	Simulation and analysis of natural and artificial lighting inside the building.
Security analysis	Use of 3D models for conducting virtual security audits, which include simulations and analysis of security and access control systems, access areas, video surveillance systems, etc.

Location analysis	An analysis in which BIM software or Geographic Information System (GIS) tools are used to select the optimal project execution location or the optimal building location on a given plot of land.
Analysis of exposure to sunlight	An analysis that includes the simulation of solar irradiation on building surfaces (including reflection analysis), shadow simulation, study of the effects of building shape and location on solar heat loads.
Construction site risk analysis	Using 3D models to identify, analyse and evaluate risks and hazards during construction. For example, a model can be created or used to identify and analyse hazards on the construction site (e.g., potential falls from height, moving heavy equipment, placement of safety railings, etc.) and then evaluate those hazards in terms of risk exposure of workers and bystanders.
Energy efficiency analysis	Using 3D models to analyse the energy efficiency of the building, including how much energy a particular building consumes and how. Analysis of the internal temperature of the building while choosing engineering system solutions and construction materials.
Sustainability analysis	Environmental impact analysis, which includes, for example, building life cycle analysis, evaluation of energy consumption and environmental pollution. If this deliverable is selected, the technical specification of the respective project may describe the requirements for the work to be performed and its specifics in more detail.
5D	5D BIM is the process of adding costs to model elements after the project timeline has been associated with those model elements.

4.7. Visual reference materials

4.7.1. Visualisations

Development of 3D models to exchange information about visual, spatial or functional properties, for example, using fly-through.

The visualisations have to be photorealistic and must be used to present and coordinate the design solutions with the user of the building. The resolution of images and videos must be at least 1920x1080 pixels, and the video must have at least 30 frames per second.

Types of visualisations and file formats to be delivered:

Visualisation	File format
Image	*.jpeg or .png
Video	*.mpeg or *.avi
360º visualisation	Specify in the BIM execution plan

4.7.2. Virtual reality

Type of use of model where 3D models are part of virtual reality allowing users to view simulated locations, objects, and processes. Virtual reality is used using a VR headset or other specialised equipment.

4.7.3. Augmented reality

Type of use of model where 3D models, along with other technology, enable the users to view virtual objects superimposed on physical (real) objects or locations. As opposed to virtual reality, augmented reality is only a partial “immersion”, which allows the physical and virtual worlds to be represented as a whole. Augmented reality is usually used by means of smart devices, headsets, holograms and projections.

4.8. Bill of materials

During the design process the material volume specifications of the existing BIM models (or “Bill of materials”) has to be submitted for the Detailed BIM and Approved BIM control points.

The bill of materials must contain all the elements presented in the 3D BIM model and their quantities, except for the existing elements that will not be changed during the construction.

The bill of materials should be based on the following sample:

No.	Project part / system	Floor	Area*	Classification				Name / Description	Material*	Type	Unit of measurement	Quantity
				Systems. Description	Systems. Number	Products. Description	Products. Number					

*If applicable

Bill of materials creation instructions

- The bill of materials must be submitted in *.XSLS format.
- The classification must be presented in full, including the parameters in the following columns (column names may differ):
    - Systems.Description
    - Systems.Number
    - Products.Description
    - Products.Number
- Material volumes have to be presented in the columns Unit of measurement and Quantity. The volumes should be stated in such a way that it is possible to accurately determine the planned amount and cost of materials for the project. Several Unit of measurement and Quantity columns have to be used based on the following parameters:
    - Number – always to be specified.
    - Length – required for elements whose volume is expressed in units of length (such as rolled profiles, pipes).
    - Area – required for elements whose volume is expressed in units of area (such as ceiling finish, flooring). Both gross and net surface area is required if these two parameters differ (apertures, holes).
    - Volume – required for elements whose volume is expressed in units of volume (such as cast concrete elements, timber).
    - Weight – required for elements whose volume is expressed in units of weight (such as rolled profiles).
- For BIM model elements with the level of development LOD200, the Post-Contract BIM Execution Plan has to be supplemented with full designations of all types of elements visible in the model. The list should be compiled by groups of elements, such as windows, doors, rather than the full designation of each individual element. When submitting the bill of materials, it is necessary to update the full designations of the types specified in the Post-Contract BIM Execution Plan.

4.9. Cost management

Comparison of the construction and operating costs of alternative technical solutions with the aim of choosing the most economical solutions and/or fitting into a certain project budget.

The information on construction elements and operating costs must be submitted as an *.XLSX table, which includes the following information:

Comparison of engineering systems:

- Equipment costs;
- Equipment assembly and installation costs;
- Energy consumption;
- Equipment operating costs (energy consumption costs);
- Information on equipment maintenance, its frequency, operations to be carried out during the operation of the equipment;
- Equipment maintenance costs (service, maintenance, etc.);
- Expected service life.

Comparison of building elements:

- Material costs;
- Construction costs (assembly costs);
- Maintenance costs (if applicable);
- Service life;
- Warranty period (if applicable).

Comparison of finishing solutions:

- Material costs;
- Construction costs (assembly costs);
- Information on the frequency of maintenance, actions to be carried out, technology applied;
- Servicing costs;
- Service life;
- Warranty period (if applicable).

If this deliverable has been chosen, the customer shall specify the following information in the technical specification of the respective service:

- engineering systems, building elements and finishing solutions, for which a comparison of construction and operating costs needs to be prepared;
- the number of alternative solutions proposed.

While preparing the comparison of the construction and operating costs of the engineering systems, building elements and finishing solutions specified in the technical specification, a bill of materials must be submitted based on the information specified in Paragraph 4.8. “Bills of material quantities”. When preparing this bill of materials, it is not mandatory to specify the floor, zone and classification for model elements in the specification.

4.10. 2D documentation

2D documentation refers to the representation of both graphical and non-graphical information:

Type	Description
Graphical information	A type of use of model where 2D drawings are obtained (created) from 3D models containing information. 2D drawings usually include 2D plans, sections, facades and assemblies.
Non-graphical information	Accompanying documentation on the solutions applied and work carried out in accordance with the provisions of the laws and regulations and the requirements specified in the technical specification of the particular project.

Detailed requirements for 2D documentation, such as for the design, are defined by the technical specification of the particular service. 2D documentation is not considered a separate deliverable in the BIM requirements. In BIM requirements, 2D documentation is considered from a technical point of view, which includes the condition that 2D drawings must be derived from 3D BIM models and no contradictions between them are permitted.

4.11. Sample models for facility management

- Sample models for facility management shall be used to test the ability of the facility management team to ensure the facility management process in the BIM environment.
- The supplier shall submit sample models in accordance with the requirements that have been set during the procurement procedure.
- If the sample models were not requested during the procurement procedure, the customer shall prepare requirements for sample models based on Annex 3 “Requirements for sample models” of the BIM requirements.
- The number of sample models should correspond to the number of BIM models expected to be submitted at the end of the project.
- The sample models must be developed in the same authoring tool as the corresponding BIM models (the versions of the corresponding authoring tools must also match).
- The sample models must be submitted in both the original file format of the authoring tool and in the IFC file format.
- Sample models for facility management must be submitted if such is required in the project special requirements.
- Sample models for facility management must be submitted six months prior to the planned construction completion date.

4.12. As-built model

The as-built model, or BIM upon completion of the construction works and handover to the customer, must reflect the actually constructed objects according to the specified level of development and comply with the following minimum requirements:

- Include all actually implemented solutions, including all implemented and approved changes to the design during construction, as well as deviations greater than 50 mm from the project, if any.
- Inconsistency of information between as-built models and 2D as-built drawings and 3D BIM as-built diagrams is not permitted.
- Include all specific information about the assets, that is, include all the information to be added to the equipment and elements which was obtained during the construction works after the assembly of the equipment/elements in accordance with the level of information requirements.

- The as-built model has to be submitted once all construction work that may affect the graphical and non-graphical information included in the BIM models has been completed and accepted.

4.13. Asset information model

The graphical models created during the design and construction phase contain a significant amount of information that is not relevant during the facility management and operations of the building. In order to create models suitable for the facility management phase, it is necessary to perform the following modifications and actions in the Project Information models:

- Clean up the redundant information that is not required for facility management operations from the authoring tool (and, if applicable, .ifc format) BIM models:
- delete drawings, views, redundant tables (except if they have been used to add or export non-graphical information) created in the model, text fields, legends;
- delete the unnecessary and unused elements present in the model (objects, images, families, etc.) (purge feature);
- delete files and links attached to the model (except for relative links to requested non-graphic information and BIM models of other parts of the design);
- delete the project options in the model (project options, work sets, scope boxes, design options, view templates);
- make sure the model does not contain any warnings or cautions.
- Verify the correct behaviour of relative links between models and attached files. Make sure that all files that have relative links are saved in a separate folder.
- Make sure that only existing solutions are visible in the model (deleted, demolished or planned elements).

  Note: The information is not lost, as it remains available in the Project Information Model at the “As-built model” stage and can be accessed if necessary.

- If the Architectural solutions model of the building has been divided into several models (Interior, Equipment layout, etc.), upon request of the customer, these models have to be combined into one model (IFC file format).
- IFC file format models need to be submitted both for each specific section of the project and for the single combined model that contains all sections of the project.
- Make sure that unique asset identification numbers (IDs) are used to record building assets.

Annexes:

1. **Annex.** Project special requirements template
2. **Annex.** Level of information requirements
3. **Annex.** Sample model requirements
4. **Annex.** Criteria for evaluating sample models
5. **Annex.** Competency questionnaire template
6. **Annex.** Competence questionnaire evaluation criteria
7. **Annex.** Pre-contract BIM execution plan template
   - 7.1. **Annex.** Responsibility matrix template
8. **Annex.** Criteria for evaluating the pre-contract BIM execution plan
9. **Annex.** Post-contract BIM execution plan template
   - 9.1. **Annex.** Task information delivery plan template
   - 9.2. **Annex.** Master information delivery plan template
10. **Annex.** Terms of use of CDE