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BIM@Siemens Real Estate

Standard Version 2.0

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Abstract

The responsibility of all real estate activities of Siemens are managed by Siemens Real Estate (SRE). As a digital and interdisciplinary method SRE will use Building Information Management (BIM) for the whole lifecycle of a building. The Standard defines the scope and the goals of BIM@SRE at new and existing buildings.

Abbildung A-1: Übersicht BIM@SRE Standards

Der BIM@SRE Standard describes a project independent Standard to define the BIM Method. Project specific documents and requirements will reference to the BIM@SRE Standard.

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Chapter A: General Conditions

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A General Conditions

A.1 General Requirements

A.1.1 BIM – a common definition

Building Information Management (BIM) is a model-based, digital, interdisciplinary and verifiable working methodology. Virtual, three-dimensional models of buildings are linked with non-geometric, alphanumeric data to form a consistent image of all information that is relevant for design, construction and operation. These multidimensional building models are digital and visual representations of the respective building, its physical and functional properties and their interrelationships. The combined data and information from all the different contributors to the project thus enable an accurate, verified acceptance and handover of "as built" data to the operators.

Building Information Management allows buildings to be planned and constructed in a way that enables transparent and efficient management throughout their entire lifecycle. The building is first built and simulated digitally, and subjected to qualitative verification before it is physically erected.

To enable consistent application of Building Information Management it is necessary to structure the information gathered from, and provided by all project members. The BIM methodology not only comprises the 3D model but also the entire process-related and technical infrastructure and its consistent implementation. This involves a number of technical, methodical and information-based requirements which are incorporated into the BIM@SRE standards.

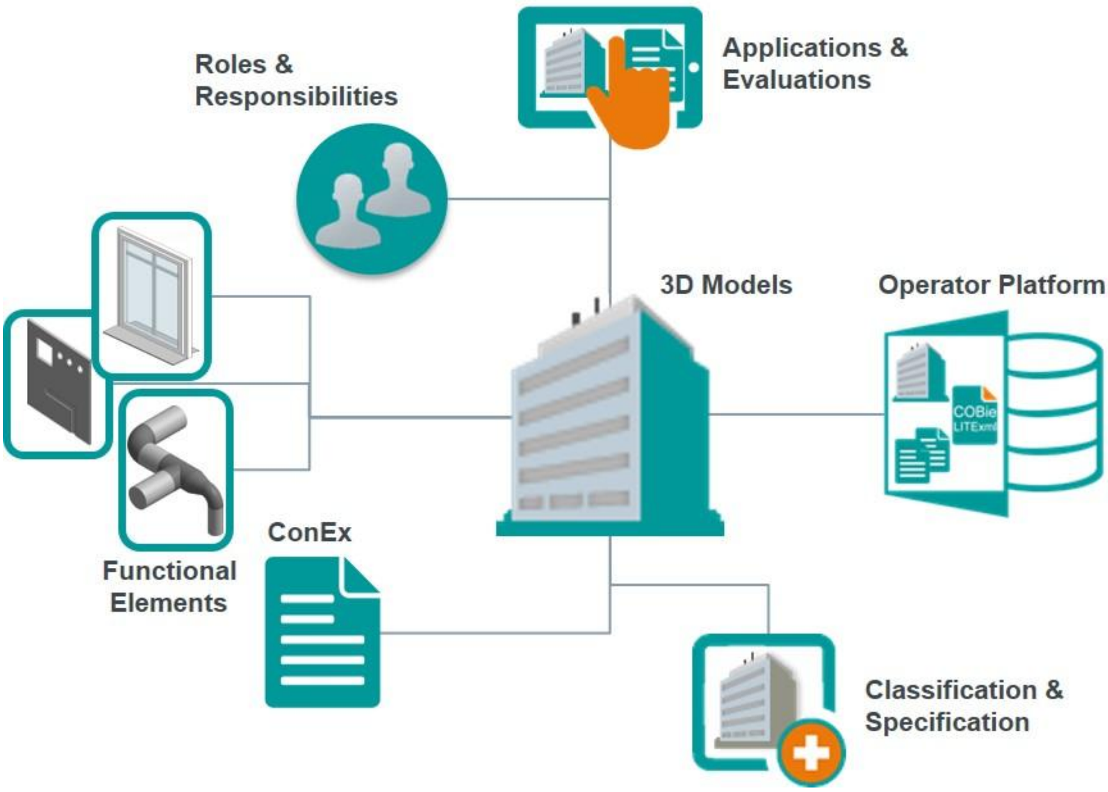

Figure A-1: Requirements for the BIM methodology

The documents of the BIM@SRE standard discuss the above-mentioned requirements and define their respective context.

A.1.2 Project-specific definition of objectives

To implement strategic objectives for a fully digitalised asset and facility management are following goals necessary:

- Creation of a digital prototype,

- optimised quality assurance,
- optimised collaboration and
- verified and accelerated acceptance and handover to operation.

In addition, project-specific objectives must be defined to ensure sustainable, cost-effective and optimised project implementation. The project-specific objectives are defined in detail in the BIM Use Cases. Proper implementation of the use cases ensures that the set objectives are achieved.

Implementation of the Must-have BIM Use Cases supports and facilitates collaboration, communication and control during the planning and building phases, as well as during commissioning and operation. What is more, it ensures transparency and the creation of a fully digitalised data basis which improves the efficiency of project execution. The benefits of defining project-specific objectives include improved resource planning, more efficient responses to design modifications, more precise key values, and optimised planning of the construction stage. Furthermore, defining these goals facilitates risk management and helps reduce disruptions and delays at the construction site by ensuring timely quality controls.

A.1.3 Methodical approach

The holistic methodical BIM@SRE approach must be followed throughout the lifecycle of the building, ensuring consistent sharing of data and information between all project members and required processes. To ensure consistent application of the BIM@SRE standards and attainment of the defined objectives, the required data must be structured uniformly among all project members. In particular, the technologies utilised must meet the following requirements:

- Consistent implementation of the BIM@SRE standards, in particular the Must-have BIM Use Cases, must be insured.
- All software applications, formats and interfaces used in implementing the BIM@SRE space standards must be internationally recognised and well-established in the relevant markets.
- Error-free use of all geometric and alphanumeric data captured during the planning and construction phases must be ensured during operation.
- It must be possible to map and archive the geometric and alphanumeric data and their formats across the entire lifecycle of the building without requiring major maintenance efforts.
- In the event of a remodelling project on the building, all geometric and alphanumeric data of the documentation must be accessible and usable at all times.
- It must be possible to capture, integrate, use seamlessly, and deploy 2D asset data.

Furthermore, the IT-platform SRE will be using worldwide for activities such as space management will feature an interface to Autodesk Revit. According to a survey conducted among the selected partners of SRE BS in four regions, Revit is the most commonly used application worldwide: More than 80 per cent of SRE BS Selected Partners worldwide use the Revit application by Autodesk in BIM projects. Even on a regional level, there is a clear trend in favour of Revit:

- In the Region Americas, all selected partners use Revit = 100%.
- In the Region Asia / Australia, Revit is used by 75%.
- In the Region Germany, Revit is used by 75%.
- Across the entire EMEA region, Revit is used by 100%.

Four products from the Autodesk suite, including BIM 360, are already being used by several Siemens divisions around the world. As for BIM applications, BT and MO are key applications.

Autodesk is currently clearly the world market leader, especially in the field of Building Data Creation, as market studies by independent firms such as Cambashi and Gartner have shown. Autodesk is the leading global provider, ahead of Nemetschek, which places second with a market share of roughly half the size that of Autodesk. Trimble and Bentley have significantly smaller market shares, while certain providers may have strong local user bases in specific countries. Examples include Fukiu, a very popular application in Japan, or Nemetschek, which plays a major role in Germany. Industry-specific particularities, such as the interlinked building and plant design process found in the automobile industry, may also be limiting factors regarding the choice of software applications; in these envirenements, providers other than Autodesk are often preferred.

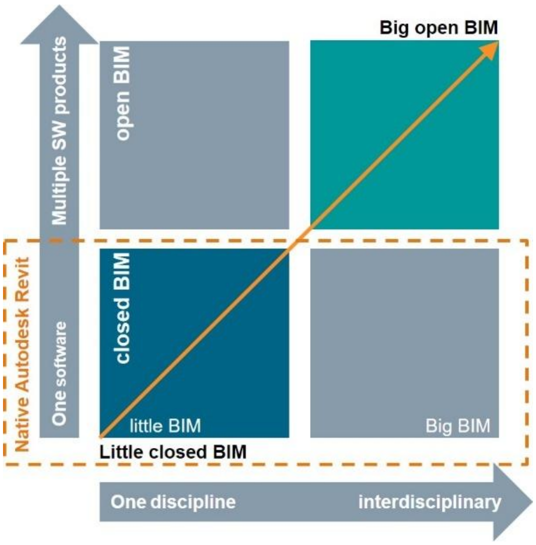

Figure A-2: Closed BIM method for all deliveries

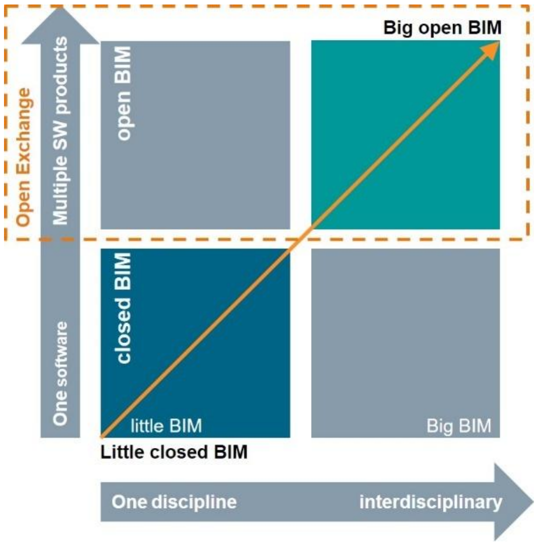

Figure A-3: Open BIM method for internal processes of service providers

Key criteria for the successful use of a BIM-based technical building management system are always the relevance of the information provided, and the required accuracy of the 3D model. The individual, discipline-specific models are handed over to the operator for documentation purposes. This is done to archive the as-built status and provide a basis for the operator's operational model. These requirements can only be met by enforcing the use of a common, consistent software format, which ensures continued maintainability of all relevant information and discipline-specific models.

To make sure the operator's needs can be accounted for appropriately, the Closed BIM method is applied as the mandatory method for all deliverables to SRE. All models must be created using the Autodesk Revit software.

For a service provider's (General Design [GD] and General Constructor [GC]) internal processes (e.g. internal collaboration) and coordination with additional third-party planners (e.g., planning of furnishings, process equipment etc.), the delivery of native Revit components is not absolutely mandatory. However, external designs, such as furnishing plans, must be incorporated into, or referenced by, the deliverable discipline-specific Autodesk Revit model. This could be accomplished e.g. by inserting an .ifc file. Discipline-specific plans with exclusively geometric relevance for the implementation of the BIM@SRE standards may also be created using non-Autodesk Revit software. For example, it would be acceptable to create reinforcement drawings using TeklaStructures, Nemetschek Scia, Bentley Systems AECOsim, or another suitable software application. In the case of reinforcement drawings however, it must be ensured that these can be included in the model-based quality assurance process (clash detection etc.).

The approach chosen by the service provider for internal implementation along with its BIM method must be documented in the BIM Execution Plan and requires approval by client (SRE Project Management). However, the approval does not affect the responsibility of the Contractor for the contractual work. The BIM Execution plan is a contractual component.

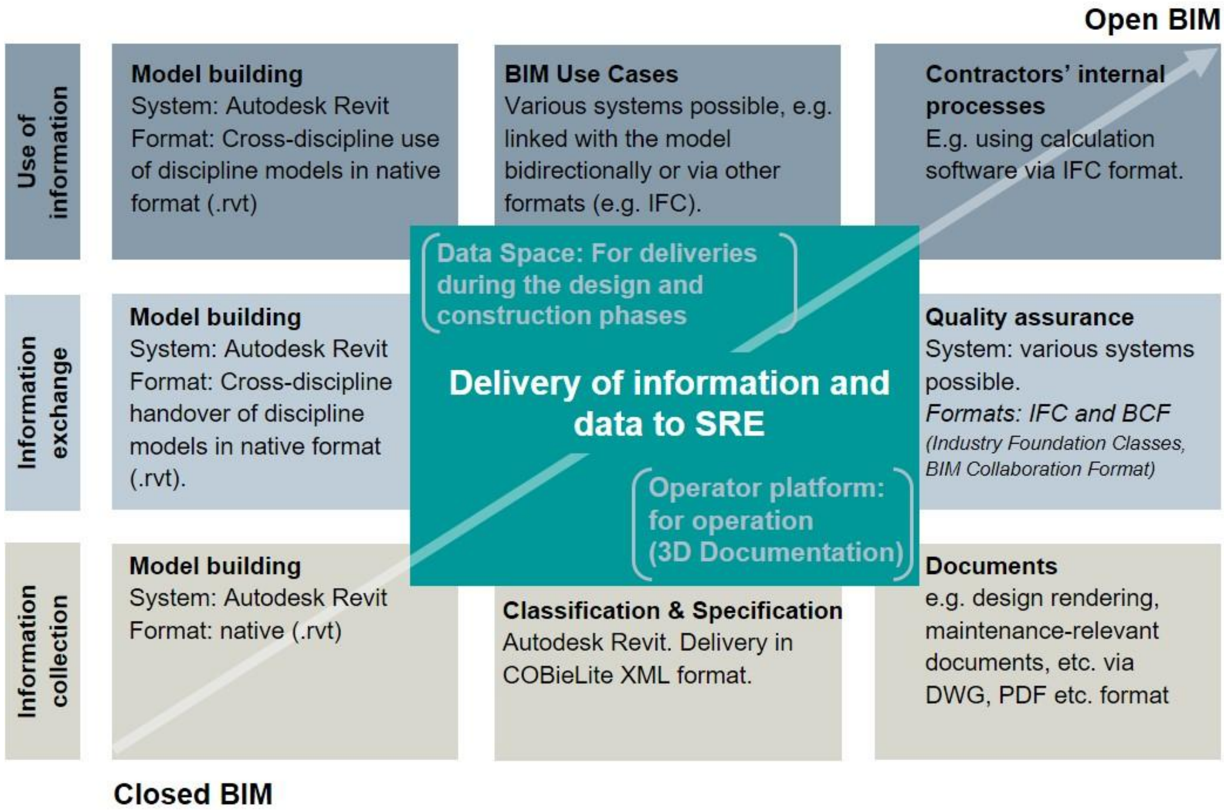

Figure A-4: Schematic representation of the BIM methodology applied by SRE

A.2 BIM Overall Process

A.2.1 BIM overall process map

The process map provides the project members with an overview of the requirements and processes of the BIM methodology. The BIM overall process map defines the content of each planning, construction and operational phase as well as the responsibilities in each project phase and the role-specific ‘swim lanes’. The BIM overall process map organises all processes and deliverables of the planning, construction and operational project phases, culminating in Data Drops.

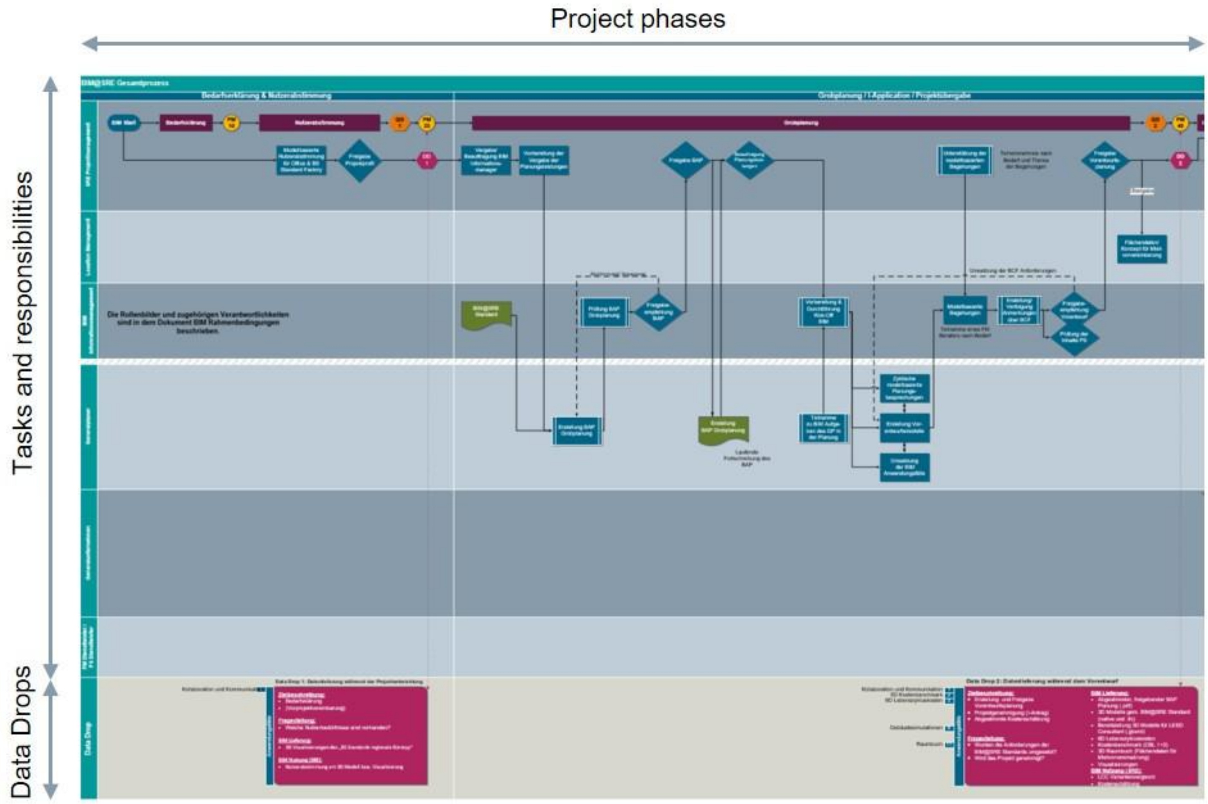

Figure A-5: Section from the BIM overall process map

The overall process map illustrated in Appendix A — BIM Overall Process Map is a constituent part of the BIM@SRE standards and of the contracts between SRE and each contractor.

A.2.2 Data Drops

To organise the data handover process, so-called data drops have been defined. These are specific deadlines for submitting graphical (e.g. 3D models) and alphanumeric information.

Arranged around the PM@SRE phases, the data drops describe:

- the definition of the objectives of each project phase,
- the coordination, processing and reviewing processes in each project phase,
- the decision-making and approval processes of each project phase, and
- the documentation (the BIM deliverables), including the relevant formats, for each project phase.

For a detailed description of the data drops please refer to the document “Data Management" of the BIM@SRE standard.

A.2.3 Project phases

The project phases of the BIM overall process map are structured as follows:

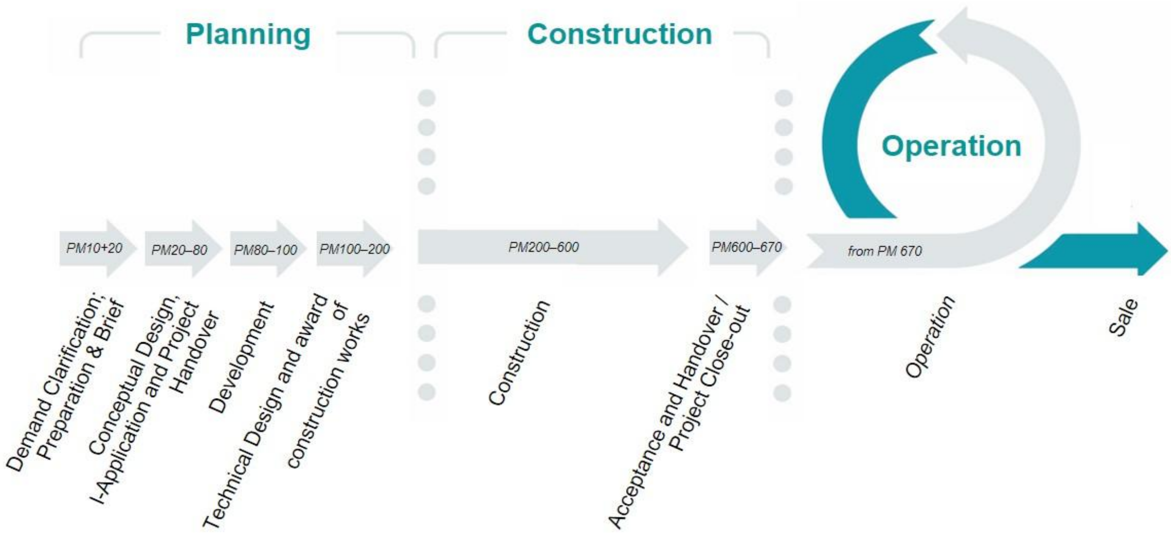

Figure A-6: BIM project phases

A.3 BIM Roles, Responsibilities and Tasks

A.3.1 Overview

To ensure smooth collaboration throughout the organisational network of the project, BIM requires clearly defined roles, responsibilities and tasks which are represented in the schematic below.

In particular, the internal BIM structure of SRE describes how the Information Management role supports the building owner's project management. The Information Management role supplements the traditional tasks of the external project management service provider, supporting Project Management in all organisational and technical matters while helping ensure throughout all phases of the project that the contractors fulfil their contractual duties and SRE fulfils its duties as Principal.

If required, the Information Manager may be supported by an FM advisory function during the planning and execution phases to optimise acceptance, handover and commissioning, ensure adherence to relevant service levels, and assure the quality of the contractors' deliverables.

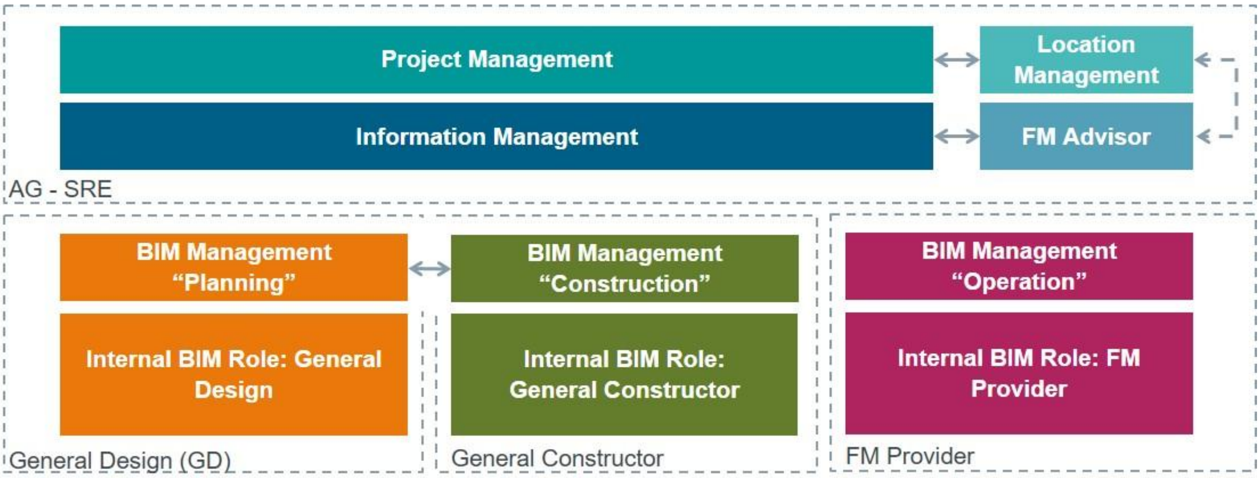

Figure A-7: BIM project organisation

Every contractor shall establish a qualified internal BIM Management which bears overall responsibility for the agreed BIM services and deliverables. It is the responsibility of each contractor to establish an appropriate internal organisational structure as required to meet its contractual obligations. Therefore, this document does not provide any definitions or specifications in this respect.

Note: Depending on the contract awarding model as well as the scope and structure of the project, several of these roles might be assumed by a single individual. For example, the BIM Management role could be taken on by the service provider's project head, if qualified appropriately. Furthermore, a service provider’s "Planning" BIM manager could also be put in charge of the subsequent responsibilities of the “Construction" BIM manager, depending on the provider's internal organisational structure.

A.3.2 Project Management

A.3.2.1 Role and responsibilities

The projects are managed by SRE Project Management. The SRE project management assumes responsibility for the overall responsibility for the project co-ordination and is responsible for all organizational, technical, issues regarding to the schedule, economic, accounting and legal matters. Project management ensures that the contracting parties fulfill their obligations as contractor and SRE as the customer.

Because of the innovative nature of the BIM methodology it may be necessary at some point, to assign the Information Management(A.3.4) role to an additional service provider specialising in the BIM methodology. Thus the Information Manager supplements the external project management services. The FM Advisory services may be rendered by an external provider or assigned by the SRE Location Management, depending on the regional scope and type of the given project.

SRE Project Management is in charge of the operational handling of the projects.

A.3.2.2 Tasks and responsibilities

Table A-1: Project Management responsibilities

	SCOPE OF RESPONSIBILITIES
Cat.	**Description**
External / Internal Management	Appoint Information Manager
	Appoint FM Advisor
	Ongoing coordination with Information Manager
	Coordination with user
	Participation in model-based inspections
	Participation in planning and construction meetings
	Organise the kick-off events
	Liaise with SRE Location Management
Use	Provision and utilisation of the project space
	Utilisation of work results (e.g. cost benchmark, lifecycle costs, etc.)
	Handover of work results to SRE Location Management
Verification	Approval of the BIM Execution Plans
	Approval of the Must-have BIM Use Cases
	Tracking and plausibility checking of quantities

A.3.3 Location Management

A.3.3.1 Role and responsibilities

SRE Location Management participates actively in the BIM process. In particular, the service provider determines information such as areas based on models, and submits this information to SRE Location Management. Furthermore, SRE Location Management may also be consulted as an FM advisor, thus assuming the roles, tasks and responsibilities of the FM Advisory role as described below. During the operation stage, Location Management is responsible for monitoring the FM Operator as well as compliance with and application of the BIM@Standards and the project-specific BIM Execution Plan "Operation".

A.3.3.2 Tasks and responsibilities

Table A-2: Location Management tasks and responsibilities

	SCOPE OF RESPONSIBILITIES
Cat.	**Description**
External / Internal Management	If applicable, accept FM Advisor's range of services
	Ongoing liaison with SRE Project Management
	Liaise with tenant
	Commission remodelling projects, including BIM requirements, during operation
	Appoint an Information Manager during remodelling projects
Use	Use of visualisations for tenants
	Utilisation of work results (e.g. spatial data, concept for lease pre-agreements)
Verifi-cation	Monitor the FM Provider during operation
	Monitor adherence to “Operation" BIM Execution Plan

A.3.4 Information Management

A.3.4.1 Role and responsibilities

The Information Management assuming overall responsibility for directing the preparation, planning and execution of the BIM-based processes during the project through to successful acceptance and handover. It bears part of the responsibility for achieving the agreed project goals. During the course of project execution, BIM Information Management ensures proper application of the BIM@SRE method as well as adherence to the defined data drops and proper delivery by the contractors' BIM Management.

The BIM Information Manager is a member of the project team, collaborates operationally with Project Management, and acts as a contact person for all internal and external BIM-related questions during the project. BIM Information Management is counterpart vis-à-vis the contractor's BIM manager, organises and directs the management-processes associated with the BIM-based project execution, and coordinates its activities with Project Management (PM) on an ongoing basis.

Tasks and responsibilities

Table A-3: Information Management responsibilities

	SCOPE OF RESPONSIBILITIES
Cat.	**Description**
Creation & updating	Define the BIM-related project requirements and contract essentials
	Prepare the operator’s requirement specifications
	Provide support for competitions/contract awarding
	Determine Project Management’s information requirements and deliver the information
	Develop and – where applicable – implement project-specific training (internal or external)
	Create documentation as a basis for Project Management decisions
External / Internal Management	Ongoing liaison with Project Management
	Submit regular reports to Project Management
	Organise and initiate BIM-related model-based inspections
	Participate in planning and construction meetings
	Cover BIM-based topics during kick-off
Participation & use of resources	BIM-related organisation of the project space
	Utilise work results in subsequent BIM applications and tasks
	Hand over work results to other project members
Verification	Monitor timely delivery of BIM services by contractor
	Check contractor’s deliverables and quality assurance reports through random sampling
	Check adherence to BIM use cases and recommend approval
	Monitor fulfilment of BIM requirements by project members
	Track and plausibility-check quantities

A.3.5 FM Advisory Service

A.3.5.1 Role and responsibilities

The FM Advisor is a member of the project team who collaborates operationally with Information Management. The FM Advisor is the contact person in connection with facility management processes, participates in coordination meetings related to plant operations, and gives plan approval recommendations to Project Management.

Note: The FM expert role may be assumed by the SRE Location Manager.

A.3.5.2 Tasks and responsibilities

Table A-4: FM Advisory tasks and responsibilities

	SCOPE OF RESPONSIBILITIES
Cat.	**Description**
Checking & Management	Participate in model-based inspections
	Check accessibility of maintenance-relevant items (e.g. machines and manholes)
	Make draft plan approval recommendations
	Check accessibility of maintenance-relevant elements (e.g. manholes)
	Make construction plan approval recommendations

A.3.6 BIM Management

A.3.6.1 Role and responsibilities

The Contractor takes over the BIM Management within the framework of the ordered scope of responsibilities.

BIM Management satisfies the information needs with respect to the BIM@SRE standards, collects the BIM Project Execution content and submits it to Information Management, and acts as a primary point of contact for questions related to the BIM-based project execution between Information Management and the contractor's internal organisation. BIM Management organises and manages the BIM-based project execution on the contractors' side pursuant to the BIM@SRE standards. This ensures consistent model-based work practices while supporting collaboration and communication within and among the project teams. BIM Management organises the technical infrastructure to make sure the documentation generated in the forms of graphics, alphanumeric data, and text documents can be exchanged easily.

The BIM Management role is subdivided basically into three main areas of responsibility, which may be implemented based on the following personnel and project-specific arrangements during the planning and construction phases. The FM service provider's BIM management is not affected by these arrangements:

1) Identical BIM Management for the entire project duration, i.e. during the planning and construction phases

Responsibility		PM@SRE phases										
Service provider	**Role**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
GD	BIM Management "Planning"											
FM Provider	BIM Management "Operation"											

2) BIM Management changes from Planning (GD) to Construction (GC) phase

Responsibility		PM@SRE phases										
Service provider	**Role**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
GD	BIM Management "Planning"											
GC	BIM Management "Construction"											
FM Provider	BIM Management "Operation"											

Depending on the awarding of the contracts (single contract or in packages) The specific scope of responsebilities must be specified in the respective contract.

The BIM Management's uninterrupted availability must be confirmed by the contractor before the contract is awarded, and ensured for the entire duration of the project. The contractor is responsible for the content and application of the delegated BIM use cases including all related advance and partial deliverables as well as third-party partial models. This shall not affect any other contractual deliverables.

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If project members other than the respective contractor – especially the Principal – depend on work results submitted by others, the originator of those work results remains accountable for both, the work results themselves and all developments relying on them.

Prior to being awarded the contract, the prospective contractor shall submit proof of qualification for all individuals in key positions who will be responsible for the creation, coordination and management of 3D models, and in particular, the preparation, control, monitoring and coordination of information flows. All qualifications shall be substantiated by providing suitable references.

A.3.6.2 Tasks and responsibilities

Beyond the responsibilities defined in the documents of the BIM@SRE standards, every BIM Management shall ensure delivery of the following services:

Table A-5: BIM Management tasks and responsibilities

	SCOPE OF RESPONSIBILITIES
Cat.	**Description**
Creation & updating	Creation, continued development and updating of the respective BIM Execution Plan
	Creation of the BIM models and the corresponding BIM Use Cases relevant for the contractual deliverables
	Creation of other BIM application content on a technical level
	Preparation of the quality assurance reports as specified
	Continuous updating of documents, applications and BIM models
External / Internal Management	Regular coordination with, and reporting to Information Management
	Overall coordination and process control on the contractor’s side
	BIM-side organisation and initiation of the planning and construction meetings (submitting BIM models)
	Ensure timely delivery of BIM services according to the Data Drop specifications for the exchange of information
	Structured maintenance of and adherence to the data security, data consistency and data distribution rules
Participation & use of resources	Use the data space
	Utilise work results in subsequent BIM applications and tasks
	Hand over work results to other, external project members
Verification	Implementation of the quality assurance rules
	Verification of content conformity with the BIM documents and standards
	Data integrity checks
	Arrangement of test runs to validate concepts and building models

A.4 BIM documents and technical project standards

The BIM documents and technical project standards explain the requirements of the BIM@SRE space standards as well as the technical requirements which must be met to deliver on the contractual commitments:

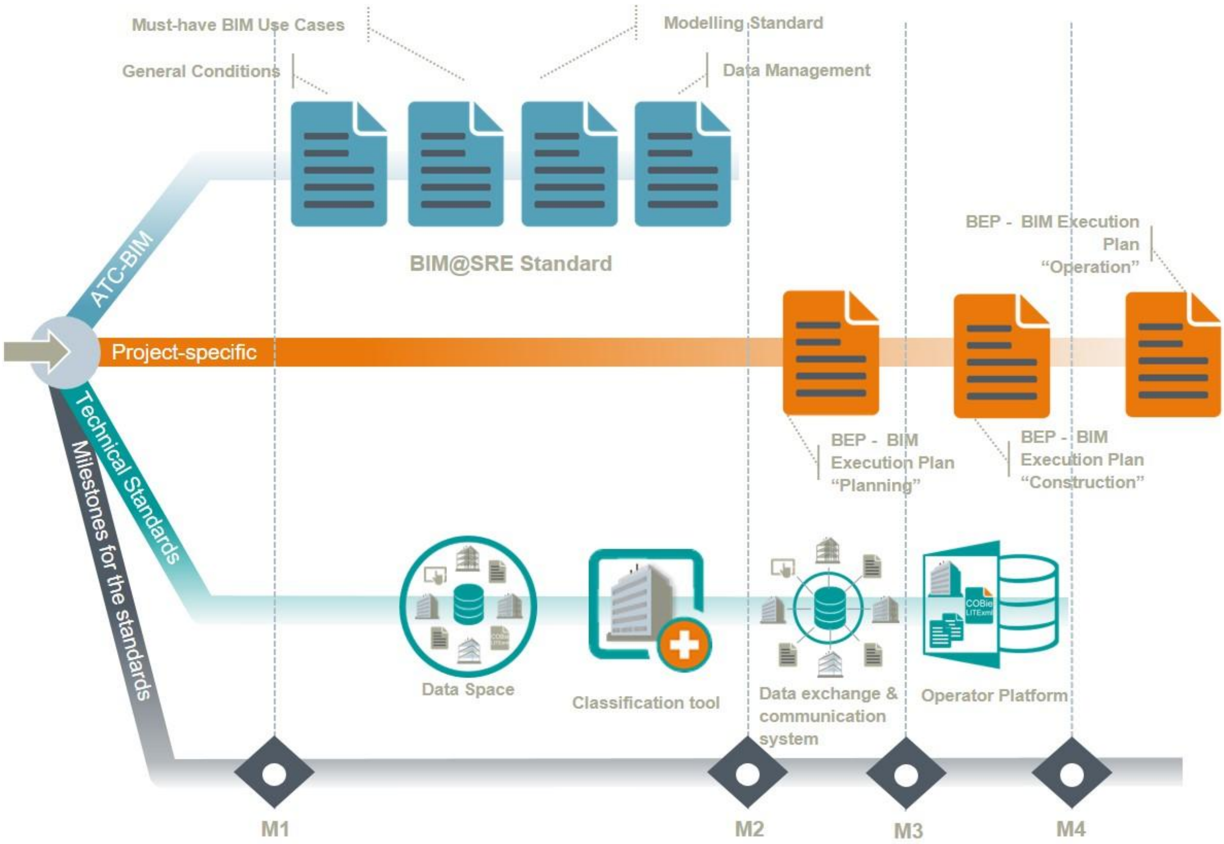

Figure A-8: Overview of documents and technical project standards

A.4.1 Milestones and responsibilities

Table A-6: Milestones and responsibilities related to the standards

Creation and submission of standards			
Mile-stone	**Description**	**Timing**	**Responsibility**
M1	Deployment of: -BIM@SRE Standards -Data space	During preparations for contract awards to service providers	SRE Project & Information Management
M2	Creation of BIM Execution Plan "Planning"	Prior to contract award	General Design (GD)
	Deployment of data exchange and communication system	Immediately after contract award	
M3	Create BEP "Construction"	prior to contract award	General Constructor (GC)
	Deployment of data exchange and communication system	Immediately after contract award	
	Deployment of the operator platform	when FM provider contract is awarded	SRE Project & Information Management
M4	Creation of BEP "Operation"	prior to contract award	FM Provider

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A.4.2 BIM@SRE Standard Documents

A.4.2.1 General Conditions

The BIM General Conditions define the Principal's high-level requirements for the existing internal processes of SRE as a basis for all further documents of the BIM@SRE standards. The General Conditions describe general and project-independent requirements the BIM methodology must meet. The document specifies the data, information and documents to be delivered by the contractor.

A.4.2.2 Modelling Standard

The Modelling Guidelines contain in particular the requirements to be met by model structures as well as classification and information standards; it also defines the levels of detail and information for BIM models.

A.4.2.3 BIM Use Cases

The document describes the possible BIM Use Cases applied in SRE projects, including details regarding their implementation and contractor deliverables.

A.4.2.4 Data Management

The BIM Data Management is used to collect, manage and distribute model data and documents between multidisciplinary project teams. The document describes the technical requirements for a collaboration environment as well as the data creation, processing and utilisation processes.

A.4.3 Project-specific documents

A.4.3.1 BIM Execution Plan (BEP)

A BIM Execution Plan (BEP) is prepared by each service provider. The BEP describes the methodical approaches, personnel resources and processes used in fulfilling the requirements and deliverables specified by the BIM@SRE standards Based on the concrete project according to the contracted scope of the contractor. These requirements must be incorporated into the BEP, and implemented during the project. Responsibilities under the BIM Execution Plan are assigned usually as follows:

- General Design (GD) prepares the “Planning” BEP for the Conceptual Design, Development, and Technical Design phases as well as for awarding the construction works.
- The General Constructor (GC) creates the “Construction” BEP for the Construction, Acceptance and Handover, and Project Close-out phases.
- The FM service provider prepares the “Operation” BEP for the operation phase including commissioning of the building.

Different constellations are possible depending on the project delivery.

The BEP is a project-specific summary of all activities of the project members under the relevant BIM method. These organisational rules are meant to structure the cooperation between the project members and simplify the progressing project work. The BIM Execution Plan (BEP) describes the planning, preparation, control and monitoring of the BIM deliverables.

The content-related requirements for the BEP are defined by the BIM@SRE Standard for the respective specifications as described. In summary, the following minimum requirements must be defined by each BEP:

General

- Definition of additional, project-specific data drops where required
- All project or region-specific deviations from the BIM@SRE standards

General Conditions

- Liaison with the respective contractor's BIM contacts and BIM manager. Qualification records are to be submitted separately.
- Setting of deadlines for BIM-related project phases and milestones.

Must-have BIM Use Cases

- Documentation of the Facility Service and Facility -related building functional elements for the relevant use cases
- Documentation of the interfaces and file formats used for data submission to other parties involved in the planning process (furnishing planners, process equipment planners, LEED consultant, etc.)
- Documentation of component specifications (Room Schedule, Equipment Schedule, FS data, etc.)

Modelling Standard

- Model and project coordinates (project zero point, coordinate system, etc.)
- Model splitting, if necessary
- Hyperlinking strategy e.g. for referencing construction drawings
- Region-specific model entities
- Description of the rendition (colour scheme) of revisions or modifications (remodelling status)
- Definition of levels and floor references
- Creation of a functional element parameter matrix
- Definition of consistent floor and zone designations
- Description of the quality assurance concept, including submission of a quality assurance report for discussion and agreement
- Documentation of the clashing matrix including times and responsibilities.

Data Management

- ETA submission cycles (e.g. for planning meetings)
- Fixing of the region-specific classification standard (Uniclass, OmniClass)
- Definition of the Level of Information for the COBie standard, if different
- Data submission plan indicating who submits data when, for whom, how and for what purpose (planning meeting, quality assurance, deliveries, etc.)
- Definition of additional naming conventions for the 3D models and documents derived from them (2D drawings, lists and additional evaluations)
- Description of any additional databases and interfaces that will be used
- Description of software applications used, including versions and file formats as well as the purpose of each application
- Description of the data sharing and communication system including milestones, roles and responsibilities for the exchange of information

The BEP is created in two successive steps.

Upon submission of the proposal, the bidder shall explain how he intends to implement BIM within the project by presenting a BIM Execution Plan. The BEP has to detail the functional elements and their planned implementation, including the technical and personnel resources that will be used in the process. Furthermore, the bidder has to explain what hardware and software it intends to use, and how they will be adapted to meet the project requirements. With respect to the application of the Must-have BIM Use Cases, it should be noted that the result in 2D construction drawings generated from the 3D model.

There will be no financial compensation for the creation of the BIM Execution Plan submitted as part of the proposal. Any such compensation is hereby expressly excluded.

In the course of the contract negotiations, the bidder will make amendments and, where applicable, modifications to its BEP until a mutually agreeable plan for executing the required BIM use cases has been created. The resulting modified BEP will be a contract component in the event of the contract being awarded in accordance with the contractual provisions..

A.4.4 Technical project standards

The technical project standards are documented and explained in detail in the document titled "BIM Data Management".

Chapter B:
BIM Use Cases

B BIM Use Cases

Overview of the BIM Use Cases

This chapter describes the essential requirements for the use and deliverables of the BIM method. The BIM use cases are part of the BIM@SRE standard and define the deliverables, including the results to be provided by the Contractor in the event of the assignment of the relevant application, unless modifications / deviations are regulated in the respective contract.. The deliverables described in this chapter exclusively refer to processes related to the implementation of the BIM method.

Table B-1: BIM Use Cases

Overview of BIM Use Cases	
Item No.	**Description**
1	Equipment Schedule
2	Equipment Information
3	Building Permit
4	Documentation
5	Updating
6	Hard and Soft clashes / Clearances
7	Collaboration, Co-Ordination and Communication
8	KPIs
9	Bill-of-quantities and Specification
10	User Fit-Out
11	Interface to Process Equipment
12	Room Schedule

Overview of deliverables and responsibilities

For each BIM use case, one or several so-called Data Drops are defined. The 3D model and the data linked to it thus form the basis for continuous updates of the BIM use cases over the entire building lifecycle.

At the time of a Data Drop, 3D models, specific documents and/or alphanumeric data are to be submitted depending on the given BIM use case. The timing of data drops for phase-related use cases varies as follows:

- One-time submission – usually at the conclusion of a phase-related data drop
- Several submissions during a project phase (where applicable, at predetermined dates depending on the BIM use case). The intervals or dates of Data Drops are to be documented in the BIM Execution Plan; this is part of the respective BIM Manager's responsibilities.

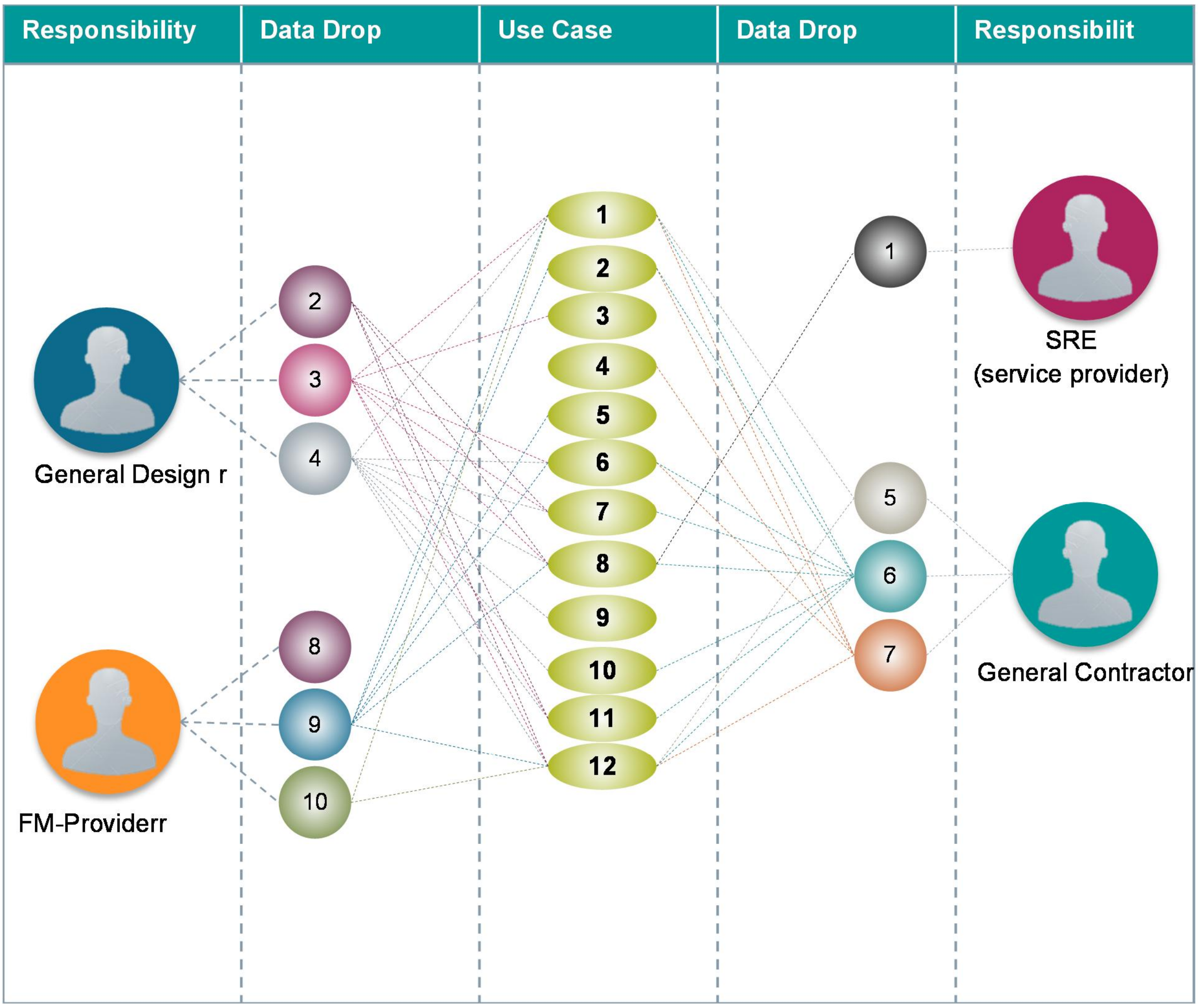


Figure B-1: Overview of deliverables and responsibilities

Data Drops

To structure the data handover process, so-called data drops have been defined. These are specific deadlines for submitting graphical (e.g. 3D models) and alphanumeric information. Data Drops specify the BIM deliverables for the respective use case, the relevant formats, and the type of information to submit.

Arranged around the PM@SRE phases, data drops describe:

- the objectives of each project phase,
- the coordination, processing and reviewing processes in each project phase,
- the decision-making and approval processes of each project phase, and
- the documentation (BIM deliverables), including the relevant formats, for each project phase.

Provided that the contractor is required to provide additional deliverables (e.g. for individual use cases) at Data Drops, such deliverables must be defined in the project-specific BIM Execution Plan (BEP). The table below specifies the Data Drops.

Table B-2: Data Drops

Data Drops		
Data Drop	**Phase**	**Timing**
Data Drop 1	Demand Clarification; Preparation & Brief	Demand Clarification; Preparation & Brief
Data Drop 2	Conceptual Design	During Conceptual Design phase At the time of Conceptual Design approval
Data Drop 3	Development	During Development phase At the time of Development approval
Data Drop 4	Technical design and awarding of construction works	During Technical Design phase When construction works are awarded At the time of Technical Design approval
Data Drop 5	Construction	During FM/FS tendering process
Data Drop 6	Construction	During Installation Planning phase During Construction phase At conclusion of Technical Design phase
Data Drop 7	Acceptance and Handover	At time of handover and documentation (As Built)
Data Drop 8	Operation	Operation start-up
Data Drop 9	Operation	During operation of the building. During or after structural or spatial modifications (e.g. remodelling)
Data Drop 10	Sale	During preparations for sale, to establish a basis for the sale
Data Drop n	*Further Data Drops*	according to project requirements

B.1 Equipment Schedule

B.1.1 Objectives and added value

The Equipment Schedule is a structured overview of defined information items on technical equipment in a building (MEP, functional elements, supply line routes, etc.) as well as functional elements requiring maintenance services.

The purpose of the Equipment Schedule is to link equipment and installations with the pertinent maintenance and electric/HVAC/plumbing-related information (such as maintenance intervals, manufacturer, type, serial number and other specific data) and their location (e.g. room information). Together with the Schedule of Legal Provisions, the Equipment Schedule is an essential prerequisite for compliant equipment operation.

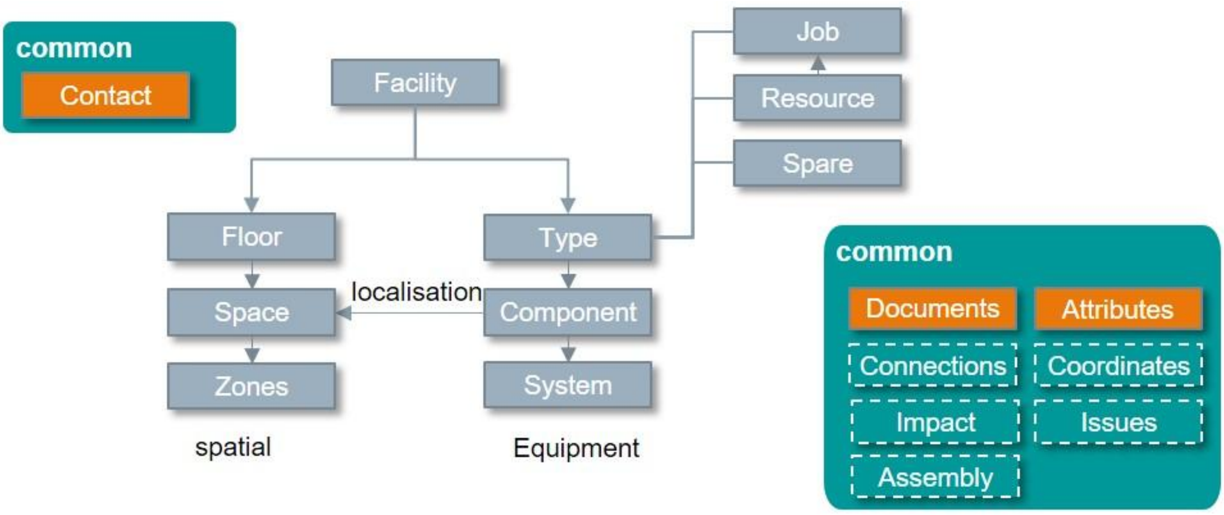
B.1.2 Requirements

B.1.2.1 Identification system

In addition to the structure of the 3D model itself, which contains the functional elements, the 3D model also incorporates a structural representation of its equipment and installations which reflects the overall functionality of all installations involved. The purpose of this structural representation is to interlink all technical assets, components and systems to provide insight into their interdependencies.

For the purposes of this document, a ‘technical asset’ is a combination of components feeding a specific system (e.g. ventilation system). A system transmits a medium in a single direction (e.g. air flow, low voltage current, etc.). In the BIM model, technical assets and systems are either represented by several constituent functional elements or assigned to a group of elements. Components are items with a specific function within a system (e.g., fire damper provides air ventilation). A component is modelled as a functional element in the 3D model. Signals are data points serving a measurement, control or regulation function within a component (e.g. close/open fire damper). In the virtual building model, signals are not represented by a functional element or assigned to a group of elements.

Links between technical assets (equipment) and their maintenance-relevant information are transferred and mapped to the operator platform via the 3D model, respectively, in the unique, functional element-based "Revit" GUID in the COBieLITE XML standard format. Please also refer to the chapters "BIM Data Management" and "Modelling standard".



B.1.2.2 Specifications

In addition to the information required by the COBie standard, certain project-specific technical asset specifications must be provided, as well. These must be recorded on the COBie Worksheet “Attributes”.

This serves the purpose of providing consistent, uniform descriptions of information on the minimum requirements for technical asset specifications. Specifications describe the information density of an object, comprising alphanumeric data or supplementary documentation (such as user instructions).

Based on the classification by Products (refer to the chapter "BIM Data Management"), the specifications are defined based on the LoI of the NBS Definition Library[1] as a minimum requirement. Level of Information (LoI) 5[2] shall be submitted with the manufacturer information as described.

The BIM Manager responsible for the deliverable shall agree the level of information on the required COBie worksheets with SRE Project Management. The level of information shall be documented in the relevant BIM Execution Plan.

B.1.3 Phase allocation

Figure B-2: Phase allocation of the Equipment Schedule use case

B.1.4 Data drops – Deliverables

In addition to the information required by the COBie standard, certain project-specific technical asset specifications may be required. These must be recorded on the COBie Worksheet “Attributes”. The minimum specification requirements must be met.

All elements relevant to operation and maintenance must be mapped to the Equipment Schedule, and the corresponding information handed over in the structured COBie XML format. The minimum requirements comprise the following elements:

- Furnishings and other accessories such as light fixtures etc.
- Windows, doors, gates, roof openings
- Facades
- Wastewater/water/gas installations
- Heating installations
- Air installations
- High voltage installations
- Telecommunications and information technology equipment
- Lifts and escalators
- User-specific equipment
- Building automation systems
- Other technical equipment

[1] https://toolkit.thenbs.com/definitions
[2] Example of boiler specifications: https://toolkit.thenbs.com/Definitions/Pr_60_60_08_33/

The Equipment Schedule elements to be included shall be agreed by the BIM Manager and SRE Project Management, and documented in the BIM Execution Plan.

Table B-3: Equipment Schedule Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
3	Development	One time	GD
4	Technical design and award of construction works	One time	GD
5	Construction	During FM/FS tendering process	GC
6	Construction	as needed	GC
7	Acceptance and Handover	One time	GC
9	Operation	as needed	FM
10	Sale	One time	FM

For Data Drops 3 and 4 at the end of the Development and Technical Design phases, respectively, the Equipment Schedule shall be compiled by General Design, including the corresponding classification and all information gathered during the planning stages.

For Data Drop 5 and, if necessary, Data Drop 6 the GC shall submit an updated Equipment Schedule reflecting the current planning status, including product-specific information, if applicable.

For Data Drop 7 the GC shall submit an updated Equipment Schedule reflecting the current "as built" status, including all product-specific information.

For Data Drop 9 and (if necessary) Data Drop 10 the FM provider shall submit an updated Equipment Schedule reflecting the current operational status.

B.1.5 Tasks and responsibilities

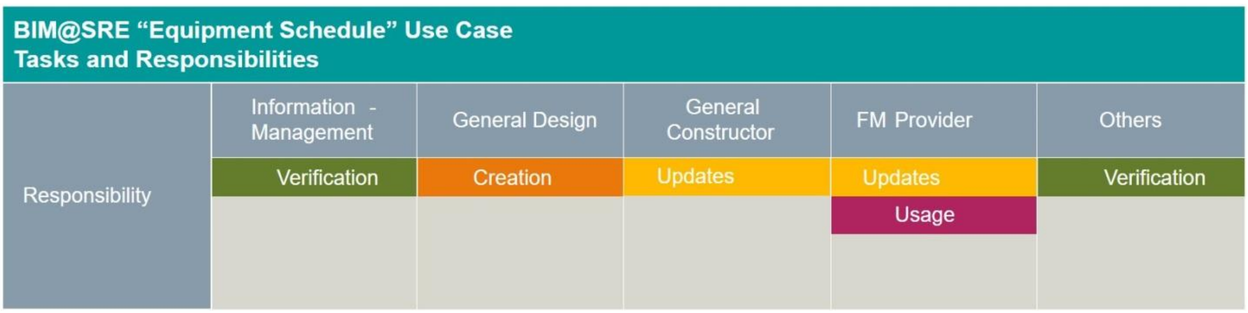


Figure B-3: Responsibilities in the Equipment Schedule use case

SRE Project Management: The responsibility for approving the deliverables rests with SRE Project Management, which may follow the approval recommendation issued by BIM Information Management. Project Management shall have unlimited access to the Equipment Schedule at any time.

Information Manager: The Information Manager is responsible for checking the handover documents for plausibility and adherence to specifications. If all requirements are met, the Information Manager shall issue an approval recommendation to Project Management.

General Design (GD): During the planning process the Equipment Schedule shall be created, updated and kept current by General Design in a continuous process making sure that all requirements regarding the levels of detail and information are being met.

General Constructor (GC): The Equipment Schedule shall be continuously updated and kept current by the General Constructor, making sure that all requirements regarding the levels of detail and information are being met.

FM Provider: The FM provider shall be responsible for updating and maintaining the Equipment Schedule during the operation phase. The FM provider may use this information for operational purposes.

Other parties: When required, the FM Consultant shall provide advisory support to the Information Manager in verification activities.

Depending on the contract, project-specific deviations are possible.

B.2 Equipment Information

B.2.1 Objectives and added value

The purpose of creating Equipment Information records is to link technical assets and systems with their digital representations and information. This enables direct viewing and editing access to relevant information using mobile devices. Equipment information may be accessed via QR, bar codes or RFID tags placed directly on technical assets and in detail drawings.

This approach makes the information content transparent, providing on-site answers about technical specifications, components subject to mandatory inspection, or equipment and system maintenance intervals. If a system problem occurs, up-to-date maintenance-relevant information is available on demand via Wi-Fi, UMTS, RFID, LoRA or LTE – instantly and reliably.

B.2.2 Requirements

The GC or the for the set up of installations commissioned contractor shall create a digital Equipment Information record containing product-/system data, functional explanations and information regarding the installation locations. An Equipment Information record comprises data and documents. It is identified using the functional element GUID issued by Revit. In addition, a QR code is generated in the form of a graphic and included in the Equipment Information record. Upon the Principal's request, a barcode, an ID for RFID marking or a combination of these means of identification may be used instead.

Equipment Information records are issued in particular for the following technical assets (functional elements/routes/elements):

- All equipment requiring approval or acceptance by an official inspector or appointed expert
- Shut-off devices
- Metering devices
- All other technical equipment requiring routine inspection/maintenance/checking
- All equipment relevant for compliant operation

Initially the data from the planning phase (including factory plans and product information) is entered into the Equipment Schedule centrally by the GC. The Equipment Information record is made accessible for the designated digital devices. The Auto ID Code (e.g. QR code) reflects the functional element GUID assigned by Revit.

In particular, the following items are to be included in the digital Equipment Information record (for each individual technical asset):

- Graphics: Barcode or QR code (GUID)
- Comprehensive manufacturer information regarding maintenance and inspection (data and documents)
- Acceptance reports
- Inspection reports for assets requiring inspection
- Proof of equipment operator training
- Next planned maintenance, inspection and review dates
- Information required for compliant equipment operation
- Other project-specific information

B.2.3 Phase allocation

BIM@SRE "Equipment Information" Use Case **Overall process allocation**								
Demand Clarification Preparation & Brief	Conceptual Design	Develop-ment	Technical Design & Award of construction works	Construction	Hand-over	Commis-sioning	Operation	Sale
					GC		FM	

Figure B-4: Phase allocation of the Equipment Information use case

B.2.4 Data Drops – Deliverables

Table B-4: Equipment Information Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
6	Construction	as needed	GC
7	Acceptance and Handover	One time	GC
9	Operation	In case of a remodelling or maintenance work	FM provider
10	Sale	In case of sale	FM provider

The GC deliverables for Data Drop 7 include two QR codes in a durable form placed at a suitable location on the respective technical asset plus two self-adhesive QR code labels to be handed over with the documentation. RFID tags, if used, shall be attached to the assets, checked and documented by properly trained personnel.

B.2.5 Tasks and responsibilities

BIM@SRE "Equipment Information" Use Case Tasks and Responsibilities					
	Information - Management	General Design	General Constructor	FM Provider	Others
Responsibility	Verification		Creation	Updates	Verification

Figure B-5: Responsibilities in the Equipment Information use case

SRE Project Management: The responsibility for approving the deliverables rests with SRE Project Management, which may follow the approval recommendations given by BIM Information Management. Equipment Information records may be used upon their approval.

Information Manager: The Information Manager is responsible for checking the technical implementation of the Equipment Information. The external project management service shall perform a content and completeness check of the Equipment Information records.

General Design (GD): No deliverables.

General Constructor (GC): The GC shall be responsible for creating the Auto ID Codes (QR, bar codes, RfID tags) as well as their proper installation.

FM Provider: The FM provider shall be responsible for the maintenance, updating and revision of all Equipment Information records and may use them during operation. New technical assets shall be incorporated and labelled properly.

Other parties: When required, the FM Consultant shall provide advisory support to the Information Manager in verification activities.

Depending on the contract, project-specific deviations are possible.

B.3 Building Permit

B.3.1 Objectives and added value

When the model for the building permit is created, all documents required for the permitting process must be generated from the model. Since decisions regarding user-specific interior works may be made at a relatively late time, the permitting documentation often requires modification and is therefore documented in a separate process by updating the model that is subject to permitting. At the same time, by reflecting every editing step made by a project member (versioning), this approach ensures a high degree of transparency.

Where supported by regional regulations, a model-based building permit allows digitally-transmitted construction documentation to be forwarded and further edited through to final permitting without having to make use of paper printouts (no media discontinuity). Any construction documentation submitted in paper form will be scanned and further processed in digital form, as well. All parties involved in the permitting process, including authorities, designers, authorised inspectors and testing engineers, shall be included in the digital revision process.

B.3.2 Requirements

For the building permit application, the following minimum requirements must be met using the model:

- Successful model-based checks for compliance with applicable rules
  - Compliance with specifications according to regional planning law
  - Compliance with property line setback rules according to regional planning law
- Visualisation of the prospective building in the context of adjacent structures and restrictions according to planning law
- Visualisation of potential infringements of neighbour rights
- Creation of permit-related documents from the 3D model
- Integration of surveying and cadastral data, plans and documents (e.g. property and siting plans etc.)
- If applicable, handover and coordination of the supporting structure model to the structural safety officer

Any modifications made during the permitting process must be documented in the 3D model in a traceable manner (via phases and filters in Autodesk Revit).
The requirements of regional regulatory reviews and any required visualisations must be discussed and agreed with SRE Project Management for the given project, and documented by General Design in the project execution plan.

B.3.3 Overall process allocation

BIM@SRE "Building Permit" Use Case
Overall process allocation

Demand Clarification Preparation & Brief	Conceptual Design	Develop-ment	Technical Design & Award of construction works	Construction	Hand-over	Commis-sioning	Operation	Sale
	GD							

Figure B-6: Phase allocation of the Building Permit use case

B.3.4 Data Drops – Deliverables

General Design shall submit to SRE a 3D permitting model in .rvt format including all connected plans and documents as well as the building permit issued by the authorities, and provide an update of the project duration, if applicable.

A building permit is usually associated with certain restrictions; furthermore, it may be necessary to submit corrected or amended documentation for permitting. In such an event it is essential for General Design to rely on the permitting model and update it as required. All annotations made by the permitting authority must be incorporated into both, the ongoing project work and the archived permitting model which must be updated accordingly.

All permitting documentation, including all modifications and annotations from the permitting process, must be handed over.

Table B-5: Building Permit Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
3	Conceptual Design	At the time the building permits is submitted/updated	GD

B.3.5 Tasks and responsibilities

BIM@SRE “Building Permit” Use Case Tasks and Responsibilities					
	Information - Management	General Design	General Constructor	FM Provider	Others
Responsibility	Verification	Creation			

Figure B-7: Responsibilities in the Building Permit use case

SRE Project Management: SRE Project Management shall be responsible for the approval and archiving of the 3D permitting documentation following handover by General Design.

Information Manager: The Information Manager shall review the technical granularity of the 3D permitting documentation, liaise with General Design regarding any new annotations, and submit an approval recommendation to SRE Project Management.

General Design (GD): General Design is in charge of defining and implementing the requirements detailed above. General Design shall submit the fully updated permitting documentation to SRE project management.

General Constructor (GC): No deliverables.

FM Provider: No deliverables.

Other parties: No deliverables.

Depending on the contract, project-specific deviations are possible.

B.4 Documentation

B.4.1 Objectives and added value

The 3D documentation plays a key role in the commissioning process and the use of the BIM method during operation. The structured handover of all information relevant for operations ensures a verifiable, more rapid building commissioning process. The 3D documentation thus enables digital transfer into the operator platform, minimising duplicated and manual information input.

Optimising/creating the 3D documentation within an operator model provides digital access to required information (such as guarantee information, the Equipment and Room Schedules, etc.) at any time during operations. What is more, it makes the building documentation available in a structured form for condition assessments at a later time.

B.4.2 Requirements

The 3D handover documentation comprises the discipline-specific 3D "as built" models including all relevant data collected during construction (e.g. acceptance records, commissioning information, maintenance instructions). Product-related data is either compiled by the GC in digital form or provided centrally in a digitalised format. The following model-based, updated deliverables shall be provided by the GC, as specified by the Must-have BIM Use Cases and other documentation:

- 3D "as built" discipline-specific models
- Soft clashes / Clearances
- Clash Detection
- Siemens Office Furnishing
- Room Schedule
- Room Categories
- Interface to Facility Services
- Equipment Schedule
- Equipment Information
- Acceptance records
- Punch lists
- Additional documents linked to the model

Note: The 3D handover documentation does not replace the contractually agreed deliverables for handover.

B.4.3 Overall process allocation

BIM@SRE "Documentation" Use Case Overall process allocation								
Demand Clarification Preparation & Brief	Conceptual Design	Develop-ment	Technical Design & Award of construction works	Construction	Hand-over	Commis-sioning	Operation	Sale
					GC			
							FM	FM

Figure B-8: Phase allocation of the Documentation use case

B.4.4 Data Drops – Data Deliverables

Table B-6: Documentation Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
7	Acceptance and Handover	One time	GC

For Data Drop 7 the 3D "as built" models shall be submitted according to the modelling standard.

- On the basis of the 3D model the 3D handover documentation deliverables shall be transferred to the operator system in COBieLITE XML format.

B.4.5 Tasks and responsibilities

BIM@SRE "Documentation" Use Case Tasks and Responsibilities					
Responsibility	Information - Management	General Design	General Constructor	FM Provider	Others
	Verification		Creation	Updates	Verification

Figure B-9: Responsibilities in the Documentation use case

SRE Project Management: The responsibility for approving the deliverables rests with SRE Project Management, which may follow the approval recommendations given by BIM Information Management. In addition, the relevant data shall be made available to users upon approval.

Information Manager: The Information Manager shall check the plausibility of the 3D handover documentation as well as proper compliance with its specifications and requirements. If all requirements of the 3D handover documentation are met, the Information Manager shall give an approval recommendation.

General Design (GD): No deliverables.

General Constructor (GC): The General Constructor shall be responsible for creating the 3D handover documentation, making sure that all requirements of the BIM@SRE standard are being met.

FM Provider: Generate the operator model. Maintain the "as built" models.

Other parties: When required, the FM Consultant shall provide advisory support to the Information Manager in verification activities.

Depending on the contract, project-specific deviations are possible.

B.5 Updating

B.5.1 Objectives and added value

Following Acceptance and Handover by the GC, the FM provider shall keep the building status documentation up to date for operation, rental and a possible sale of the building. This includes updating the 3D model (e.g., architecture, supporting structure, HVAC, plumbing, electrical installations) and all related attributes.

B.5.2 Requirements

Following Acceptance and Handover to operation, the FM provider shall maintain the as-built documentation current at all times. The FM provider shall incorporate minor remodelling measures into the "as built" model and the bidirectionally linked operator system. This will ensure that the data basis used for operating, letting and any possible future sale is always current and fit for purpose.

B.5.3 Phase allocation

BIM@SRE “Updates” Use Case Overall process allocation								
Demand Clarification Preparation & Brief	Conceptual Design	Develop-ment	Technical Design & Award of construction works	Construction	Hand-over	Commis-sioning	Operation	Sale
							FM	

Figure B-10: Phase allocation of the Updates use case

B.5.4 Data Drops – Deliverables

Table B-7: Updates Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
9	Remodelling	In the event of remodelling measures	FM

For Data Drop 9 the FM provider shall submit updated remodelling documentation, ensuring proper adherence to the requirements of the modelling standard. The remodelling documentation comprises the following items:

- Updated 3D model including documents linked to it
- Updated Equipment Schedule
- Updated Equipment Information records
- Updated 3D Room Schedule including room categories and facility services
- Updated Soft clashes / Clearances

B.5.5 Tasks and responsibilities

BIM@SRE “Updates” Use Case Tasks and Responsibilities					
	Information - Management	General Design	General Constructor	FM Provider	Others
Responsibility	Verification			Creation	Verification
				Updates	
				Usage	

Figure B-11: Responsibilities in the Updates use case

SRE Project Management: The responsibility for approving the deliverables rests with SRE Project Management, which may follow the approval recommendations provided by Information Management. In addition, the relevant data shall be made available to users upon approval.

Information Manager: The Information Manager shall check the 3D remodelling documentation for plausibility as well as proper implementation of its specifications by the FM provider. If all requirements of the 3D handover documentation are met, the Information Manager shall give an approval recommendation.

General Design (GD): No deliverables.

General Constructor (GC): No deliverables.

FM Provider: The main responsibility of the FM provider is to transfer the remodelling data into the 3D as-built model and keep it up to date. Apart from creating and updating the 3D model, the FM provider is expected to use the data.

Other parties: When required, the FM Consultant shall provide advisory support to the Information Manager in verification activities.

Depending on the contract, project-specific deviations are possible.

B.6 Hard and Soft clashes / Clearances

B.6.1 Objectives and added value

3D clash detection checks are performed primarily to improve design quality. Checking the model elements for potential clashes at an early time improves planning reliability. It allows conflicts between two or more structural and/or technical elements to be detected and eliminated at the planning stage, thereby minimising the risk of clashes at the construction site.

For the purposes of building operation, key clearances, restricted areas, access openings and ramps (e.g. for initial installation, replacement) and exclusion zones (e.g. for future tenant's installations) must be defined. The resulting information should be covered by Quality Assurance according to the "Clash Detection" use case (also refer to “Modelling Standard”).

The objective is to improve the technical coordination between all project members. Furthermore, enhancing planning quality and taking appropriate measures to ensure the accessibility of technical assets and functional elements.

B.6.2 Requirements

The service providers must merge all partial, discipline-specific models to form a multi-disciplinary, consolidated comprehensive model for clash detection. Clash checks must detect the following types of clashes:

- Hard clashes: Two or more model elements (e.g. a joist and a ventilation duct) intersect or occupy identical locations.
- Soft clashes: A soft clash indicates that a model element requires additional spatial geometric tolerances and clearances for insulation material as well as installation, insulation and maintenance activities.
- Functional checks: Functional checks ensure that the functional requirements of functional elements are not compromised by adjacent functional elements (e.g. preventing a door from opening 90 degrees).

For clashes of either type it is advisable to model auxiliary bodies or placeholders, respectively, defined geometric tolerances which will be included into the geometry checks.

In particular, the following partial models of the project should be checked against each other for 3D clashes:

- Supporting structure and architecture
- Heating installations
- Refrigeration and cooling
- Air ventilation installations
- Sanitary installations
- Electric installations

installations
- Sprinkler system
- Other items depending on project requirements

The above-listed partial, trade-specific models also include clearances All clearances must be included in the clash detection checks. If a single partial model is being created by designers representing several different disciplines (e.g. Electric Installation partial model including the High-Voltage, Low-Voltage etc. sub-models), the sub-models must be clash-checked against each other as well as against the other partial models.

3D models used for clash detection must meet the requirements for the 3D model. This is contingent upon the establishment of a suitable quality assurance procedure applied by all disciplines to ensure adherence to the modelling standard as well as achievement of the desired model quality.

The space needed to ensure accessibility of technical assets and functional elements shall be represented in the 3D model. The service providers shall ensure accessibility as follows:

- For initial installation of equipment/functional elements
- For maintenance work
- To ensure compliance with legal and Siemens safety requirements
- For exchanging equipment in case of unscheduled outage or total failure

Accessibility means on the one hand providing sufficient space for common, regular intervention/work on the equipment/functional element. On the other hand, there must be enough room in case of intervention measures/work to place ladders or simple, movable scaffolds. The 3D Clearances must be dimensioned to ensure compliance with applicable safety regulations (e.g. UVV, EVU, etc.). Furthermore, any space requirements specified in maintenance and operating manuals must be met, as well, for example, sufficient space for one or two individuals.

In particular, 3D Clearances must be provided in all technical rooms, lift wells, above suspended ceilings, below elevated floors (except raised flooring), and inside accessible shafts for building services (MEP). Outside these areas, 3D Clearances should generally be modelled only where tenant-specific installations may be required or a higher installation density is required locally, such as in utility line branching areas in underground car parks.

In particular, 3D Clearances must always be modelled around the following types of equipment and functional elements:

- Fire dampers
- Volume flow controllers (VFC)
- Clearance areas e.g. around central ventilation equipment
- Heat exchanger for indoor ventilation
- Control cabinets
- Electric consumer units
- Shafts and shaft manholes

The following attributes shall be generated for relevant equipment and components of building services trades represented in the 3D model:

- Name of clearance space (acronym and brief description)
- Associated system/equipment/trade
- Room number (of room providing the 3D clearance)
- Floor area of the clearance space
- Means of access (where required: Ladder, scaffold, work platform, etc.)

The proper ways of representing 3D Clearances are explained in the description of the placeholder elements found in the modelling standard.

B.6.3 Phase allocation

Figure B-12: Phase allocation of the Soft Clashes / Clearances use case

B.6.4 Data Drops – Deliverables

The GD and GC must submit review reports to demonstrate successful coordinated planning and clash elimination. All review reports (pdf format) and consolidated, checked models must be submitted at the following Data Drops:

Table B-8: Soft Clashes / Clearances Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
3	Development	One time, at the time of Development approval	GD
4	Technical design and award of construction works	One time, at the time of Technical Design approval	GD
6	Construction	In case of changes	GC
7	Handover and documentation	At time of handover and documentation	GC
9	Operation	During or after structural or spatial modifications (e.g. remodelling)	FM Provider

Data Drop 3: GD to model the 3D Clearances according to the modelling standard and planning progress. Absence of clashes must be demonstrated based on the "Clash Detection" use case.

Data Drop 4: GC to adapt the 3D Clearances and associated attributes to the planning status.

Data Drop 6: GC to make any modifications required to the 3D Clearances and associated attributes to reflect the current planning status.

The review reports must cover at least the following review parameters:

- Which trades where checked against each other?
- Which model objects where checked?
- What data status was used for verification?
- Which section was checked?
- Limitations/tolerances
- What software was used?
- What data formats where checked? (Export formats or native formats)
- Verification method/rules applied
- Precise descriptions of the definitions of "clashes" that were used. What has been tolerated (as agreed with the principal, if applicable)?

In addition, clash detection checks should be performed throughout all planning processes, especially in preparation of regular planning meetings. An appropriate procedure and the related clashing matrix must be documented in the corresponding BIM Execution Plan.

B.6.5 Tasks and responsibilities

BIM@SRE Use-Case „Hard and Soft Clashes / Clearances Responsibilitys					
Responsibilitys	Information - management	General Design	General Constructor	FM-Provider	Others
	Prüfung	Erstellung	Erstellung	Fortschreibung	

Figure B-13: Responsibilities in the Soft Clashes / Clearances use case:

SRE Project Management: Based on the Information Manager's approval recommendation, Project Management is responsible for approving the deliverables on the SRE side.

Information Manager: The Information Manager shall check whether the use case was applied as required and the objectives achieved. If so, the Information Manager shall recommend approval.

General Design (GD): Create a clashing matrix as part of the BIM Execution Plan. General Design shall check at the beginning of the project whether the file formats used for modelling can be consolidated in the verification software. If the native file formats cannot be used in conjunction with the verification software, General Design must ensure that using alternative export formats allows all relevant model elements and required information to be represented within the verification software. General Design shall perform clash detection checks across the entire consolidated model pursuant to the defined scope and the requirements of the modelling standard. Following the clash detection checks, General Design shall submit a review report reflecting the results. Based on the clash detection results, General Design shall eliminate whatever clashes have been detected.

General Constructor (GC): Create a clashing matrix as part of the BIM Execution Plan. The General Constructor shall check at the beginning of the Technical Design phase whether the file formats used for modelling can be consolidated in the verification software. If the native file formats cannot be used in conjunction with the verification software, the General Constructor must ensure that using alternative export formats allows all relevant model elements and required information to be represented within the verification software. The General Constructor shall perform clash detection checks across the entire consolidated model pursuant to the defined scope and the requirements of the modelling standard. Following the clash detection checks, the General Constructor shall submit a review report reflecting the results. Based on the clash detection results, General Design shall eliminate whatever clashes have been detected.

FM Provider: The FM provider shall be responsible for proper application of the use case in the event of remodelling and/or room-forming measures.

Other parties: Where required, the FM Consultant shall support the Information Manager's verification activities.

Depending on the contract, project-specific deviations are possible.

B.7 Collaboration, Co-ordination and Communication

B.7.1 Objectives and added value

3D models and visualisations support the planning process as well as Project Management by supporting communication among all project members and enhancing transparency. Key benefits of model-based communication include optimised quality, enablement of rapid visual comparison of variants, increased interaction between the parties involved in the planning process, and transparent, fast decision-making based on the comparison of variants. Visualisations also cater to the needs of external stakeholders, such as authorities or publicity work, as well as marketing processes.

Close examination of variants enables quantitative and qualitative assessments of solution proposals. Visualisation thus not only supports the planning activities themselves but also the management and monitoring of the planning process (within the scope of Project Management responsibilities).

B.7.2 Requirements

The deliverable visualisations are subdivided into three categories:

- Photorealistic visualisations
- Technical representations of design solutions
- 3D models (walk-through models)

The required informational content of the visualisations of design solutions is defined in the project-specific BEP.

The implementations listed here are minimum requirements which may vary from project to project and can be expanded:

- 3D studies on arrangements for the space allocation programme
- Investment and lifecycle cost comparisons among variants
- Virtuel Mock-Ups

The 3D model serves as a basis for all deliverable visualisations.

B.7.3 Phase allocation

Figure B-14: Phase allocation of the Collaboration and Communication use case

B.7.4 Data Drops – Deliverables

The formats, quantities and quality of visualisations required for each project phase are determined prior to contract award and shall be documented by the BIM Manager in the project-specific BIM Execution Plan.

The deliverables shall be submitted at least in the following formats:

- Photorealistic visualisations in .pdf and .jpg format
- Technical representations of design solutions in 3D PDF, .pdf and .jpg format
- 3D models (walk-through models) 3D model visualisations are deployed using a viewer programme provided to the contractor free of charge.

Table B-9: Collaboration and Communication Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
2	Conceptual Design	During Conceptual Design phase: multiple times, as required	GD
3	Development	During Development phase: multiple times, as required	GD
4	Technical design and award of construction works	During Technical Design phase: multiple times as required	GD
6	Construction	During interior design/user-specific design phase: multiple times as required	GC

B.7.5 Tasks and responsibilities

BIM@SRE "Collaboration & Communication" Use Case Tasks and Responsibilities					
	Information Management	General Design	General Constructor	FM Provider	Others
Responsibility		Creation	Creation		

Figure B-15: Collaboration and Communication responsibilities

SRE Project Management SRE Project Management is responsible for defining the visualisations which are to be created, in particular their informational content, the visualisation category and the number of submissions.

Information Manager: No deliverable.

General Design (GD): General Design is responsible for the delivery of visualisations, their documentation and tracking, as well as their description in the BIM Execution Plan.

General Constructor (GC): The General Constructor is responsible for the delivery of visualisations, their documentation and tracking, as well as their description in the BIM Execution Plan.

FM Provider: No deliverable.

Other parties: No deliverable.

Depending on the contract, project-specific deviations are possible.

B.8 KPIs

B.8.1 Objectives and added value

By allowing key values to be determined very accurately, building models are a reliable data source for calculating investment costs and establishing benchmarks. What is more, cost changes caused by modifications can be computed more quickly as a basis for decision-making. This is of decisive importance especially during the early phases where it is easiest to influence the expected costs.

The objective of determining model-based key input values for investment costs and establishing benchmarks is to increase the dependability of overall costing data and improve the comparability of projects.

B.8.2 Requirements

To establish Benchmarks, KPIs must be tracked along the entire project execution process. The KPIs are determined and compared at various project stages based on planning depth. As regards the "Bill-of-quantities and specification" use case, the information required for determining costs is collected in a model-based approach as comprehensively as possible.

The cost benchmarks are requested by the service provider at four cost benchmark levels (CBL). CBL 1 and CBL 2 refer to the gross floor area (GFA). CBL 3 & 4 should be determined in a component-based approach as far as possible and derived from the 3D model.

Building KPIs

Tabelle 10: Modellbasierte Flächenkennzahlen

Area KPIs	
Fläche	**Einheit**
Plot area	m²
Building footprint - all buildings on the plot	m²
Gross Floor Area (GFA) - all buildings	m²
Energy Reference Area (ERA=heated or cooled)	m²
Net Building Area (NBA) - all buildings	m²
Facade area	m²
…thereof: area of glass facade	m²
Maximum possible build-up area according to building law on plot	m²

Tabelle 11: Modellbasierte Kennzahlen Fabrikgebäude

Fabric KPIs	
Kennzahl	**Einheit**
Gross Floor Area (GFA) - factory only	m²
Number of floors (above and under ground)	n
Floor loads maximum	t/m²
Crane loads maximum	t
Power demand for production equipment	MVA
Number of gates	n
Gate height maximum	m
Length	m
Width	m
Height (building height)	m
Grid - x	m
Grid - y	m

Facade element grid - x	m
Facade element grid - y	m

Tabelle 12:Modellbasierte Kennzahlen Bürogebäude

Office KPIs	
Kennzahl	**Einheit**
Gross Floor Area (GFA) above ground	m²
Gross Floor Area (GFA) underground (e.g. parking, technical ….)	m²
Number of floors (above and under ground)	n
…therein: Number of entire underground floors (e.g. underground parking, technical areas)	n
Rentable space (without special purpose areas)	m²
Area for special purpose: central conferencing area, locker room, …	m²
Workplaces	n
Area for server rooms / data center	m²
Grid - x	m
Grid - y	m
Facade grid - x	m
Facade grid - y	m

Tabelle 13:Modellbasierte Kennzahlen Kantine

Gebäudekennzahlen Kantine	
Kennzahl	**Einheit**
Name of canteen building (e.g. "Forum 2")	
Gross Floor Area (GFA) - canteen only	m²
Number of floors (above and under ground)	n
Number of seats	n

Tabelle 14:Modellbasierte Kennzahlen Parkhaus

Gebäudekennzahlen Parkhaus	
Kennzahl	**Einheit**
Name of parking building (e.g. "Parkdeck North")	
Gross Floor Area (GFA) - parking only	m²
Number of Floors (above and underground)	n
Number of parking lots	n

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Cost KPIs

Cost Benchmark Level (CBL) 1: Floor area-based benchmarks based on WBS 300 & 400

The deliverable for CBL 1 comprises the following requirements:

- Benchmark value 1: Total cost for the cost type (e.g.: WBS 400) based on the GFA in m²

Table B-15: Evaluation for CBL 1

Evaluation for CBL 1		
WBS	**Description**	**Benchmark**
300	Building – Structure	€/m² GFA
400	Building – Technical equipment	€/m² GFA

Cost Benchmark Level (CBL) 2: Floor area-based benchmarks based on WBS 310-370 & 410-490

- Benchmark value 1: Total cost for the cost type (e.g.: WBS 400) at the first level based on the GFA in m²
- Benchmark value 2: Total cost for the cost type (e.g.: WBS 410) at the second level based on the GFA in m². (e.g.: The overall costs of WBS 400 equal the sum of cost items 410 to 490).

Table B-16: Evaluation for CBL 2

Evaluation for CBL 2		
WBS	**Description**	**Benchmark**
310	Construction pit	€/m² GFA
320	Foundation	€/m² GFA
330	Supporting structure	€/m² GFA
335	Façade	€/m² GFA
340	Equipment	€/m² GFA
360	Roof	€/m² GFA
390	Other structures	€/m² GFA
410	Wastewater/water/gas installations	€/m² GFA
420	Heating installations	€/m² GFA
430	Air installations	€/m² GFA
440	High voltage installations	€/m² GFA
450	Telecommunications and information technology equipment	€/m² GFA
460	Lifts and escalators	€/m² GFA
470	User-specific equipment	€/m² GFA
480	Building automation systems	€/m² GFA
490	Other technical equipment	€/m² GFA

Cost Benchmark Level (CBL) 3: Functional element-level floor area-based benchmarks

All deliverables are computed in a model-based approach. For CBL 3 the level of detail of the 3D models under evaluation must be equivalent at least to LOD 200. Any exceptions from the prescribed level of detail must be agreed with the Information Manager and approved by the clients project head for the given project.

The deliverable for CBL 3 comprises the following requirements:

- Benchmark value 1: Total cost for the cost type (e.g.: WBS 410)
- Benchmark value 2: Overall costs for the cost type by cost drivers (e.g.: The overall costs of WBS 410 equal the sum of the wastewater, water, gas and fire extinguishing installations.).
- Benchmark value for the cost drivers (e.g.: WS 410 - water installations, mains line)

Table B-17: Evaluation for CBL 3

Evaluation for CBL 3		
WBS	**Description**	**Benchmark**
310	Excavation	€/m^3 excavation
320	Shallow and slab foundations	€/m^3 concrete €/to steel €/m^3 foundation slab
	Deep foundations	€/m of pile length
	Construction waterproofing	€/m^2 waterproofing
330	Pillars, trusses (factories only), walls	€/m^3 concrete €/m^3 steel
	Breasts (offices only), bare floors	€/m^2 bare floor
335	Façade (transparent, opaque)	€/m^2 external surface
	External sunshades	€/m^2 sunshade external surface
340	Dividing walls	€/m^2 wall
	Flooring/floor coating	€/m^2 flooring €/m^2 cover
	Ceiling lining	€/m^2 ceiling
360	Roof covering	€/m^2 of roof
410	Waste water systems	€/m underground line/riser €/sanitation items
	Water installations	€/m main supply line
	Gas installations	€/kW heat output
	Fire extinguishing installations	€/sprinkler head €/m^3 displacement volume
420	Heating	€/W/m^2 specific thermal capacity €/kW heat exchanger power
430	Ventilation system	€/m^3/h supply air €/m^3/h process exhaust air
	Refrigeration system	€/kW refrigerating capacity €/W/m^2 specific refrigerating capacity €/m^2 chilled ceiling
440	Electric installations	€/control cabinet modules €/circuit €/KVA transformer output €/lux x m^2 lighting
450	Telecommunications & IT	€/RJxx port
460	Lifts	€/stop
470	User specific	€/Nm^3/h^3 compressed air
480	Building automation	€/data point €/field unit

Cost Benchmark Level (CBL) 4: Functional element-based benchmarks

All deliverables are computed in a model-based approach. The level of detail of the “as built” 3D models evaluated must be equivalent to at least LOD 300 for CBL 4. Any exceptions from the prescribed level of detail must be agreed with the Information Manager and approved by the clients project head for the given project.

The deliverable for CBL 4 comprises the following requirements:

- WBS 300 benchmark: €/Type (classification e.g. to Uniclass 2015 Product, as well as number, dimensions and material)
- WBS 400 benchmark: €/Type (classification e.g. to Uniclass 2015 Product, as well as output and quantity)

Table B-18: Evaluation for CBL 4

Evaluation for CBL 4		
WBS	**Description**	**Benchmark**
330	pillars (production buildings only)	€/type
	trusses (production buildings only)	€/type
335	windows	€/type
	metal panels for opaque facade	€/type
	gates	€/type
340	doors	€/type
	ceiling panels	€/type
	office modules, fitted	€/type
	factory modules, fitted	€/type
360	roof openings (domes, smoke & heat extraction [SHE])	€/type
410	sewage lifting units	€/type
	water treatment plant	€/type
	gas extinguishing system	€/type
	sprinkler pump	€/type
420	heating furnace	€/type
	water chiller	€/type
440	transformer	€/type
	diesel emergency power generator	€/type
	low-voltage main distribution (LVMD)	€/type
	medium-voltage main distribution	€/type
470	air compressor	€/type

B.8.3 Phase allocation

Figure B-16: Phase allocation of the 5D Cost Benchmarks use case

B.8.4 Data drops / deliverables

The cost benchmark deliverable is submitted using a template file provided by the Principal. This parameter list must be entered into an .xls file. The Excel file serves as a globally valid basis for determining cost benchmarks and lifecycle costs (refer to "Lifecycle Cost" use case).

The template file describes unified parameters using predefined parameter names, types and required attributes. The cost benchmark levels are reflected using several tabs and are colour-coded in the file.

The currency unit (€) referenced here should be replaced by the local currency used in the given project. The currency exchange rate for the local currency shall be entered into the template file and should reflect the exchange rate valid at the time of entry.

Table B-19: 5D Cost Benchmark Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
1	Demand Clarification; Preparation & Brief	multiple times, as required	SRE/Service provider
2	Conceptual Design	During Conceptual Design handover	GD

3	Development	During Development handover	GD
4	Technical design and award of construction works	During Technical Design handover	GD
6	Construction	During Construction plan handover In case of changes During Acceptance and Handover	GC
9	Operation	In case of changes	SRE/Service provider

Note: The deliverables described above do not supersede the contractual obligation to submit a cost estimation.

Table B-20: CBL-specific Data Drops

Submission of benchmark values per each data drop						
	Data Drop 1	Data Drop 2	Data Drop 3	Data Drop 4	Data Drop 6	Data Drop 9
CBL1						
CBL2						
CBL3						
CBL4						

B.8.5 Tasks and responsibilities

Table B-21: Responsibilities in the 5D cost benchmark use case

BIM@SRE "5D Cost Benchmarks" Use Case Tasks and Responsibilities					
Responsibility	Information - Management	General Design	General Constructor	FM Provider	Others
	Verification	Creation	Creation		

SRE Project Management: SRE shall be responsible for approving the evaluations and will use them for internal benchmarking purposes.

Information Manager: The Information Manager shall review the model-based bill of quantities and will issue an approval recommendation.

General Design (GD): General Design will provide the deliverables at the time of each Data Drop, including the relevant evaluations based on the requirements detailed above.

General Constructor (GC): The General Constructor will provide the deliverable evaluations at the time of each Data Drop based on the requirements detailed above.

FM Provider: No deliverables.

Other parties: No deliverables.

Depending on the contract, project-specific deviations are possible.

B.9 Bill-of-quantities and Specification

The 3D model prepared by General Design shall used for the functional call for tenders. Consequently the BIM model should be provided to the General Constructor as a calculation basis for submitting a more detailed proposal.

Furthermore, the bill of quantities serves as a basis for the "5D Cost Benchmark" and "Lifecycle Costs" use cases. Preparation of the bill of quantities should rely on the model as much as possible.

Depending on the contract, project-specific deviations are possible.

B.9.1 Requirements

The 3D model must be consistent with the requirements of the modelling standard.

B.9.2 Phase allocation

Table B-22: Phase allocation of the Bill-of-quantities and Specification use cases

BIM@SRE "Bill-of-quantities and Specification" Use Case Overall process allocation								
Demand Clarification Preparation & Brief	Conceptual Design	Develop-ment	Technical Design & Award of construction works	Construction	Hand-over	Commis-sioning	Operation	Sale
			GD					

B.9.3 Data Drops – Deliverables

Table B-23: Bill-of-quantities and Specification Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
4	Technical design and award of construction works	One time, at time of call for tenders	GD

At the time of Data Drop 4, General Design shall submit the 3D model and grant permission to publish it as part of the call for General Constructor tenders.

The model-based bill of quantities continues to be part of the deliverables for the "5D Cost Benchmark" and "Lifecycle Costs" use cases.

B.9.4 Tasks and responsibilities

BIM@SRE "Bill-of-quantities and Specification" Use Case Tasks and Responsibilities					
	Information - Management	General Design	General Constructor	FM Provider	Others
Responsibility	Verification	Creation	Usage		
		Usage			

Figure B-17: Responsibilities in the Bill-of-quantities and Specification use case

SRE Project Management: SRE Project Management shall use the model-based bill of quantities for the "5D Cost Benchmark" and "Lifecycle Costs" use cases. The associated 3D draft model is used as part of the Specification documents for the call for General Constructor tenders.

Information Manager: The Information Manager shall check the plausibility of the model-based bill of quantities, and ensure that the 3D draft model complies with the modelling standard.

General Design (GD): General Design shall provide the 3D model as part of the specifications for the construction works. General Design shall compile the model-based bill of quantities and uses the results for evaluating the "5D Cost Benchmark" and "Lifecycle Costs” use cases.

General Constructor (GC): The General Constructor receives the 3D model as part of the specification of the construction works and may use the 3D model for its calculations. The General Constructor continues to bear the risk of quantities. The General Constructor shall compile the model-based bill of quantities and use the results for evaluating the "5D Cost Benchmark" and "Lifecycle Costs” use cases.

FM Provider: No deliverables.

Other parties: No deliverables.

Depending on the contract, project-specific deviations are possible.

B.10 User Fit-Out

B.10.1 Objectives and added value

The geometric data of the 3D model will be provided to the specialist designer for Siemens Office. This will ensure a consistent data basis while reducing the time and effort of the specialist designers working for Siemens Office.

B.10.2 Requirements

The most recent status of the 3D model shall be handed over to the furnishing planner in the native format of the modelling software (.rvt) as well as in .ifc format. Furnishings are planned in 3D using a format compatible with that of the modelling software. The service provider shall make sure that the result of the 3D furnishing plan is integrated into the general plan based on the modelling standard. This will allow SRE to make use of the furnishing plan (visualisations, user coordination, etc.).

The relevant BIM Execution Plan shall document how the 3D models and interfaces are to be used, when and how they are to be handed over, and who is responsible.

B.10.3 Phase allocation

BIM@SRE "Siemens Office Furnishing" Use Case Overall process allocation								
Demand Clarification Preparation & Brief	Conceptual Design	Develop-ment	Technical Design & Award of construction works	Construction	Hand-over	Commis-sioning	Operation	Sale
			GD					
				GC				

Figure B-18: Phase allocation of the Siemens Office Furnishing use case

B.10.4 Data Drops – Deliverables

GD/GC shall hand over the 3D model to the interior designer. The interior designer shall create the "Furnishings" partial model using 3D objects from the Siemens Office concept, such as desks, chairs, floor lamps, lounges, lockers and movable shelving units.

All planning of a constructive and room-forming nature, such as ThinkTanks, PhoneBoxes, or individual offices, remains the responsibility of GD/GC. The same applies to stationary furnishings such as tea kitchens.

The 3D models of furnishings support visualisation. The result of the utilisation planning process, the 3D "Furnishings" model created by the interior designer, shall be submitted to GD. GD/GC shall integrate this 3D model into the architectural plans. GD/GC shall then perform a compatibility check of the furnishings and the architectural plan.

Table B-24: Siemens Office Furnishing Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
4	Technical design and award of construction works	As needed	GD
6	Construction	As needed	GC

No deliverables are due to SRE. GD/GC shall provide the 3D model to the specialist planner as required. This shall be determined specifically for the given project.

B.10.5 Tasks and responsibilities

BIM@SRE "Siemens Office Furnishing" Use Case Tasks and Responsibilities					
	Information - Management	General Design	General Constructor	FM Provider	Others
Responsibility		Creation	Creation		Usage

Figure B-19: Responsibilities in the Siemens Office Furnishing use case

SRE Project Management: No deliverables.

Information Manager: No deliverables.

General Design (GD): General Design shall handle coordination with the furnishing planner. General Design shall provide the 3D model to the furnishing planner when needed and integrate the completed 3D furnishing plan into the 3D draft model. In the event of any clashes between these two discipline models, GD shall make arrangements for their elimination.

General Constructor (GC): The GC shall handle coordination with the furnishing planner. The GC shall provide the 3D model to the specialist planner when needed and integrate the completed 3D furnishing plan into the 3D draft model. In the event of any clashes between these two discipline models, GC shall make arrangements for their elimination.

FM Provider: No deliverables.

Other parties: The specialist planner for Siemens Office shall use the 3D model for 3D interior design according to the Siemens Office concept and hand over the resulting "Furnishing Model" to GD, respectively, the GC.

Depending on the contract, project-specific deviations are possible.

B.11 Interface to Process Equipment

B.11.1 Objectives and added value

The purpose of the Interface to Process Equipment is to support the customers' factory layout designers by providing the building geometry at an early time, thereby improving coordination between building design and equipment design.

B.11.2 Requirements

The most current version of the 3D model shall be handed over to the process equipment designer (in its native .rvt or .ifc format and .jt format if required) for coordination and reconciliation. The process equipment designer shall use the provisional model to design the factory equipment. Since this may involve sensitive information, the process equipment designer is not obligated to hand over the results of its work. Based on the SRE Interface List, the parties may agree specific elements subject to mandatory disclosure by General Design/the General Constructor for the given project (e.g. machine foundations, compressed air, etc.).

B.11.3 Phase allocation

Figure B-20: Phase allocation of the Interface to Process Equipment use case

B.11.4 Data Drops – Deliverables

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
2	Conceptual Design	At the beginning of Conceptual Design based on the last approved status from the previous phase	GD
3	Development		GD
4	Technical design and award of construction works		GD
6	Construction	As needed	GC

Figure B-21: Interface to Process Equipment Data Drops

The 3D model including all relevant geometries and information shall be submitted for Data Drops 3 and 4. The required formats shall be agreed with the process equipment designers and documented in the BIM Execution Plan under the auspices of the responsible BIM Manager. In the event of significant equipment changes affecting construction, the 3D models must be updated accordingly by the service provider.

B.11.5 Tasks and responsibilities

BIM@SRE "Interface to Process Equipment" Use Case Tasks and Responsibilities					
	Information - Management	General Design	General Constructor	FM Provider	Others
Responsibility	Verification	Creation	Creation		Usage

Figure B-22: Responsibilities in the Interface to Process Equipment use case

SRE Project Management: The responsibility for approving the deliverables rests with SRE Project Management, which may follow the approval recommendation issued by BIM Information Management.

Information Manager: The Information Manager shall be responsible for reviewing the provisional model and submitting it to Project Management. Furthermore, the Information Manager shall verify adherence to the modelling specifications and formats and issue an approval recommendation.

General Design (GD): General Design shall prepare a provisional model. General Design shall be responsible for reconciling, coordinating and submitting the models. All project-specific definitions (including additional submission formats if applicable) are to be documented in the BIM Execution Plan.

General Constructor (GC): The General Constructor shall prepare a provisional model. GC shall be responsible for reconciling, coordinating and submitting the models. All project-specific definitions (including additional submission formats if applicable) are to be documented in the BIM Execution Plan.

FM Provider: No deliverables.

Other parties: The process equipment designer on the customer side shall use the provisional model to design the factory equipment.

Depending on the contract, project-specific deviations are possible.

B.12 Room Schedule

B.12.1 Objectives and added value

The combination of all room information is called “3D Room Schedule”. The digital room schedule is generated from the 3D model using object-based (windows, doors, furnishings, etc.), surface-based (floor surface, all surface, etc.) and/or alphanumeric information from the 3D model. The objective is to have a "single source of truth", i.e. all relevant information should be entered only once and used across all phases, if possible. For example, results from the Construction phase should be reused and maintained during the operational phase. The Principal shall be given unlimited access to the 3D Room Schedule at any time.

B.12.2 Requirements

There is an essential distinction between information which is generated directly from the 3D model and additional information attributed to rooms. All links between information items and a specific room are established using the room number. GD/GC must make sure that the 3D model supports exports of all Room Schedule-related information.

Depending on the project, an additional database connected bidirectionally with the 3D model may be used. The design of the database must be agreed with the Information Manager and requires approval by the project head. It must be documented in the relevant BIM Execution Plan. It must be ensured under all circumstances that at the time the documentation is handed over all information has been evaluated via COBieLITE XML and can be transferred to the operator platform.

Room information in the 3D model:

The location of each room, all geometric information as well as the numeric design content relevant for generating 2D plans are created and maintained within the 3D model. In addition, at least the following attributes shall be maintained in the 3D model:

- COBie requirements (COBie Sheet Space)
- Room category (main and sub category; refer to "Room Categories" use case)
- Floor structure (type and height), raised flooring (yes/no)
- Load bearing capacity of the floor within the room
- Suspended ceiling design (type, height)
- Ceiling suspended load inside the room
- Room floor area, clear height, circumference, volume
- Number of workspaces
- Ventilation type
- Electric wall outlets and other non-modelled installations
- Special room features
- Soundproofing requirements (room acoustics)
- Maximum number of installed, fully furnished workspaces
- Description of room usage including maximum occupancy (number of persons)
- Safety zone
- Energy reference area – heating (yes/no)
- Energy reference area – air-conditioning (yes/no)
- Escape route (yes/no)
- Machine surface area
- Tenants
- Cost centre
- Organisational unit
- Additional, project-specific specifications may be defined as needed.

Elements not included in the COBie information requirements must be recorded on the COBie Worksheet “Attributes”.

Room Categories

The following attributes shall be assigned to the rooms in the 3D model:

- Room type according to the SRE Framework Standards Room Categories – Reference List (room name, if applicable)
- Two-digit room subcategory according to the SRE Framework Standards Room Categories – Reference List
  Each room object within the 3D model is assigned an attribute reflecting one of the 21 SRE rental subcategory numbers (e.g.: 1.1 for office (including meeting)).

Figure B-23: SRE Room Categories

These main and sub categories must be used under all circumstances to make spaces comparable globally.

The operator platform provides an interface for evaluation and utilisation in the COBieLITE XML standard format.

The modelling standard specifies how to handle individual room elements to reflect the SRE rental categories.

Additional room attributes:

Numerical data in the 3D model (and database, if applicable) is created and maintained by General Design and the General Constructor. This information is defined specifically for each project.

The 3D model (and the database, if applicable) are designed to allow exporting all information contained in the room type schedule or Room Schedule. This information may be converted into documents which can be printed out room by room. A sample room type schedule and Room Schedule will be provided prior to data entry, specifying the deliverable information and documents as well as their required content with regards to planning information.

The modelling standard specifies how each individual room element should be handled.

B.12.3 Phase allocation

Figure B-24: Phase allocation of the Room Schedule use case

B.12.4 Data Drops – Deliverables

Table B-25: Room Schedule Data Drops

Use case allocation to Data Drops			
Data Drop	**Description**	**Submission of data**	**Responsibility**
2	Conceptual Design	One time	GD
3	Development	One time	GD
4	Technical design and award of construction works	One time	GD
5	Construction	During FM/FS tendering process	GC
6	Construction	as needed	GC
7	Acceptance and Handover	One time	GC
9	Operation	as needed	FM
10	Sale	One time	FM

The responsible parties are to submit the following deliverables at the Data Drops listed above:

- Bidirectional interlinking of the 3D model with the database and the associated specifications
- 3D Room Schedule report in Excel and PDF export formats, providing all relevant information

B.12.5 Tasks and responsibilities

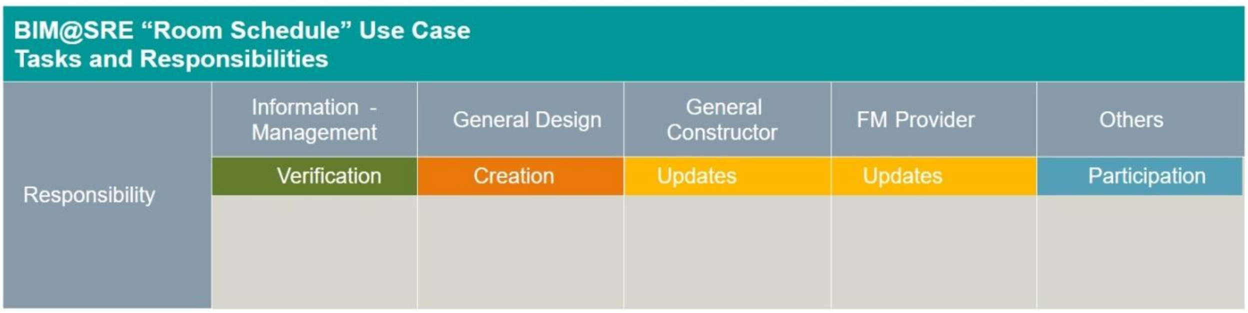

Figure B-25: Responsibilities in the Room Schedule use case

SRE Project Management: The responsibility for approving the deliverables rests with SRE Project Management, which may follow the approval recommendation issued by BIM Information Management.

Furthermore, Project Management shall have unlimited access to the 3D Room Schedule for use at any time. The Data Drop 3 and 5 deliverables will be used by Project Management to create the Specification for the General Constructor or FM service provider call for tenders. The Data Drop 10 deliverable is used to prepare the sale of the object, if applicable.

Information Manager: The Information Manager is responsible for checking the handover documents for plausibility and adherence to specifications. If all requirements are met, the Information Manager will issue an approval recommendation to Project Management.

General Design (GD): General Design is responsible for creating the 3D Room Schedule based upon the 3D model, making sure that all requirements regarding the levels of detail and information are met.

General Constructor (GC): The General Constructor is responsible for updating the 3D Room Schedule during the construction phase. It is important to ensure adherence to the level of detail and information requirements when updating the 3D Room Schedule.

FM Provider: The FM provider maintains the 3D Room Schedule upon handover and uses it to operate the building.

Other parties: The FM Consultant supports Project Management as required in the preparation of project-specific information requirements for the Room Schedule.

Chapter C:

Modelling Standard

C Modelling Standard

C.1 General modelling requirements

The BIM modelling standard defines the model properties, the minimum requirements for modelling, as well as the levels of detail and information for SRE projects.

C.1.1 Modification of the modelling standard

New technological and practicability-related information contradicting the current modelling standard should be discussed by all project members prior to project launch. Once a planning process has started, deviations from or modifications to the modelling standards require approval by SRE. Any such changes must be fully documented in the Project Execution Plan.

C.1.2 3D models

A 3D model is a digital image of the physical and functional properties of the actual project. It is a comprehensive three-dimensional computer model combining all the geometric and other descriptive characteristics of the model elements. In this document, it is referred to as the ‘3D Model’. This term is used to describe a model element, a specific partial model or a consolidated model composed of several integrated partial models.

A functional element is an element or a group of elements within the 3D model that represents physical (e.g. a wall), functional (e.g. a room), or an abstract (e.g. a load) design component or a combination thereof (a system, a group).

A partial model is a discipline-specific model (e.g. architecture) or a workflow-specific model (e.g. 4D scheduling) which primarily contains model elements for evaluation purposes.

A discipline-specific model (e.g. architecture, mechanical/electrical/plumbing installations, etc.) contains primarily functional model elements of one particular design view.

A consolidated model comprises several integrated discipline-specific models and is used for purposes such as cross-discipline quality assurance. It is part of the project phase deliverables.

C.1.2.1 Basic requirements for the 3D model

The service provider shall create a consolidated model for each of the defined Data Drops. The consolidated model is the result of integrating all or specific partial models for joint viewing and evaluation, e.g. for process planning or clash detection.

C.1.2.2 Model building tool

Deliverables must be submitted in .rvt format (also referred to BIM Data Management).

All model elements are created using functional element-specific software features, i.e. walls are created using wall tools, shells are created using the shell tool etc. Elements which do not have a tool of their own are assigned to the most similar element category.

For a contractors (General Design [GD] and General Constructor [GC]) internal processes (e.g. internal collaboration) and coordination with additional third-party planners (e.g., planning of furnishings, process equipment etc.), the delivery of native Revit components is not absolutely mandatory. However, external designs, such as furnishing plans, must be incorporated into, or referenced by, the deliverable discipline-specific Autodesk Revit model. This could be accomplished e.g. by inserting an .ifc file. Discipline-specific plans with exclusively geometric relevance for the implementation of the BIM@SRE standards may also be created using non-Autodesk Revit software. For example, it would be acceptable to create reinforcement drawings using TeklaStructures, Nemetschek Scia, Bentley Systems AECOsim, or another suitable software application. In the case of reinforcement drawings however, it must be ensured that these can be included in the model-based quality assurance process (clash detection etc.).

The approach chosen by the service provider for internal implementation, along with its BIM method, must be documented in the BIM Execution Plan and requires approval by SRE Project Management.

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C.1.2.3 File formats

All modelled information is submitted in a .rvt file containing all geometric and structural functional elements as well as all related plans, views, sections, floorplans and functional element lists. In addition, 2D files conforming to SRE's CAD requirements shall be submitted (e.g., the CAD4CAFM standard is mandatory for projects in Germany). The applicable regional standard shall be described by the service provider in the BEP.

All functional elements are referred to as ‘families’, for example lettering, walls, doors, windows or data fields. Existing families may be modified and new families loaded into a project (.rvt).

C.2 Model and functional element environment

C.2.1 Project coordinates

Requirements for handling the coordinate system, centre-to-centre grid and reference point shall be defined specifically for the given project, agreed with SRE and documented in the BIM Execution Plan by the responsible BIM Manager.

A unique project zero point with a specific reference elevation shall be defined by General Design. This common project zero point must not be changed during the planning, construction or operation phase. When partial models are used, they must use common base coordinates.

When building the model it is important to place the functional elements precisely according to the construction specifications. The 2D plan must be consistent with the model. All functional elements should be modelled with all points located on the positive side of the axes.

C.2.2 Project set-up

It is important to use consistent conventions for 3D modelling. At least the following basic conventions should be defined and applied by the service provider prior to project launch:

- Project basepoint and triangulation station
- Lists, project units, orientation to geographic North and project North
- Planning area
- Project-specific parameters
- Plains, views, view templates, filters
- Plan layouts and plan lists
- Projects-specific dimensioning, lettering, symbols, room stamps, etc.

C.2.3 File sizes

File sizes should be as small as possible without sacrificing functionality or other requirements. Unlimited model use by the service provider’s BIM Manager must be ensured. Where appropriate, models may be split. This should be agreed between the service provider and SRE for the given project prior to beginning work. If a model is split, this should be documented in the BIM Execution Plan.

File sizes for functional element families should be kept as small as possible without sacrificing functionality or other requirements. This means that information which is no longer needed should be deleted.

Direct linking of items such as .dwg files (existing asset plans etc.) with a project can cause project performance problems, depending on the number of linked .dwg files and/or their accumulated file sizes. This should be avoided from the very beginning when setting up the project. In general, .dwg files should not be imported directly into the project. The service provider's linking strategy should be documented in the BIM Execution Plan.

C.2.4 Model units

All 3D models of the project must use the same units of measure. The standard unit for all models is equivalent to the 1:1 scale. The model units differ by region:

- Metric system
- Imperial system

The model units of measure must be defined for the given project and region, and documented in the BIM Execution Plan.

C.3 Graphical representation

C.3.1 Materials, textures and hachures

All functional elements used must be defined using appropriate material designations. Functional element materials must feature textures and hachures adapted to the varying on-screen representations. The 2D plan must be consistent with the model.

C.3.2 Symbolic representations

Functional elements represented by a symbol in the floorplan (e.g. shafts, barriers, pumps, etc.) should be defined using country and region-specific symbols consistent with customary local graphical standards and regulations.

C.3.3 Schematic representation

All schematic 2D representations not linked with the 3D model may be created using a 2D software application (e.g. equipment schematics, functional schematics, electric wiring diagrams, etc.). Completed 2D CAD files shall be referenced in the 3D model as DWG files. Symbols must conform to the regional regulations regarding type and size.

C.3.4 Lettering

In general, lettering must be derived from model information. Pure, manual text should only be used for special reasons by mutual agreement. Deviations predictable prior to the beginning of the project should be agreed and recorded in the BEP.

C.3.5 Title blocks

The title block shall be completed and controlled via centralised plan management. All revisions emerging during the planning process shall be administered centrally. The requirements for the title block design shall be defined specifically for the given project. The service provider shall propose a draft title block and liaise with SRE Project Management to reach final agreement. The title block shall be created by the service provider as a parameterised functional element family of its own with the associated sheet sizes defined as types.

C.3.6 Phase representation

The individual phases of a project, such as existing functional elements, dismantling or new construction, shall be marked in the graphical plan using appropriate colours. This is done based on the phase management functionality of the software used. For example, for each functional element the parameters "Phase Created" and "Phase Aborted" should be defined in the functional element properties. The individual classifications are represented in the plans using the "Phase" and "Phase Filter" features.

C.4 Model and functional element requirements

C.4.1 Composition of model elements

All model elements shall be created by the contractor as 3D functional elements. Functional elements may not be composed of lines or surfaces. Furthermore, the functional elements from the relevant categories should be used for modelling. For example, architectural functional elements should be used to create the Architecture 3D model, i.e. a wall should be created using the architectural functional element "Wall". Creating a 3D cube or pillared object instead of a wall object is not permitted.

Functional elements with complex geometries as well as special functional elements which cannot be assigned to an existing category shall be created using the "General Model" category.

All discipline-specific models shall be structured based on the levels of the building so that model data can be output floor by floor without superimposing any areas. The number and frequency of data exchanges shall depend upon the planning requirements; all retroactive modifications to a status already handed over shall be documented graphically in a suitable manner (e.g. revision clouds in the 2D documentation and appropriate representation in the model, e.g. remodelled status highlighted in a different colour). The exact modalities shall be documented in the BIM Execution Plan by the responsible BIM Manager.

C.4.2 Functional element requirements

C.4.2.1 Functional element orientation

When building the model it is important to place the functional elements precisely as specified (location, coordinates, interface). The 2D plan representation must be derived from the 3D model and reflect the most recent status.

C.4.2.2 Doors and windows

All doors and windows must be created using the specified dimensions. Care must be taken to make sure allocations, e.g. of a door to a specific room, can be evaluated properly. This applies to interior and exterior doors. In this context, the term ‘doors’ also includes gates, flaps, skylights and SHEs used to access shafts or other, similar localities.

C.4.2.3 Structural and other openings

Structural and other openings must be created in a way that allows them to be directly addressed as well as evaluated.

C.4.2.4 Technical components, piping and cabling

The model elements of building services (MEP) shall be distinguished using specific linear functional elements (pipes, cable routes) and property form functional elements. Functional elements must reference the respective room, i.e. the room number shall be added to the functional element as an attribute.

Furthermore, the following minimum requirements must be met when building the model:

- Elements/families inserted into a system must form the physical continuation of the existing system and therefore require proper connectors.
- Elements/families located at the end of the system must likewise be equipped with proper connectors.
- All system branches must be properly terminated (e.g. there must always be a connector at the end of a wastewater line).
- All components within the system must be interlinked using the proper topology so that flow calculations can be performed.

C.4.2.5 Placeholders

Placeholders are volume bodies which are used, e.g., to keep clearances or transport routes open within the plan. They must be directly addressable model element of their own. Placeholder attributes such as those required for the must-have use case "3D soft clash us/clearances" must be provided.

C.4.3 Rooms, floors and zones

C.4.3.1 Rooms

A room is usually a three-dimensional element surrounded by walls, ceilings and floors. Rooms must border directly on their adjacent functional elements. In general, and especially in the Room Categories use case, it is possible to define rooms without placing a limiting element on each side. Rooms which are not formed by surrounding elements, or are formed by mobile elements only, may still be declared room objects without delimiting elements.

The following minimum requirements must be met when modelling rooms:

- A room contained within another room with a different function must be expressly created. In this case, the rooms must not overlap.
- A model must not contain any open volumes or overlaps.
- Technical shafts, light wells and lift shafts must be modelled as a room on each level.
- Rooms must conform to the information linked to the specified room programme. In particular, room names must be assigned consistently.
- All rooms must be contained.

Rooms and shaft sections per floor must be created as 3D rooms by the service provider. They are usually defined by the inside surfaces of the surrounding functional elements. Their vertical dimension usually extends from the surface of the finished floor to the lower edge of the ceiling, respectively, across the clear height of the room. The horizontal dimension is defined by the adjacent vertical construction element layers. However, shaft sections extend from the upper edge of the lower raw ceiling to the upper edge of the role of the ceiling.

The attributes defined in the must-have use cases and the project-specific BEP shall be provided in the 3D model by the service provider and read from the 3D model automatically.

The SRE room categories – also refer to the "Room Categories" use case – require rooms to be modelled in a highly differentiated matter. For example, in certain projects circulation zones in open office areas may have to be classified separately and accounted for individually in evaluations, distinguishing between escape routes (minimum width 1.5 metres) and other traffic areas. Furthermore, individual interior finishing elements for basic and modular interior completion (in particular think tanks, individual offices, phone boxes etc.) must likewise be defined as rooms. If several different types of flooring are installed in a single room, the room is subdivided accordingly into several individual “rooms” (e.g. using room separation lines).

C.4.3.2 Zones

Zones are combinations of existing rooms or other zones. A room can be a "member" of several different zones. Depending on the project-specific requirements, rooms (especially MEP rooms) are subdivided into zones.

C.4.3.3 Levels and floors

Level references must be defined for the given project and region and documented in the BIM Execution Plan. Apart from floor levels, foundation, intermediate, installation and roof levels must be accounted for in the BIM Execution Plan.

C.5 Model development – Level of development

The LOD (Level of Detail) and LOI (Level of Information) must be defined for each individual phase including the specific requirements related to planning and operations. This serves the purpose of achieving a consistent granularity of details and attributes throughout the functional element descriptions. Additional requirements are laid down in the compulsory use cases and must be adhered to accordingly.

C.5.1 Delimitation

The LoD defines the required level of detail and completeness for building models. The LoD is dependent upon the respective discipline and performance phase. Within a phase the degree of completeness may vary among the individual disciplines. Since the BIM@SRE standard is highly innovative, it is unlikely that a high LoD (e.g. LoD 400) can be provided by all disciplines and throughout a project. This is due to the fact that the BIM methodology has not yet reached a very high degree of market-readiness. The LoD shall be agreed between SRE and the service providers for the given region and project, and documented in the BIM Project Execution Plan. The minimum requirement for deliverables should be LoD 300.

C.5.2 LoD and LoI allocation

From one project Data Drop to the next the 3D model is built or expanded by adding new information. This information consists of progressively more detailed geometric properties of the model elements themselves as well as attributes which are added to them.

Table C-1: Allocation of model development LoD and LoI to phases and Data Drops

LoD of modelling			
Level of Detail	**Phases**	**Data Drop**	**Description**
LoD/LoI 100	Project development Preliminary draft plan	Data Drops 1+2	Rendering with sufficiently accurate outside dimensions
LoD/LoI 200	Schematic design Construction permit	Data Drop 3	Rendering with true dimensions
LoD/LoI 300	Construction plan	Data Drop 4	Rendering with actual structural composition and details
LoD/LoI 400	Installation planning	Data Drop 4	Submission of all details and information for installation
LoD/LoI 500	Construction Documentation	Data Drops 5-7	Update according to as-built status

The levels of detail and information of all functional elements must conform to the requirements of the must-have use cases and the COBie standard.

C.5.3 Sequence of model versions

Every consolidated model and every partial model of a building builds upon the previous 3D model and therefore includes all properties of the previous consolidated model/partial model. 3D models must be suitable to implement the planned BIM use cases. The service provider shall create at least the following partial models:

Table C-2: Requirements for partial models

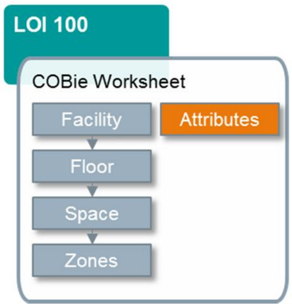
<table>
<tr><th colspan="3">Model designation</th></tr>
<tr><th>3D models</th><th>Model content</th><th>Allocation</th></tr>
<tr><td>Site model</td><td>e.g. streets and walkways, parking spaces, vegetation, terrain</td><td rowspan="4">Architecture</td></tr>
<tr><td>Room model</td><td rowspan="3">Basic interior construction, modular interior design, roof, façade e.g. non-load-bearing walls, suspended ceilings, windows, doors, façade, stairs, rooms, permanently installed furnishings</td></tr>
<tr><td>Equipment (furniture, machines, etc.)</td></tr>
<tr><td>Architectural model</td></tr>
<tr><td>Supporting structure model</td><td>Structural work, e.g. foundations, floors, pillars, load-bearing walls, breakthrough openings</td><td>Supporting structure</td></tr>
<tr><td>Heating system model</td><td>e.g. circular main, riser, stationery heating surfaces, reheater</td><td rowspan="5">Building services</td></tr>
<tr><td>Refrigeration system model</td><td>e.g. circular main, riser, functional element activation, sealing radiant cooling panels, air-conditioning equipment</td></tr>
<tr><td>Room air ventilation model</td><td>Ventilation ducts and elements (e.g. fire dampers, volume flow controllers, reheaters)</td></tr>
<tr><td>Plumbing model</td><td>e.g. wastewater/freshwater, rainwater/ greasy wastewater (piping), facilities</td></tr>
<tr><td>Electrical installation model</td><td>e.g. horizontal and vertical cable channels, luminaires, manholes, distribution panels, transformer.</td></tr>
</table>

C.5.4 Level of Information

The level of information (LoI) provides detailed information about the required functional element specifications for each project phase.

The LoI describes the level of information regarding an object contained in the building model. As the project progresses, the level of detail typically improves continuously. It describes the information density for a functional element which may comprise alphanumeric data and/or supplementary documentation. The LoI-to-schedule allocation is defined along with the requirements for each data drop, the COBie content requirements and the use cases as described.

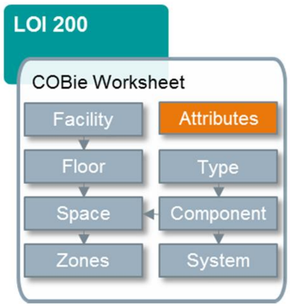
LoI 100



The model contains all information required to extract the required key values and information for preliminary draft planning.

- Facilities: Building information. E.g. location, address, etc.,
- Floors: Floor information/levels
- Spaces: Room information (e.g. room types)
- Zones: Definition of Spaces to create room groups for purposes such as joint services or specific activities

LoI 200 (builds upon LoI 100):



The models contain all information, including classifications, required to extract the key values and information needed for the building permit and the completion of the draft design phase.

- Type: Functional elements including product information and materials
- Component: Individual physical objects/functional elements containing, e.g., maintenance and/or inspection information for the operation phase
- System: Combination of several functional elements to describe a function.

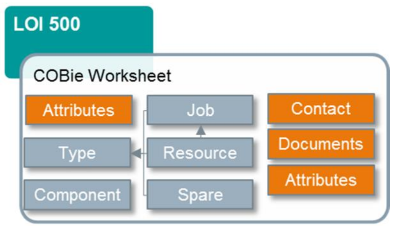
C.5.4.1 LoI 300 (builds upon LoI 200):

Building upon LoI 200, the models contain all information required to extract the key values and information needed to complete the construction planning phase.

C.5.4.2 LoI 400 (builds upon LoI 300):

Building upon LoI 300, the models contain all information required to extract the key values and information needed to complete the construction planning phase.

C.5.4.3 LoI 500 (builds upon LoI 400):



As in LoI 400, however all functional elements are prepared with the information required for transfer to the operator platform and supplemented with information from the construction phase.

- Documents: Links to documents. e.g. maintenance instructions, plans etc.
- Attributes: Specific properties, e.g. weight
- Contact: Contact information for operation

C.5.5 Functional element parameters

C.5.5.1 Requirements

All functional elements and equipment contained in the 3D model must be assigned property and quality attributes. The parameters must satisfy the following requirements:

- Classification
- Specifications according to the COBie standard
- Additional specifications according to the requirements of the Must-have BIM Use Cases

The parameters and the associated characteristics can vary among projects and regions. In any case, the service provider must create a parameter matrix for all deliverable specifications of the Must-have BIM Use Cases, and documented in the BIM Execution Plan. The matrix is always composed of the parameter name, the data type and the requirement (refer to the next chapter "Parameter Requirements"); it must be agreed with SRE.

All parameters subject to evaluation must be created as Shared Parameters. The associated parameter file (.txt) must always be included with the respective deliverable.

C.5.5.2 Room classification parameter

All rooms contained in the 3D model are classified according to the SRE room categories (refer to Room Categories use case), with due consideration given to the use cases as described. The classification of floors and zones is defined specifically for the given project and documented in the BIM Execution Plan. The room categories are precisely specified in the equally named use case.

Consistent application of the room categories at SRE allows rental spaces to be compared worldwide. This way the classification of the rental spaces based on the SRE rental categories becomes part of the 3D model. The classification can be represented graphically and analysed numerically. It can be used as a basis for categorised definition and distinction of spaces.

The room categories must remain discernible and available for evaluation in the 2D plan, as well. Any applicable region or country-specific SRE CAD requirements must be accounted for and implemented. When classifying rooms, the ‘Room Categories’ SRE Framework Standard and the Must-have BIM Use Cases must be adhered to.

Table C-3: Classification of rental spaces

Parameters for functional element classification			
Parameter name	**Requirement**	**Data type**	**Example**
Room main category	Number and name of the room main category	Text	1. Office
Room subcategory	Number and name of the room subcategory	Text	1.3 Meeting Zone

C.5.5.3 Functional element classification parameter

All functional elements contained in the 3D model are classified according to Uniclass2015 or, depending on the region and project-specific conventions, according to OmniClass™. The following separate parameters must be created in the 3D model for this purpose:

Table C-4: Functional element classification

Parameters for functional element classification			
Parameter name	**Requirement**	**Data type**	**Example**
UniClass2015Code (Omniclass if applicable)	Classification number	Text	Pr_40_30_25_42
UniClass2015Title (Omniclass if applicable)	Classification name	Text	Interactive whiteboards

C.5.5.4 COBie parameters

All FM and FS-relevant functional elements contained in the 3D model (rooms, installations, components, systems, equipment, etc.) must be specified using COBie parameters. The relevant functional elements are described in the use cases. In particular, the following use cases are affected:

- 5D Cost Benchmarks
- 6D Life Cycle Cost
- Soft clashes / Clearances
- Siemens Office Furnishing
- Room Schedule
- Room Categories
- Interface to Facility Services
- Equipment Schedule
- Equipment Information

There may be region and project-specific differences in the naming and requirements of COBie worksheets and the associated parameters. Prior to project launch the deliverable parameters or attributes shall be defined in the project-specific BEP and documented by the BIM Manager in the parameter matrix within the project execution plan. For irrelevant COBie parameters or unknown information, such as manufacturer details, the parameter matrix should be marked “n/a".

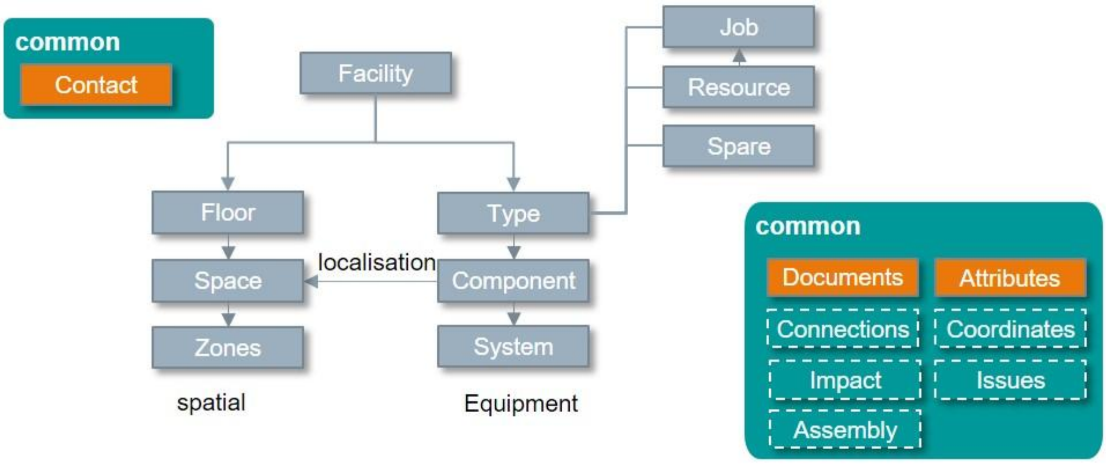


Figure C-1: Overview of deliverable COBie worksheets

C.5.5.5 COBie “Type” Parameters

Below, the COBie “Type” and COBie “Component” parameters are explained in detail as examples.

Table C-5: Parameter matrix for the COBie “Type” worksheet

Parameters for type classification according to COBie			
Parameter name	**Requirement**	**Data type**	**Example**
Name	An alphanumeric name in plain language (e.g. Product)	Text	Hand drier
Category	Classification (Uniclass or Omniclass) Consists of number - colon - classification name	Text	Pr_40_70_62_37: Hand driers
Description	Brief description of the functional element	Text	Hand drier, light
AssetType	“Fixed" for permanently installed objects (heating, plumbing, lifts). "Movable" for objects not permanently installed (chair, table lamp)	Text	Fixed
Manufacturer	Valid e-mail addresses of the individuals responsible for the creation and delivery	Text	manufacturer@mail.com
ModelNumber	Product, article or equipment number information provided by the manufacturer	Numeric	553
Warranty GarantorParts	Valid e-mail address of the individual responsible for product guarantee	Text	manufacturer@mail.com

Warranty DurationParts	Term of the product guarantee	Numeric	5
Warranty GuarantorLabor	Valid e-mail address of the individual responsible for service guarantee	Text	manufacturer@mail.com
Warranty DurationLabor	Guarantee period	Numeric	5
Warranty DurationUnit	Unit of measure for the guarantee term	Text	Year
ReplacementCost	Purchasing price in the currency relevant for the project.	Numeric	300
ExpectedLife	Expected lifespan of the product	Numeric	10
DurationUnit	Unit of measure for the product lifespan value	Text	Year
Warranty Description	Brief description of the content and disclaimers	Text	On-site guarantee and pre-emptive replacement guarantee
NominalLength	Nominal length (primary / largest dimension of the product) in mm	Numeric	310
NominalWidth	Nominal width (primary / largest dimension of the product) in mm	Numeric	180
NominalHeight	Nominal height (primary / largest dimension of the product) in mm	Numeric	240
ModelReference	Manufacturer’s product name	Text	Hand drier, light
Shape	Characteristic form of the product	Text	Square
Size	Characteristic size of the product	Text	310mm x 240mm x 180mm
Color	Characteristic primary colour of the product	Text	White
Finish	Characteristic surface finish of the product	Text	Matt
Grade	Product grade designation	Text	Class 1
Material	Typical material of the product	Text	Diecast aluminium
Constituents	Details regarding the components of the product	Text	n/a
Features	Primary characteristics and other key properties with respect to the product specifications	Text	Low noise operation, Tamper-proof screws
Accessibility Performance	Product use	Text	Automatic
Sustainability Performance	Information regarding the sustainability of the product (e.g. link to the product database)	Text	n/a
CodePerformance	Operating notes for the product	Text	Low energy

C.5.5.6 COBie “Component” Parameter

Table C-6: Parameter matrix for the COBie “Component” worksheet

Parameters for component classification according to COBie		
Parameter name	**Requirement**	**Data type**
SerialNumber	Sequential number (e.g. item number)	Text
InstallationDate	Installation dates standard format: “2016-12-31T23:59:59”	Text
WarrantyStartDate	Standard format for maintenance start date: “2016-12-31T23:59:59”	Text
TagNumber	Tag number e.g. for RFID tags	Text
Barcode	Barcode	Text
AssetIdentifier	Project or building number	Text

C.5.5.7 Specification parameters

In addition to the COBie requirements every functional element in the 3D model is specified by stating its required properties with due consideration of the use cases as described.

Delivery for all FM and FS-relevant functional elements in rooms (installations, components, systems, equipment, etc.) is made using the COBie worksheet "Attributes". Prior to project launch the deliverable parameters or attributes shall be defined and documented by the responsible BIM Manager in the parameter matrix within the BIM execution plan.

The minimum requirements for the parameters and the relevant functional elements are described in the use cases. In particular, these are the following use cases:

- 5D Cost Benchmarks
- 6D Life Cycle Cost
- Soft clashes / Clearances
- Siemens Office Furnishing
- Room Schedule
- Room Categories
- Interface to Facility Services
- Equipment Schedule
- Equipment Information

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C.5.6 Level of Detail

The level of detail (LoD) provides precise information about the required geometric modelling accuracy of functional elements for each project phase. As the project proceeds, the interdependent geometric granularity and precision continue to increase. The following definitions describe the minimum content of the 3D models.

Additional partial and discipline-specific models not mentioned among these examples must be specified by the service provider in the BEP as needed for the project.

C.5.6.1 LoD 100:

The model contains functional elements from which the required key values can be derived. The functional elements and their respective approximates sizes, geometries, orientation and rooms are represented. A massing model represents the entire volume of the building. The modelling for the building services contains functional elements with flexible positions and dimensions. For visualisation purposes, volume bodies represent presumptive functional elements which have not been defined yet.

C.5.6.2 LoD 200 (builds upon LoD 100):

The models contain functional elements indicating the arrangement and specifications of key systems from which key values can be derived with sufficient accuracy to apply for the construction permit and carry the models over into the construction planning phase. The functional elements are represented with unique classifications, designation and defined geometries, intended location, form, orientation as well as the required non-graphical information. In addition, the key functional elements may be grouped and dimensioned.

All functional elements are organised by type (e.g. based on material, thickness, structure, etc.). The design and orientation remain flexible at this time. The structural design is represented with sufficiently accurate functional element geometry. Main components, horizontal and vertical supply routes and MEP centres have been modelled. Furthermore, the modelling of the building services/MEP includes a draft schematic indicating approximate functional element sizes, geometries and orientation. Shafts and main distribution points are modelled in a generic form indicating the expected dimensions.

System components (e.g. sun shades, windows, doors, etc.) are modelled as simple functional elements and represented, e.g., by simple frames and panes. The planned external dimensions must be final.

The main trades can be coordinated based on the model. Planning of structural openings has been coordinated across all trades with sufficient accuracy based on the model, i.e. structurally relevant openings in structurally relevant functional elements are present.

C.5.6.3 LoD 300 (builds upon LoD 200):

The models contain detailed functional elements for coordinating and awarding the individual trades and for determining precise, true key values.

The model includes specific functional element sizes and positions and represents actual sizes, geometries and orientations with added detailing as appropriate for this phase. All surfaces are defined in the model with the exception of functional elements which are influenced by the choice of manufacturer. Approximate allocation of clearances and working spaces is required for all specified mounting fixtures, anchors, supports and installed components. The components of the building services/MEP are assigned to specific trades. The planning of structural openings has been precisely coordinated across all trades.

C.5.6.4 LoD 400 (builds upon LoD 300):

The models contain detailed functional elements for the purposes of work and installation planning and production as well as extracting key values. All installation components contain exact geometry, orientation and position information including component connections, mounting fixtures, attachments and installed components. Additional information providing details on production, design and installation is represented. In addition, non-graphical information has been added to the functional elements, as well.

The model indicates the actual geometry, clearances/spacing and workspaces for all mounting fixtures, anchors, supports, installed parts and add-on functional elements of the model required for building and installation on site.

C.5.6.5 LoD 500 (builds upon LoD 400):

The models contain all functional elements as specified in LoD 400, however "as built", along with the installed geometries and orientations. The models undergo quality control and are compared with the as-is status of the building. The functional elements are verifiable, true representations of what was installed in terms of size, appearance, position, quantity and orientation.

C.5.7 Model content and requirements

C.5.7.1 Site models

LoD 100:

- Representation as a volume body for visualisation purposes and deducing key values

LoD 200 (builds upon LoD 100):

- Representation of the existing functional elements including their actual dimensions and positions, layers, surfaces and design
- Representation of exterior rooms

LoD 300 (builds upon LoD 200):

- Site topography has been generated, including ground-level disruptions and lines as required for accurate surface rendering.
- Functional elements are represented with actual external dimensions and location.
- Functional elements are specified in terms of material and quality as well as final design

LoD 400 (builds upon LoD 300):

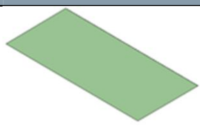
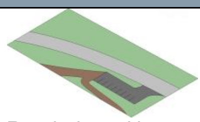
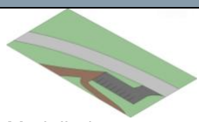
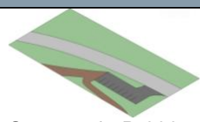
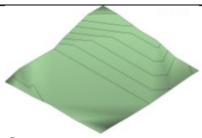
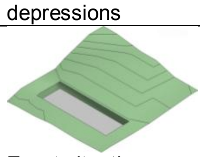
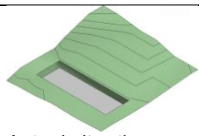
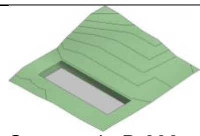
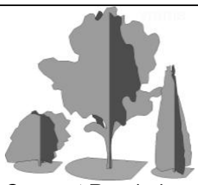
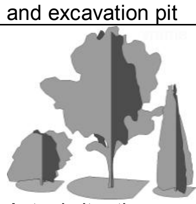
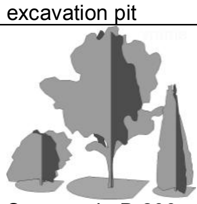
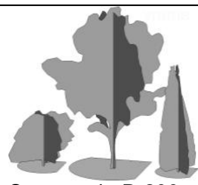
- Same as LoD 300

LoD 500 (builds upon LoD 400):

- Update to match as-built status

The schematic below provides an overview of the functional element requirements and corresponding levels of detail. This information is not exhaustive in terms of deliverables and contract performance.

Table C-7: LoD for site models

Level of detail requirements					
Category	**LoD 100**	**LoD 200**	**LoD 300**	**LoD 400**	**LoD 500**
Carparks Access routes	 Concept representation	 Rendering with actual situation, elevations and depressions	 Modelled underground strata and surfaces	 Same as LoD 300	Update to match as-built status
Topography	 Concept representation	 Exact situation, elevation and depression profile and excavation pit	 Actual situation, elevation and depression profile and excavation pit	 Same as LoD 300	Update to match as-built status
Vegetation	 Concept Rendering with sufficiently accurate situation	 Actual situation, elevations and diameter	 Same as LoD 200	 Same as LoD 200	Update to match as-built status

C.5.7.2 Architectural models including fire protection requirements

Model details and content

LoD 100:

- Representation of functional elements with sufficiently accurate space requirement and position information
- Definition of the desired room programme (room model)
- Representation of additional functional elements for visualisation purposes

LoD 200 (builds upon LoD 100):

- Representation of functional elements with preliminary dimensions and positions
- Definition of functional elements and allocation to types and materials
- Representation of connections and intersections
- Definition of the actual room programme (room model)
- Representation of structurally relevant openings for loadbearing functional elements

LoD 300 (builds upon LoD 200):

- Functional elements are represented with actual external dimensions and location.
- Specification of functional elements in terms of material and quality
- Definition of layers and composition
- Coordinated planning of openings

LoD 400 (builds upon LoD 300):

- Creation of all required details and information for installation
- Adaptation to product specifications

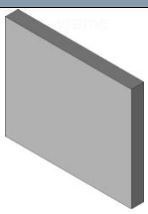
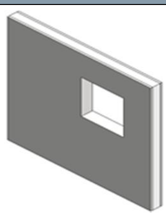
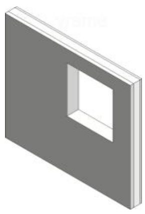
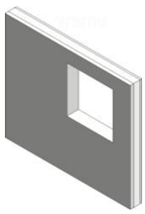
LoD 500 (builds upon LoD 400):

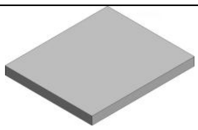
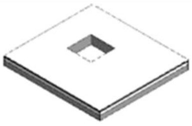
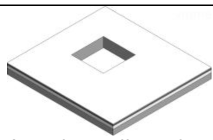
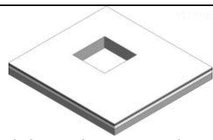
- Update to match as-built status

Model representation

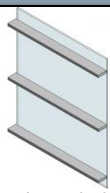
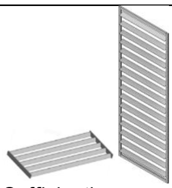
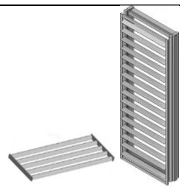
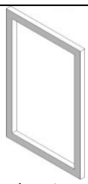
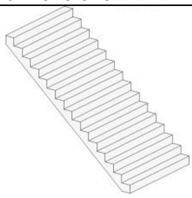
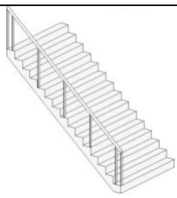
The schematic below provides an overview of the functional element requirements and corresponding levels of detail. This information is not exhaustive in terms of deliverables and contract performance.

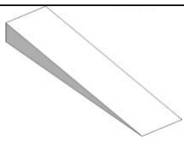
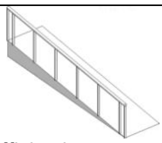
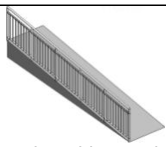
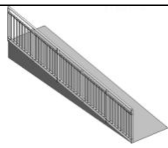
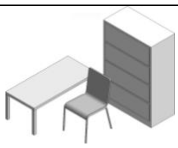
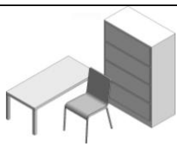
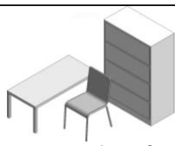
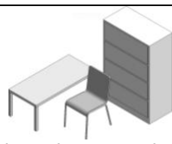
Table C-8: LoD for Architectural models

Level of detail requirements					
Category	**LoD 100**	**LoD 200**	**LoD 300**	**LoD 400**	**LoD 500**
General (Wall, pillars, others)	 Sufficiently accurate overall strength	 Coordinated, sufficiently accurate overall strength including layer structure and material	 Actual coordinated overall strength and planning of openings including layer structure	 Adaptation to product specifications. Installation details and information	Update to match as-built status

General (Floors, ceilings, roofs, others)	 Sufficiently accurate overall strength	 Coordinated, sufficiently accurate overall strength including layer structure and material	 Actual coordinated overall strength and planning of openings including layer structure	 Adaptation to product specifications. Installation details and information	Update to match as-built status

Level of detail requirements

Cat.	LoD 100	LoD 200	LoD 300	LoD 400	LoD 500
Façades	 Sufficiently accurate dimensions	 Orientation relative to the functional units with sufficiently accu-rate position and di-mensional information	 Actual position and dimensions including implementation details	 Adaptation to product specifications. Installation details and information	Update to match as-built status
Sun protection	 Sufficiently accurate dimensions	 Sufficiently accurate position and dimensional information	 Actual positions and dimensions including implementation details	 Adaptation to product specifications. Installation details and information	Update to match as-built status
Windows Skylights, doors, gates	 Approximate position, size, quantity. Sufficiently accurate external dimensions	 Sufficiently accurate external dimensions and position	 Actual position and dimensions including implementation details (joints, sur-faces, connections)	 Adaptation to product specifications. Installation details and information	Update to match as-built status
Stairs Hand rails	 Sufficiently accurate position and external dimensions	 Sufficiently accurate position and dimensions. Steps and rises, hand rails, including materials	 Actual position and dimensions including implementation details (joints, surfaces, etc.)	 Adaptation to product specifications. Installation details and information	Update to match as-built status

Ramps Hand rails	 Sufficiently accurate position and external dimensions	 Sufficiently accurate position and dimensions. Slope, handrails, including materials	 Actual position and dimensions including implementation details (joints, surfaces, etc.)	 Adaptation to product specifications. Installation details and information	Update to match as-built status
Furnishings	 Representation for visualisations, if applicable	 Coordination and definition with furnishing planner	 Representation of actual furnishings	 Adaptation to product specifications and installation details	Update to match as-built status

C.5.7.3 Supporting structure model

LoD 100:

- Representation of functional elements with sufficiently accurate space requirement and position information
- Representation of the desired materials rsp. design
- Representation of additional functional elements for visualisation purposes

LoD 200 (builds upon LoD 100):

- Representation of functional elements with preliminary dimensions and positions
- Definition of functional elements and allocation to types and materials
- Representation of structurally relevant openings

LoD 300 (builds upon LoD 200):

- Representation of the functional elements with actual external dimensions and positions
- Representation of coordinated structural openings
- Representation of built in parts, reinforcements etc.
- Representation of additional implementation details

LoD 400 (builds upon LoD 300):

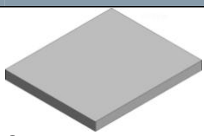
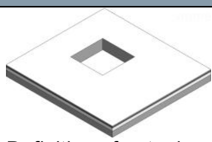
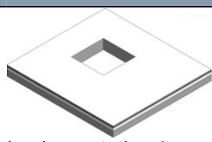
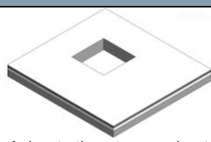
- Creation of all required details and information for installation
- Adaptation to product specifications

LoD 500 (builds upon LoD 400):

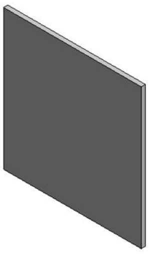
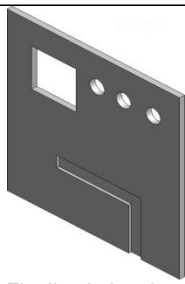
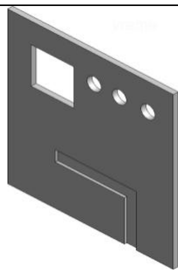
- Update to match as-built status

The schematic below provides an overview of the functional element requirements and the corresponding levels of detail. This information is not exhaustive in terms of deliverables and contract performance.

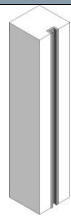
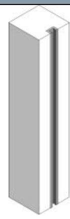
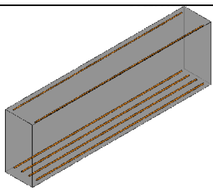
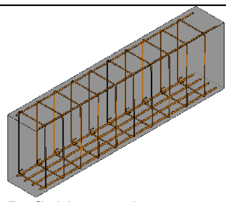
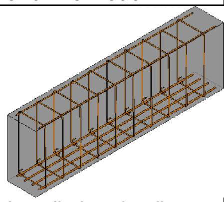
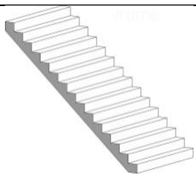
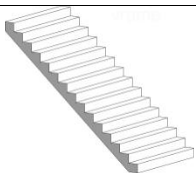
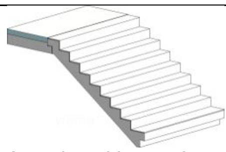
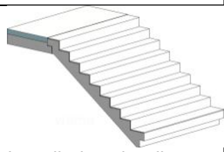
Table C-9: LoD for supporting structure models

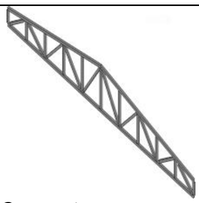
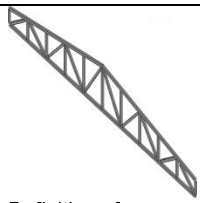
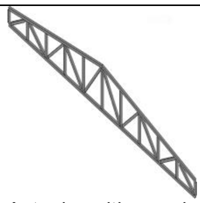
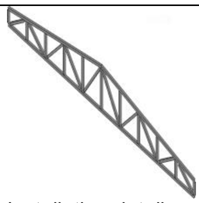
Level of detail requirements					
Category	**LoD 100**	**LoD 200**	**LoD 300**	**LoD 400**	**LoD 500**
General (Roof, ceiling, stairs, etc.)	 Concept representation	 Definition of actual external dimensions, type and material.	 Implementation (e.g. filigree floor) Finalised planning of openings and surfaces	 Adaptation to product specifications. Installation details and information	Update to match as-built status

Model details and contentModel representation

General (Wall, pillars, joists)	 Concept representation	 Definition of actual external dimensions, type and material. Representation of consoles, structural openings,	 Finalised planning of openings and surfaces	 Adaptation to product specifications. Installation details and information	Update to match as-built status

Level of detail requirements

Category	LoD 100	LoD 200	LoD 300	LoD 400	LoD 500
Built-in parts	No requirements	No requirements	 Definition of actual external dimensions, type and material.	 Adaptation to product specifications. Installation details and information	Update to match as-built status
Reinforcement	No requirements	 Representation in sufficient detail of reinforcements for definition of functional element dimensions	 Definition and representation of actual reinforcement	 Installation details and information	Update to match as-built status
Connections Anchorage Connections	 Concept representation	 Representation for calculations	 Representation including bolted connections, bolts and other anchors	 Adaptation to product specifications. Installation details and information	Update to match as-built status
Stairs	 Concept representation	 Definition of sufficiently accurate external dimensions, type and material	 Actual position and dimensions including implementation details (joints, surfaces, etc.)	 Installation details and information	Update to match as-built status

Trussed rafters, girders, struts	 Concept representation	 Definition of sufficiently accurate external dimensions, type and material	 Actual position and dimensions including implementation details (joints, surfaces, etc.)	 Installation details and information	Update to match as-built status

C.5.7.4 Building services/MEP

Model details and content

LoD 100:

- Representation of routes including sufficiently accurate space requirements and positions
- Representation of technical assets and components (suppliers, consumers, control cabinets, etc.) for visualisation purposes

LoD 200 (builds upon LoD 100):

- Representation of functional elements with preliminary dimensions and sufficiently accurate dimensions and positions:
  - of shafts, pipes, channels and lines including routes and sloping/vertical zones
  - of installations and components including their foundations
  - of insulation, lining, bulkheading in shafts, shaft exits and main lines
  - of lines/cables, conduit, drains and minor installations

LoD 300 (builds upon LoD 200):

- Representation of functional elements with actual external dimensions and location:
  - of shafts, pipes, channels including routes and sloping/vertical zones, technical assets and components
  - of flanges, section lengths, connecting pieces, connectors, outlets, controls, regulators, engines and manifolds
  - Representation of pipe joints (no representation of bolted joints)
  - of insulation, lining, bulkheading
  - of pipes in planar systems
  - of fastenings
  - of installation zones, maintenance and inspection areas
  - conduit, drains and minor installations
  - of lightning protection systems, air terminal rods, down conductors and ring earth conductors
- Definition and representation of materials and quality

LoD 400 (builds upon LoD 300):

- Creation of all required details and information for installation
- Representation of line installation spacing and interconnections
- Representation of fastening points and suspensions

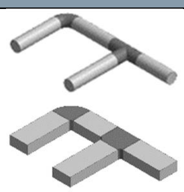
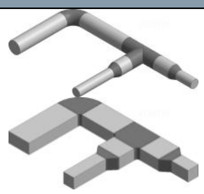
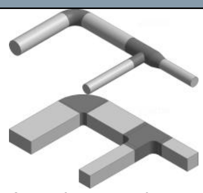
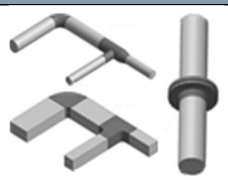
LoD 500 (builds upon LoD 400):

- Update to match as-built status

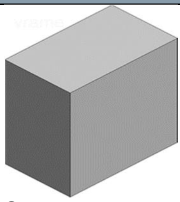
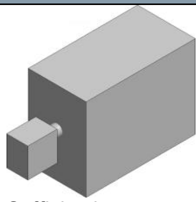
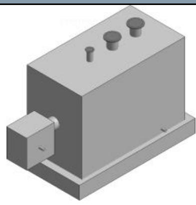
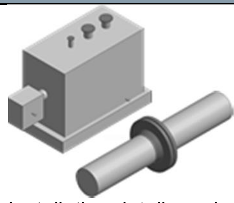
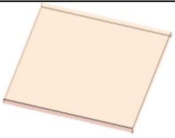
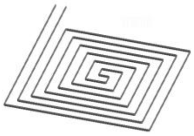
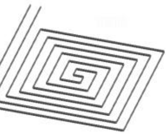
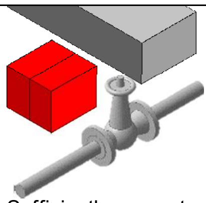
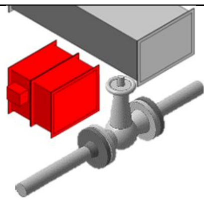
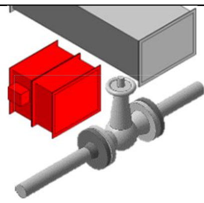
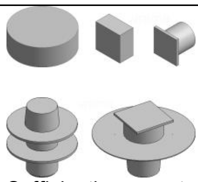
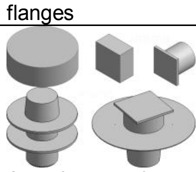
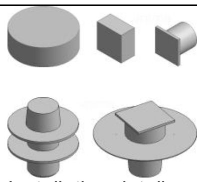
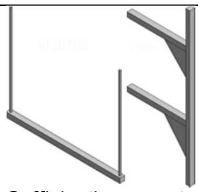
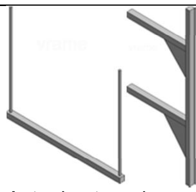
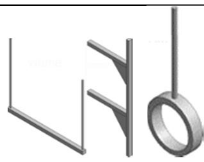
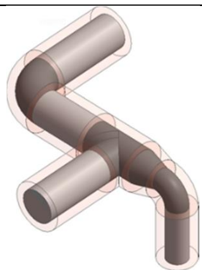
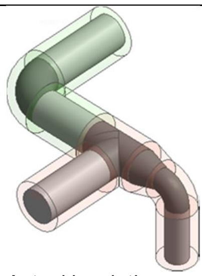
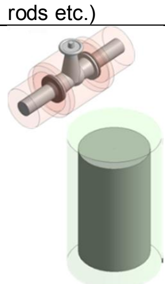
Model representation

The schematic below provides an overview of the functional element requirements and corresponding levels of detail. This information is not exhaustive in terms of deliverables and contract performance.

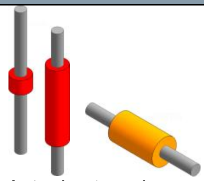
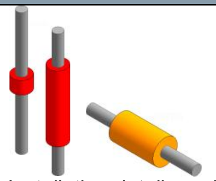
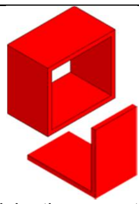
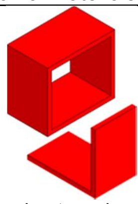
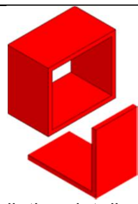
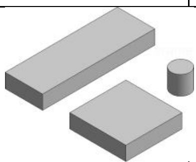
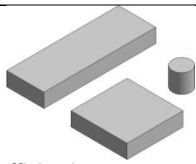
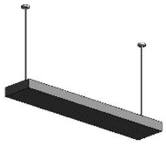
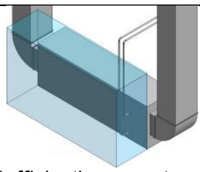
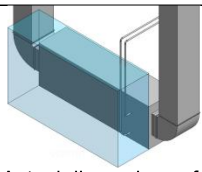
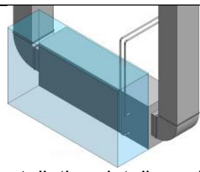
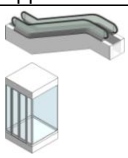
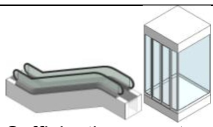
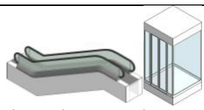
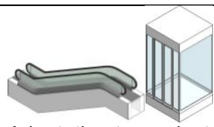
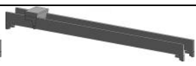
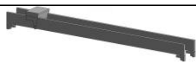
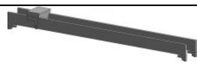
Table C-10: LoD for building services/MEP

Level of detail requirements					
Cat.	**LoD 100**	**LoD 200**	**LoD 300**	**LoD 400**	**LoD 500**
General Pipes, lines, channels. Routes, etc.	 Space requirements and position. Including special fittings where applicable.	 Sufficiently accurate external dimensions including special fittings	 Actual external dimensions including flanges, sockets and section lengths	 Installation details and information, e.g. bolted connections	Update according to as-built status

SIEMENS

Level of detail requirements					
Cat.	**LoD 100**	**LoD 200**	**LoD 300**	**LoD 400**	**LoD 500**
Technical assets/installations Suppliers, manifolds, consumers, components, others	 Space requirements and position	 Sufficiently accurate external dimensions	 Actual external dimensions including connecting sockets	 Installation details and information, e.g. connection type	Update according to as-built status
Planar systems Heating, cooling	No requirements	 Sufficiently accurate external dimensions of installation zones	 Actual external dimensions of installation zone per cooling/heating circuit	 Representation of pipes including spacing, installation type and connections	Update according to as-built status
Built-in parts Fittings, regulators, metering devices, others	No requirements	 Sufficiently accurate external dimensions	 Actual external dimensions and representation of flanges	 Installation details and information	Update according to as-built status
Minor installations Drains, alarm boxes, switches, electrical boxes	No requirements	 Sufficiently accurate external dimensions	 Actual external dimensions	 Installation details and information	Update according to as-built status
Fastenings Suspensions, supports, others	No requirements	 Sufficiently accurate external dimensions	 Actual external dimensions	 Representation of all installation details and information (threaded rods etc.)	Update according to as-built status
Insulation Piping, built-in parts, components, channels, outlets, others	No requirements	 Sufficiently accurate external dimensions (main lines only, in shafts and shaft exits)	 Actual insulation thickness. Differentiation by material (All lines)	 Installation of built-in parts and components	Update according to as-built status

Level of detail requirements

Cat.	LoD 100	LoD 200	LoD 300	LoD 400	LoD 500
Bulkheading and pass-through openings	No requirements	No requirements	 Actual external dimensions Definition of materials	 Installation details and information	Update according to as-built status
L 90 Lining/panelling	No requirements	 Sufficiently accurate external dimensions	 Actual external dimensions Definition of materials	 Installation details and information	Update according to as-built status
Lighting	 For visualisations, if applicable	 Sufficiently accurate external dimensions	 Actual external dimensions	 Installation details and information	Update according to as-built status
Maintenance Inspection and installation work	No requirements	 Sufficiently accurate external dimensions of maintenance- and inspection areas as volume bodies	 Actual dimensions of maintenance- and inspection areas as volume bodies	 Installation details and information	Update according to as-built status
Plumbing objects	 For visualisations, if applicable.	 Sufficiently accurate external dimensions	 Actual dimensions. Representation of connection points	 Installation details and information	Update according to as-built status
Lifts and escalators	 For visualisations, if applicable	 Sufficiently accurate external dimensions	 Actual external dimensions	 Adaptation to product specifications. Installation details and information	Update according to as-built status
Lifting equipment	 For visualisations , if applicable	 Sufficiently accurate external dimensions	 Actual external dimensions including connection points etc.	 Adaptation to product specifications. Installation details and information	Update according to as-built status

C.6 Quality assurance requirements

Quality Assurance describes the methods and responsibilities for creating, sharing and using data and information. Key objectives of quality assurance include:

- To improve the quality of work results
- To enable the project members to share data and information more efficiently
- To increase the granularity of data and information
- To monitor compliance with the requirements of the BIM@SRE standards and the project goals

Quality assurance requires ensuring the quality of planning and execution solutions, their consistency with the requirements of the BIM@SRE standards, and the ability to plan the construction process. It aims to reduce modifications of the plans and designs during construction and ensure the creation of a functional, high-quality building as a final project result, as well as successful handover and the availability of useful results for operation. It includes a consistent information flow without media breaks or manual manipulation of data and information.

It should be noted that additional discipline-specific or local quality standards, laws and regulations not included in these BIM requirement specifications must be adhered to. The quality assurance requirements described in the BIM@SRE Standard shall apply in addition to all other contractually-agreed regulations and do not supersede them.

C.6.1 General Requirements

C.6.1.1 Test runs

Before the planning stage can be initiated, the responsible BIM Manager must check the internal coordination of the cross-discipline planning and quality assurance mechanisms jointly with all disciplines involved. In particular, the following should be checked:

- Compatibility of discipline-specific models
- Use of common coordinates (project zero point)
- Use of a common centre-to-centre grid
- Use of common units of measure for the model and the functional elements
- Compatibility of cross-discipline data and information
- Use of common project templates

C.6.1.2 Use cases

3D models used for clash detection must meet the requirements for the 3D model. This is contingent upon the establishment of a suitable quality assurance procedure applied by all disciplines to ensure adherence to the BIM modelling standard as well as achievement of the desired model quality.

The requirements for clash detection are defined in the must-have BIM use cases "Clash Detection" and "Soft Clashes/Clearances".

During the course of the construction process, information such as quality assurance data, e.g. acceptance data, and any deficiencies detected are recorded. The holistic approach includes direct digital creation of all technical documents; at the least, however, the GC should link digitalised documents with the 3D model so they are accessed automatically. This ensures traceability of the construction process and the associated elimination of defects.

The requirements for handling defects are defined in the must-have use case "punch list".

C.6.1.3 Collaboration

In connection with the BCF (BIM Collaboration Format) method, all annotations are managed centrally and linked to the 3D models. The BCF process is described in the Data Management chapter. Using this model-based collaboration method ensures that current annotations, problems and deadlines including the respective responsibilities will be duly noted. The method thus supports continuous, transparent visibility of the delivery status across all disciplines. Collaboration practices must adhere to the specifications of the BIM Data Management rules.

C.6.2 Quality assurance methods

There are essentially two BIM quality assurance methods. They can be subdivided into two main categories:

C.6.2.1 Verification procedure

The verification process involves methods to validate the accuracy of the information contained in a model file. Quality assurance serves the purpose of ensuring in a traceable manner that the BIM model was built according to these requirements. In particular, verification includes the following checks:

- Clash detection
- Model-based functional checks
- Compliance with regulations, in particular the BIM@SRE standards
- Geometric completeness (LoD)
- Completeness of information (LoI)
- Others

C.6.2.2 Analytics

The analytical procedures relate to the utilisation of the BIM models in implementing the must-have BIM use cases. The quality and accuracy of the models must be validated in a traceable manner, in particular covering the following items:

- Costs and calculations
- Planning status
- Construction progress monitoring
- Quantity checking
- Others

C.6.3 Deliverables

C.6.3.1 Handover

The data deliverables for quality assurance always verify adherence to the specifications in the BIM Execution Plan and are structured as follows:

- Handover of documents for project meetings
- Handover of documents for approval of a planning stage
- Intermediate deliverables required by SRE (e.g. model-based inspections)

C.6.3.2 Incoming and outgoing document checks

The project specific deliverables are always checked for compliance of the 3D models with the specified requirements.

It is explicitly stressed that:

- SRE's validation of incoming documents never replaces the service provider’s pre-delivery check. The service provider thus remains responsible for the quality and results of its planning and design work.
- SRE may at any time request data and will generally validate all data submitted.

C.6.3.3 Review reports

Proof of successful quality control must be submitted by the responsible BIM Manager in the form of a review report. The content of a review report depends on the applicable must-have BIM use case.

C.6.3.4 Tasks and responsibilities

Internal quality assurance of BIM models is the sole responsibility of the respective service provider. General Design – respectively the General Constructor – must submit to SRE all relevant data together with the review report at the project-specific data drops. Deliveries are checked by the Information Manager for compliance with the applicable requirements of the BIM@SRE standard, whereupon the Information Manager may give an approval recommendation to SRE’s project managers. The validation by the Information Manager does not supersede the contractors accountability for the integrity and consistency of the content and results of its planning work and is not equal to an acceptance or partial acceptance.

Chapter D:

Data Management

D Data Management

D.1 General Requirements

D.1.1 Data security

To uphold the safety and security of all data, the Siemens guidelines shall be applied and adhered to.

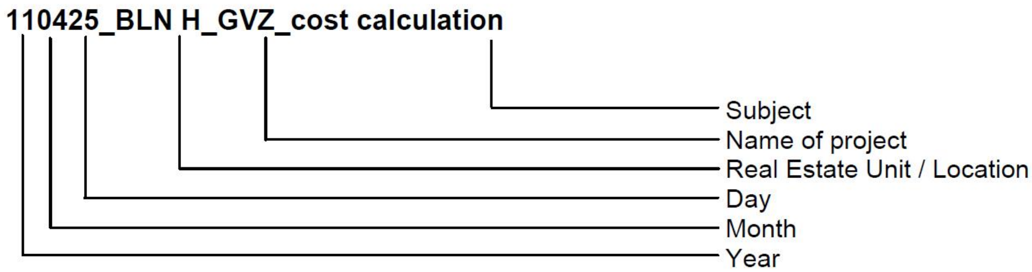
D.1.2 Intellectual property and copy rights

The contractor shall assign to the Principal all rights of use, exploitation and modification in all project-specific documents and deliverables the contractor has created without limitation in terms of time or territory. Siemens shall be entitled to use and/or change the contractor's documents and deliverables without the contractor's involvement. The Principal may assign his rights of use, exploitation and modification to third parties. The contractor warrants to the Principal that his performance under this contract is free of third-party rights, and shall hold the Principal harmless against any third-party claims for violation of intellectual property rights and ancillary copyrights or any other rights of third parties.

The 3D models and all functionalities or information derived from them shall be the sole property of the Principal. The contractor shall transfer all data for the Principal's unlimited use. The Principal shall expressly be under no obligation to name the author or originator of the 3D models. The contractor agrees not to publish any parts of the data without the Principal's written permission.

D.1.3 File naming conventions

For the purposes of sharing and delivering files and data, all files shall be named by General Design and the General Constructor according to the following conventions:



FigureD-1: Naming standard for files and documents

All project members shall comply with the mutually agreed naming conventions for the project without exception throughout the entire duration of the project. This applies especially to the Principal's requirements with regard to delivery and filing structures.

General Design, respectively, the General Constructor shall define deviations from and amendments to the naming conventions for the 3D models and any documents derived from them (2D drawings, lists and additional evaluations) as applicable. Such deviations shall be agreed with the Principal and documented in the BIM Execution Plan.

Depending on the BIM use case it may be necessary to define additional naming conventions for other components of the BIM tools used, especially when using information for additional processes:

- Floor and level designations
- Names of model elements (in particular, layers, families and family types)
- Materials
- Others

In addition to the requirements described above, the name of every functional element in the 3D model shall reflect its properties/characteristics with due consideration of the use cases as described.

D.2 Classification and information standards

D.2.1 Classification standard

The applicable classification standard defines the structure for all information and provides a structured approach to classifying building information, allowing information items to be grouped and assigned to hierarchies based on common properties. The classification standard arranges the building elements and systems of the 3D model based on logical relationships. The elements and systems themselves consist of individual functional elements which describe products and their respective properties. Depending on the region, all functional elements contained in the 3D model are classified according to Uniclass2015 or OmniClass™. To achieve this, the following separate attributes must be defined for each element within the 3D model:

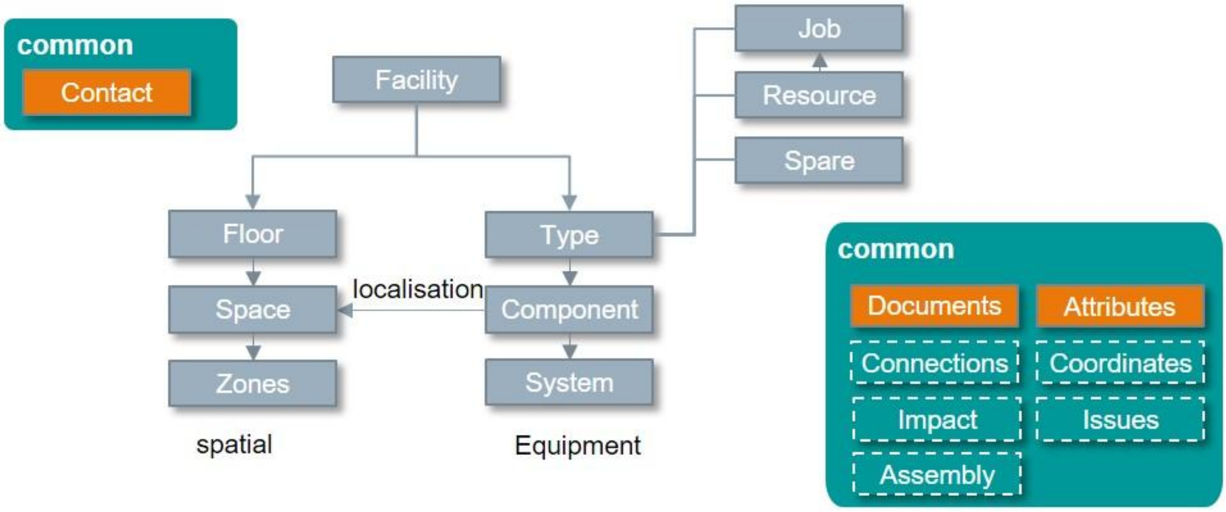
- Uniclass2015 Table Ss- Systems and Uniclass2015 Table Pr- Products – for countries such as Germany, United Kingdom etc.
- OmniClass™ Table 21 Elements, OmniClass™ Table 23 Products – e.g. for USA

All rooms contained in the 3D model are classified according to the room categories of the SRE Framework Standard. The classification standard shall be agreed under the responsibility of the BIM Manager with SRE Project Management, and documented in the respective BIM Execution Plan.

D.2.2 Information standard

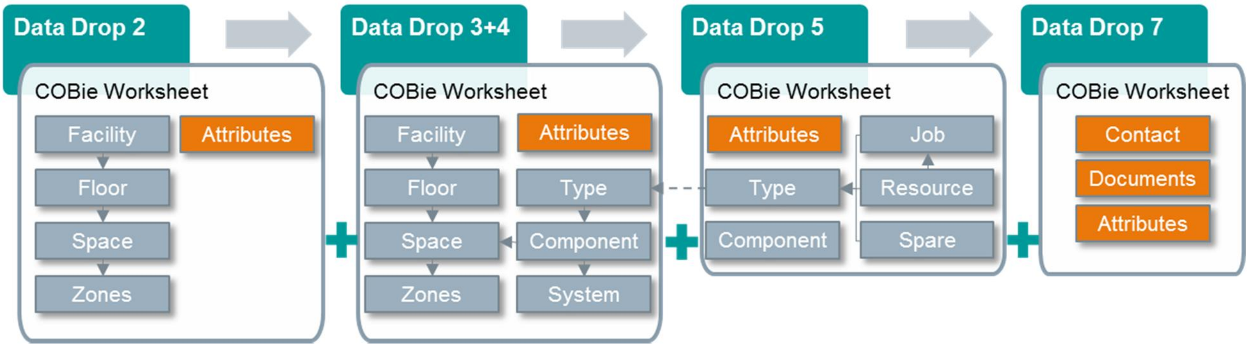
COBie (Construction Operations Building Information Exchange) is a data standard for building information (BIM) that defines nongeometric attributes specifically for the needs of facility management. The applicable COBie information standard is a specification addressing specifically the handover of building information to the operator based on the classification system. Its focus is on the description of the rooms and building services (MEP) rather than geometric information so as to support the tendering process for, and the performance of, operation and maintenance services on functional elements.

The COBie standard accelerates and simplifies the automated exchange of information between the construction (BIM) and operation (CAFM) of the building. The ability of these systems to share information harbours significant savings potential in terms of building lifecycle costs. BIM systems provide a host of valuable information to CAFM systems for purposes such as maintenance management, remodelling, space management or sustainability management. Typical information transferred through COBie include the type of a technical asset or component, its manufacturer, the serial number or the maintenance interval. COBie data is supplemented by linked electronic documents such as operator or maintenance manuals or engineering drawings for individual pieces of equipment.



FigureD-2: Schematic of the required COBie information standard

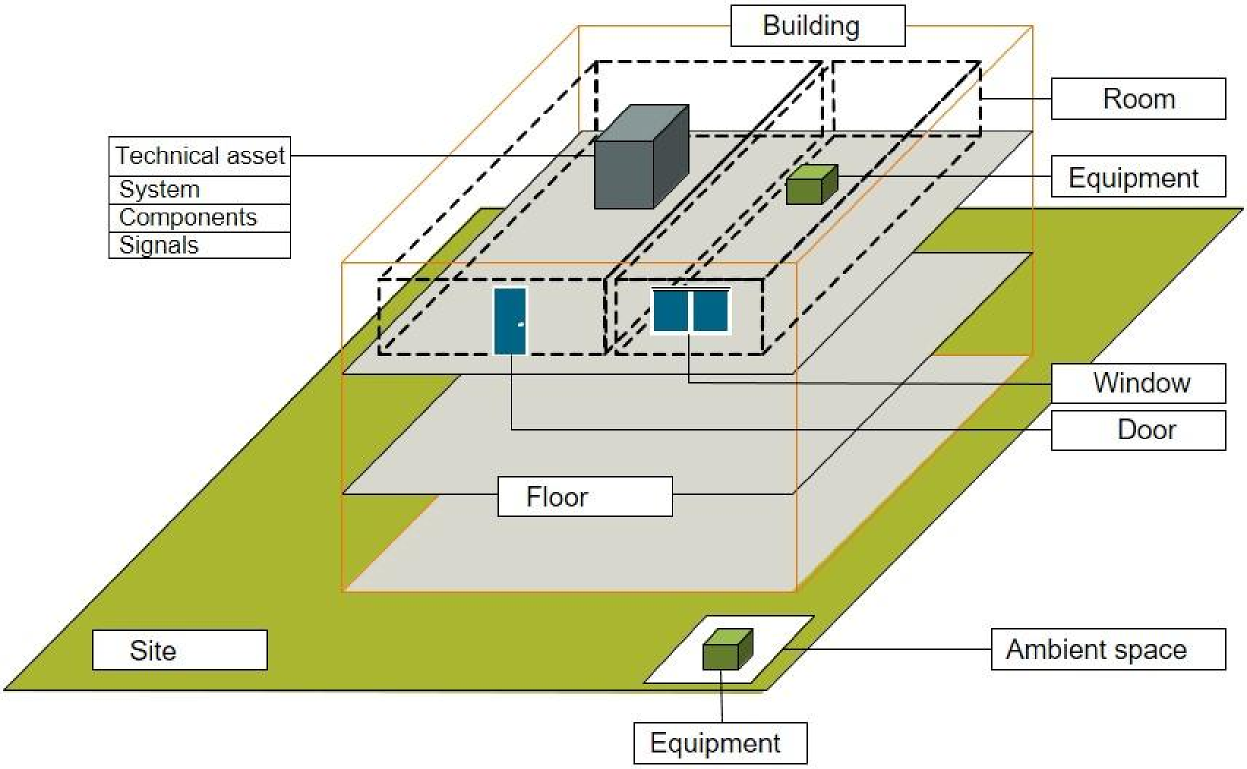
The COBie standard is the required information standard across all project phases.All relevant functional elements and technical assets are to be submitted via the 3D model in COBieLite XML format. Based on the COBie standard the responsibilities for compiling and submitting information are defined as follows:



FigureD-3: Responsibilities for submitting COBie worksheets

D.2.3 Specifications

The service provider's BIM Manager responsible for the deliverable shall agree the level of information on the required COBie worksheets with the Information Manager. The level of information shall be documented in the relevant BIM Execution Plan. As a minimum however, the requirements described in the must-have BIM use cases and the modelling standard must be met.



FigureD-4: Explanation and representation of relevant functional elements

D.2.3.1 Cost-driving and LCC-relevant functional elements

All requirements spelled out in the:

- 5D cost benchmark and
- 6D Life Cycle Costs

must be reflected in the COBie. Provided that the required attributes are not consistent with the standard, they must be allocated using the Attributes worksheet.

D.2.3.2 Rooms, zones and equipment

In addition to the attributes required by the COBie standard, the following use cases must be accounted for:

- Soft clashes / clearances,
- Room schedule,
- Room categories, and
- Interface to Facility Services

In the event that the requested attributes are not consistent with the COBie standard, they must be allocated using the Attributes worksheet.

D.2.3.3 FM/FS-relevant functional elements and technical assets

Within the 3D building model, a building services system structure is ensured through the COBie standard which reflects the overall functionality of all installations involved. The purpose of this system structure is to interlink all technical assets, components and systems via the COBie standard to provide insight into the interdependencies within the FM/FS processes.

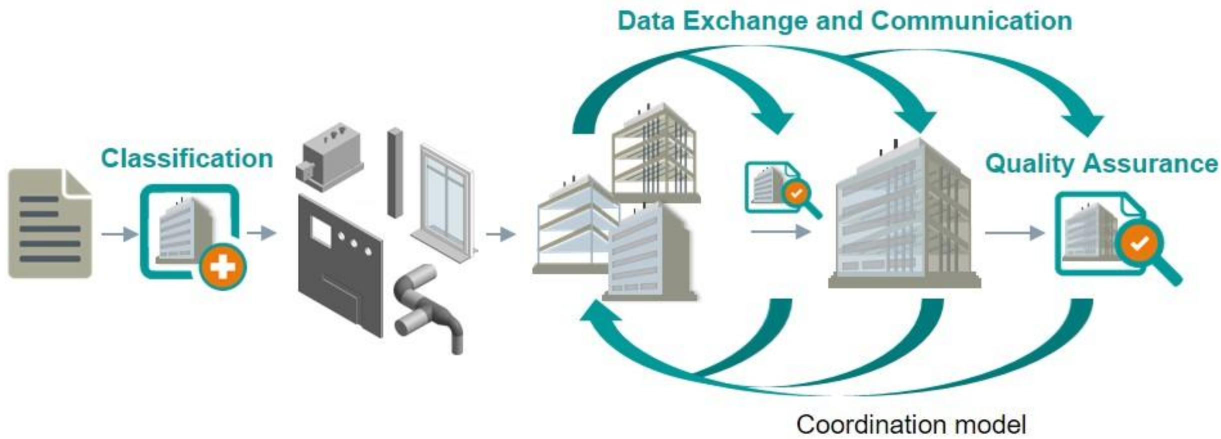
All requirements called for in the:

- Equipment schedule and
- Equipment Information

must be reflected in the COBie. If the required attributes are not consistent with the standard, they must be allocated using the Attributes worksheet.

D.3 BIM data management systems and tools

D.3.1 Creating models and data during the planning stages



FigureD-5: System environment for creating models and data during the planning stages

D.3.1.1 Model building tools

Unless provided otherwise, Autodesk Revit is the model building tool to be used throughout the project. The responsible contractor shall document the agreed software version in the BIM Execution Plan at the point of contract closing. The same software version shall be used from the onset of the project until its end. If General Design or the General Constructor intends to switch to another software version after the project has been initiated, SRE approval shall be required.

Conceivably, in some projects some of the additional planners or designers (e.g. those in charge of furnishings or process equipment) may be unable to support the .rvt software format. The project members shall make sure that the software used to create the affected models enables efficient exports of the agreed version of Industry Foundation Classes, but at the least IFC2x3 TC1. The IFC core model is described in ISO specification ISO/PAS 16739.

The responsible BIM Manager shall agree the relevant requirements with the project members and document the outcome in the BIM Execution Plan.

D.3.1.2 Classification tool

It is one of the core requirements of BIM@SRE that the data and information created during the planning and execution phases must be available in a form which can be used by facility management. In particular, the requirements of the must-have BIM use cases and the modelling standard must be met.

Consistent adherence to the classification requirements shall be ensured by filling in the required functional element attributes. Classification may be performed using add-on tools (Autodesk Revit add-ins).

Error-free fulfilment of the defined requirements must be insured by appropriate measures taken by the contractor.

D.3.1.3 Data exchange and communication system

For the duration of project execution, General Design and the general constructor shall provide and use a centralised data exchange and communication platform (plus a BIM server or similar if applicable) for the planning and construction processes.

The respective BIM manager shall define in the BIM Execution Plan the document and data creation, sharing and distribution processes so as to establish standardised procedures and ensure timely submission of information. Among other items, the milestones, roles and responsibilities for the exchange of information shall be described in the BIM Execution Plan.

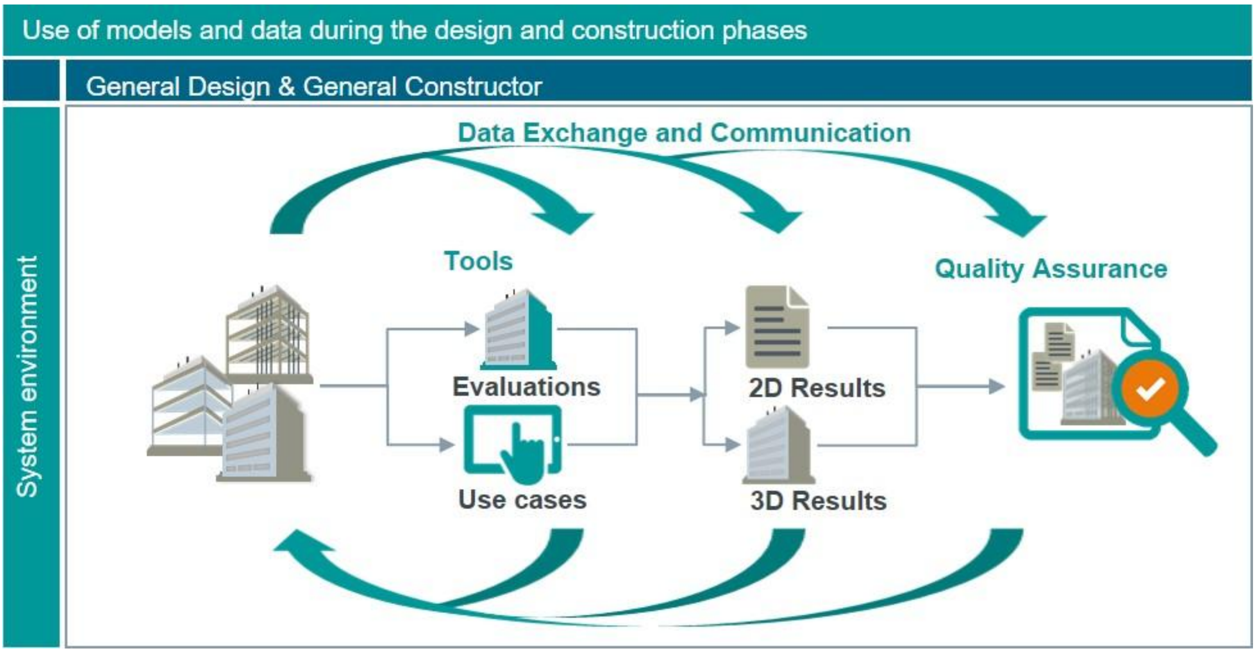
D.3.1.4 Quality assurance software on the contractor side

The results of the individual, discipline-specific planning processes shall be merged in a coordination model (e.g. using Solibri MC, Navisworks, Tekla BIMsight, etc.), and validated in terms of quality and quantity. The quality assurance requirements and the associated processes shall be described in the modelling standard.

The responsible BIM Manager shall document the following software information in the BIM Execution Plan:

- Name of the quality assurance software used
- File formats used for quality assurance purposes
- Software version used

D.3.2 Use of models and data during the planning and construction phases



FigureD-6: System environment for the use of models and data during the planning and construction phases

D.3.2.1 Software for evaluating results

Evaluations generated from the 3D model (lists, plans, etc.) must be generated on the basis of the 3D model as well as the associated model building tools (Autodesk Revit).

In particular, the following use cases must be accounted for:

- 5D Cost Benchmarks
- 6D Life Cycle Cost
- Bill-of-quantities and Specification
- Room Schedule
- Equipment Schedule
- Documentation
- Updates

Conceivably, in some projects additional, non-specified software may be used for evaluation purposes. This must be agreed with SRE and documented in the BIM Execution Plan by the responsible BIM Manager.

D.3.2.2 Software used for implementing use cases

To implement some of the use cases, contractors will need certain software applications. In particular, contractors must provide software for the following use cases:

- Collaboration and coordination
- Clash Detection
- Simulations
- Punch List
- 4D Scheduling

All software used to implement BIM use cases must be stated in the BIM Execution Plan, indicating the purpose. In particular, the responsible BIM Manager shall document the following software information:

- The name of any software used to implement the use cases
- File formats used
- Software version used

As a general rule, switching to another software version during the course of a project is not permitted. The software version chosen must be used throughout the project from its beginning until the end. If the contractor intends to switch to another software version or software product at some point during the project, SRE approval must be obtained.

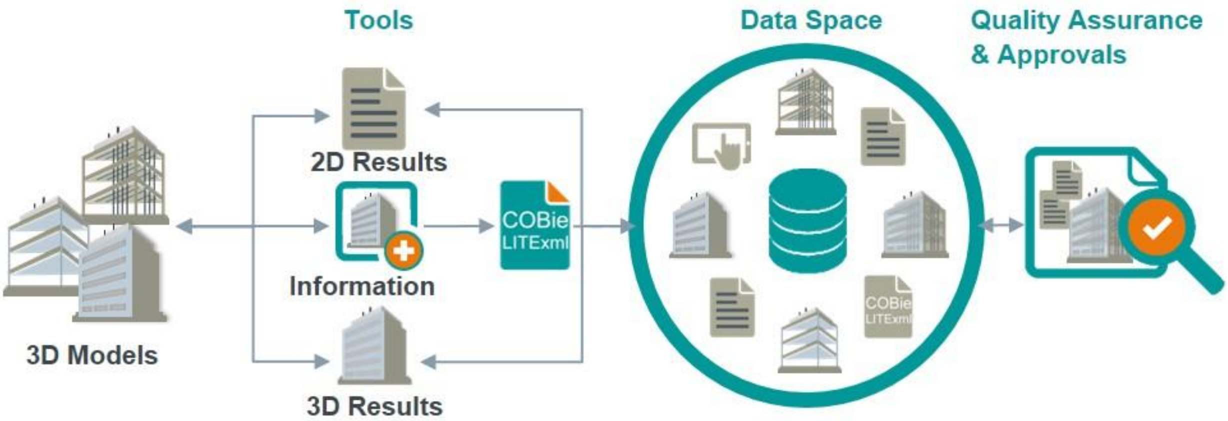
Software access and access privileges must be granted to SRE Project Management, the external project management service and the Information Manager.

D.3.2.3 Data exchange and communication system

For the duration of project execution, General Design and the General Constructor shall provide and use a centralised data exchange and communication platform (plus a BIM server or similar if applicable) for implementing the BIM use cases (also refer to chapter D.3.1.3 Data exchange and communication system).

The respective BIM manager shall define in the BIM Execution Plan the document and data creation, sharing and distribution processes applied in implementing the BIM use cases.

D.3.3 Model and data deliveries during the planning and construction phases



FigureD-7: System environment for model and data deliveries during the planning and construction phases

D.3.3.1 Data space

The contractor shall deliver and archive all deliverable data as agreed in the required format using the data space created by the Principal.

The project members shall be granted Internet access to the data under assigned access privileges. The project platform shall provide:

- Online access to data from any location
- Data security: Managed access for all relevant stakeholders with access privileges granted at the user level
- Data backups: All data shall be archived and backed up according to defined rules.
- Data versioning
- Incorporation of digital forms
- Management of document types (including 3D models, construction drawings and forms for construction documentation)

Inadequate or illegible data must be corrected/completed to the agreed extent and in the agreed format within the agreed timeframe. Any data not conforming to the procedures defined in this document are considered as not delivered.

The data submission plan to be prepared by the contractor as part of the relevant BIM Execution Plan shall form the basis for the coordination of work between the contractor and the Principal and shall be submitted as part of the project-specific BEP before the contract is signed. General Design and the General Constructor shall be responsible for the consistent use, addressing, completeness and conformity of all document and data submissions on the IT side.

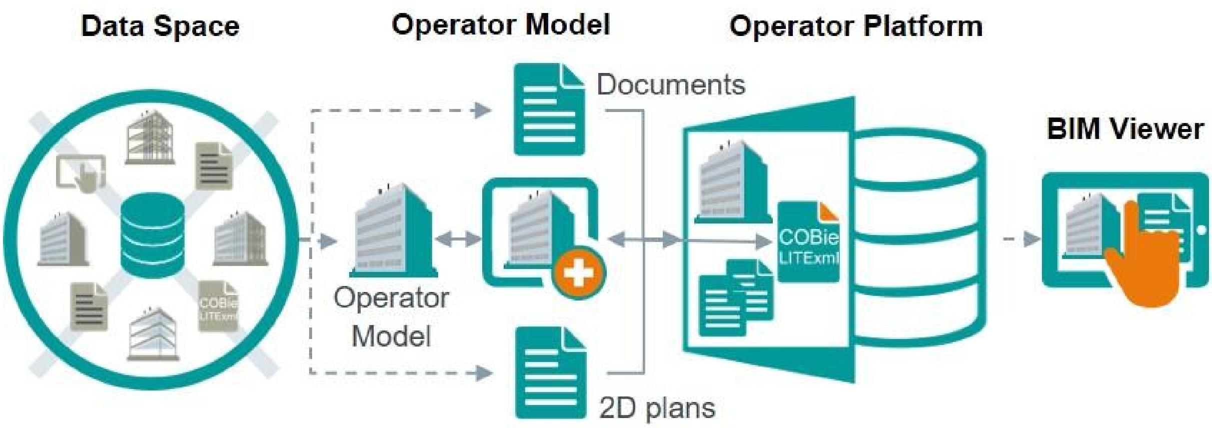
D.3.3.2 COBieLite XML

The COBie standard is the required information standard across all project phases. The documentation shall be handed over via the 3D model and the interface provided by the operator platform (Autodesk Revit add-in) in COBie XML format (also refer to chapter D.3.1.2 Classification tool).

D.3.3.3 Quality assurance software and approvals by SRE

BIM data deliveries shall be quality-checked by the Information Manager who will give an approval recommendation to SRE Project Management. For this purpose, the Information Manager shall provide appropriate quality assurance software (also refer to chapter D.5 Collaboration and Communication Structures).

D.3.4 Use of models and data during operation



FigureD-8: System environment for using models and data during operation

D.3.4.1 Data space

The data space provided by the Principal (also refer to chapter D.3.3.1 Data space) still contains the entire 3D documentation (“Documentation” use case) created by the General Constructor. Following handover of the documentation to Operations, all data is archived and the data space is closed. The FM service provider must ensure that all relevant data is transferred to the operator platform.

D.3.4.2 Information transfer tools

In addition to classification (chapter D.3.1.2 Classification Tool), the transfer of information from the operator model to the operator platform is accomplished via the 3D model and the interface provided (Autodesk Revit ad-in) in COBie XML format.

Questions to be asked: as in the case of the process map, who should generate the operator model from the "as built" model? In our opinion this should be the responsibility of the FM service provider, in which case the Information Manager should perform the quality check!? Or should the General Constructor generate the operator model, integrating COBie, maintenance-relevant documents, plans, etc. into the operator platform?

D.3.4.3 Operator platform

An operator platform shall be provided by the Principal for the FM processes. The interface to the 3D model (Autodesk Revit ad-in) should be integrated into the platform. At the same time, handover of all relevant operator information in COBieLite XML format (also referred to chapters D.3.1.2 Classification tool and D.3.3.2 COBieLite XML) shall be ensured.

The operator platform will store the 3D documentation for the FM processes (refer to Use Case 17 "3D Documentation") in the internal database. This will in particular ensure proper interlinking of various different file formats throughout the platform (e.g. maintenance-relevant documents with 3D functional elements).

The operator platform will provide a tablet model viewer application for the following FM processes:

- Space Management
- Asset Management
- Maintenance Management

This will ensure that the following use cases can be evaluated for FM processes:

- Soft clashes / Clearances
- Room Schedule
- Classification of rental spaces
- Interface to Facility Services
- Equipment Schedule
- Equipment Information
- Documentation

D.4 Data Drops

D.4.1 Data Drops – Data Deliverables

To structure the data handover process, so-called data drops have been defined. These are specific deadlines for submitting graphical (e.g. 3D models) and alphanumeric information. Data Drops specify the BIM deliverables for the respective use case, the relevant formats, and the type of information to submit.

Arranged around the PM@SRE phases, the data drops describe:

- the objectives of each project phase,
- the coordination, processing and reviewing processes in each project phase,
- the decision-making and approval processes of each project phase, and
- the documentation (BIM deliverables), including the relevant formats, for each project phase.

If the contractor is required to provide additional deliverables (e.g. for individual use cases) at Data Drops, such deliverables must be defined in the project-specific BIM Execution Plan (BEP). The table below specifies the Data Drops.

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Table D-1: Data Drops

Data Drops		
Data Drop	**Description**	**Timing**
Data Drop 1	Demand Clarification; Preparation & Brief	Demand Clarification; Preparation & Brief
Data Drop 2	Conceptual Design	During Conceptual Design phase At the time of Conceptual Design approval
Data Drop 3	Development	During Development phase At the time of Development approval
Data Drop 4	Technical design and award of construction works	During Technical Design phase When construction works are awarded At the time of Technical Design approval
Data Drop 5	Construction	During FM/FS tendering process
Data Drop 6	Construction	During Installation Planning phase During Construction phase At conclusion of Technical Design phase
Data Drop 7	Acceptance and Handover	At time of handover and documentation ("as built")
Data Drop 8	Operation	Operation start-up
Data Drop 9	Operation	During operation of the building. During or after structural or spatial modifications (e.g. remodelling)
Data Drop 10	Sale	During preparations for sale, to establish a basis for the sale
Data Drop n	Further Data Drops	according to project requirements

The data handover processes are described in the use cases. The responsible BIM Manager shall determine in the BIM Execution Plan who hands over what data to whom, when, for whom, how, and for what practical purpose.

Prior to handover to SRE, the 3D model data shall be prepared at least as follows:

- Data must be cleansed
- References not conforming to handover requirements must be removed
- Each 3D model must be editable independently

The BIM model shall be handed over as an overall model. Where appropriate, models may be split. This shall be agreed between the BIM Manager and the Information Manager prior to project launch, and documented in the BIM Execution Plan.

Before the models are handed over at the agreed time, all irrelevant parts and components (e.g. auxiliary bodies) shall be removed from the model by the service provider. The same shall apply to all reference models from other disciplines. The discipline-specific models to be handed over to the Principal may only contain model elements which where created or added by the respective discipline.

D.4.2 Handover of 3D models

The services to be rendered include continuous development of the 3D models as planning and execution progress. Furthermore, the processes and use cases to be developed for the planning and execution phases shall be incorporated, achieving the best possible ratio of costs versus benefits.

For archiving, the 3D model shall be submitted at the data drops specified below. Any intermediary submissions shall be subject to the use cases. At specified milestones, and subject to the specified requirements, the contractor shall submit to the Principal and archive the most current version of the model. In particular, these are:

Table D-2: Model submissions and responsibilities

3D models			
Models	**Time of submission**	**Deliverables**	**Responsibilities**
3D conceptual design models	Data Drop 2	Discipline models & Consolidated model in native format (.rvt)	General Design (GD)
3D permitting model	Prior to Data Drop 3, along with building permit	Consolidated model in native format (.rvt)	General Design (GD)
3D Development models	Data Drop 3	Discipline models & Consolidated model in native format (.rvt)	General Design (GD)
3D technical design models	Data Drop 4	Discipline models & Consolidated model in native format (.rvt)	General Design (GD)
3D construction models	Data Drop 6	Discipline models & Consolidated model in native format (.rvt)	General Constructor (GC)
3D "as built" models	Data Drop 7	Discipline models & Consolidated model in native format (.rvt)	General Constructor (GC)
3D operator model	Data Drop 8	Consolidated model in native format (.rvt)	FM provider

These models will be used by the respective service providers during the BIM performance phases as key resources for the specified use cases. The required General Conditions and procedural guidelines for deliveries shall be defined in advance in the BIM Execution Plan by the service provider and require approval by SRE. During the entire project execution phase the models are used to monitor and ensure adequate coordination of all trades.

All models must be updated continuously, i.e. the models as well as the information they contain shall be kept up to date, and all changes shall be entered without delay. The 3D models shall be created by the respective service provider pursuant to the modelling standard and comprise all required trades and deliverables.

D.5 Collaboration and Communication Structures

D.5.1 Objectives and added value

To support decision-making processes and define the resulting tasks and responsibilities, the 3D models shall be used consistently as collaboration and communication tools throughout all planning stages. In connection with the BCF (BIM Collaboration Format) method, all annotations are managed centrally and linked to the 3D models. Using this model-based collaboration method ensures that current annotations, issues and associated deadlines including the respective responsibilities will be duly noted. This approach supports continuous, transparent visibility of the delivery status across all disciplines.

In particular, the following processes shall be adopted and reflected in the models:

Planning meetings

The BCF approach improves the transparency of the periodical planning meetings for all parties involved, enhances communication and supports interdisciplinary collaboration. This encourages the sense of responsibility among all project members.

Model-based inspections for building owner meetings and user coordination

Coordination meetings with the Principal, the User and the FM Consultant shall be scheduled during the draft and execution planning periods and communicated to the parties involved in the planning process along with the resulting annotations in conjunction with the model. This ensures that any issues and all responsibilities (such as directions to the planner which are relevant for the operation of the building) will be communicated error-free to all project members.

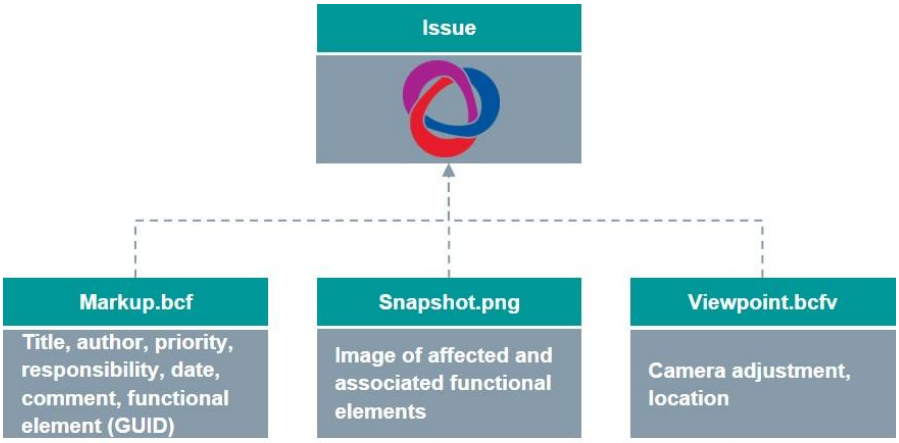
Verifications and acceptance checks (e.g. design reviews)

Using the models for design reviews and acceptance checks reduces the communication effort and the likeliness of errors occurring between the originator and the reviewer. In addition, it avoids a large number of documents needing to be synchronised with plan lists.

D.5.2 Requirements

Milestones relevant for decision-making shall be created in BCF (BIM Collaboration Format), recorded and then implemented by the responsible parties following contract award.

A BCF contains one annotation or issue related to the BIM model.



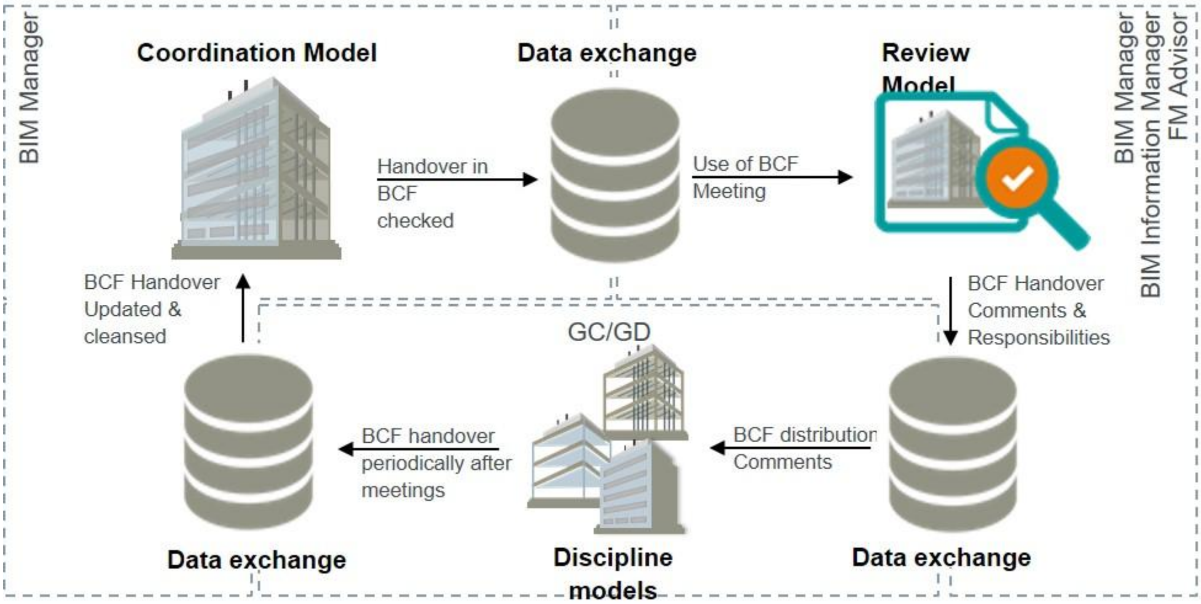
FigureD-9: BCF procedure

Data in BIM Collaboration Format comprise information on all parameters required to represent an issue in a 3D model or capture and render it comprehensibly. This information consists of the name of the author, descriptive comments and the identification of the affected functional elements. In addition, it includes viewing angle settings (location in the 3D model) as well as settings related to the objects shown and the view itself.

The 3D model handover times for the regular planning meetings and the parties responsible for handover shall be documented in the BIM Execution Plan by GD and the GC.

General Design and the GC shall submit the models for building owner and user coordination meetings in cleansed form. The times for submitting consolidated, validated models shall be determined and documented in the BIM Execution Plan by the responsible BIM Manager upon liaising with the Information Manager.

D.5.3 Collaboration process



FigureD-10: BCF Process

The responsibilities for creating the review model may vary from one process to another. The respective BIM Manager shall be responsible for the planning meetings.

in the case of model-based inspections for the purposes of user coordination, reviewing and acceptance by SRE, the Information Manager shall be responsible for the review model and the creation of the associated BCF (refer to the quality assurance requirements set forth in the modelling guideline). The data exchange systems may vary along with the responsibilities. The contractor's data exchange and communication system shall be used for planning meetings (chapter D.3.1.3 Data exchange and communication system). The data space provided by the Principal shall be used for user coordination meetings, reviews and acceptance checks (chapter D.3.4.1 Data space).

SRE Project Management/external project management service: The external project management service shall be in charge of scheduling the model-based planning and user coordination meetings. It shall notify General Design and the General Constructor in a timely fashion at the beginning of each planning phase about the dates set. The external project management service shall participate in planning meetings and inspections.

Information Manager: The Information Manager shall participate in model-based inspections. The Information Manager shall keep the minutes via BCF and assign annotations or issues to the parties responsible for planning. The Information Manager shall perform model reviews prior to giving approval recommendations, and provide technical support to the external project management service for approvals etc.

General Design (GD): General Design shall record the handover times and the regular planning meetings in the BIM Execution Plan and provide the consolidated coordination models for model-based inspections. Following each meeting, GD shall incorporate the recorded annotations and results via BCF. GD shall provide the consolidated coordination models for model-based planning meetings, record annotations via BCF, and assign responsibilities. GD shall subsequently incorporate the annotations.

General Constructor (GC): The General Constructor shall record the handover times and the regular planning meetings in the BIM Execution Plan and provide the consolidated coordination models for model-based inspections. Following each meeting, the GC shall incorporate the recorded annotations and results via BCF.
The GC shall provide the consolidated coordination models for model-based planning meetings, record annotations via BCF, and assign responsibilities. GD shall subsequently incorporate the annotations.

FM Provider: No deliverable.

Other parties: Where applicable, discipline-specific planners/designers (furnishing planners, process equipment planners, etc.) may participate in model-based inspections. The FM Consultant shall participate in model-based building owner and user coordination meetings and support the external project management service and the Information Manager.

Chapter E:

Glossary

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E Glossary

E.1 Definitions

Expression	Description
BIM Model	The BIM model is a virtual model of the building and a digital image of the physical and functional properties of the actual project. It is a comprehensive three-dimensional computer model combining all the geometric and other descriptive characteristics of the model elements. In this document, it is referred to as the 'BIM Model'. This term may be used to describe a model element, a specific partial model or a consolidated model composed of several integrated partial models. A model element is an element or a group of elements within the 3D model that represents physical (e.g. a wall), functional (e.g. a room), or an abstract (e.g. a load) design component or a combination thereof (a system, a group). A partial model is a discipline-specific model (e.g. architecture) or a processing-specific model (e.g. 4D scheduling) which primarily contains model elements of a design view or for a specific purpose.
Use Case	Describes the functionality – i.e. the services and other deliverables to be submitted – from the perspective of the project / company. Use cases are user-driven, providing the information relevant to the user (digital data: graphical and/or numerical) in a process.
Room Schedule	The 3D Room Schedule is the totality of room information contained in the 3D model or in the lists/database which supplement the 3D model. This room-specific information is fully and uniquely interlinked via the room number of the 3D model. The 3D Room Schedule documents planning results in the 3D model which are used to control/monitor the construction performance targets as well as the results of the construction work for the purposes of building operation upon completion.
Data Drop	The Data Drops describe the BIM deliverables for each project, the relevant formats, and the type of information to submit. In addition to the models, the deliverables may also comprise plans, further analyses and reports. A thoroughly specified and submitted Data Drop supports clear communication of the delivery requirements.
Service Provider	In the BIM@SRE standards, General Design, the General Constructor and the FM Provider are collectively referred to as "service providers".
Classification and Information Standard	The BIM@SRE classification standard defines the structure for building information and provides a structured approach to classifying building information, grouping information items based on common properties. Information is grouped and structured in hierarchies: The BIM@SRE classification standard is structured logically according to the rooms and systems of buildings. The systems themselves consist of individual functional elements which describe products and their respective properties. The BIM@SRE information standard is a specification addressing specifically the handover of building information to the operator based on the classification system. It largely ignores geometric information; rather, the focus is on descriptions of the rooms, technical assets and building services, with the particular aim of supporting the operation and maintenance of functional elements.
3D Development Models	The 3D development models form the basis of feasibility checks, comparisons of variants, and visualisations during early project stages. They are used during the project definition stage when liaising with the user.
3D Conceptual	The 3D conceptual design models are to be developed based on the 3D

Design Models	development models. They continue to evolve until the end of the conceptual design phase. The 3D conceptual design models consist of individually delivered, discipline-specific models and one Coordination Model.
3D Permitting Model	The 3D permitting model is generated from the 3D conceptual design model. It documents the planning status at the time the building permit is issued (refer to "Building Permit" use case).
3D Technical Design Models	The 3D technical design models are to be developed based on the 3D conceptual design models. They are continually updated until the end of the technical design phase. Integrated as a coordinated 3D model, they form the basis for awarding the contract to the GC. The 3D Technical Design models consist of individually delivered, discipline-specific models and one Coordination Model.
3D Construction Models	The completed 3D construction models represent the solution which is ready to execute, based on the previous development of the 3D technical design models. The 3D construction model is the final solution for construction execution. The 3D construction models consist of individually delivered, discipline-specific models and one Coordination Model.
3D “As-Built" Models	Following the construction planning process, the 3D construction models are transformed into 3D “as-built" models step-by-step in parallel with construction progress. As-built models represent the status of the building at the respective stage of completion. The as-built 3D models are to provide a structured, consistent and comprehensive data basis which facilitates handover of the as-built project documentation once construction is completed. Furthermore, these models should anticipate and support the requirements of the FM processes. 3D “As-Built" models consist of individually delivered, discipline-specific models and one Coordination Model.
3D Operator Model	The 3D operator model is an integrated model intended for integration into the operator platform and for use by Facility Management (FM). The operator model only comprises information and geometries relevant to FM.
BIM Manager	Refer to chapter B.3 “BIM Roles, Responsibilities And Tasks”, section B "General Conditions".
Consolidated Model	The result of integrating all or specific partial models for joint viewing and evaluation (e.g. for process planning or clash detection).
Parameter/Attribute	A parameter/attribute is a specific property/concrete parameter/attribute of a model element; a non-geometric property of a model element. A model element is uniquely defined by all of its parameters/attributes.

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E.2 List of Abbreviations

German acronym	Description	English acronym	Description English
2D	zweidimensional	**2D**	two-dimensional
3D	dreidimensional	**3D**	three-dimensional
4D	vierdimensional	**4D**	four-dimensional
5D	fünfdimensional	**5D**	five-dimensional
BAP	BIM Abwicklungsplan	**BEP**	BIM Execution Plan
BGF	Bruttogrundfläche	**GFA**	Gross floor erea
BIM	Building Information Management	**BIM**	Building Information Management
AIA	Auftraggeber Informationsanforderungen	**EIR**	Employers Information Requirements
CAD	Computerunterstütze Planung	**CAD**	Computer Aided Design
CAFM	Computerunterstützte Betreiberprozesse	**CAFM**	Computer Aided Facility Management
COBie	Austauschformat für die Übergabe von Planungs- und Ausführungsinformationen in den Betrieb.	**COBie**	Construction Operations Building Information Exchange
ConEx	Construction Excellence	**ConEx**	Construction Excellence
ConEx 2.0	Construction Excellence Digitale BIM Bauteilbibliothek	**ConEx 2.0**	Construction Excellence Digital BIM Object Library
DIN	Deutsches Institut für Normung	**DIN**	German Institute for Standardization
FM	Facility Management (Dienstleister)	**FM**	Facility Management (Consultant)
FS	Facility Services	**FS**	Facility Services
GP	Generalplaner	**GD**	General Design
GU	Generalunternehmer	**GC**	General Constructor
GÜ	Generalübernehmer	**GC**	General Contractor
ID	Identifikator	**ID**	Identificator
IFC	Industry Foundation Classes	**IFC**	Industry Foundation Classes
ISO	Internationale Organisation für öffentliche Standardisierung	**ISO**	International Organization for Standardization
KPI	Kennzahl für Vergleichsbetrachtungen	**KPI**	Key Performance Indicator
LOD	Detailierungstiefe	**LoD**	Level of Detail
LOI	Informationstiefe	**LoI**	Level of Information
PAS	Öffentlich verfügbare Spezifizierung	**PAS**	Publicly Available Specification
QR Code	Maschinell auffindbare und lesbare Information	**QR Code**	Quick Response Code

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German acronym	Description	English acronym	Description English
SRE	Siemens Real Estate	**SRE**	Siemens Real Estate
Uniclass	Gemeinsame Klassifikation für die Bauindustrie	**Uniclass**	Unified Classification for the Construction Industry
WBS, PSP	Projektstrukturplan	**WBS**	Work breakdown structure
ZTV	zusätzliche technische Vertragsbedingungen	**ATC**	Additional technical contract conditions

Chapter F:

Appendix

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F Appendix

F.1 Attachment 4: 5D Room Schedule Template

SRE global Specification Room Book					
Nr.	**Title**	**Attributes**	**Field Type**	**Unit (Exampels)**	**Description**
1	General	**Room category**	dropdown	text	accoding to SRE business definition and framework
2	General	**Remark**	free	text	further desciption
3	General	**Room ID**	ID		
4	General	**FloorLevel ID**	Referenz		im BIM gemäss COBie und Matching seitens Bouygues
5	General	**Room Number**	free		Nummer gemäss Nummerierungskonzept
6	General	**Room Name**	free		Nummer vor Ort
7	General	**Building Number**	free		Format: N (N: Numerisch) Projektinformation Attribut möglichst durch Referenzierung automatisch ausfüllen
8	General	**Responsibility - Ownership**	dropdown	SRE	bestehender Siemenskatalog
9	General	**Room area**	dropdown	m2	Nettofläche
10	General	**Net Area**	free	m2	Attribut erstellen, kann bei Bedarf später genutzt werden
11	General	**CreatedBy**	free		automatisch
12	General	**CreatedOn**	free		automatisch
13	General	**Ext System**	free		automatisch
14	General	**Ext Object**	free		automatisch
15	construction	**Floor finish**	dropdown	text	carpet, parket, tiles
16	construction	**Wall finish**	dropdown	text	paint, metal, wood
17	construction	**Room circumference**	integer	m	
18	construction	**Room area**	integer	m^2	
19	construction	**Room volume**	integer	m^3	
20	construction	**Room height**	integer	2,5	in metric (meter, inch)

21	construction	**Raised flooring (type)**	dropdown	text	stelzen, contrete etc.)
22	construction	**Raised flooring (hight)**	integer	2,5	in metric (meter, inch)
23	construction	**Load bearing**	integer	2kN/m²	capacity of the floor within the room
24	construction	**Ceiling finish**	dropdown	text	gipsonboard, metal
25	construction	**Suspended ceiling design (height)**	integer	2,5	in metric (meter, inch)
26	construction	**Lighting**	dropdown	text	in-side, stand alone
27	construction	**Heating system**	dropdown		e.g. ventilation, gas heater, electric heater etc.
28	construction	**Ventilation type**	dropdown		e.g. ventilation, aircon, etc.
29	construction	**Electric wall outlets**	integer	7	number of plugs
30	construction	**Lan ports**	integer	10	number of plugs
31	construction	**Wifi ports**	integer	13	number of plugs
32	construction	**Special room features**	text		free text
33	construction	**Soundproofing requirements (room acoustics)**	integer	40db	
34	construction	**Building type**	free		Format: AA (A: Alphanumerisch) Projektinformation Attribut möglichst durch Referenzierung automatisch ausfüllen
35	construction	**Floor assembly height**	free	m	Attribut wird primär auf Flächenobjekt geführt und manuell eingetragen. Sofern Bodenobjekte raumspezifisch modelliert werden, ist eine Ermittlung durch die Objektreferenz möglich.
36	construction	**Raised floor**	dropdown		Attribut wird primär auf Flächenobjekt geführt und manuell eingetragen. Sofern Bodenobjekte raumspezifisch modelliert werden, ist eine Ermittlung durch die Objektreferenz möglich.
37	construction	**Suspended Ceiling Type**	free		Attribut wird primär auf Flächenobjekt geführt und manuell eingetragen. Sofern Deckenobjekte raumspezifisch modelliert werden, ist eine Ermittlung durch die Objektreferenz möglich.
38	construction	**Wall**	dropdown		überwiegender Wandbelag gemäss Auswahlliste Attribut wird primär auf Flächenobjekt geführt und manuell eingetragen. Sofern Wandobjekte raumspezifisch modelliert werden, ist eine Ermittlung durch die Objektreferenz möglich.

39	construction	**Wall area**	free	m2	Standardmässig wird die Fläche manuell eingetragen. Wenn Ermittlung über eindeutige Zuordnung der Wandobjekte möglich ist, kann die Fläche berechnet werden, Wandfläche exkl. Glaswänden; Umfang x Höhe abzügl. aller Öffnungen; Dezimaltrennung mit „Punkt“
40	construction	**Glazed walls - area of glass**	free	m2	Standardmässig wird die Fläche manuell eingetragen. Wenn Ermittlung über eindeutige Zuordnung der Wandobjekte möglich ist, kann die Fläche berechnet werden, Fläche aller Glaswände im Raum exkl. Glastüren; Dezimaltrennung mit „Punkt“
41	construction	**area of glass doors**	free	m2	Standardmässig wird die Fläche manuell eingetragen. Wenn Ermittlung über eindeutige Zuordnung der Türobjekte möglich ist, kann die Fläche berechnet werden, Fläche aller Glastüren im Raum; Dezimaltrennung mit „Punkt“
42	construction	**area of internal windows**	free	m2	Standardmässig wird die Fläche manuell eingetragen. Wenn Ermittlung über eindeutige Zuordnung der Fensterobjekte möglich ist, kann die Fläche berechnet werden,
43	construction	**Acoustic requirements**	free		
44	construction	**Area to be removed from floor cleaning calculation**	dropdown	m2	
45	construction	**Area to be cleaned as part of vendors cost calculation**	dropdown	m2	
46	layout	**Room Use**	free		Beschreibung Raumnutzung
47	layout	**Building Level**	free		Format: ANNA (A: Alphanumerisch, N: Numerisch) Attribut möglichst durch Referenzierung automatisch ausfüllen
48	layout	**Room Category according to SIA/DIN**	free		
49	layout	**Floor assembly type**	free		Attribut wird primär auf Flächenobjekt geführt und manuell eingetragen. Sofern Bodenobjekte raumspezifisch modelliert werden, ist eine Ermittlung durch die Objektreferenz möglich.
50	layout	**Security zone**	dropdown		

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F.2 Attachment 5: 5D Equipment Schedule Template

Attribut						Responsibility		
Classification	**Type**	**Name**	**Valuep**	**Example**	**Umit**	**Con-tractor**	**LMU/AMU**	**FM-Provider**
General	General	**Standard asset**	text	12345678	k.A.		x	x
General	General	**old ID code**	text	0000001	k.A.		x	x
General	General	***code**	auto fill	0000002	k.A.		x	x
General	General	**Description**	text	Zuluftanlage B10.1	k.A.		x	x
General	General	**Main asset**	dropdown	RLT Anlage B10	k.A.		x	x
General	General	**Type**	auto fill	?	k.A.		x	x
General	General	***Status**	auto fill	ordered, in use, idle, disposed	k.A.		x	x
General	General	**Sorting field**	string	?	k.A.		x	x
General	General	**Remark**	text	This is a remark	k.A.		x	x
General	Classification	**Global (WBS extended)**	dropdown	421.15	k.A.	x	x	x
General	Classification	**Local**	dropdown	4.253.30.01	k.A.	x	x	x
General	Reference	**QR code**	string		k.A.	x		x
General	Reference	**AKS / plant coding system**	string		k.A.	x		x

General	Reference	**BIM Model**	Link		k.A.	x		
General	Reference	**BIM Model Object**	Link		k.A.	x		
General	Location	***Property**	dropdown		k.A.		x	x
General	Location	***Building**	dropdown		k.A.		x	x
General	Location	***Space**	dropdown		k.A.		x	x
General	Ownership	***Owner**	dropdown	SRE, Other	k.A.		x	
General	Ownership	***Contract ID**	text	S0815	k.A.		x	
General	Ownership	**OrgID and account**	auto fill	SPIE_089	k.A.		x	
General	Ownership	**Contract start date**	auto fill	01.01.2017	k.A.		x	
General	Ownership	**Contract end date**	auto fill	01.01.2018	k.A.		x	
General	Ownership	**Contract with owner**	Link	e.g. lease contract	k.A.		x	
General	Asset Specs	**Brand**	text	Wolf	k.A.	x		x
General	Asset Specs	**Model/type**	text	GT 3000	k.A.	x		x
General	Asset Specs	**serial number**	text	12345678	k.A.	x		x
General	Asset Specs	**Unique (y/n)**	dropdown	Yes/No	k.A.	x		x
General	Asset Specs	**Maintenance instruction**	Link		k.A.	x		x
General	Asset Specs	**Cleaning instructions**	Link		k.A.	x		x
General	Asset Specs	**Safety instructions**	Link		k.A.	x		x

General	Asset Specs	**Installation manual**	Link		k.A.	x		x
General	Asset Specs	**Commissioning instruction**	Link		k.A.	x		x
General	Asset Specs	**Operater manual**	Link		k.A.	x		x
General	Asset Specs	**Spare Part List**	Link		k.A.	x		x
General	Asset Specs	**Scheme**	Link		k.A.	x		x
General	Asset Specs	**Initial Inspection document**	Link		k.A.	x		x
Maintenance	Planned maintenance	***is planned maintenance required**	dropdown	No; Yes due to legal obligations; Yes due to functional requirements; Yes due to manufacturer specification; Yes due to customer requirement	k.A.			
Maintenance	Planned maintenance	**Maintenance start date**	date	01.01.2017	k.A.			
Maintenance	Planned maintenance	**Maintenance end date**	date	01.01.2018	k.A.			
Maintenance	Planned maintenance	**Maintenance Plan**	Link		k.A.			
Maintenance	Planned maintenance	**Last maintenance performed**	date	01.01.2017	k.A.			
Maintenance	Planned maintenance	**Due date for next maintenance**	date	01.01.2018	k.A.			

Maintenance	Inspection (legal obligation by law/regulations)	***is inspection required**	dropdown	Yes/No	k.A.			
Maintenance	Inspection (legal obligation by law/regulations)	***Last inspection performed**	date	01.01.2018	k.A.			
Maintenance	Inspection (legal obligation by law/regulations)	***Routines (#/year)**	integer	0,25	k.A.			
Maintenance	Inspection (legal obligation by law/regulations)	**Due date for next inspection**	auto fill		k.A.			
Maintenance	KPI & Performance	**Resolution Time (h)**	dropdown	1,5;6;12;30;60	k.A.			
Maintenance	KPI & Performance	**Availability**	dropdown	99%; 97%; 95%; 93%; <93%				
Maintenance	KPI & Performance	**Operating hours (h)**	integer	5000	h			
Maintenance	Warranty	**Date of manufacture or construction**	date	01.01.2017	k.A.			
Maintenance	Warranty	**Date first used**	date	01.01.2018	k.A.			
Maintenance	Warranty	**Age of asset**	auto fill		k.A.			
Maintenance	Warranty	**Warranty expires on**	date	01.01.2018	k.A.			
Maintenance	Warranty	**Construction company**	text	HochTief ("Errichter")	k.A.			

Maintenance	Warranty	**Warranty contract**	Link		k.A.			
Maintenance	Warranty	**As-build documentation**	Link		k.A.			
Maintenance	Latest Condition Score	**Score**	dropdown	rating from 1-5	k.A.			
Maintenance	Latest Condition Score	**Date**	date	01.01.2018	k.A.			
Maintenance	Contract	***Contract ID**	text	S0815	k.A.			
Maintenance	Contract	**Service company**	auto fill	SPIE_089	k.A.			
Maintenance	Contract	**Contract start date**	auto fill	01.01.2017	k.A.			
Maintenance	Contract	**Contract end date**	auto fill	01.01.2018	k.A.			
Maintenance	Contract	**Service contract**	Link		k.A.			
Technical Data	WBS 300	**Doors - type**	Dropdown	single, double, sliding, rotating	k.A.	x		
Technical Data	WBS 300	**Doors - material**	Dropdown	wood, metal, glass, etc.	k.A.	x		
Technical Data	WBS 300	**Doors - hardware set**	Dropdown	automated, manual	k.A.	x		
Technical Data	WBS 300	**Cladding - Construction**	Dropdown	combined glass and frame, Stick Built, Structural Glass	k.A.	x		
Technical Data	WBS 300	**Cladding - Material**	Dropdown	metal, stone/concrete, glass, wood, fibre	k.A.	x		
Technical Data	WBS 300	**Roof Material - skin**	Dropdow	tiles, composite, sheet	k.A.	x		

			n	metal				
Technical Data	WBS 300	**Roof Material - substrate**	Dropdown	corrugated metal, plywood, composite panels	k.A.	x		
Technical Data	WBS 300	**Roof Material - insulation**	Dropdown	Batt, rigid, etc.	k.A.	x		
Technical Data	WBS 300	**Fire Rating**	text	UL label - A,B,C,D,E,S	k.A.	x		
Technical Data	HVAC	**Power Input (heat)**	integer	350	kW	x		
Technical Data	HVAC	**Heating Capacity/Output**	integer	450	kW	x		
Technical Data	HVAC	**Total Cooling Capacity/Output**	integer	350	kW	x		
Technical Data	HVAC	**Sensible Cooling Capacity/Output**	integer	350	kW	x		
Technical Data	HVAC	**Latent Cooling Capacity/Output**	integer	350	kW	x		
Technical Data	HVAC	**(Outside Air) Flowrate**	integer	5000	m^3/h	x		
Technical Data	HVAC	**Supply air volume**	integer	10000	m^3/h	x		
Technical Data	HVAC	**Return air volume**	integer	9000	m^3/h	x		
Technical Data	HVAC	**Recirculating air volume**	integer	8000	m^3/h	x		
Technical Data	HVAC	**Exhaust air volume**	integer	7000	m^3/h	x		
Technical Data	HVAC	**Cooling Tower - type**	Dropdown	dry, wet, hybrid	k.A.	x		

Technical Data	HVAC	**Cooling Tower - capacity**	text	400	kW	x		
Technical Data	HVAC	**Chiller/compressor - type**	Dropdown	scroll, centifugal, screw, turbo	k.A.	x		
Technical Data	HVAC	**Efficiency (COP / EER)**	integer	4,5	k.A.	x		
Technical Data	HVAC	**Refrigerant type**	text	R-123	k.A.	x		
Technical Data	HVAC	**Heat Exchanger - type**	Dropdown	Plate, Shell and tube, rotary (thermal wheel), KVS (Kreislaufverbundsystem)	k.A.	x		
Technical Data	HVAC	**Heat Exchanger - capacity**	integer	300	kW	x		
Technical Data	HVAC	**Filter typ**	Dropdown	Air, Water, Oil	k.A.	x		
Technical Data	HVAC	**Filter class**	text	f5	k.A.	x		
Technical Data	Electrical	**Current**	integer	10	A	x		
Technical Data	Electrical	**Voltage**	integer	230	V	x		
Technical Data	Electrical	**Power Input (elec.)**	integer	1000	kW	x		
Technical Data	Electrical	**Power Output (elec. [kW])**	integer	1000	kW	x		
Technical Data	Electrical	**Power Output (elec. [kVA])**	integer	250	kVA	x		
Technical Data	Electrical	**Lighting - Type**	Dropdown	LED, T5, T8, halogen, mercury vapor	k.A.	x		
Technical Data	Electrical	**Lighting - Light color**	integer	4000	Kelvin	x		

Technical Data	Electrical	**UPS - type**	Dropdown	Standby, Line Interactive, Standby on-line hybrid	k.A.	x		
Technical Data	Electrical	**UPS - voltage & capacity**	integer	500	kVA	x		
Technical Data	Electrical	**Battery - type**	text	Lithium ion, lead	k.A.	x		
Technical Data	Electrical	**Battery - capacity**	integer	2000	Ah	x		
Technical Data	Electrical	**Transformer - type**	Dropdown	oil, dry	k.A.	x		
Technical Data	Electrical	**Transformer - prim. power**	integer	200	kVA	x		
Technical Data	Electrical	**Transformer - prim. voltage**	integer	400	V	x		
Technical Data	Electrical	**Power Factor**	integer	95%	Percent	x		
Technical Data	Fire Protection	**Fire extinguishers - type**	Dropdown	gas, water, foam, sand	k.A.	x		
Technical Data	Fire Protection	**Fire extinguishers - capacity**	text	300	k.A.	x		
Technical Data	Fire Protection	**Sprinkler Valves - Type**	Dropdown	gas, water	k.A.	x		
Technical Data	Fire Protection	**Sprinkler self test function**	Dropdown	manual, auto	k.A.	x		
Technical Data	Elevator	**Elevator - type**	Dropdown	hydraulic, roped	k.A.	x		
Technical Data	Elevator	**Elevator - #stops**	integer	5	k.A.	x		

Technical Data	Elevator	**Elevator - #doors**	integer	5	k.A.		x	
Technical Data	Elevator	**Elevator - load**	integer	2500	kg	x		
Technical Data	WBS 400	**Efficiency (%)**	integer	98%	Percent	x		
Technical Data	WBS 400	**Pressure (rise)**	integer	2	bar	x		
Technical Data	WBS 400	**Weight**	integer	1234	kg	x		
Technical Data	WBS 400	**(Volume) Control - type**	text	constant, frequency control	k.A.	x		
Technical Data	WBS 400	**Motor Drive - type**	dropdown	direct, belt, coupling, unknown	k.A.	x		
Technical Data	WBS 400	**Storage/ tank - typ**	text	water, oil, expansion, pressure, ice	k.A.	x		
Technical Data	WBS 400	**Storage/ tank - volume**	integer	300	liter	x		
Technical Data	WBS 400	**Storage/ tank - capacity**	integer	300	kWh	x		
Technical Data	WBS 400	**Damper - type**	text	fire, smoke	k.A.	x		
Technical Data	WBS 400	**Damper - control**	text	manuel, controlled	k.A.	x		
Technical Data	WBS 400	**Meter Purpose**	Dropdown	Master, Submaster, Submeter, Other, Unknown	k.A.	x		
Technical Data	WBS 400	**Meter Type (medium)**	Dropdown	Electricity, Gas, Oil, Water	k.A.	x		
Technical Data	WBS 400	**Meter ID**	text	M4711	k.A.	x		
Technical Data	WBS 600	**Desks - type**	Dropdown	electrified, static	k.A.	x		

F.3 Attachment 1: BIM@SRE Overall Process Map


BIM Overall Process Map
Demand Clarification; Preparation & Brief
Conceptual Design / I-Application / Project Handover
Development
Technical Design & Award of Construction Worksen
Construction execution
Handover & Correction of Deficiencies / Project Completion
Operation
Operation
Sale
BIM Start
Demand Clarification
Preparation & Brief
Conceptual Design
I-Application
Project Handover
Development
Technical Design and Award of Construction Works
Construction execution
Handover & Correction of Deficiencies
Project Completion
Operation
End