ITEA4 22003 FireBIM

Deliverable 5.1

Demonstrator definitions and descriptions

Deliverable type:	Document	
Deliverable reference number:	ITEA 22003 | D5.1	
Related Work Package:	WP5	
Submission date:	2025/12/31	
Dissemination level:	Public	
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Abstract:	The ITEA4 FireBIM project aims to improve fire safety compliance in building design through the integration of Building Information Modeling (BIM). Within this framework, Work Package 5 (WP5) focuses on enabling realistic demonstrations, validating project results with key stakeholders, and assessing progress against defined objectives and KPIs. This report presents Deliverable D5.1, which defines and characterizes the end-to-end demonstrators developed in the project. A holistic and hierarchical demonstrator strategy is adopted, based on the use of real-world BIM datasets and structured validation scenarios. These scenarios illustrate the practical relevance, applicability, and impact of FireBIM results, forming the foundation for demonstrator development. The proposed demonstrators address real industry needs through national and cross-country collaborations and focus on key fire safety aspects, namely, the fire compartmentation compliance and evacuation and escape routes.	
Keywords:	Demonstrators definition; datasets; validation scenarios.	

Contents

1 Introduction

The ITEA4 22003 FireBIM project seeks to enhance fire safety compliance in building design through the integration of Building Information Modeling (BIM).

Within the FireBIM project, WP5 aims to provide the tools and methodologies needed to carry out realistic demonstrations, validate project results with key stakeholders, and assess the extent to which the project objectives and associated KPIs have been achieved.

This deliverable, D5.1, is the first outcome of the work developed so far within WP5 and includes the definition and detailed characterization of the proposed end-to-end demonstrators for the FireBIM project.

D5.1 is focused on the holistic and hierarchical strategy adopted for the demonstrators based on the definition of datasets and validation scenarios. Datasets are represented by BIM models, mostly from real projects, collected in the different countries. Validation scenarios demonstrate the practical relevance, applicability, and impact of the project's results by clarifying what is being validated, why it is significant, and how it contributes to improving fire safety practices. The validation scenarios are based on a set of relevant datasets and constitute the basis for the development of demonstrators.

Demonstrators showcase the tangible outcomes and add value of the proposed technology through a holistic perspective that integrates technical performance, societal impact, and practical applicability. They are closely aligned with real industry needs and concrete use cases, ensuring both relevance and feasibility for real-world deployment. In addition, demonstrators are developed through national and cross-country collaborations, promoting interaction among core stakeholders and partners from different regions, and thereby strengthening knowledge exchange and overall innovation impact.

This report is structured into six chapters. Chapter 1 introduces the document by outlining its scope, content, and relevance within the FireBIM project. Chapter 2 presents the overall framework of the work carried out in WP5, including its alignment with the FireBIM strategic plan and its connections with other work packages, in particular WP2 and WP4. This chapter also describes the hierarchical concept developed for the FireBIM demonstrators framed on WP5.1. Chapter 3 details the 18 datasets collected across the participating countries by the project partners. Chapter 4 provides an overview of the validation scenarios proposed by the different countries, highlighting both national and transnational cooperation efforts. Chapter 5 focuses on the proposed demonstrators, which are organized around two main clusters: fire compartmentation compliance, and evacuation and escape routes. Lastly, Chapter 6 summarizes the main conclusions of the work and outlines directions for the next developments.

2 WP5 overview

2.1 Framework and layout

WP5 provide the necessary resources and tools to define, realize and deploy demonstrators that integrate parts of WP2, WP3 and WP4 to support end-to-end validation with end users. Additionally, the demonstrators will be validated within FireBIM consortium staff and evaluated by relevant external stakeholders, to ensure how effectively the project objectives and resulting KPIs have been achieved. The knowledge acquired from executing, validating and evaluating the demonstrators will be utilized to investigate the potential for utilizing products and services based on these demonstrators and the technical resources created in the project.

Considering these specific goals/ambitions, WP5 is divided in four distinct activities, detailed in Figure 1.

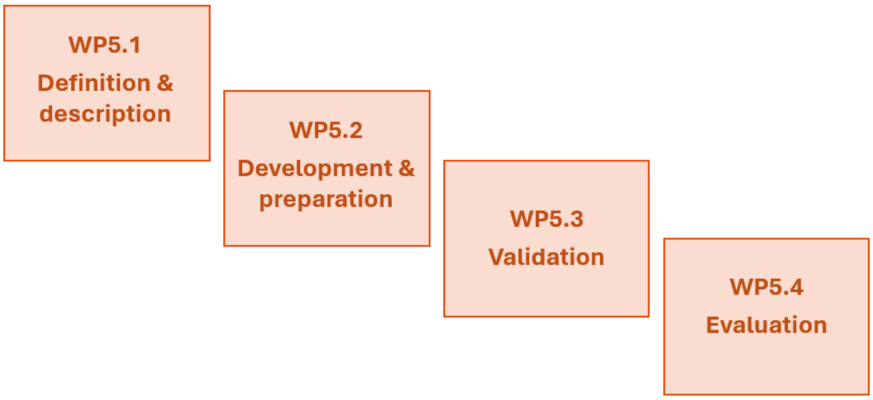


Figure 1: Flow of activities planned within WP5

- **WP5.1: definition and description of demonstrators.** This activity identifies, defines and describes in detail the end-to-end demonstrators, based on the use case scenarios and applications derived from WP4. A clear view of the demonstrators used in the various countries, as well as across countries, will be given. Some relevant aspects crucial for the demonstrators definition are:
  - Selection of representative and similar use types (covering residential and service buildings, including new constructions and existing constructions).
  - Definition of indicators and realistic features to select the demonstrators (e.g., based on the most frequent asset types evaluated by National competent Authorities, based on applicability of prescriptive strategies, etc.).
  - Inclusion of different design stages/maturity levels and guarantying that models must have all the required information to be checked and inclusion of proofs-of-concept to understand IFC mapping, as well as defining adequate modelling strategies.
  - Consideration of copyright restrictions, confidentiality and use restrictions.
- **WP5.2: development and preparation of demonstrators.** This activity involves the harmonization of the execution of the different demonstrators based on fire safety digital strategies and applications, derived from WP2 and WP4, and in close articulation with the developers of the FireBIM Automatic Compliance Check (ACC) platform (WP3). All BIM models used in this activity should consider the FireBIM information requirements defined in WP2.
- **WP5.3: validation of demonstrators.** Within this activity the project consortium staff evaluates the technical performance of the FireBIM ACC platform based on the demonstrators defined in WP5.1 and developed within WP5.2. The evaluation features are the productivity gains, performance gains (e.g. safety, cost, lead time) and their potential for disrupting the way of working. Some relevant aspects within this activity are:
  - Definition of an improvement strategy. From validation activities a loop enhancement strategy will be performed with WP2, WP4, and mainly with WP3, to enhance/upgrade/correct the FireBIM ACC platform.
  - Definition of benchmarking cases based on simplified and synthetic cases strategically envisaging the validation of specific FireBIM ACC platform features.

- **WP5.4: evaluation of demonstrators.** This activity involves the evaluation of the results of FireBIM ACC platform by external end-users considering the evaluation features also used in WP5.3. Some relevant aspects within this activity are:
    - Definition of evaluation metrics to evaluate the current level of performance of the FireBIM ACC platform.
    - Definition of a set of companies as b-users and set an efficient strategy to incorporate their feedback towards the continuous enhancement of the FireBIM ACC platform.

2.2 Alignment with FireBIM strategic plan

The definition of the FireBIM demonstrators was guided by the FireBIM Strategic Plan, which aimed to establish an interoperable, data-driven digital ecosystem to support fire safety management across the building lifecycle. The demonstrator definition strategy followed a two-step approach:

- the preparation and structuring of datasets.
- the future development of demonstrators evolving from those datasets into integrated validation scenarios.

In the first stage, datasets were selected and structured according to their relevance and representativeness for FireBIM. Originating from the five participating countries, they included both partner-provided and publicly available data, selected based on technical characteristics, national contexts, and regulatory frameworks to support subsequent demonstrator planning. During this phase, each country also identified building types and scenarios outside its national regulatory scope, documented as potential non-regulatory cases that may inform future refinements of the FireBIM scope.

In the next stages, the datasets will evolve into demonstrators, designed to assess the interoperability, scalability, and practical applicability of FireBIM solutions across residential and tertiary buildings, and both new and existing constructions.

Aligned with the ITEA demonstrator framework, the FireBIM strategy emphasises four main objectives:

- Validation and proof of concept: verifying performance and integration of FireBIM technologies.
- Scalability and interoperability: ensuring adaptability across building types and lifecycle stages.
- Commercial exploitation: demonstrating value for industry stakeholders; and
- Dissemination and awareness: promoting understanding among end users, authorities, and the wider ecosystem.

In summary, the strategy translates the FireBIM vision into a structured process that establishes representative datasets, identifies relevant non-regulatory contexts, and prepares the foundation for future demonstrators that will validate both technical robustness and exploitation potential.

2.3 Alignment with ongoing activities on WP2 & WP4

WP5 has several dependencies and conections with other WPs, namely WP2, WP3 and WP4. Figure 2 schematically representes these cross-links with the other WPs.

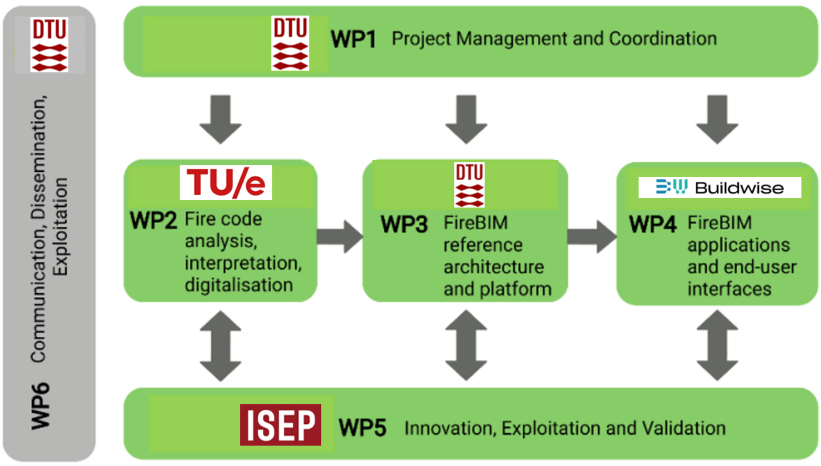


Figure 2: WPs structure and dependencies

The most relevant interactions - between WP2 and WP5, and between WP4 and WP5 - are described in detail below.

WP2–WP5 Interaction

WP5 leverages the structured, harmonized, and digitalized knowledge developed by WP2 to design, implement, and validate project demonstrators. WP2 provides a comprehensive database of fire safety terms, definitions, and ontologies, forming the foundational knowledge base of the project. This enables WP5 to configure realistic scenarios, integrate data with BIM models, and assess the practical applicability of regulatory content in end-user contexts.

The collaboration between WP2 and WP5 is characterized by:

- **Knowledge utilization:** WP5 operationalizes WP2's conceptual and semantic resources for scenario design and validation.
- **Validation of digital outputs:** Demonstrators test the completeness, clarity, and usability of WP2 outputs, ensuring they meet stakeholder needs.
- **Feedback loop:** Insights from WP5 inform refinements in WP2, enhancing the robustness of definitions, structures, and documentation.
- **Integration with end-user contexts:** WP5 evaluates how effectively WP2 outputs support realistic workflows and BIM integration.
- **Exploitation potential:** Practical testing allows assessment of future applications, services, and business models based on validated knowledge.

In summary, WP2 provides the theoretical and semantic foundations, while WP5 translates them into validated, practical demonstrators, ensuring project outputs are both rigorous and operationally applicable.

WP4–WP5 Interaction

The link between WP4 and WP5 is a central pillar of the FireBIM approach, ensuring alignment between user needs, software design, and practical validation. WP4 formalizes functional requirements and models user journeys, structuring all project use cases and target applications based on a detailed analysis of stakeholder needs. This results in a structured list of use cases and applications that guide the project.

WP5 builds on WP4 by selecting and structuring representative datasets from the five partner countries, covering diverse building types, regulatory contexts, and BIM maturity levels. These datasets form the basis for defining validation scenarios, which demonstrate the ability of FireBIM solutions to meet WP4 requirements, particularly regarding interoperability, scalability, and practical applicability.

Validation scenarios follow a dual logic: addressing national objectives, risks, and challenges, while systematically aligning with WP4 user journeys, use cases, and solutions. Each scenario explicitly links to WP4, identifying the relevant user journeys, features tested, and requirements validated. A correspondence between WP5 validation scenarios and WP4 use cases ensures traceability, highlights discrepancies, and facilitates feedback and prioritization of further developments.

In summary, WP4 defines the project's functional framework, while WP5 operationalizes it through demonstrators grounded in real-world practices and regulations. This iterative and structured approach ensures that FireBIM solutions are robust, relevant, usable, and continuously adaptable to the evolving needs of the construction sector, supporting the creation of an interoperable, scalable, and value-centered digital ecosystem.

2.4 Proposed demonstrator strategy

In the FireBIM project, WP5 is responsible for enabling realistic demonstrations, validating outcomes with stakeholders, and evaluating how effectively project objectives and KPIs are met.

The work follows a hierarchical framework linking datasets, validation scenarios, and demonstrators. Collected from real projects across partner countries, the datasets - primarily BIM models - serve as the foundation for validation scenarios, which illustrate the practical use, relevance, and impact of FireBIM solutions. These scenarios clarify the purpose of the validation, its significance, and its contribution to improving fire safety practices.

Based on these scenarios, demonstrators are developed to showcase the tangible benefits of the technology, combining technical performance, societal impact, and practical applicability. They are designed to address real industry requirements and use cases, ensuring they are feasible for deployment. Additionally, demonstrators are implemented through both national and international collaboration, promoting engagement among stakeholders, facilitating knowledge exchange, and enhancing the overall innovation potential of the project.

Figure 3 presents a schematic overview of the holistic and hierarchical proposed demonstrator strategy.

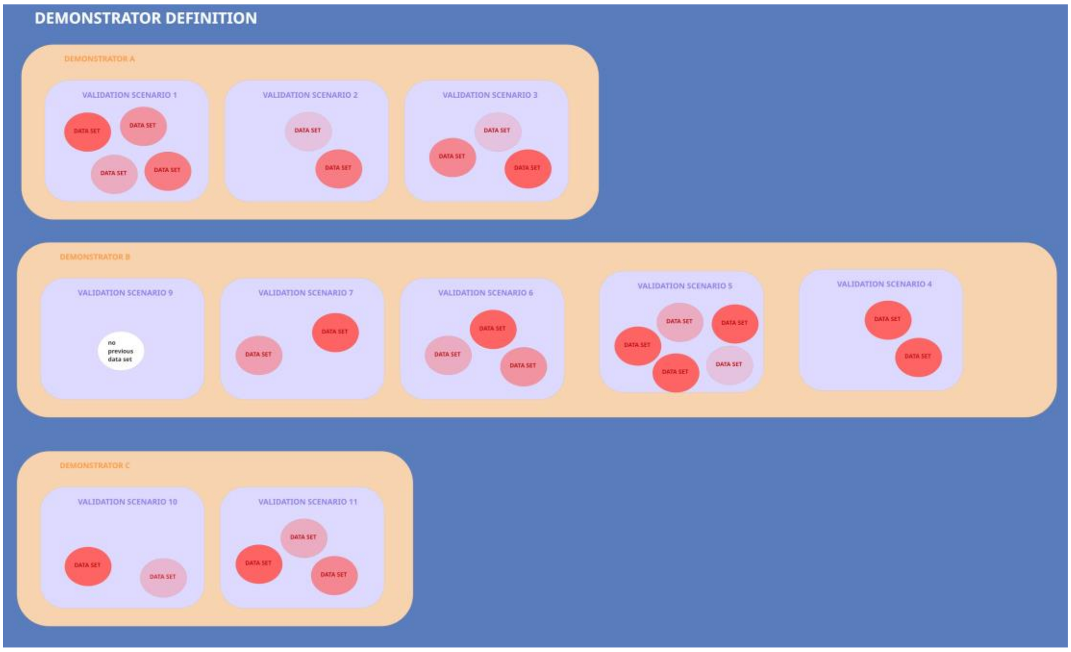


Figure 3: Holistic and hierarchical demonstrator strategy.

3 Datasets

3.1 Preliminary survey

Before collecting datasets for the demonstrators, a preliminary survey (see Link to Google Forms) was conducted to gather partners' insights and perceptions regarding the datasets to be used.

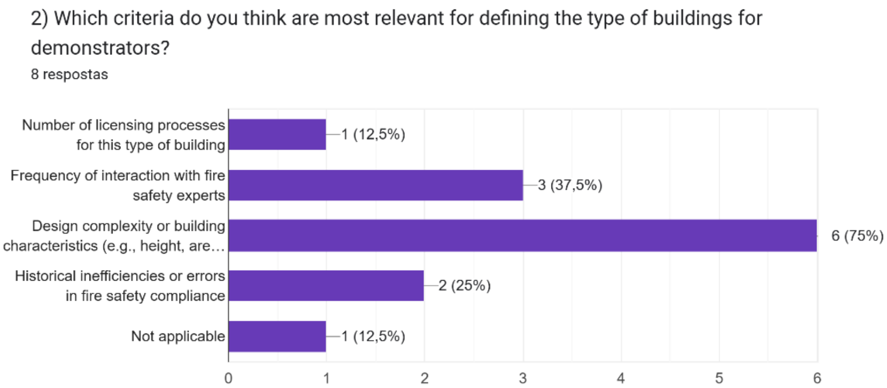
The survey, which closed on February 3rd, 2025, included 14 questions, eight of which were directly related to datasets.

Table 1 presents the eight questions addressed to the partners organized into three distinct sections.

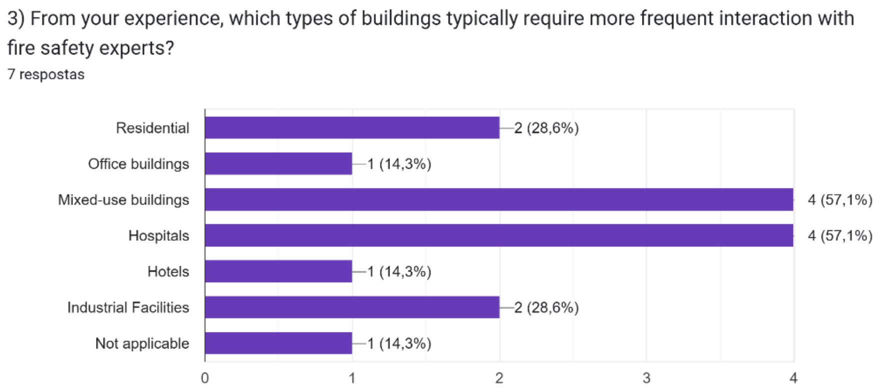
Table 1 – Overview of the datasets per country and type of dataset

Section 1: General Interest	**1)** Is your company/institution interested in collaborating on the definition of national datasets for FireBIM?
Section 2: Criteria and Building Characteristics	**2)** Which criteria do you think are most relevant for defining the type of buildings for datasets?
	3) From your experience, which types of buildings typically require more frequent interaction with fire safety experts?
	4) Are there any building types, characteristics, or others that you think should be excluded from the FireBIM scope? Why?
Section 3: Building Types and Datasets	**5)** Which types of buildings would your company/institution be interested in contributing as datasets?
	6) How many demonstrators would your company/institution be willing to develop or participate in for each selected building type?
	7) Could you describe each proposed dataset? For each dataset, provide details such as: - Building use (e.g., hospital, residential complex) - Key characteristics (e.g., area, height, number of floors) - Lifecycle stages to analyze (e.g., conceptual design, construction, operation)
	8) Does your company/institution have BIM models available for the proposed datasets? For each dataset, please specify: - Native platform of the BIM models (e.g., Revit, ArchiCAD, Allplan) - Type of fire safety information included (e.g., fire barriers, escape routes, compartmentation) - Disciplines models (e.g., architecture, HVAC, structure) - Copyright restrictions (e.g., limitations on sharing, conditions for public use)

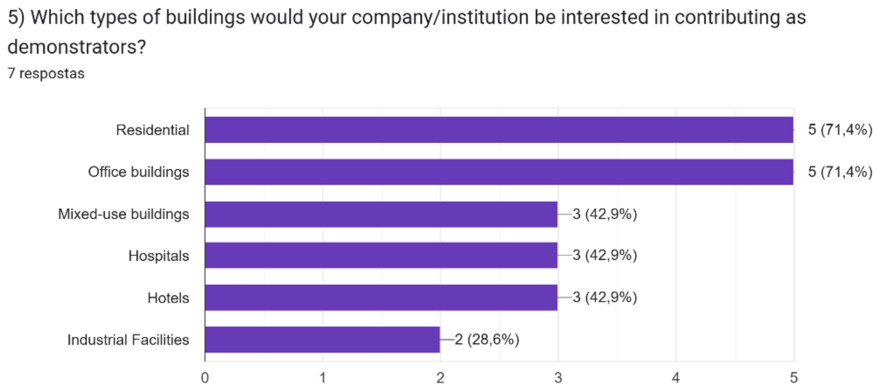
As an example, the answers to questions 2, 3 and 5 are presented in Figure 4.



a)



b)



c)

Figure 4: Answers to the preliminary survey: a) question 2; b) question 3; c) question 5.

The main conclusions of the survey are summarized below:

- **Question 1:** 9 partners expressed their interest in participating in the dataset definition process, namely, Buildwise, RFT, Peutz, Stam + De Koning, Assar, DStudio, Kabandy, VN2R, and Exactusensu.
- **Question 2:** design complexity or building characteristics were defined as most critical for dataset definition.
- **Question 3:** hospitals and mixed-use buildings typically require more interactions with fire safety experts.
- **Question 4:** most voted exclusions were very specialized buildings.
- **Question 5:** partners are more prone to contribute with residential and office buildings datasets.
- **Question 6:** in average 2 datasets per partner are expected.
- **Question 7:** hospital, residential buildings, office buildings, hotels.
- **Question 8:** half of the partners have BIM models available, and another half don't have BIM models.

3.2 Datasets overview

Datasets are defined by country and include BIM models (mostly from real projects) with a set of relevant information related to these models, particularly, type of project, design stage, key features of the project, model restrictions, model available formats, and graphical representations. Table 2 gives an overview of the characteristics of the datasets proposed per country and per type of dataset (P – real project or S -Sample).

Table 2 – Overview of the datasets per country and type of dataset

Country	Belgium	Denmark	Netherlands	Portugal	Lithuania	General
Dataset | Type of dataset	1 | P 8 | P 9 | S 12 | P	3 | P 17 | P	2 | P 4 | P 13 | P	10 | P 11 | P 14 |P 18 |P	15 | P 16 | P	5 | S 6 | P 7 | S
Section of the document	3.3	3.4	3.5	3.6	3.7	3.8

3.3 Belgium Datasets

3.3.1 Dataset 1 – 't Huis (Kortrijk Care Campus)

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

't Huis is a project by Assar architects, finished in 2024. It consists of the development of a new masterplan for a healthcare campus in the Belgian city of Kortrijk. The campus had been part of the local healthcare landscape since 1966 but needed an update. In addition to the masterplan, Assar created the architectural design of a new building that houses an elderly care centre for 135 residents, a local service centre, after school care and a daycare/nursery. The client, Zorg Kortrijk, put a strong emphasis on the use of BIM throughout the project, with the intention to use the available data in facilities management once the building is in use. As a result, high quality BIM models are available. The dataset includes two sets of BIM models: one for the 'early design stage' that shows the status of a BIM model at the very beginning of the project; the other contains a complete set of as-built models for different disciplines. The as-built models use (a modified version of) the Belgian BB/SfB system for element classification.

B. Project location

(city, country)

Kortrijk, Belgium

C. Type of Building

(Residential, Office, Health Care, other - please specify)

Healthcare and community centre

D. Type of project

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

Thomas Goossens, tgo@assar.com, Assar architects

F. Design Stage

(according to RIBA, mark with a cross (X)) | *+ INFO*

Strategic definition	
Preparation and briefing	
Concept design	X
Spatial coordination	
Technical design	

Manufacturing and construction	
Handover	X
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	-1: 3315 m^2 +0: 4068 m^2 +1: 3862 m^2 +2 1944 m^2 Total: 13 189 m^2	m^2
Number of stories (below ground level)	1	
Number of stories (above ground level)	3	
Height (top floor level)	7,20	m
Height (roof level)	12,41	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	automatic fire detection, automatic alarm system, fire extinguishers, fire hose reels, natural and mechanical smoke ventilation	
Number of rooms	135 rooms/residents	
Number of apartments (or independent units)	NA	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Parking garage and technical rooms (boiler, electrical, ventilation) in basement; communal kitchens	
Others	Many of the occupants are elderly people or young children who require assistance in emergency situations	

H. Available models

IFC *(Y/N)*	Y
IFC version	4.0
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph...) Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Y Revit 2023 / 2025 / architecture, structural, interior design, landscape, MEP

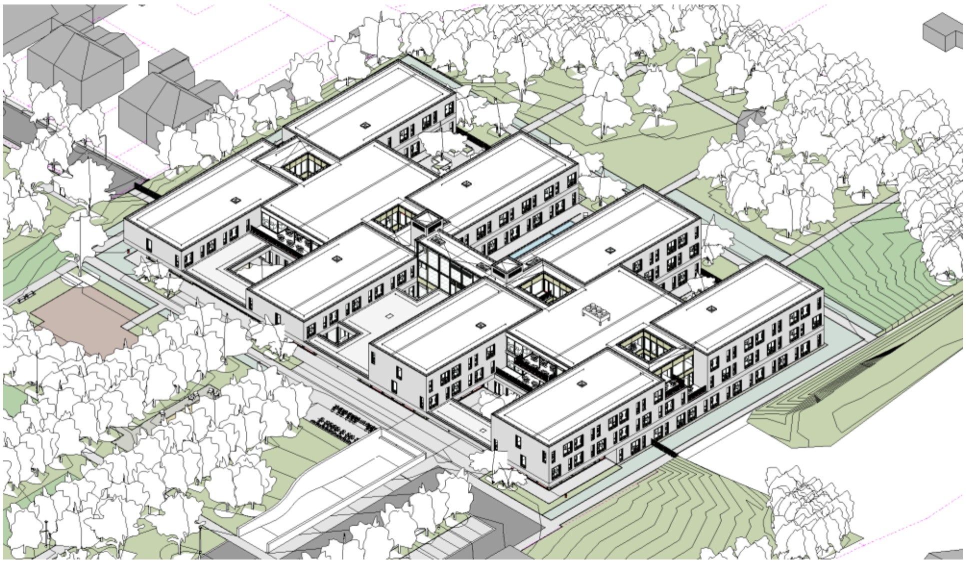
I. Model restrictions

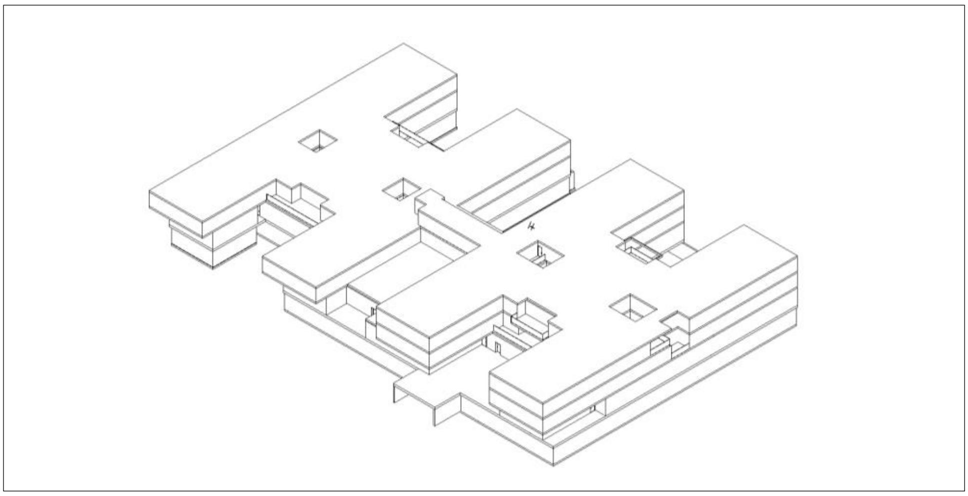
Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

J. Figures/images & graphical animations

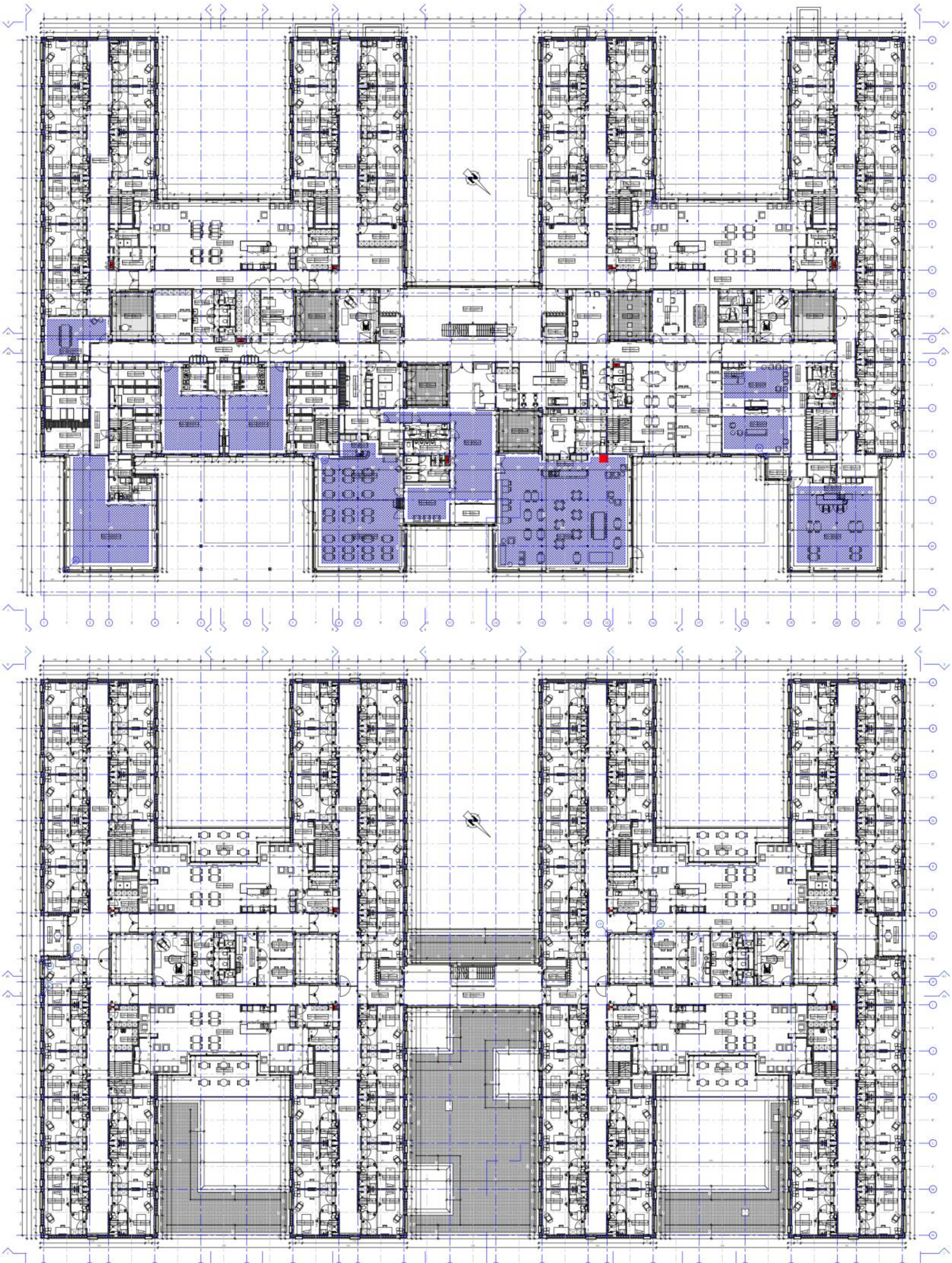
3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓

See images below. Floor plans, sections and elevations to scale are available as part of the dataset.





't Huis Kortrijk
Pictures of the finished project, image of the as-built BIM model & image of the early design BIM model
© Assar architects



't Huis Kortrijk
Floor plans of ground floor and level +1 (not to scale)
© Assar architects

't Huis Kortrijk
Sections and elevations (not to scale)
© Assar architects

K. Fire safety information requirements (1st stage – macro perspective) regarding BIM data.

	Early design model(s)		As built model(s)	
Included in model?	*Y/N*	More details about the adopted modelling strategy	*Y/N*	More details about the adopted modelling strategy
Building Information *(Occupancy Type; Risk Category; etc.)*	N		N	
Reference Plane	Y	All levels, with ground level at elevation +0.00	Y	All levels, with ground level at elevation +0.00
Occupancy data	N		(Y)	For HVAC purposes, not for fire safety
Room Type (living room; technical room;..)	Y	Room name and occupancy type (awake, sleeping, dependent)	Y	Room name
Independent units	NA		NA	
Fire walls	N		Y	Required fire rating (EI30 / EI60 / EI120) included as parameter of walls. Fire rating of doors (EI_1 30 / EI_1 60) included as parameter of doors.
Fire Compartment (including delimitation of fire compartment area)	Y	Compartment name included as parameter of rooms	Y	Compartment name included as parameter of rooms
Buildings Surroundings *(Isolated; Gable walls; surrounding buildings less than x m; etc.)*	N		Y	Discipline model with landscaping and surroundings available

L. Fire safety information of the model not included in the previous topics *(If you identified that in your country is required additional information available on models related with fire safety, please specify here)*

The as-built MEP models contain additional equipment for active fire safety: extinguishers, hydrants, fire hose reels, alarm buttons, smoke detectors, mechanical smoke ventilation, safety management system, etc.

3.3.2 Dataset 8 – Buildwise Research Model (School in Rethel, France)

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

Buildwise Research Model is a project located in Rethel, France. The project focuses on the development of a school building and serves as a demonstrator model for research purposes. The building consists of four above-ground levels, with a total floor area of 17.587 m^2, including a gymnasium of 1.960 m^2. The top floor reaches 11,5 m, while the roof height is 15,22 m. The project includes 103 working and life spaces and is equipped with safety systems such as fire extinguishers and fire hose reels. The BIM model is created in Revit 2025 and is compliant with IFC4 standards. It is intended for research and free use, with the official model expected to be shared by the end of May / beginning of June. The dataset will provide a complete BIM representation suitable for different research scenarios, including spatial planning, safety analysis, and facility management. This demonstrator model aims to support the exploration of BIM-based workflows and digital construction strategies.

B. Project location

(city, country)

Rethel, France

C. Type of Building

(Residential, Office, Health Care, other - please specify)

School

D. Type of project

(synthetic, real project)

Research project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

Jenny Delacroix, jenny.delacroix@buildwise.be, Buildwise

F. Design Stage

(according to RIBA, mark with a cross (X)) | + INFO

Strategic definition	
Preparation and briefing	
Concept design	X
Spatial coordination	
Technical design	X
Manufacturing and construction	X
Handover	
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	+0: 4.694 +1: 5.321 +2: 2.776 +3: 2.836 gym: 1.960 = total 17.587	m^2
Number of stories (below ground level)	0	
Number of stories (above ground level)	4	
Height (top floor level)	11,5	m
Height (roof level)	15,22	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Extinguisher, Fire hose reel	
Number of rooms	103 (working & life spaces)	
Number of apartments (or independent units)	NA	
Is there any risk compartment in the building?	Gymnasium and technical rooms (boiler, electrical, ventilation);	

(e.g., technical rooms, boiler rooms, electrical rooms, etc.)	communal kitchens	
Others	NA	

H. Available models

IFC *(Y/N)*	Y
IFC version	4.0
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph...) Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Y Revit 2025 NA architecture, structural, interior design, MEP (without electrical and ventilation system)

I. Model restrictions

Confidentiality *(only internal use in the scope of the project, full open)*	Free to use
Others	Free to use

J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓

K. Fire safety information requirements (1st stage – macro perspective) regarding BIM data

	Early design model(s)	
Included in model?	*Y/N*	More details about the adopted modelling strategy
Building Information (Occupancy Type; Risk Category; etc.)	Y	School and gymnasium
Reference Plane	Y	All levels, with ground level at elevation +0.00
Occupancy data	Y	
Room Type (living room; technical room;..)	Y	Room name and occupancy type
Independent units	NA	
Fire walls	Y	Some of them are drawn, some not, to see the difference
Fire Compartment	Y	Compartment name included as parameter of rooms

(including delimitation of fire compartment area)		
Buildings Surroundings *(Isolated; Gable walls; surrounding buildings less than x m; etc.)*	N	

L. **Fire safety information of the model not included in the previous topics** *(If you identified that in your country is required additional information available on models related with fire safety, please specify here)*

The MEP models contain additional equipment for active fire safety: extinguishers, fire hose reels, etc. The MEP models does not contain the electrical plan, the ventilation system, the fire hydrants, ni le Flammability Rating Properties.

3.3.3 Dataset 9 – D4C-DST

A. **General description**

(framework, motivation to develop it, relevance/significance at national level, etc.)

Non-built building to test modelling conventions for research projects, including LCA and Fire Safety. It contains spaces, zones and modelled compartments, applying multiple methods of modelling in parallel. The model is small enough to be parsed quickly, yet it also contains sufficient complexity in comparison with a single-family dwelling. As such, the different fire safety concepts can be applied, although the small scale would not necessitate complex fire protection measures.

B. **Project location**

(city, country)

No actual location

C. **Type of Building**

(Residential, Office, Health Care, other - please specify)

Mixed (residential + office + commercial)

D. **Type of project**

(synthetic, real project)

Synthetic

E. **Responsible for delivering the model**

(Contact person, e-mail, Company)

Stefan Boeykens, sb@dstudio.be, D-studio BV (Belgium)

F. **Design Stage**

(according to RIBA, mark with a cross (X)) | *+ INFO*

Strategic definition	
Preparation and briefing	
Concept design	X
Spatial coordination	
Technical design	

Manufacturing and construction	
Handover	
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	-1: 170,19 +0: 278,05 +1: 232,75	m^2
Number of stories (below ground level)	1	
Number of stories (above ground level)	2	
Height (top floor level)	6	m
Height (roof level)	9	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Nothing foreseen	
Number of rooms	35	
Number of apartments (or independent units)	5 = 2 appartments + 2 others + 1 garage	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Technical room and shared elevator/staircases	
Others		

H. Available models

IFC *(Y/N)*	Y
IFC version	IFC4 Add2
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph...) Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Y Archicad 28 NED (BE-Template) Various exports Architecture

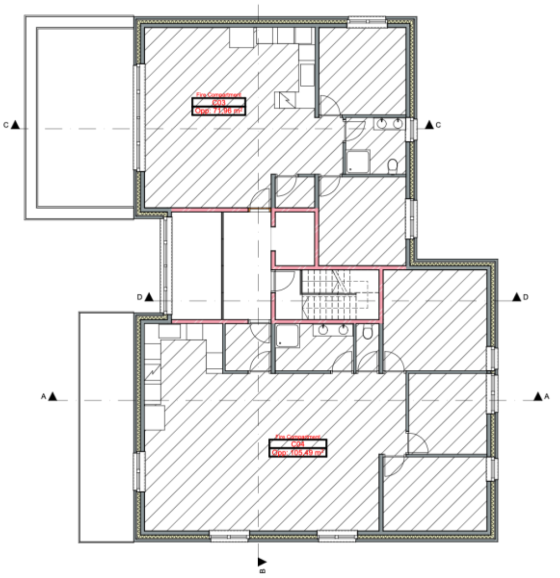
I. Model restrictions

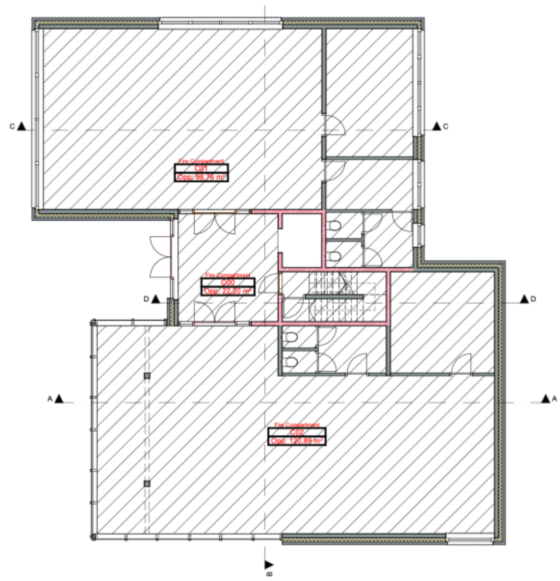
Confidentiality *(only internal use in the scope of the project, full open)*	Free to use
Others	

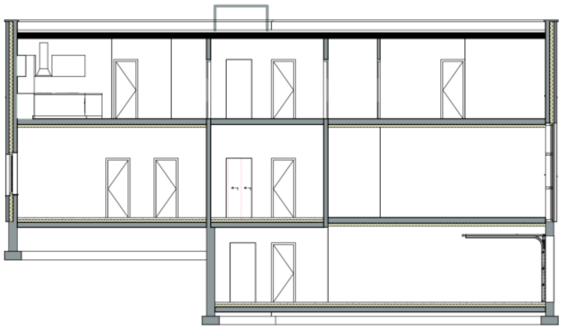
J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓

See images below. Floor plans, sections and elevations to scale are available as part of the dataset.







3.3.4 Dataset 12 – ZIN

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

Large-scale mixed-use project in Brussels, which has been completed in 2024. This project is not a public dataset but gives a good benchmark due to its size and complexity. It represents realistic, large high-rise buildings, with a complex programme and various fire protection measures. As a renovation project, material re-use and recycling were major design concerns. More info on the owner's website: https://www.befimmo.be/en/buildings/zin. Additional info on the Flemish Government site (as one of the main occupants):
https://www.vlaanderen.be/intern/werkplek/kantoor-en-gebouwen/gebouwen/overzicht-gebouwen/marie-elisabeth-belpairegebouw

B. Project location

(city, country)

Brussels (Belgium)

C. Type of Building

(Residential, Office, Health Care, other - please specify)

Mixed use (office, hotel, parking, residential)

D. Type of project

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

Stefan Boeykens, sb@dstudio.be, D-studio BV

F. Design Stage

(according to RIBA, mark with a cross (X)) | *+ INFO*

Strategic definition	
Preparation and briefing	
Concept design	X
Spatial coordination	X
Technical design	X
Manufacturing and construction	X
Handover	X
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	115K	m^2
Number of stories (below ground level)	5	
Number of stories (above ground level)	31	
Height (top floor level)	107	m
Height (roof level)	111	m

Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Sprinklers, extinguishers, fire dampers, hosereels	
Number of rooms		
Number of apartments (or independent units)	192 appartments 200 hotel rooms + offices & parking	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Yes (technical rooms)	
Others		

H. Available models

IFC *(Y/N)*	Y
IFC version	2x3
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph...) Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Y Revit 2023 Architecture, Structure, MEP, ...

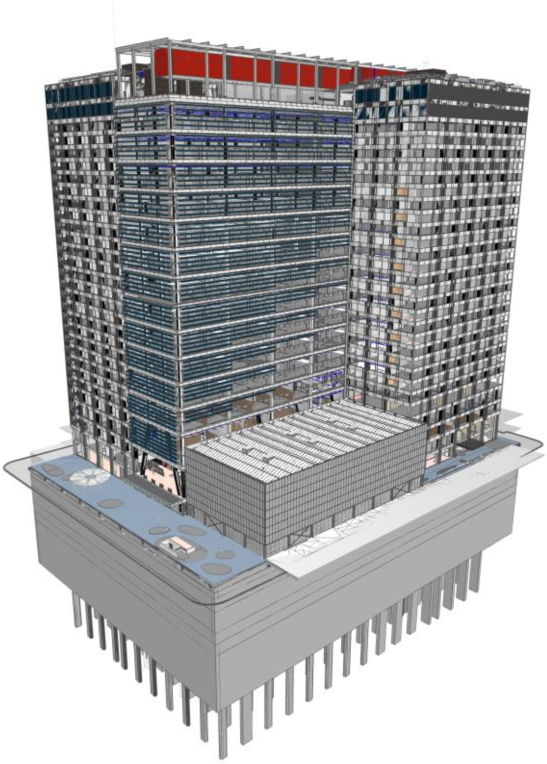
I. Model restrictions

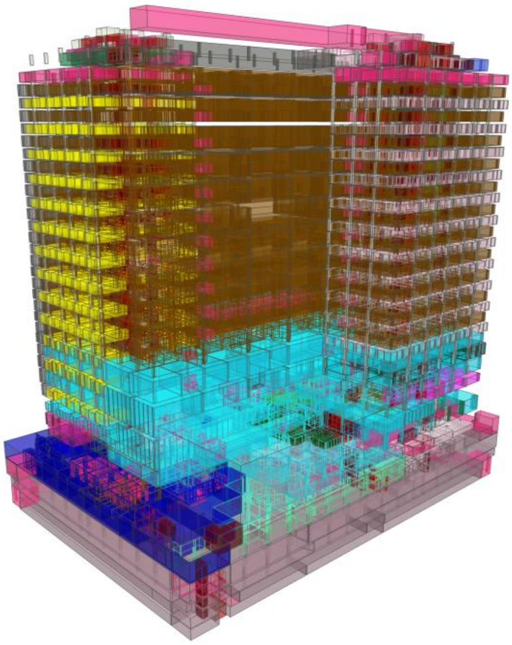
Confidentiality *(only internal use in the scope of the project, full open)*	Internal use by D-studio only (under NDA from the owner)
Others	

J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓

See images below. Floor plans, sections and elevations to scale are available as part of the dataset.





3.4 Denmark Datasets

3.4.1 Dataset 3 – Hovparken

A. **General description**

(framework, motivation to develop it, relevance/significance at national level, etc.)

Hovparken is a public housing development with 210 apartments located at Søndermarken 60-88, Kornmarken 2-28 and Hovvej 1-25, in Espergærde. The development is residential blocks consisting of three floors (ground floor, first floor, and second floor) and an unused attic space. Some of the blocks are connected with staggered intermediate gables. Approximately half the entrances have full basements, and the remaining have crawl spaces. Basements are equipped with storage rooms and shared technical, laundry, and security rooms. The basement will not be altered in connection with the renovation. The blocks have floor areas ranging from 1140 to 3775 m^2, and are arranged with apartments on the ground, first, and second floors. The ground floor is raised 0.9 meters above ground level, and there is 6.5 meters to the ceiling on the top floor. The apartments are set up with stairwells that lead directly to the ground outside. Each stairwell serves a maximum of nine apartments. The apartments were built in 1965 and are constructed with traditional brick construction as the exterior wall material and tiles as the roofing material.

B. **Project location**

(city, country)

Espergærde, Denmark

C. **Type of Building**

(Residential, Office, Health Care, other - please specify)

Residential (apartments)

D. **Type of project**

(synthetic, real project)

Real project

E. **Responsible for delivering the model**

(Contact person, e-mail, Company)

Daniel Tykjær Pedersen, danieltykjaer.pedersen@sweco.dk, Sweco Denmark. The project team consists of Sweco Denmark, and Sweco Architects. The developer is “Boligselskabet Nord-kysten”.

F. **Design Stage**

(according to RIBA, mark with a cross (X)) | + INFO

Strategic definition	
Preparation and briefing	
Concept design	
Spatial coordination	
Technical design	X
Manufacturing and construction	
Handover	
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	The blocks have floor areas ranging from 1140 to 3775 m^2	m^2
Number of stories (below ground level)	1	
Number of stories (above ground level)	3	
Height (top floor level from terrain)	6.43	m
Height (roof level from terrain)	9.15	m
Fire protection equipment (sprinklers, extinguishers, etc.)	Smoke alarms in every apartment	
Number of rooms	N/A	
Number of apartments (or independent units)	210	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Theres storage- technical- laundry- and security rooms in the basement (but its not a part of the primary project)	
Others		

H. Available models

IFC *(Y/N)*	Y - Can be exported from Revit
IFC version	Unknown
Native software format *(Y/N)*	N
Native software name and version	Revit 2024
Other formats (CAD, 3D, Graph...)	
Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Architecture (fireplans is in 2d)

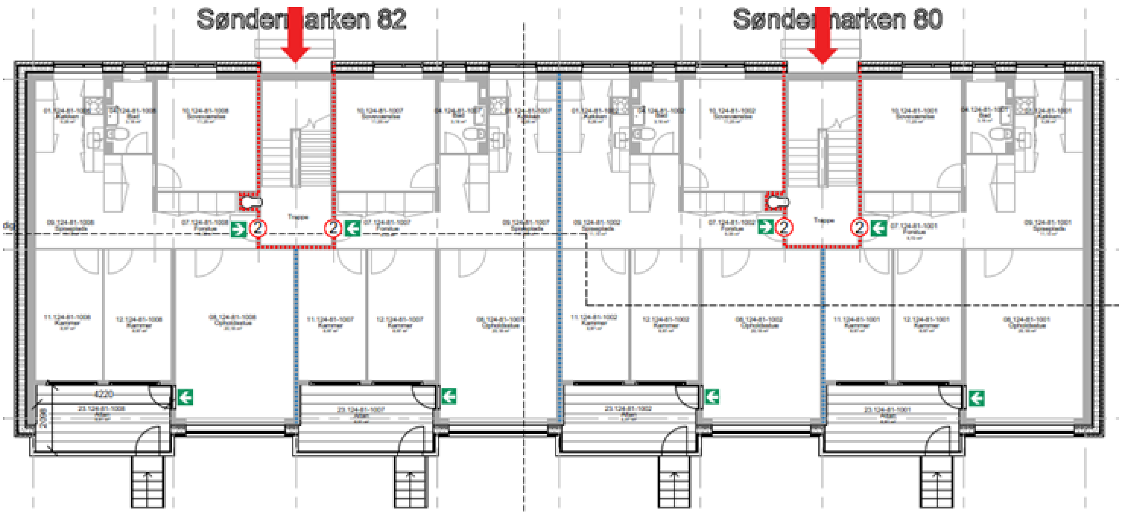
I. Model restrictions

Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	

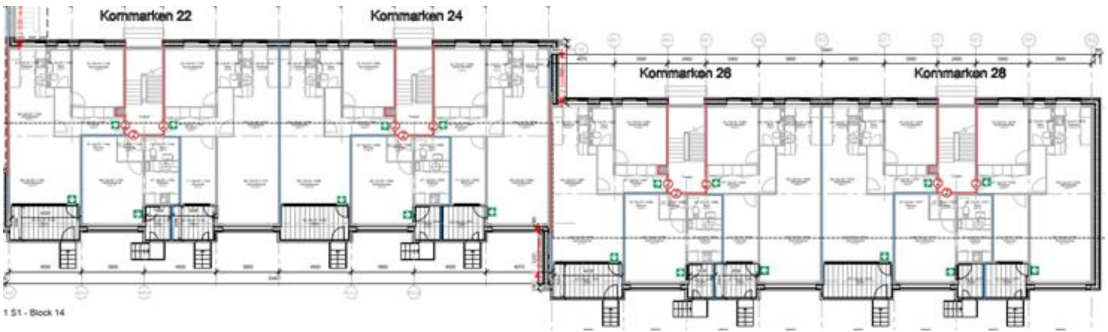
Situation plan, overview



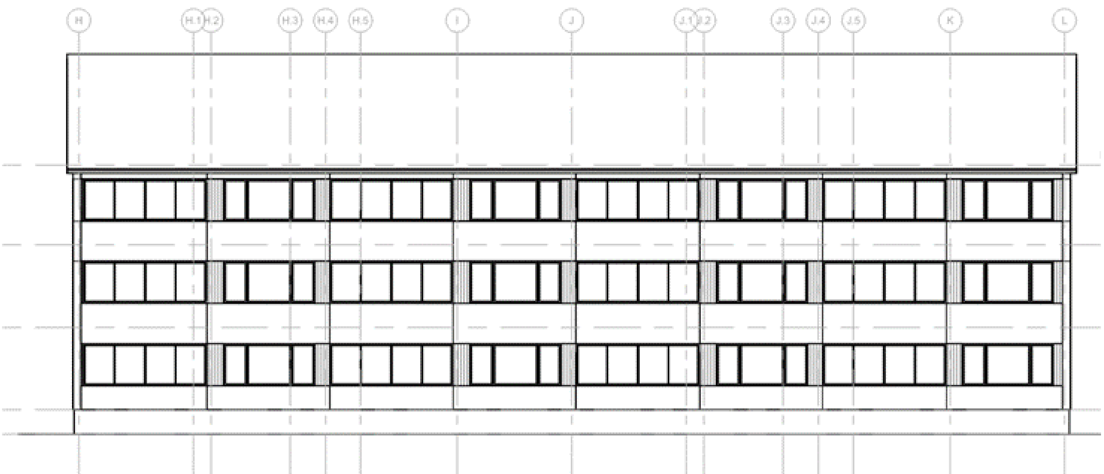
Residential block 10, 11 and 12

Residential block 13 and 16

Residential block 14 and 15



Residential block 14 and 15



Facade drawing block 10, 11 and 12

Basement block 11

3.4.2 Dataset 17 – DTU Space

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

The Technical University of Denmark (DTU) has its main campus in Lyngby and is unique in owning most of its premises, whereas other universities typically rent facilities from the state or private sector. The campus has undergone significant development to accommodate the university's growing activities. DTU Space is a department specializing in space and earth science, space technology, and instrumentation systems. The design process for its new building involved close collaboration between the client, architects, engineers, and contractors. The building, which will be connected to an existing campus facility, is planned for completion in 2028. It will have five floors and a total gross floor area of 8,300 m^2. The design phase has been finalized, and the project includes a dedicated fire safety model.

B. Project location

(city, country)

Lyngby, Denmark

C. Type of Building

(Residential, Office, Health Care, other - please specify)

University: Laboratories and offices

D. Type of project

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

Jan Karlshøj, jkar@dtu.dk, Technical University of Danmark. The project team consists of contractor Elindco, consulting engineer company Artelia and Christensen & Co Architects.

F. Design Stage

(according to RIBA, mark with a cross (X)) | + INFO

Strategic definition	
Preparation and briefing	
Concept design	

Spatial coordination	
Technical design	X
Manufacturing and construction	
Handover	
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	8.273 (Total, with basement) 1.463 (floor -1) 1.463 (ground level) 1.463 (floor 1) 1.463 (floor 2) 1.463 (floor 3) 1.048 (floor 4)	m^2
Number of stories (below ground level)	1	
Number of stories (above ground level)	5	
Height (top floor level)	20,10	m
Height (roof level)	25,67	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Fire extinguishers, Automatic fire alarm systems	
Number of rooms	N/A	
Number of apartments (or independent units)	1	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*		
Others		

H. Available models

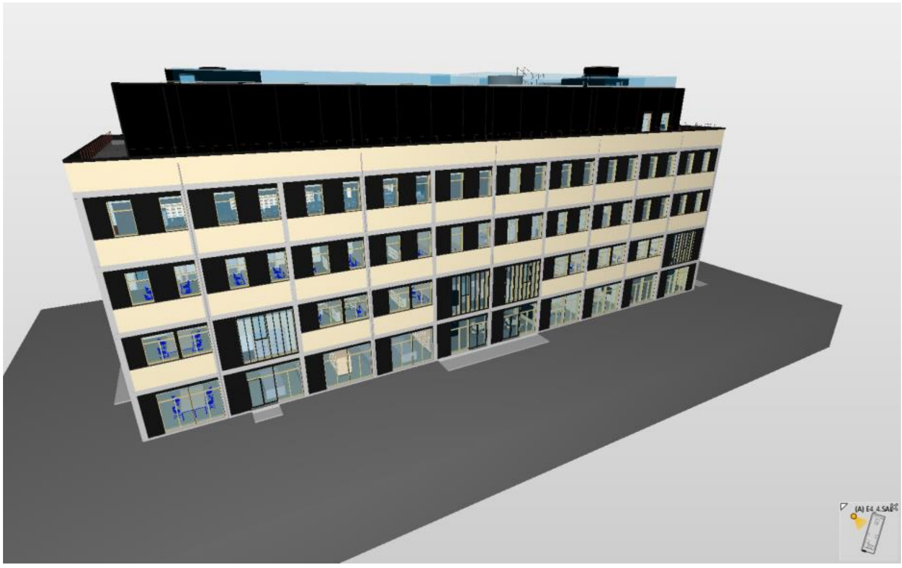
IFC *(Y/N)*	Y
IFC version	2x3
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph...) Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	N Revit Architecture, Fire

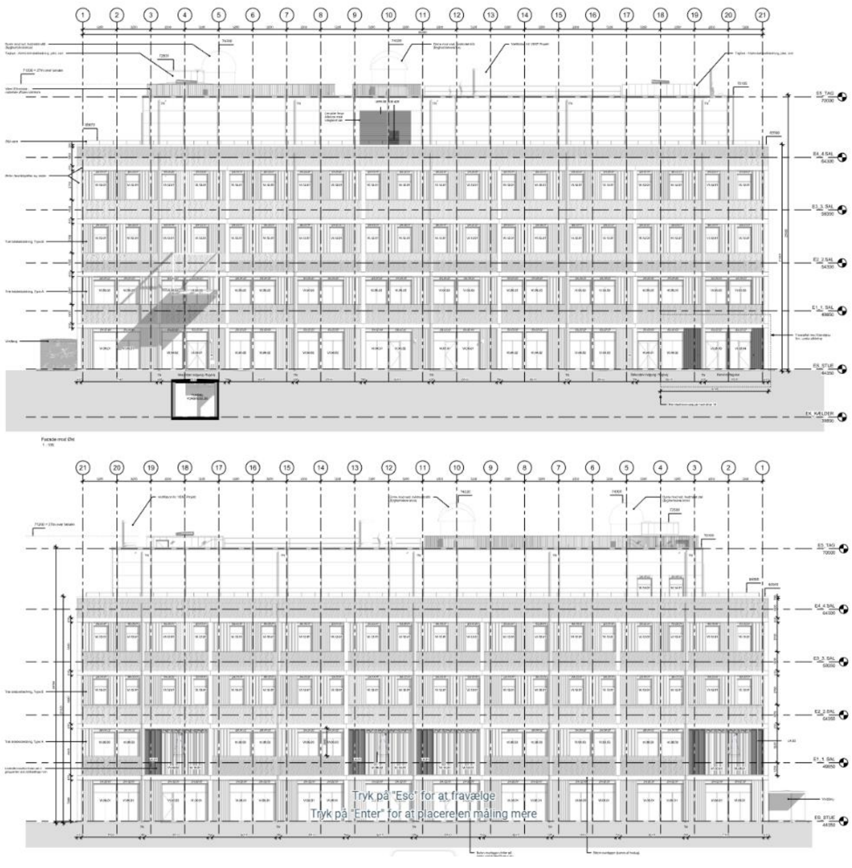
I. Model restrictions

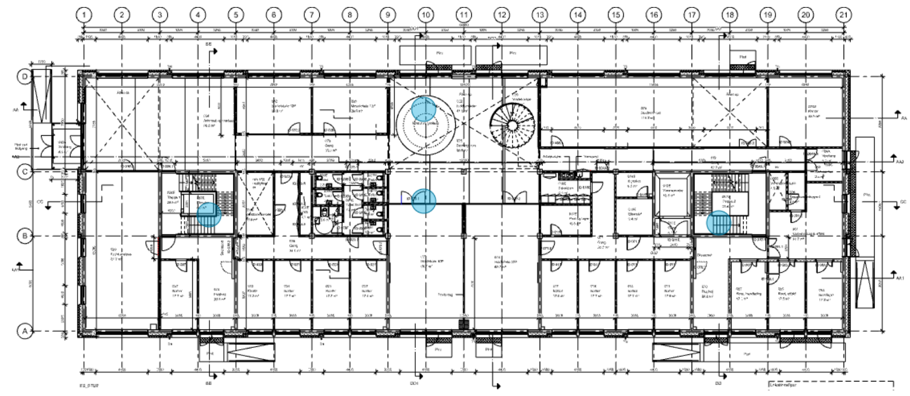
Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

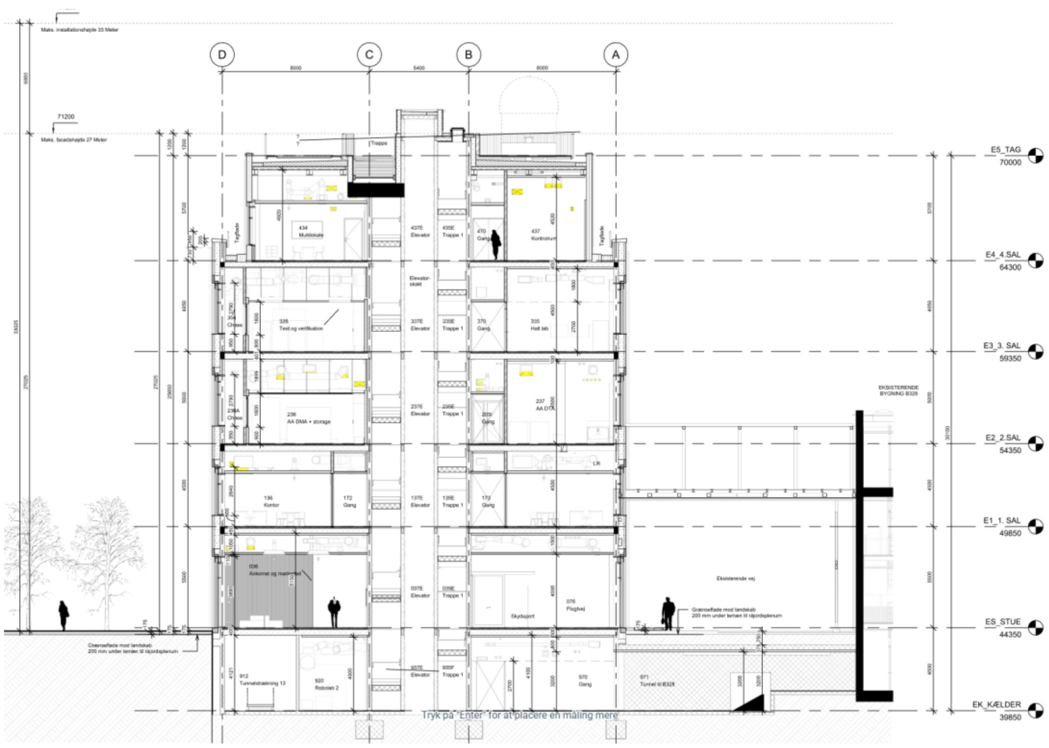
J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓








D
C
B
A
E5_TAG
70000
E4_4.SAL
64300
E3_3. SAL
59350
E2_2.SAL
54350
E1_1. SAL
49850
ES_STUE
44350
EK_KÆLDER
39850

3.5 Netherlands Datasets

3.5.1 Dataset 2 - Eurostaete

A. **General description**

(framework, motivation to develop it, relevance/significance at national level, etc.)

In the Netherlands, urban densification and the requalification of inner-city areas are key priorities in housing policy. The Eurostaete project represents a prominent example of large-scale residential redevelopment in Eindhoven, located in the city center. The project consists of one high-rise tower, reaching 100 and one mid-rise tower, reaching 37 meters in height. The project provides a total of approximately 480 residential units. In addition to housing, the development includes mixed functions such as commercial spaces, shared amenities, and underground parking facilities, resulting in a multifunctional and high-density building complex. The dataset is significant in the Dutch context as it demonstrates current trends in vertical urban living, combining residential use (occupancy type I), parking (occupancy type II), and commercial functions, corresponding to a mixed-occupancy and higher risk category building. The gross floor area amounts to over 50,000 m^2, distributed across residential, parking, and retail spaces. The surroundings are characterized by a highly urbanized environment, with strong connections to existing infrastructure and public space.

B. **Project location**

(city, country)

Eindhoven, The Netherlands

C. **Type of Building**

(Residential, Office, Health Care, other - please specify)

Mixed: residential, commercial and parking

D. **Type of project**

(synthetic, real project)

Real project

E. **Responsible for delivering the model**

(Contact person, e-mail, Company)

Selahattin Dülger, sdulger@stamendekoning.nl, Stam + De Koning Bouw.

F. **Design Stage**

(according to RIBA, mark with a cross (X)) | *+ INFO*

Strategic definition	
Preparation and briefing	
Concept design	
Spatial coordination	
Technical design	
Manufacturing and construction	
Handover	X
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	50.000 m2 totall	m^2
Number of stories (below ground level)	1	
Number of stories (above ground level)	31	
Height (top floor level)	96,10	m
Height (roof level)	99,3	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Fire extinguishers, sprinklers for tower and garage	
Number of rooms	480 residential, 9 commercial	
Number of apartments (or independent units)	48	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Technical rooms and parking garage	
Others		

H. Available models

IFC *(Y/N)*	Y
IFC version	2x3
Native software format *(Y/N)*	Y
Native software name and version	Revit v.2021
Other formats (CAD, 3D, Graph...)	DWG (2D and 3D)
Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Architecture

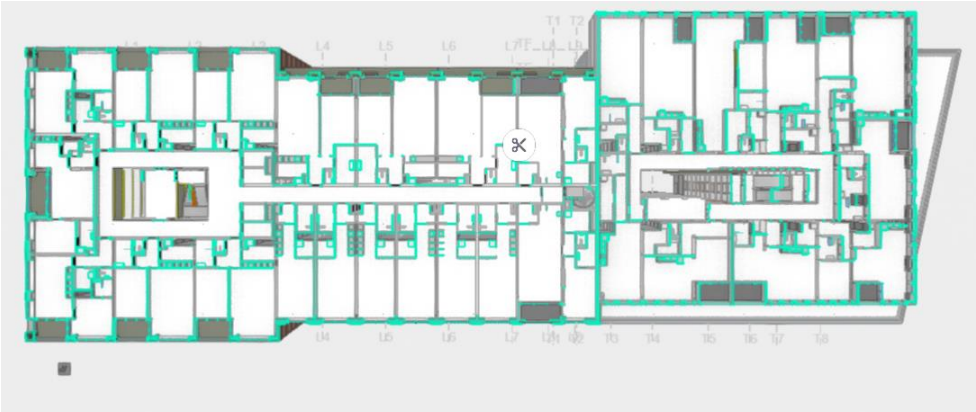
I. Model restrictions

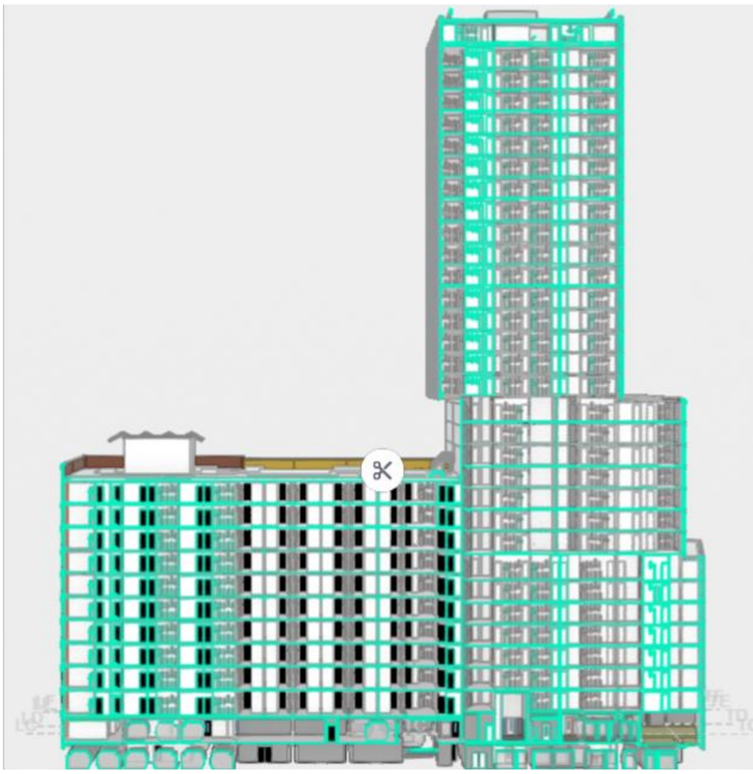
Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓







K. Fire safety information requirements (1st stage – macro perspective) regarding BIM data.

Has model ...?	*Y/N*	More details about the adopted modelling strategy
Building Information (Occupancy Type; Risk Category; etc.)	Y	Information related to FireRating modeled
Reference Plane	Y	. Residential – level . Parking – level
Occupancy data	N	
Room Type (living room; technical room;..)	N	No spaces modeled in IFC, but in RVT
Independent units	Y	Mid-rise and High-rise
Fire walls	Y	EI 30, 60, and 120
Fire Compartment *(including delimitation of fire compartment area)*	Y	Separate model available
Buildings Surroundings *(Isolated; Gable walls; surrounding buildings less than x m; etc.)*	N	

L. Fire safety information of the model not included in the previous topics *(If you identified that in your country is required additional information available on models related with fire safety, please specify here)*

- The car park is protected by a fire detection system and automatic smoke control.
- Pressurization system used.
- Staircases are protected with smoke windows.
- All common areas of the building are protected by emergency lighting.

3.5.2 Dataset 4 - De Tribune

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

In the Netherlands, there is increasing demand for housing solutions that are socially inclusive, sustainable, and well-integrated in urban renewal areas. The De Tribune project in Eindhoven (Strijp-S) is a relevant example that responds to these trends. Developed by housing corporation Trudo in collaboration with architect MVRDV, the project is set on "Field I", between existing landmarks Anton, Haasje Over, and Area51. De Tribune will consist of 56 apartments, all with their own balcony or roof terrace, with sizes ranging from approximately 60 to 80 m^2. On the ground floor and first floor, there will be commercial spaces. The building will have nine storeys and is designed to have a stepped (terraced) profile with a wooden appearance and green balcony edges; terraces will feature trees, shrubs, and sedum plants. The project is nationally significant in that it aligns with policy aims for affordable housing ("middenhuur" or discounted purchase) and with sustainability by integrating green design, biophilic elements, and efficient land use. The surroundings are an urban redevelopment area, with De Tribune contributing to densification in Strijp-S, close to amenities, mixed uses, and existing public infrastructure.

B. Project location

(city, country)

Eindhoven, The Netherlands

C. Type of Building

(Residential, Office, Health Care, other - please specify)

Mixed: residential and commercial

D. Type of project

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

Selahattin Dülger, sdulger@stamendekoning.nl, Stam + De Koning Bouw.

F. Design Stage

(according to RIBA, mark with a cross (X)) | + INFO

Strategic definition	
Preparation and briefing	
Concept design	
Spatial coordination	

Technical design	X
Manufacturing and construction	
Handover	
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	8.000 m2 total	m^2
Number of stories (below ground level)	0	
Number of stories (above ground level)	8	
Height (top floor level)	28,3	m
Height (roof level)	32,4	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Fire extinguishers	
Number of rooms	56 residential, 6 commercial	
Number of apartments (or independent units)	56	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Technical rooms	
Others		

H. Available models

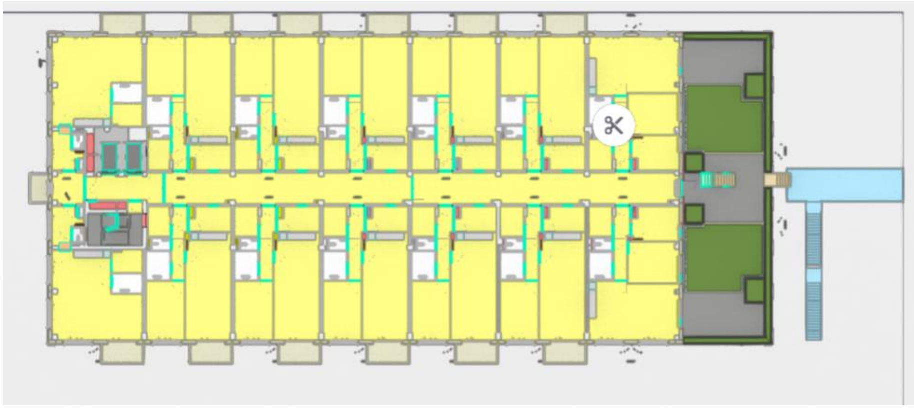
IFC *(Y/N)*	Y
IFC version	2x3
Native software format *(Y/N)*	Y
Native software name and version	Revit v.2022
Other formats (CAD, 3D, Graph...)	DWG (2D and 3D)
Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Architecture

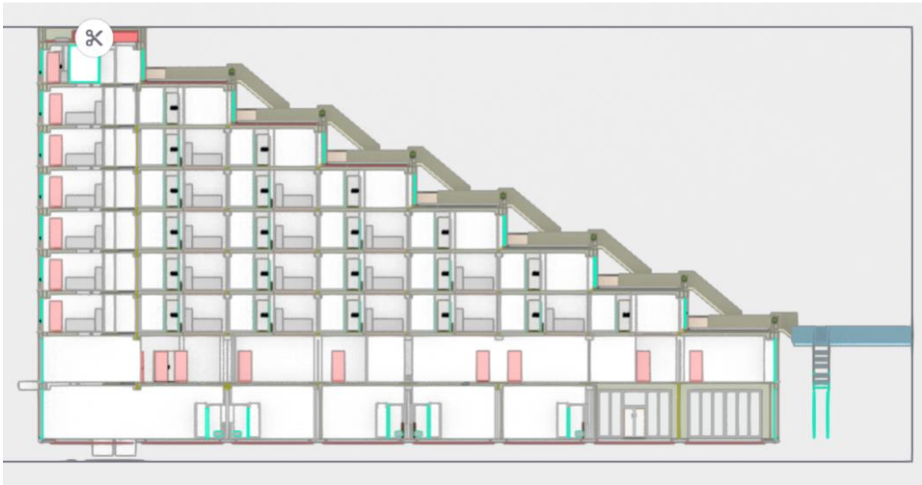
I. Model restrictions

Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓





K. Fire safety information requirements (1st stage – macro perspective) regarding BIM data

Has model ...?	Y/N	More details about the adopted modelling strategy
Building Information (Occupancy Type; Risk Category; etc.)	Y	Information related to Fire Rating modeled
Reference Plane	Y	Residential – level
Occupancy data	N	
Room Type (living room; technical room;..)	N	No spaces modeled in IFC, but in RVT
Independent units	N	
Fire walls	Y	EI 30, 60, and 120
Fire Compartment (including delimitation of fire compartment area)	Y	Separate model available
Buildings Surroundings (Isolated; Gable walls; surrounding buildings less than x m; etc.)	N	

L. Fire safety information of the model not included in the previous topics *(If you identified that in your country is required additional information available on models related with fire safety, please specify here)*

- Staircases are protected with smoke windows.
- All common areas of the building are protected by emergency lighting.

3.5.3 Dataset 13 - S1

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

In the Netherlands, there is a sustained need for high-quality urban housing that respects heritage while delivering luxury living in compact city developments. The Sixty5 (S1) project in Eindhoven (Strijp-S, Spoorzone) exemplifies this approach: it transforms a former industrial site—part of the Philips heritage—into a modern residential building. The project comprises 105 luxury apartments, ranging from studios to large units, designed for both young and older urban residents. The building fronting the street has a height of approx. 25 meters, aligning with neighbouring structures. Above that, a stepped massing creates terraces on the south side for larger apartments, maintaining a respectful distance from the nearby industrial chimney, and offering good solar exposure. Architecturally, off-white pigmented concrete with board-form textures references the industrial cast forms of the old Philips buildings. Large windows with slender frames enhance light penetration and living quality, particularly in the lower parts of the building. Internal circulation is organized via a central corridor that runs the building's length, with large windows at both ends to ensure daylight in the hallways. The project holds national relevance as part of urban redevelopment trends: combining heritage conservation with new housing to densify inner-city areas, providing premium rental housing in a sustainable, well-connected location. The gross floor area is about 10,150 m^2, located in a dense urban environment with mixed uses and strong ties to existing infrastructure and public amenities.

B. Project location

(city, country)

Eindhoven, The Netherlands

C. Type of Building

(Residential, Office, Health Care, other - please specify)

Mixed: residential and commercial

D. Type of project

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

Selahattin Dülger, sdulger@stamendekoning.nl, Stam + De Koning Bouw.

F. Design Stage

(according to RIBA, mark with a cross (X)) | *+ INFO*

Strategic definition	
Preparation and briefing	
Concept design	
Spatial coordination	
Technical design	
Manufacturing and construction	
Handover	

Use	X

G. Key features of the project

GFA (Gross Floor Area) (per floor)	10.150 m2 total	m^2
Number of stories (below ground level)	0	
Number of stories (above ground level)	16	
Height (top floor level)	52,5	m
Height (roof level)	55,9	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Fire extinguishers	
Number of rooms	105 residential, 2 commercial	
Number of apartments (or independent units)	105	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Technical rooms	
Others		

H. Available models

IFC *(Y/N)*	Y
IFC version	2x3
Native software format *(Y/N)*	N
Native software name and version	Archicad
Other formats (CAD, 3D, Graph...)	DWG (2D and 3D)
Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Architecture

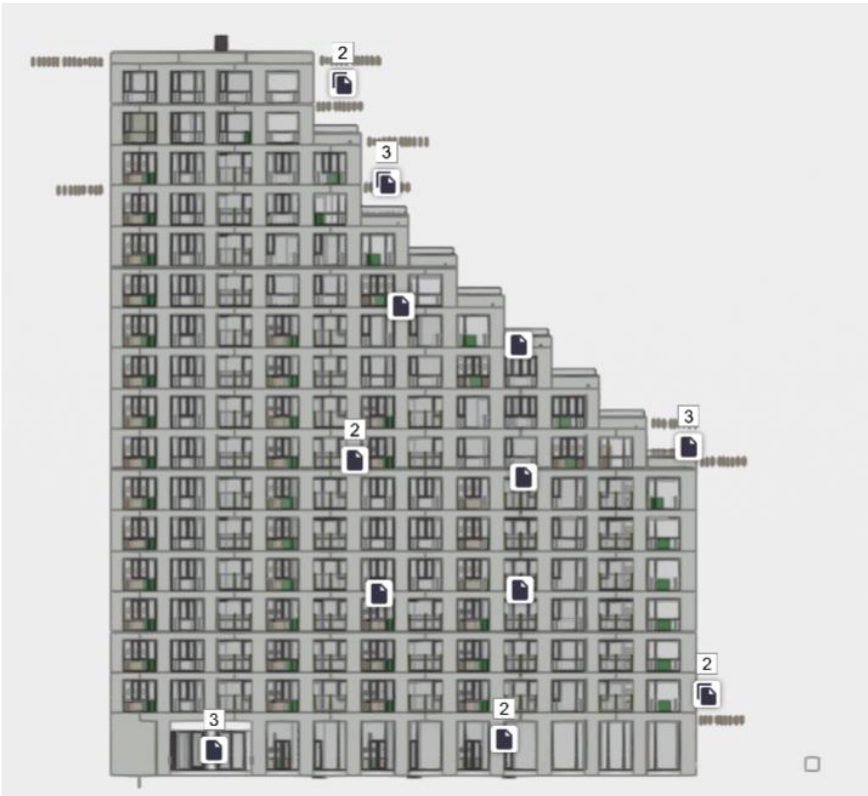
I. Model restrictions

Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓


5
2
2
5
3
3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K. Fire safety information requirements (1st stage – macro perspective) regarding BIM data.

Has model ...?	*Y/N*	More details about the adopted modelling strategy
Building Information (Occupancy Type; Risk Category; etc.)	Y	Information related to Fire Rating modeled
Reference Plane	Y	Residential – level
Occupancy data	N	
Room Type (living room; technical room;..)	N	No spaces modeled in IFC
Independent units	N	
Fire walls	N	
Fire Compartment (including delimitation of fire compartment area)	N	
Buildings Surroundings (Isolated; Gable walls; surrounding buildings less than x m; etc.)	N	

L. Fire safety information of the model not included in the previous topics *(If you identified that in your country is required additional information available on models related with fire safety, please specify here)*

- Staircases are protected with smoke windows.
- All common areas of the building are protected by emergency lighting.

3.6 Portugal Datasets

3.6.1 Dataset 10 - Quinta de Nápoles

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

In Portugal, the Douro Valley stands as a key wine region with increasing relevance in sustainable viticulture and high-quality wine production. This dataset represents a typical wine estate in the Douro Demarcated Region, integrating viticulture, winemaking and tourism activities, and classified as risk category 1. The estate comprises wine production facilities, storage cellars, tasting rooms and administrative areas, with a gross built area of approximately 2 500 m^2. Surrounding the main buildings are around 30 hectares of terraced vineyards and natural landscape, ensuring an isolated rural context that minimizes external urban influence.

B. Project location

(city, country)

São João da Pesqueira, Viseu, Portugal

C. Type of Building

(Residential, Office, Health Care, other - please specify)

Industrial building

D. Type of project

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

José Aidos Rocha, j.aidos.rocha@exactusensu.pt, Exactusensu.

Jéssica Reis, jessica.reis@vn2r.pt, VN2R.

F. Design Stage

(according to RIBA, mark with a cross (X)) | *+ INFO*

Strategic definition	
Preparation and briefing	
Concept design	
Spatial coordination	
Technical design	X
Manufacturing and construction	
Handover	
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	1 459 (Total) 460,60 (floor -1) 910,60 (ground level) 87,80(floor 1)	m^2
Number of stories (below ground level)	1	

Number of stories (above ground level)	2	
Height (top floor level)	4,46	m
Height (roof level)	9,40	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Fire extinguishers	
Number of rooms	4	
Number of apartments (or independent units)	NA	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Technical room on the 1º floor	
Others		

H. Available models

IFC *(Y/N)*	Y
IFC version	2021
Native software format *(Y/N)*	Y
Native software name and version	Revit v.2021
Other formats (CAD, 3D, Graph...)	DWG (2D and 3D)
Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Architecture

I. Model restrictions

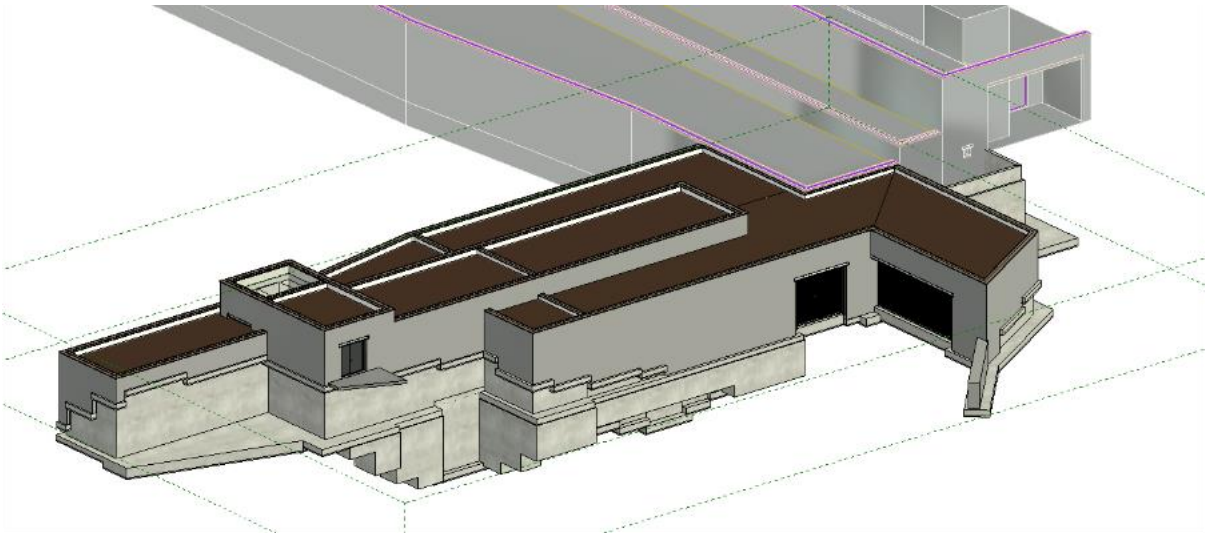
Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

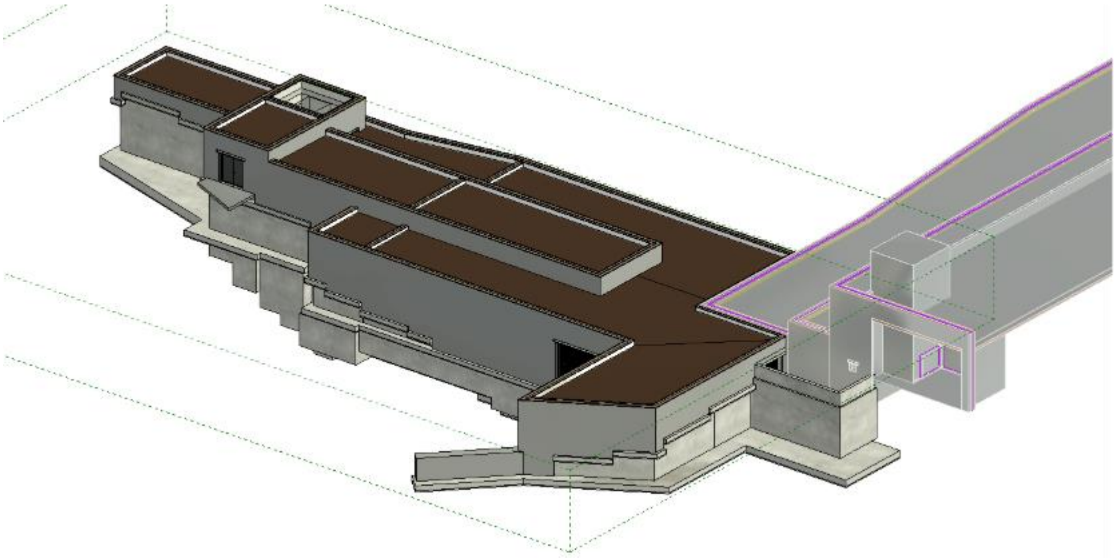
J. Figures/images & graphical animations

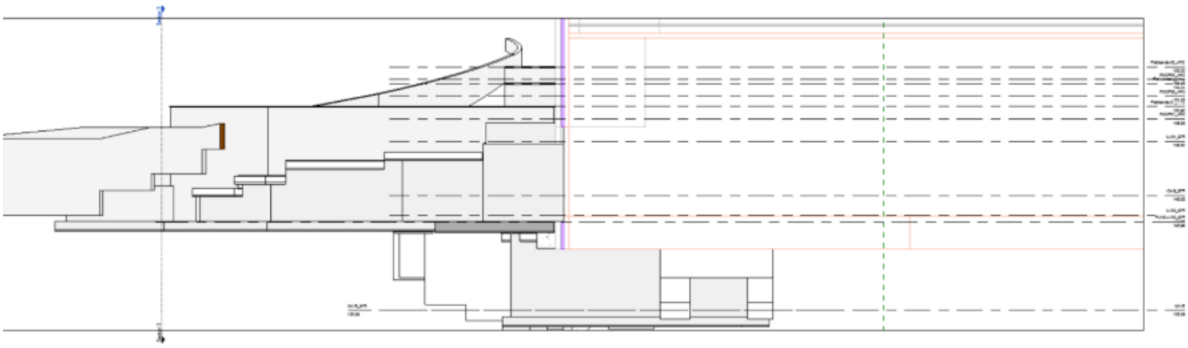
3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓

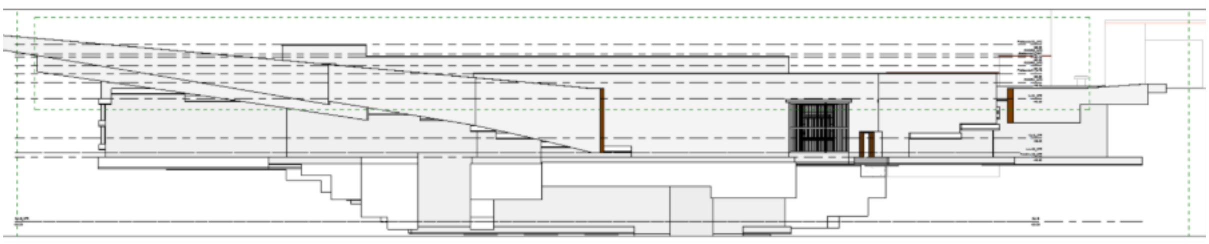
K. Figures/images & graphical animations

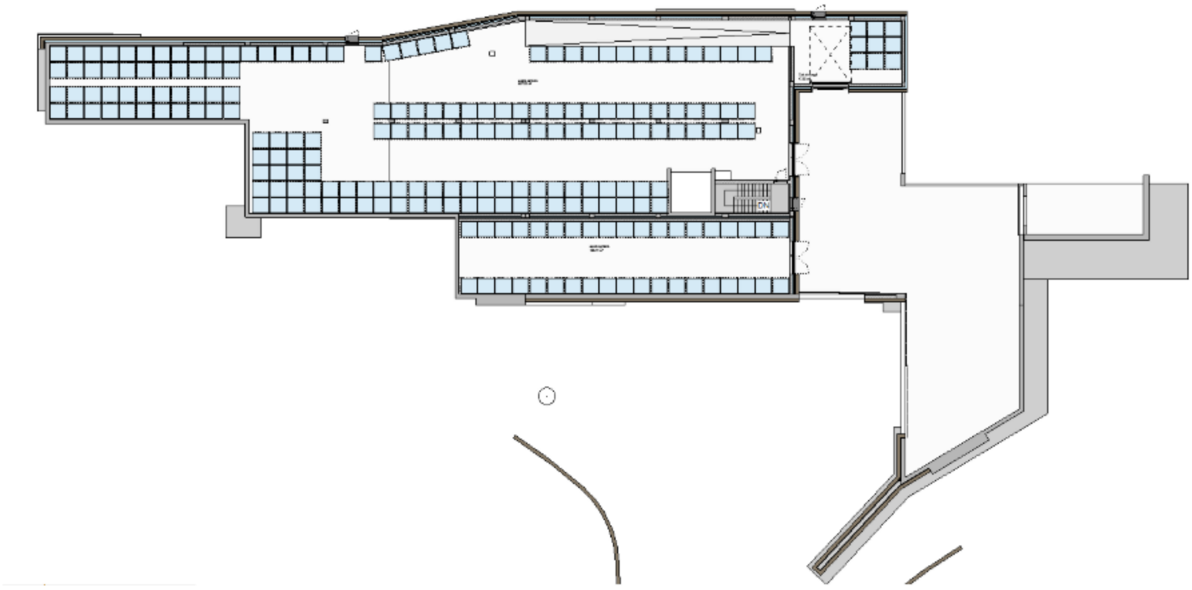
3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓







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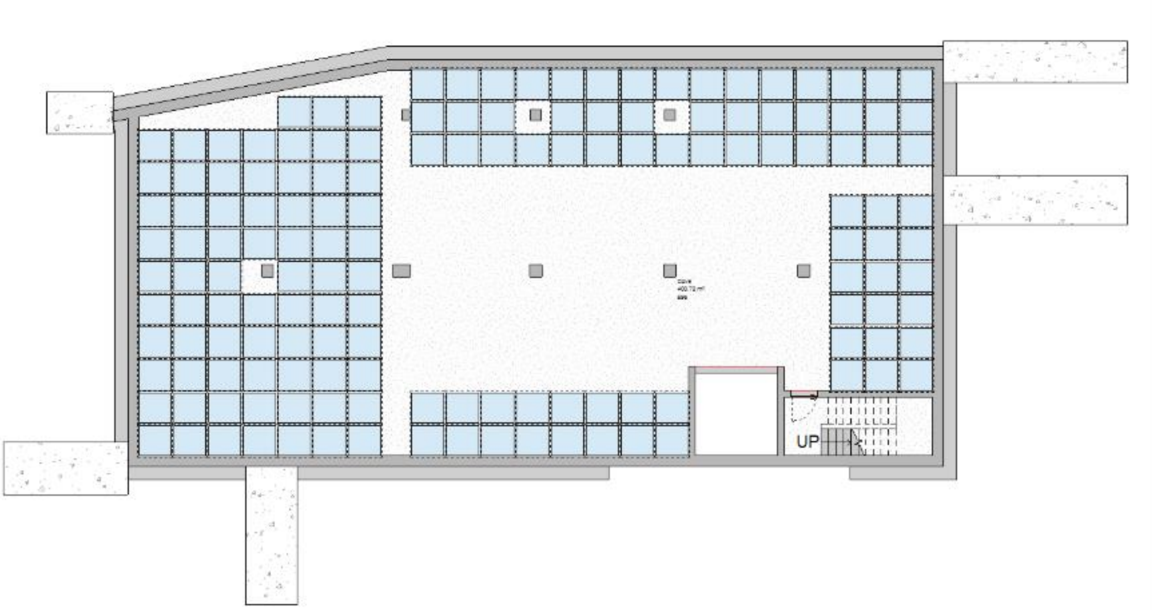

UP

L. **Fire safety information requirements (1st stage – macro perspective) regarding BIM data**

Has model ...?	*Y/N*	More details about the adopted modelling strategy
Building Information *(Occupancy Type; Risk Category; etc.)*	Y	. Industrial – risk category 1
Reference Plane	Y	. Industrial – level 0 and 1
Occupancy data	NA	38
Room Type (living room; technical room;..)	Y	Technical Room (basement)
Independent units	Y	. Residential . Parking
Fire walls	Y	. EI 60 [fire protection of the staircases, lift loads and compartimentation walls]
Fire Compartment *(including delimitation of fire compartment area)*	Y	. EI 60 [insulation between floors]
Buildings Surroundings *(Isolated; Gable walls; surrounding buildings less than x m; etc.)*	NA	The building is **isolated**. The part under analysis is an **extension** and is **attached** to the existing structure.

M. **Fire safety information of the model not included in the previous topics** *(If you identified that in your country is required additional information available on models related with fire safety, please specify here)*

- The building is protected by a detection and warning system.
- The building is protected by emergency lighting.

3.6.2 Dataset 11 - Hotel do Carmo

A. **General description**

(framework, motivation to develop it, relevance/significance at national level, etc.)

In Portugal, the city of Porto plays a central role in tourism and cultural heritage, driving significant investment in hospitality infrastructure. This dataset represents one building, Block B, of a typical urban hotel, classified as Occupancy Type VII – Hotel use, and risk category 3. The building comprises three above-ground floors and one basement level, integrating 17 guest rooms at the upper levels, reception, lobby and wine bar at ground floor, reception and lounge areas, and technical/service areas in the basement. The gross built area is approximately 3 100 m^2. The hotel is located in a dense urban setting near the historic Carmo Church, surrounded by mixed-use buildings with commercial and residential functions.

B. **Project location**

(city, country)

Porto, Portugal

C. **Type of Building**

(Residential, Office, Health Care, other - please specify)

Hotel

D. **Type of project**

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

José Aidos Rocha, j.aidos.rocha@exactusensu.pt, Exactusensu.

Jéssica Reis, jessica.reis@vn2r.pt, VN2R.

F. Design Stage

(according to RIBA, mark with a cross (X)) | *+ INFO*

Strategic definition	
Preparation and briefing	
Concept design	X
Spatial coordination	
Technical design	
Manufacturing and construction	
Handover	
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	3 121,90(Total) -711,50 (floor -1) 818,20 (ground level) 796,10 (floor 1) 796,10 (floor 2)	m^2
Number of stories (below ground level)	3	
Number of stories (above ground level)	1	
Height (top floor level)	9,30	m
Height (roof level)	13,60	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Fire extinguishers, fire hose reels, sprinklers and wet pipe	
Number of rooms	17	
Number of apartments (or independent units)	NA	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Rooms are separated in sectors (EI30), horizontal evacuation paths (EI60), stairs and technical areas (EI90)	
Others		

H. Available models

IFC *(Y/N)*	Y
IFC version	2022
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph...)	Y Revit v.2021 DWG (2D and 3D)

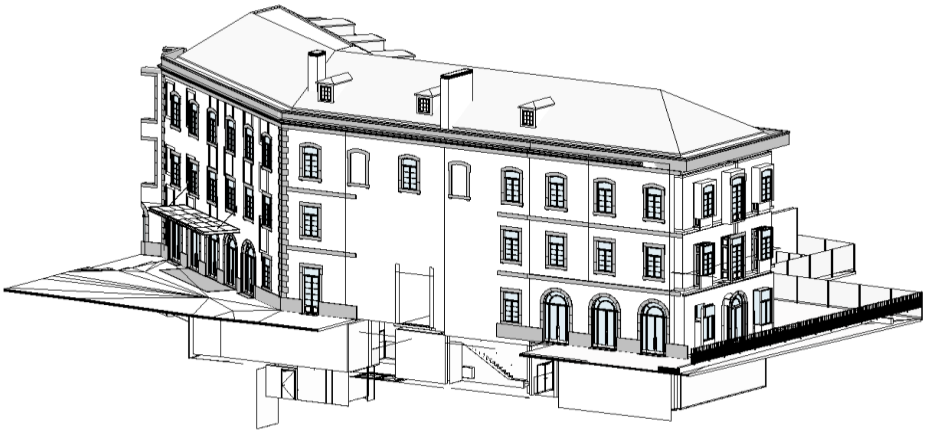
Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Architecture

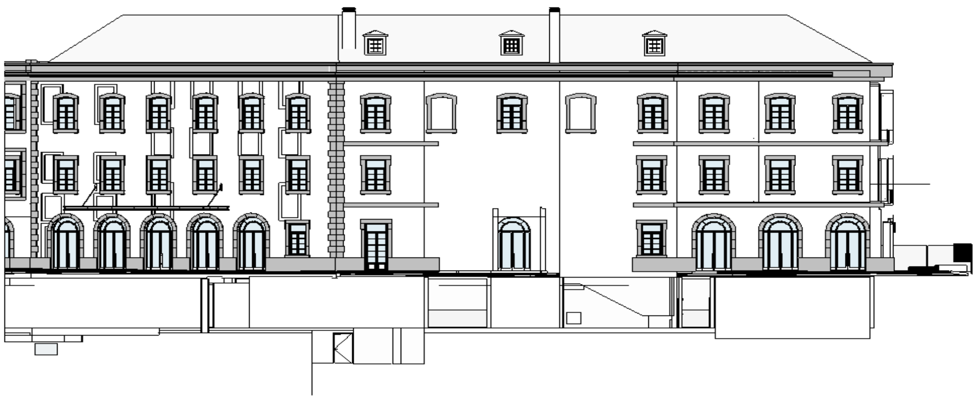
I. Model restrictions

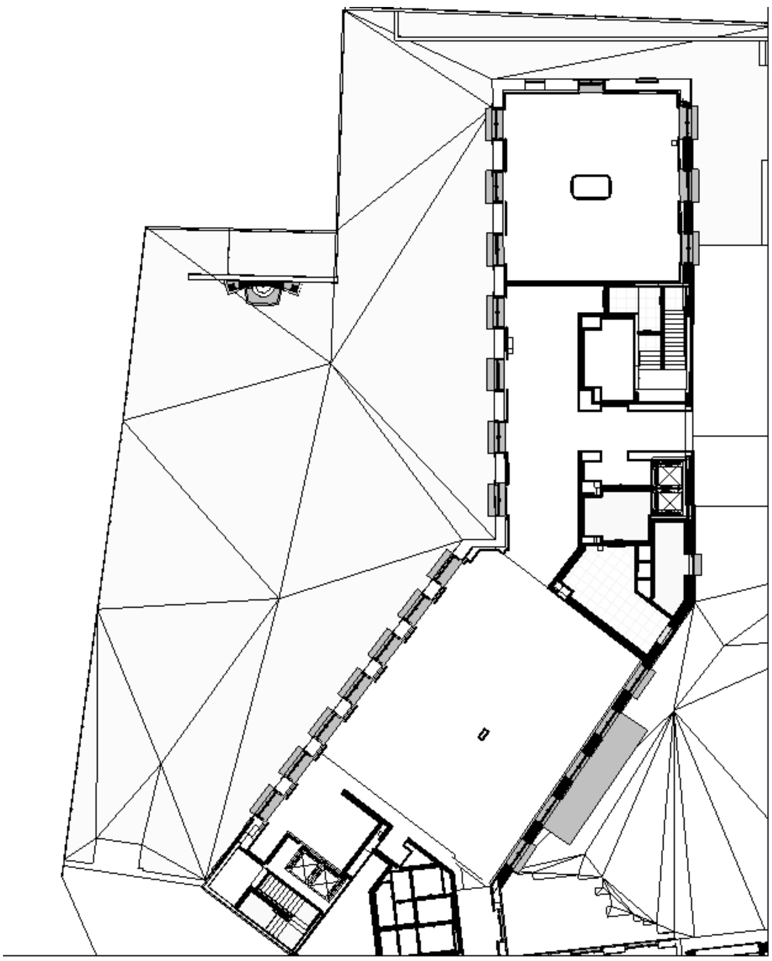
Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

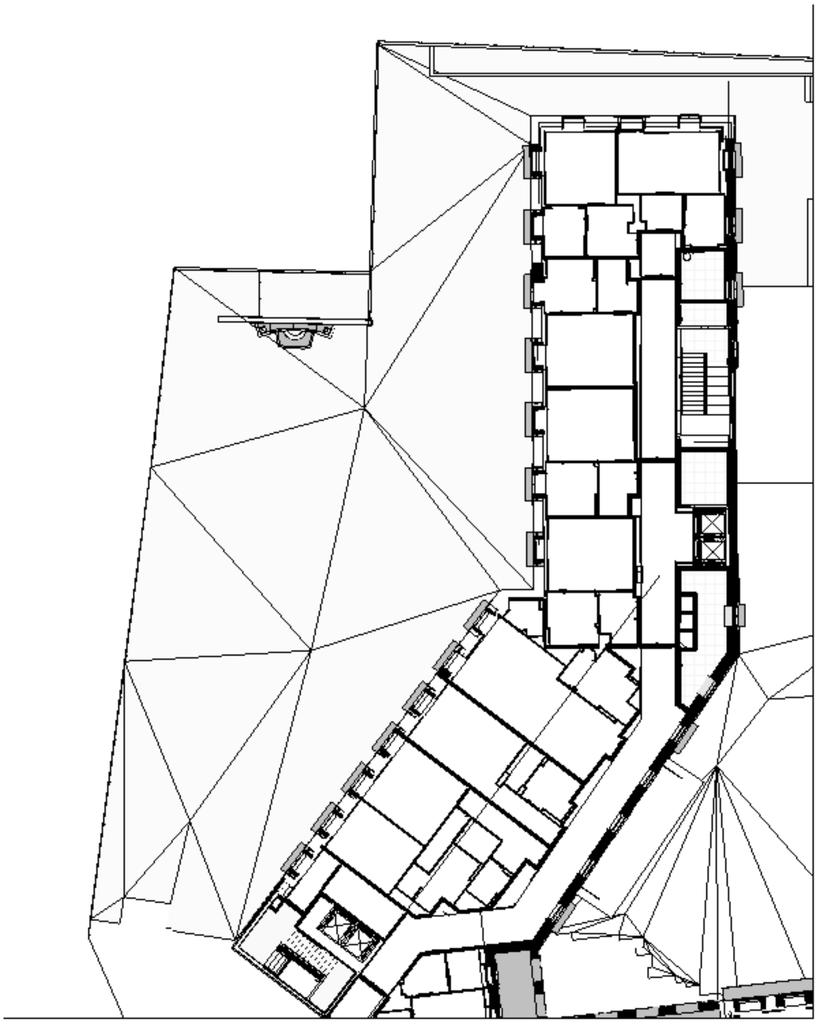
J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓









K. Fire safety information requirements (1st stage – macro perspective) regarding BIM data

Has model ...?	*Y/N*	More details about the adopted modelling strategy
Building Information *(Occupancy Type; Risk Category; etc.)*	Y	. Hotel– risk category 3
Reference Plane	Y	. Hotel – ground level
Occupancy data	Y	Wine bar – 81 Bedrooms – 34 Reception - 68
Room Type (living room; technical room;..)	Y	Technical Rooms, bed-rooms, foyers, offices, wine bar, reception
Independent units	Y	. Residential . Parking
Fire walls	Y	. EI 60 [elevators, technical rooms and corridors] EI 90 [stairs, operation room, fire water reserve and fire pump room]
Fire Compartment *(including delimitation of fire compartment area)*	Y	. REI 90 [insulation between floors and stairs]
Buildings Surroundings *(Isolated; Gable walls; surrounding buildings less than x m; etc.)*	Y	Bloc B has a separation with Blocs A and C, with walls EI60 and E30C for windows and general openings.

L. Fire safety information of the model not included in the previous topics *(If you identified that in your country is required additional information available on models related with fire safety, please specify here)*

- The building is completely protected by a sprinkler system.
- All evacuation staircases are protected with smoke control systems.
- All areas of the building are protected by emergency lighting, smoke detection and signage of fire-fighting equipment and evacuation routes.

3.6.3 Dataset 14 - HCC Amadora

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

In Portugal, the strategic public policies for the forecoming years encourage a relevant investment in low-cost housing. This dataset is representative of most of the building stock in Portugal, since includes occupancy types I (residential use) and II (parking), resulting in mixed occupancy, and risk category 1. The dataset consists of a residential building composed of 4 floors, 3 of which are dedicated to housing and the lower floor to car parking. In each floor there are 16 independent units and the gross area per floor is 887 m^2. The total number of independent units is 48. The building surroundings consist predominantly in a non-occupied area.

B. Project location

(city, country)

Amadora, Portugal

C. Type of Building

(Residential, Office, Health Care, other - please specify)

Mixed: residential and parking

D. Type of project

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

José Aidos Rocha, j.aidos.rocha@exactusensu.pt, Exactusensu.

Jéssica Reis, jessica.reis@vn2r.pt, VN2R.

F. Design Stage

(according to RIBA, mark with a cross (X)) | + INFO

Strategic definition	
Preparation and briefing	
Concept design	X
Spatial coordination	
Technical design	
Manufacturing and construction	
Handover	
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	3972 (Total) 1311 (floor -1) 887 (ground level) 887 (floor 1) 887 (floor 2)	m^2
Number of stories (below ground level)	1	
Number of stories (above ground level)	3	
Height (top floor level)	6,10	m
Height (roof level)	9,40	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Fire extinguishers, fire hose reels [only the the parking]	
Number of rooms	N/A	
Number of apartments (or independent units)	48	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Technical are in the basement	
Others		

H. Available models

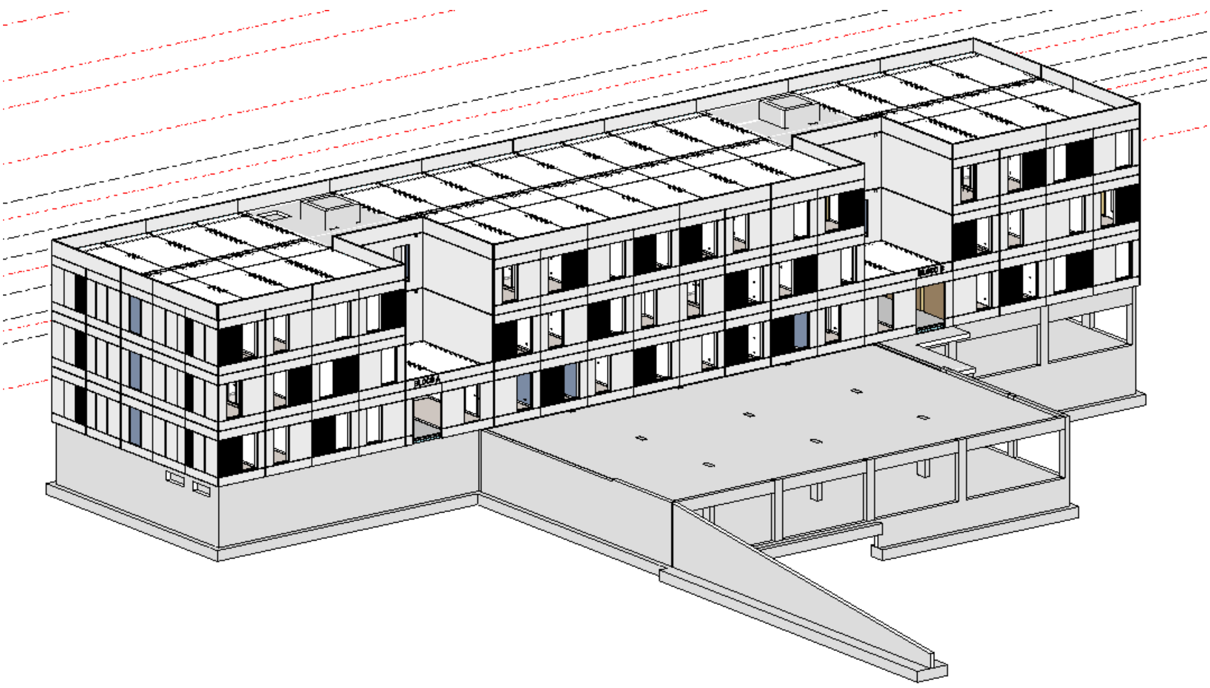
IFC *(Y/N)*	Y
IFC version	
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph…) Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Y Revit v.2021 DWG (2D and 3D) Architecture

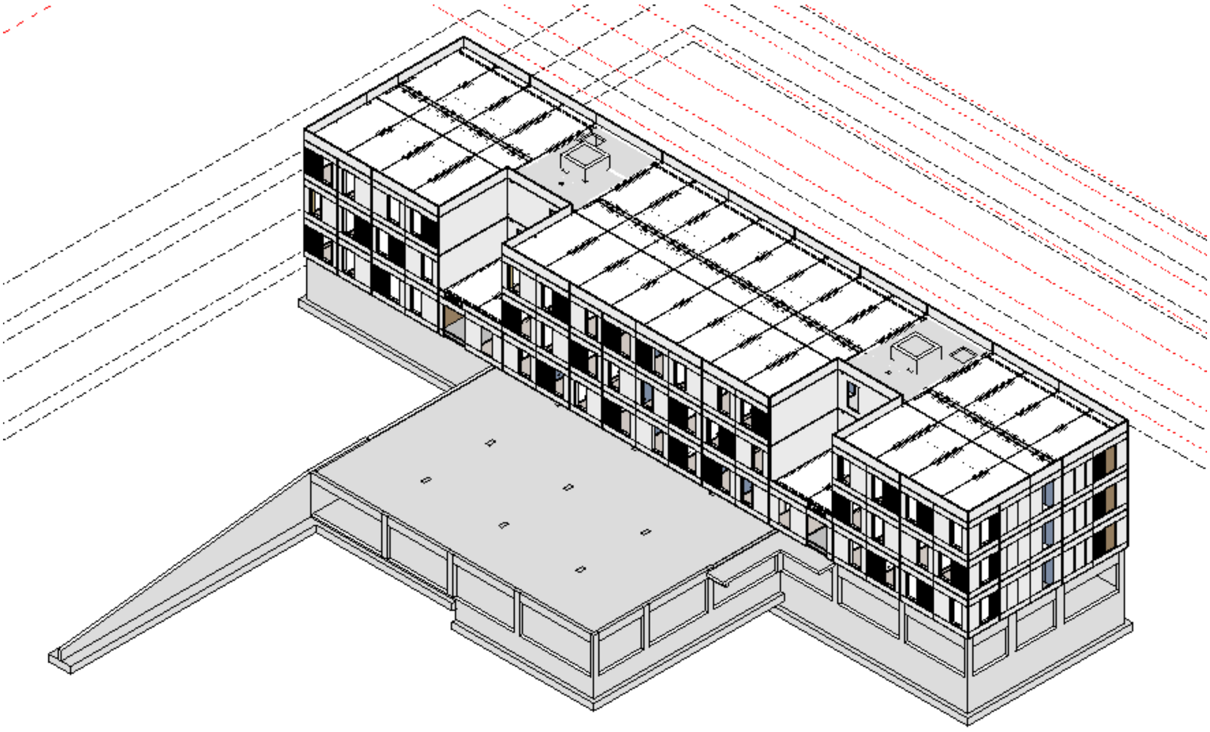
I. Model restrictions

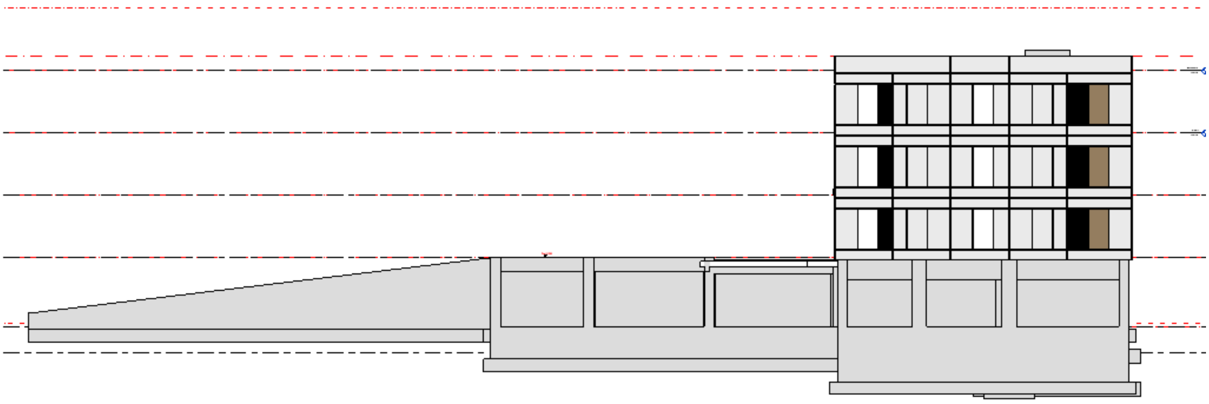
Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

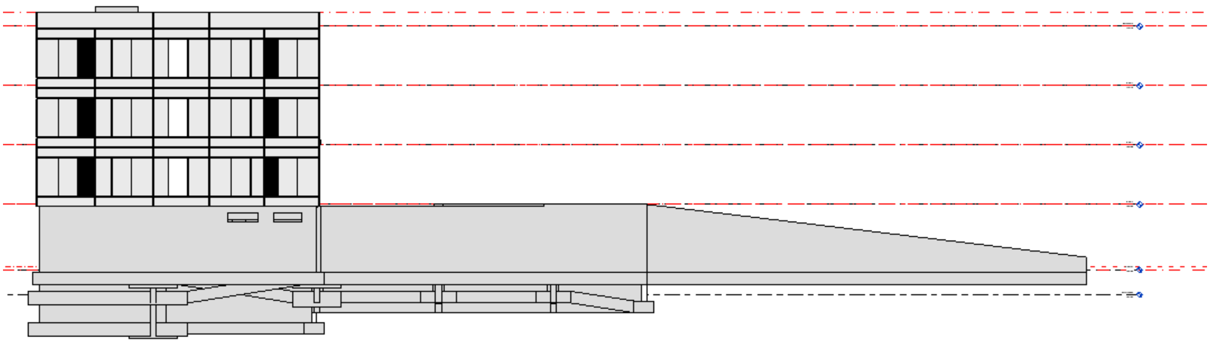
J. Figures/images & graphical animations

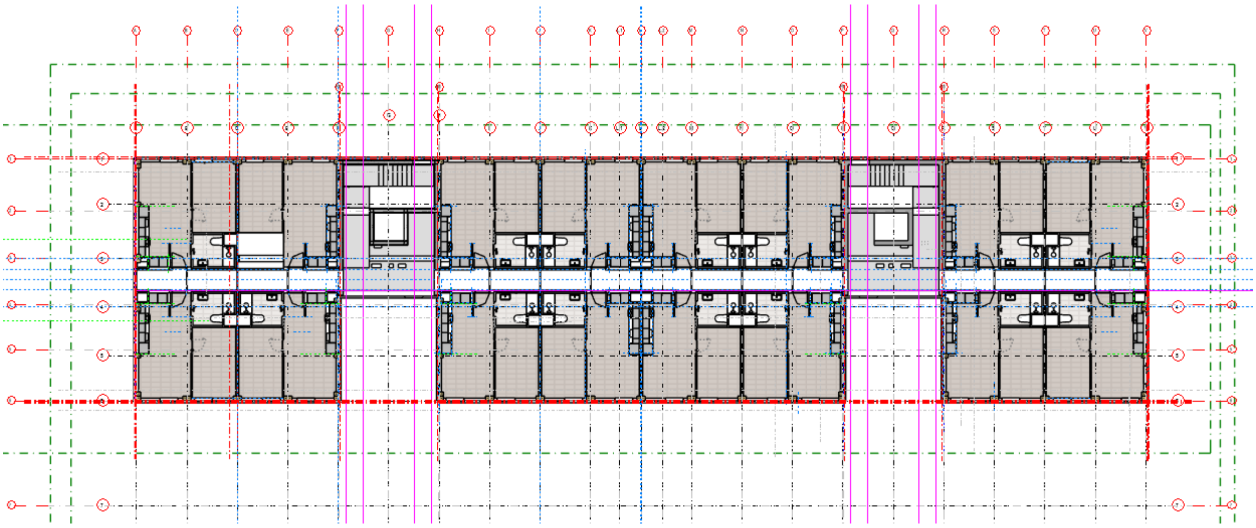
3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓

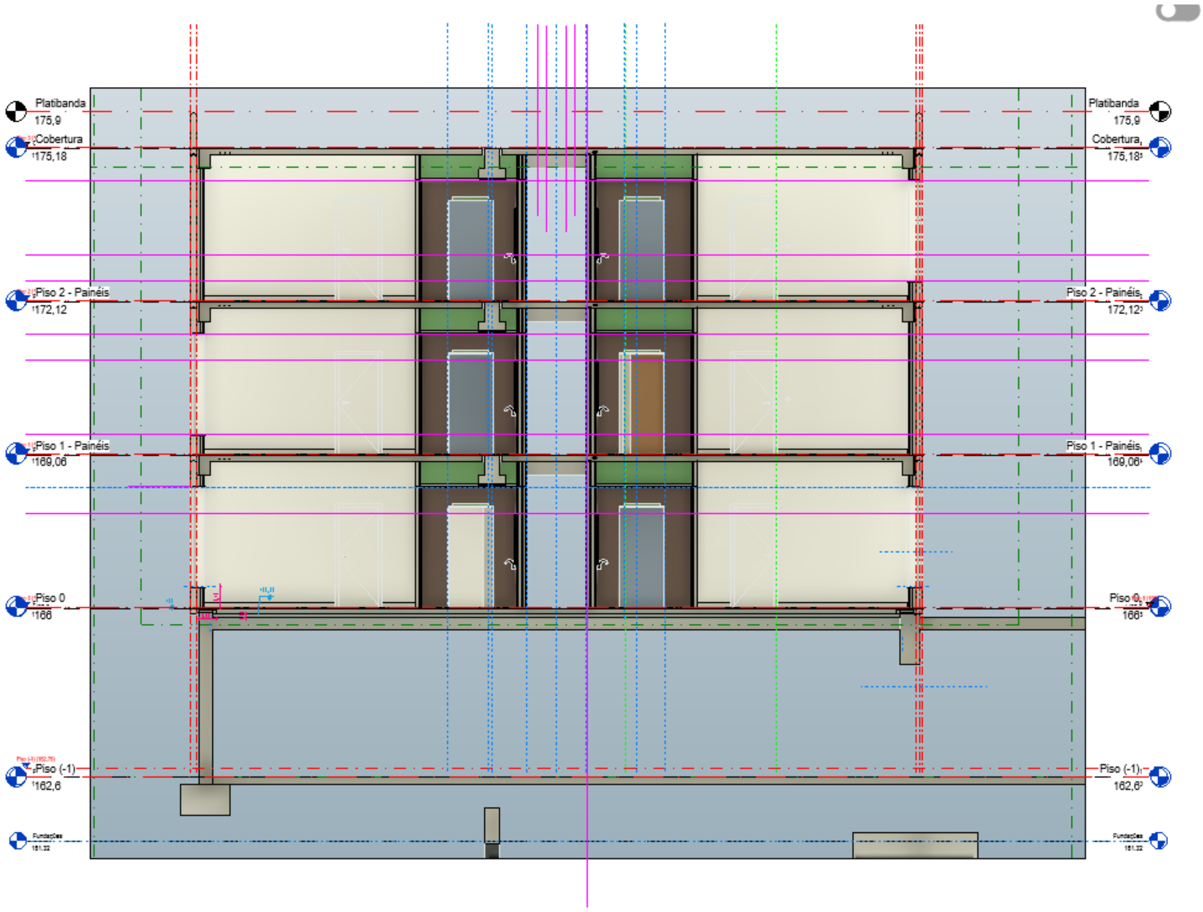












K. Fire safety information requirements (1st stage – macro perspective) regarding BIM data

Has model ...?	Y/N	More details about the adopted modelling strategy
Building Information (Occupancy Type; Risk Category; etc.)	Y	. Residential – risk category 1 . Parking – risk category 1
Reference Plane	Y	. Residential – level . Parking – level
Occupancy data	NA	Not applicable in residential buildings.
Room Type (living room; technical room;..)	Y	Technical Room (basement)
Independent units	Y	. Residential

		. Parking
Fire walls	Y	. EI 30 [insulation between apartments] . EI 60 [fire protection of the staircases]
Fire Compartment *(including delimitation of fire compartment area)*	Y	. REI 60 [insulation between parking and residential]
Buildings Surroundings *(Isolated; Gable walls; surrounding buildings less than x m; etc.)*	NA	Safety distances to neighbouring buildings are complied with

L. Fire safety information of the model not included in the previous topics *(If you identified that in your country is required additional information available on models related with fire safety, please specify here)*

- The car park is protected by a fire detection system and natural smoke control.
- Staircases are protected with smoke windows.
- All common areas of the building are protected by emergency lighting.

3.6.4 Dataset 18 – Hotel Stay Porto Centro Trindade

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

In Portugal, the city of Porto plays a central role in tourism and cultural heritage, driving significant investment in hospitality infrastructure; similar to dataset 11, this hotel reflects that trend through its relevance within the city's hospitality landscape. This dataset represents a typical urban hotel, classified as Occupancy Type VII – Hotel use, and risk category 2. The building comprises eight above-ground floors and one basement level, integrating 73 guest rooms at the upper levels, reception, lobby and reception with technical areas and a meeting room in the basement. The hotel is situated in a central urban area near Trindade metro station, surrounded by mixed-use buildings that combine residential, commercial, and service functions within the heart of Porto.

B. Project location

(city, country)

Porto, Portugal

C. Type of Building

(Residential, Office, Health Care, other - please specify)

Hotel

D. Type of project

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

José Aidos Rocha, j.aidos.rocha@exactusensu.pt, Exactusensu.

Jéssica Reis, jessica.reis@vn2r.pt, VN2R.

F. Design Stage

(according to RIBA, mark with a cross (X)) | [+ INFO]

Strategic definition	
Preparation and briefing	
Concept design	
Spatial coordination	
Technical design	
Manufacturing and construction	
Handover	
Use	X

G. Key features of the project

GFA (Gross Floor Area) (per floor)	3 800,00(Total) 450,00 (floor -1) 450,00 (floor 0 to 6) 200,00 (floor 7)	m^2
Number of stories (below ground level)	1	
Number of stories (above ground level)	8	
Height (top floor level)	18,00	m
Height (roof level)	22,00	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Fire extinguishers and fire hose reels	
Number of rooms	73	
Number of apartments (or independent units)	NA	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Rooms compose a single fire sector, elevators (EI30), stairs and technical areas (EI60)	
Others		

H. Available models

IFC *(Y/N)*	Y
IFC version	2022
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph...) Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Y Revit v.2021 DWG (2D) Architecture

I. Model restrictions

Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

J. Figures/images & graphical animations

Not yet, but soon.

3D Perspective screen shot (at least 1)	X
Lateral views (at least 2)	X
Plan view of the standard floor (at least 1)	X
Cross section of the building (at least 1)	X

K. Fire safety information requirements (1st stage – macro perspective) regarding BIM data

Has model …?	*Y/N*	More details about the adopted modelling strategy
Building Information (Occupancy Type; Risk Category; etc.)	Y	. Hotel– risk category 2
Reference Plane	Y	. Hotel – ground level
Occupancy data	Y	Meeting room – 28 Bedrooms – 144 Reception - 48
Room Type (living room; technical room;..)	Y	Technical Rooms, bed-rooms, foyers, offices, meeting room, reception
Independent units	N	
Fire walls	Y	. EI 30 [elevators] . EI 60 [stairs, technical rooms and corridors] . EI 90 [technical rooms]
Fire Compartment (including delimitation of fire compartment area)	Y	. REI 60 [insulation between floors and stairs]
Buildings Surroundings (Isolated; Gable walls; surrounding buildings less than x m; etc.)	Y	In the west side, there is a residential building.

L. Fire safety information of the model not included in the previous topics *(If you identified that In your country is required additional information available on models related with fire safety, please specify here)*

- The building is fully protected by a hose reel system.
- The kitchen area and the underground technical area are individualized fire compartments.
- All evacuation staircases are protected with smoke control systems.
- All areas of the building are protected by emergency lighting, smoke detection and signage of fire-fighting equipment and evacuation routes.

3.7 Lithuania Datasets

3.7.1 Dataset 15 - VilniusTECH P1 LAB

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

In Lithuania, the requirements applicable to the public sector establish the mandatory application of BIM methods in the design and construction of special structures. On 16 October 2024, the Government of the Republic of Lithuania amended Resolution No. 1061 of 8 December 2021 "On determining the cases of application of building information modelling methods" and established that BIM methods must be applied when public authorities purchase new construction design services for buildings classified as special buildings, and when the investment amount equals or exceeds 3 million euros, including taxes. Other investment thresholds have been set for civil engineering structures, movable property, and neighbourhoods renovation projects. From 1 January 2026, the investment thresholds will be reduced. From 1 January 2026, in the cases specified in the resolution, it will be mandatory to apply BIM methods when preparing design proposals/concepts. Therefore, one of the selected demonstration objects in Lithuania is a public sector project. Demonstrator dataset consists of the laboratory building of the Faculty of Electronics, Mechanical and Transport Engineering of VilniusTECH, composed of 5 floors, with a total building area of 9186.5 m2. The building surroundings consist of two other university buildings, a parking lot, and a nearby complex of dwellings.

B. Project location

(city, country)

Vilnius, Lithuania

C. Project location Type of Building

(Residential, Office, Health Care, other – please specify)

Educational (university)

D. Type of project

(synthetic, real project)

Real project (completed)

E. Responsible for delivering the model

(Contact person, e-mail, Company)

Vaidotas Šarka, info@innobim.lt, InnoBIM, UAB.

F. Design Stage

(according to RIBA, mark with a cross (X)) | + INFO

Strategic definition	
Preparation and briefing	
Concept design	
Spatial coordination	X
Technical design	X
Manufacturing and construction	X
Handover	X

Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	8 472,06 (Total) 140,76 (floor -1) 2 702,84 (ground level) 2 290,85 (floor 1) 2 254,61 (floor 2) 1 083,00 (floor 3)	m^2
Number of stories (below ground level)	1	
Number of stories (above ground level)	4	
Height (top floor level)	17	m
Height (roof level)	25	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Smoke ventilation, Automatic fire detection, Automatic alarm system, Evacuation management system (voice, signal, lighting), Extinguisher, Fire hose reel, Internal fire hydrant, Evacuation signs and schemes, Evacuation doors	
Number of rooms	N/A	
Number of apartments (or independent units)	48	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	No	
Others		

H. Available models

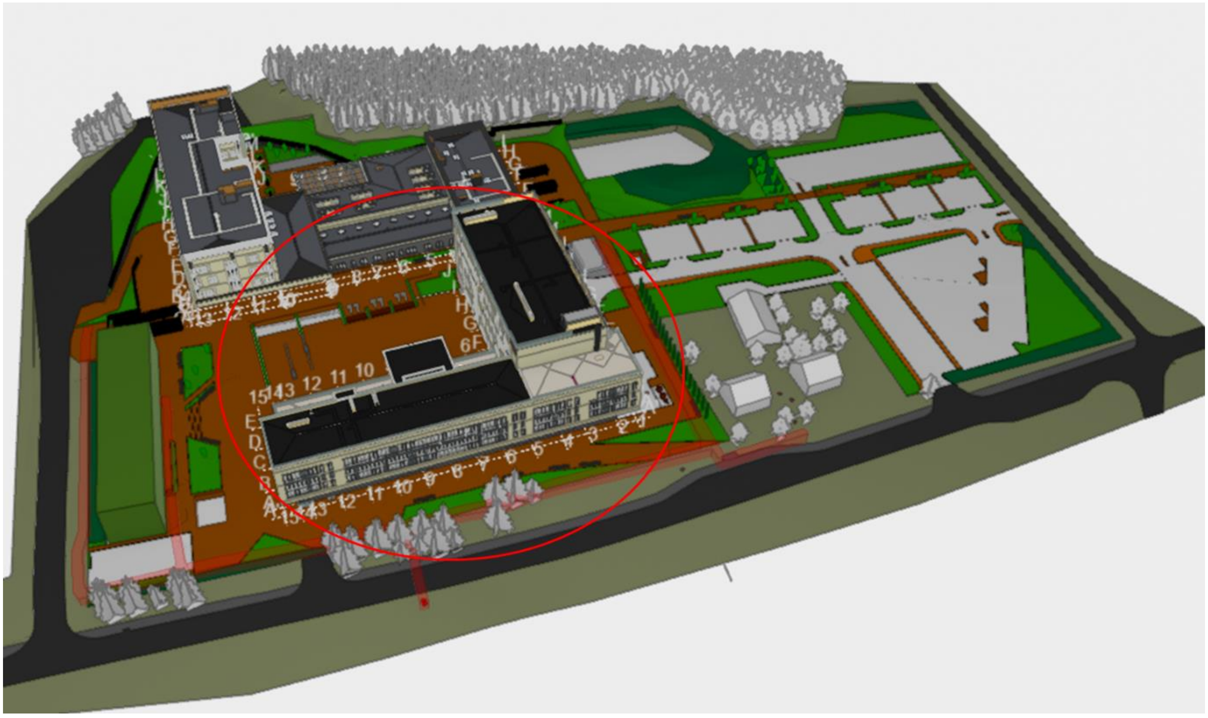
IFC *(Y/N)*	Y
IFC version	IFC2x3; IFC4.0
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph...) Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	No No No Architecture

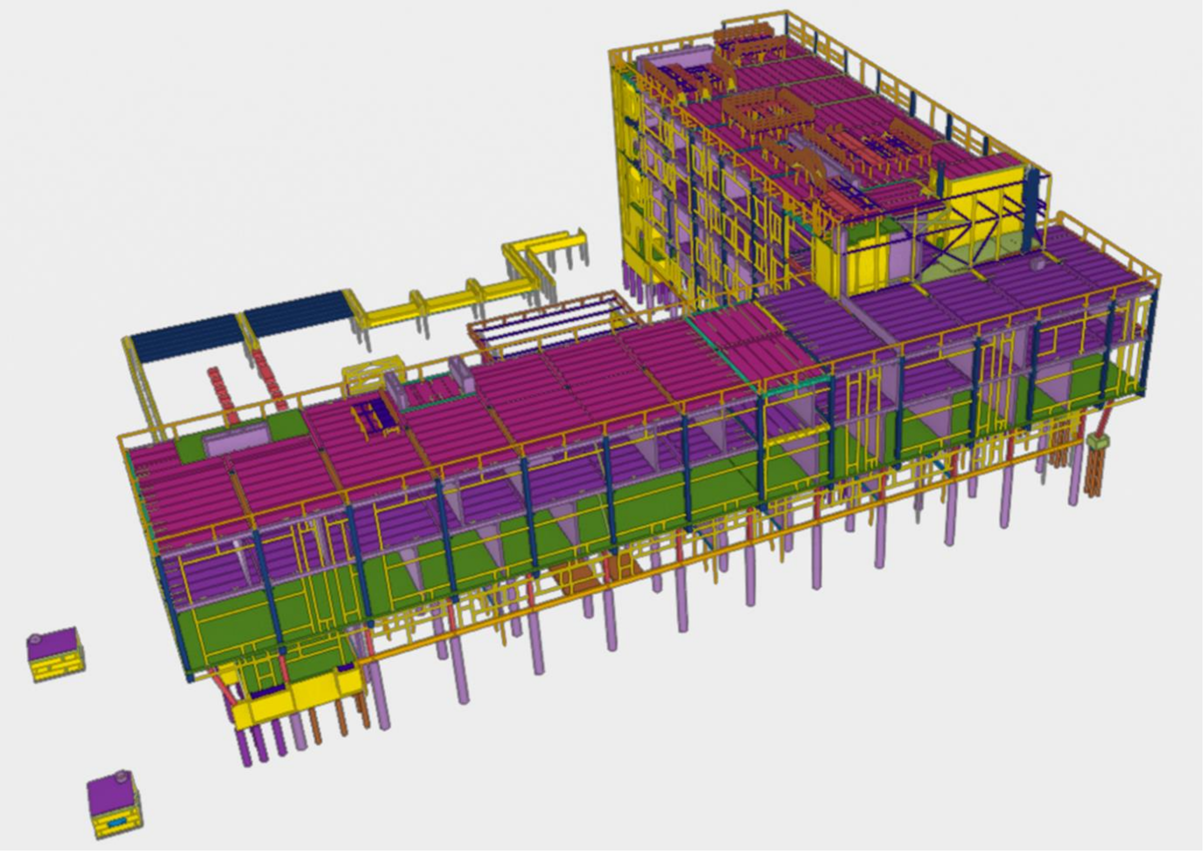
I. Model restrictions

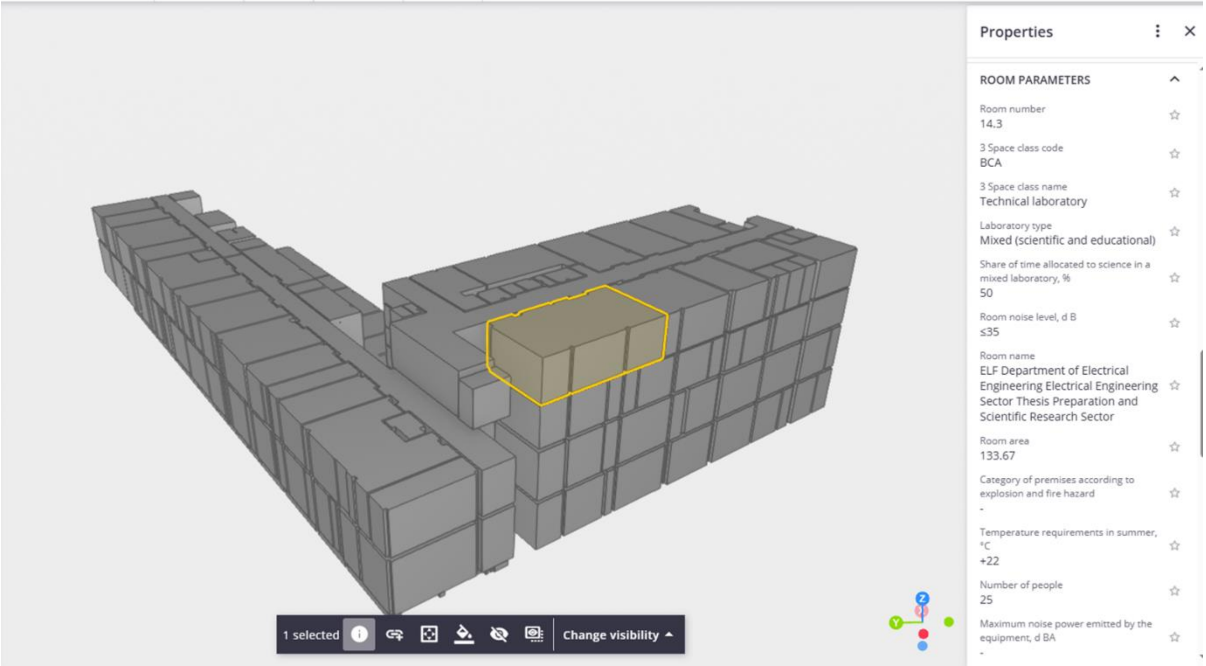
Confidentiality *(only internal use in the scope of the project, full open)*	Only project partners, only for work related to FireBIM
Others	Cannot be published or shared with partners and institutions outside the FireBIM project

J. Figures/images & graphical animations

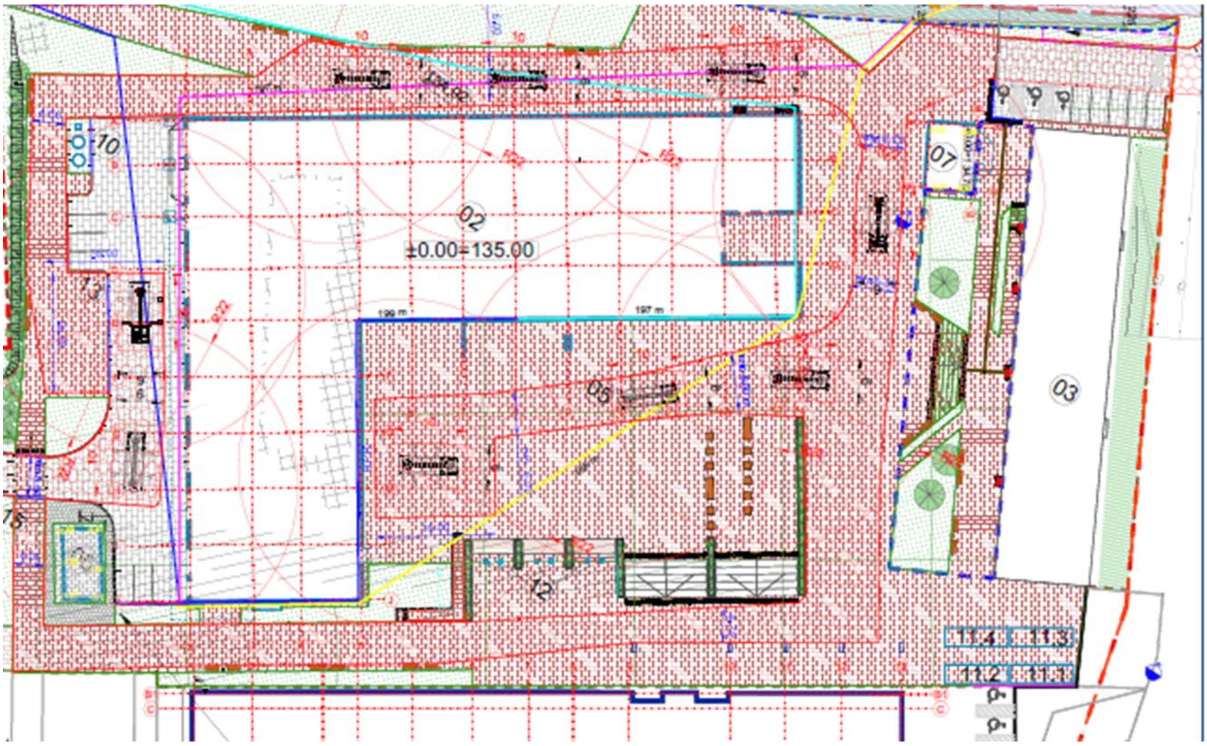
3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓







Properties
ROOM PARAMETERS
Room number
14.3
3 Space class code
BCA
3 Space class name
Technical laboratory
Laboratory type
Mixed (scientific and educational)
Share of time allocated to science in a mixed laboratory, %
50
Room noise level, d B
≤35
Room name
ELF Department of Electrical Engineering Electrical Engineering Sector Thesis Preparation and Scientific Research Sector
Room area
133.67
Category of premises according to explosion and fire hazard
-
Temperature requirements in summer, °C
+22
Number of people
25
Maximum noise power emitted by the equipment, d BA
1 selected
Change visibility



±0.00=135.00
02
03
07
10
11.4
11.3
11.2
11.1

K. Fire safety information requirements (1st stage – macro perspective) regarding BIM data

Has model ...?	Y/N	More details about the adopted modelling strategy
Building Information (Occupancy Type; Risk Category; etc.)	Y	Project code; Spaces; Building code; Level code; Floor no.
Reference Plane	Y	Level code
Occupancy data	Y	Number of people in room
Room Type (living room; technical room;..)	Y	Space class code; Space class name; Laboratory type
Independent units	N/A	-
Fire walls	N	-
Fire Compartment (including delimitation of fire compartment area)	N	-
Buildings Surroundings (Isolated; Gable walls; surrounding buildings less than x m; etc.)	Y	All surrounding buildings are in BIM model. Safety distances to neighboring buildings. Passage of vehicles.

L. Fire safety information of the model not included in the previous topics *(If you identified that in your country is required additional information available on models related with fire safety, please specify here)*

N/A

3.7.2 Dataset 16 - VIS34

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

VIS34 is a Production laboratory building at Vismaliukai str. 34 in Vilnius, currently in the early design phase. The building has one fire compartment, but multiple occupancy purposes: production and administration. Those areas are separated by firewalls. It is a one-floor building with a mezzanine. The ground floor and mezzanine are connected via open stairs. Project is in early design phase therefore dataset and BIM model contain very little information regarding not only fire safety but also building information overall. However, information can be added and updated during further design phases. This project can evolve together with FireBIM and be tested, to check FireBIM significance in current market conditions.

B. Project location

(city, country)

Vilnius, Lithuania

C. Type of Building

(Residential, Office, Health Care, other - please specify)

Production laboratory

D. Type of project

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

Kornelija Vaitiekutė, kornalija@poliprojektas.lt, Poliprojektas.

F. Design Stage

(according to RIBA, mark with a cross (X)) | *+ INFO*

Strategic definition	
Preparation and briefing	
Concept design	X
Spatial coordination	
Technical design	
Manufacturing and construction	
Handover	
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	2256,58 (Total) 1705,97 (ground level) 551,86 (mezzanine)	m^2
Number of stories (below ground level)	none	
Number of stories (above ground level)	1 + mezzanine	
Height (top floor level)	4,5	m
Height (roof level)	9,02	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Sprinklers, internal hydrants, fire detection and alarm systems	
Number of rooms	N/A	
Number of apartments (or independent units)	6	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	There are technical rooms on the ground floor	
Others		

H. Available models

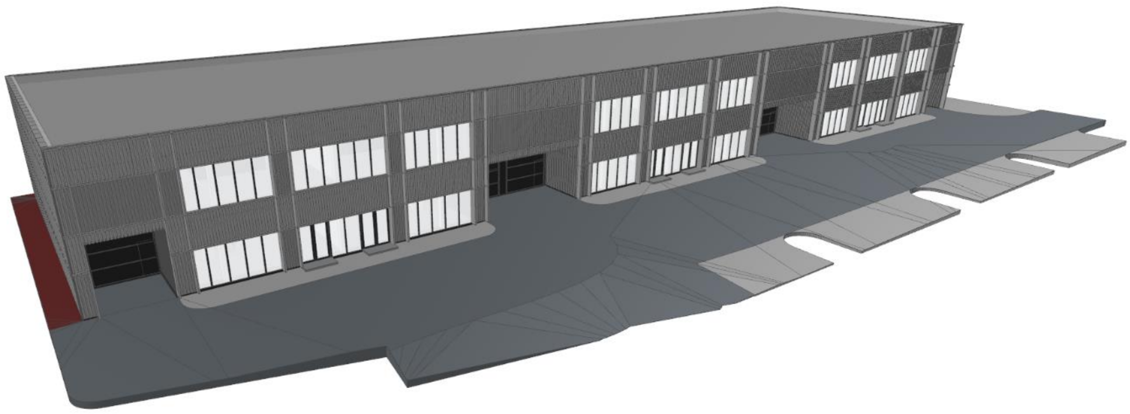
IFC *(Y/N)*	Y
IFC version	IFC2X3
Native software format *(Y/N)*	N
Native software name and version	
Other formats (CAD, 3D, Graph…)	DWG (2D)
Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Architecture

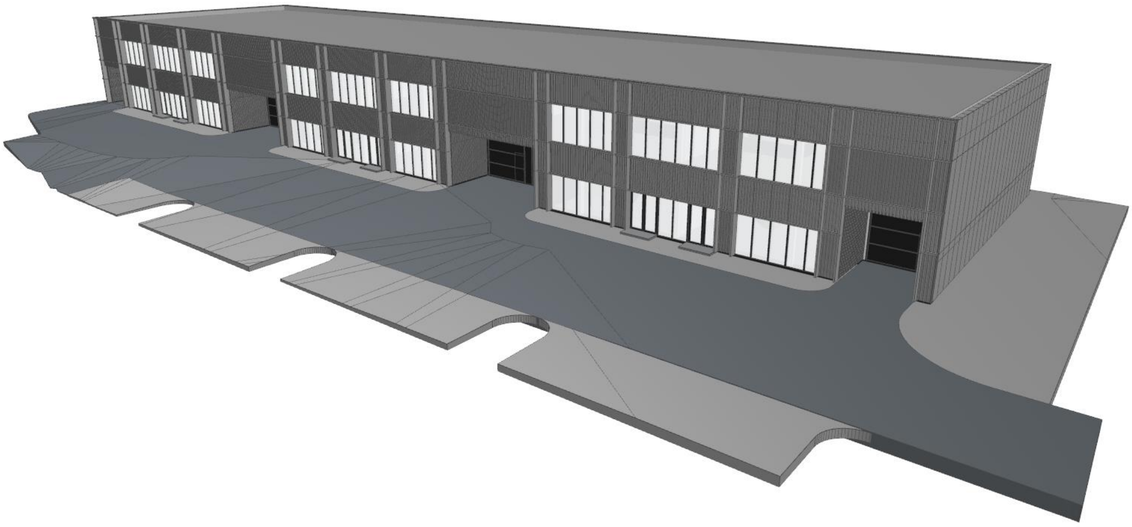
I. Model restrictions

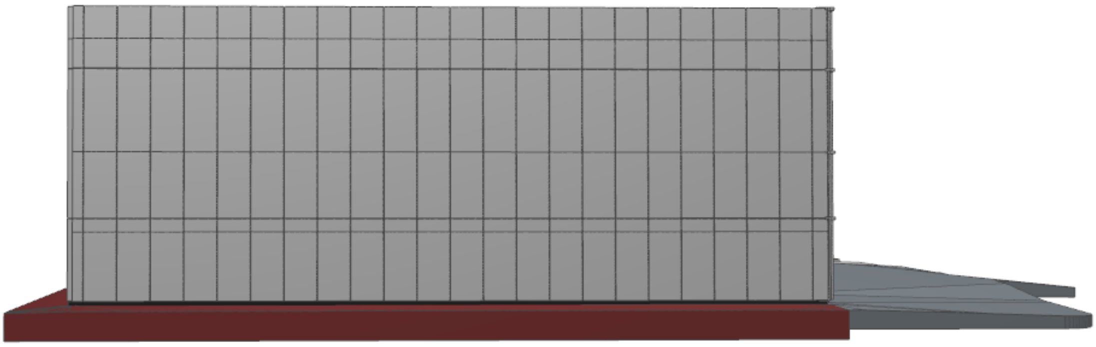
Confidentiality *(only internal use in the scope of the project, full open)*	Only internal use in the scope of the project
Others	Cannot be published or shared with partners and institutions outside the FireBIM project. Might be more open to sharing in later stages.

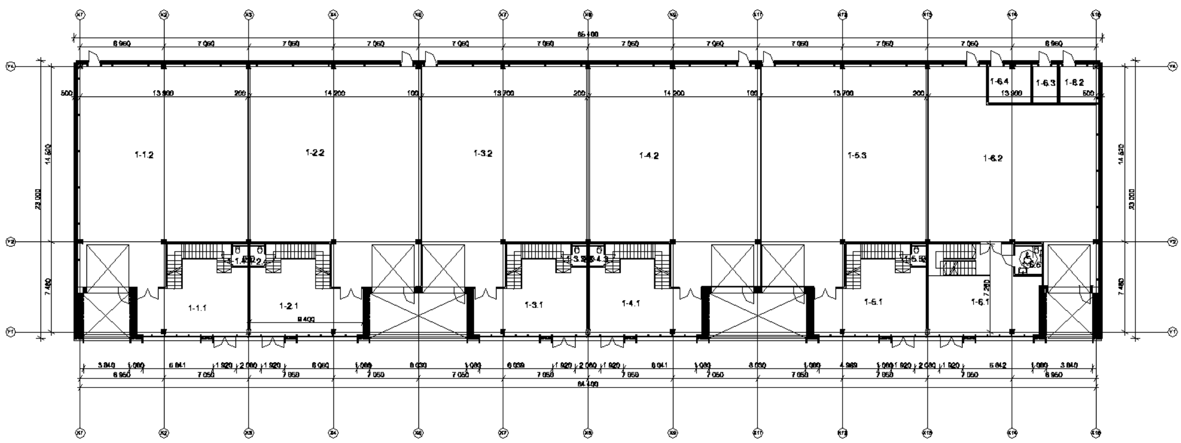
J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓








1-1.2
1-2.2
1-3.2
1-4.2
1-5.3
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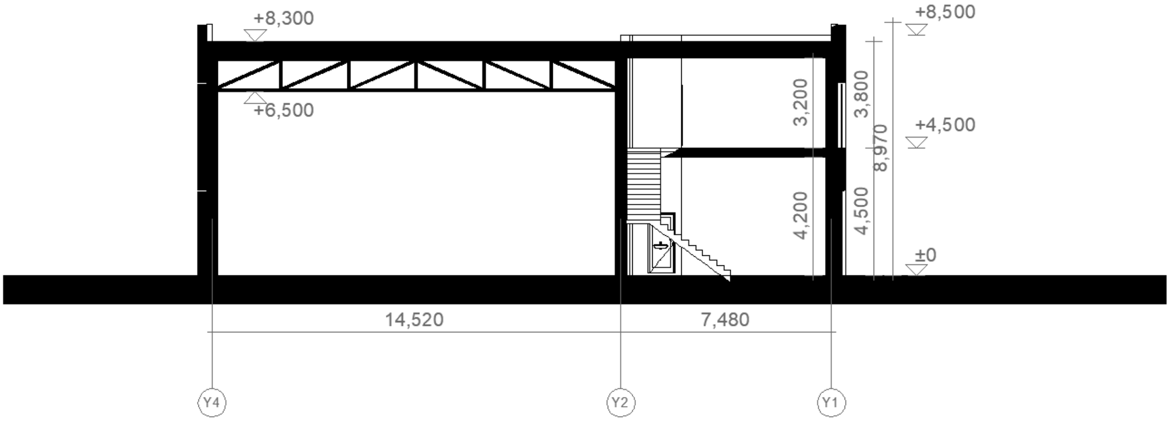
1-3.1
1-4.1
1-5.1
1-6.1



K. Fire safety information requirements (1st stage – macro perspective) regarding BIM data

Has model …?	*Y/N*	More details about the adopted modelling strategy
Building Information (Occupancy Type; Risk Category; etc.)	N	
Reference Plane	Y	. Ground floor level . Mezzanine floor level . Roof
Occupancy data	N	
Room Type (living room; technical room;..)	N	
Independent units	N	
Fire walls	N	
Fire Compartment *(including delimitation of fire compartment area)*	N	
Buildings Surroundings *(Isolated; Gable walls; surrounding buildings less than x m; etc.)*	N	

L. Fire safety information of the model not included in the previous topics *(If you identified that in your country is required additional information available on models related with fire safety, please specify here)*

- Production and administration areas are separated by firewalls
- Technical rooms are separated by firewalls
- The building is equipped with a sprinkler system, internal fire hydrants, portable extinguishers, automatic fire detection system with smoke detectors, and emergency lighting

3.8 Public datasets

The next datasets are publicly available models gathered by organisations such as buildingSMART. While some of them are based on actual projects, some of them should be considered as synthetic datasets, used while benchmarking or developing IFC-based applications. They are widely used in literature and to illustrate software and other automation workflows.

3.8.1 Dataset 5 – Duplex

A. **General description**

(framework, motivation to develop it, relevance/significance at national level, etc.)

Public sample file, widely used with IFC and openBIM examples. The Duplex Apartment project was first published in Germany and provided to the US Construction Engineering Research Laboratory. Many copies of this design are available online, using various versions and software. buildingSMART provides it as a sample file in their github repository. As a small residential project, it may be out-of-scope for some fire safety regulations.

https://github.com/buildingsmart-community/Community-Sample-Test-Files/tree/main/IFC%202.3.0.1%20(IFC%202x3)/Duplex%20Apartment

B. **Project location**

(city, country)

NA

C. **Type of Building**

(Residential, Office, Health Care, other - please specify)

Residential

D. **Type of project**

(synthetic, real project)

Synthetic, based on a real project

E. **Responsible for delivering the model**

(Contact person, e-mail, Company)

Publicly available from buildingSMART

F. **Design Stage**

(according to RIBA, mark with a cross (X)) | + INFO

Strategic definition	
Preparation and briefing	
Concept design	
Spatial coordination	
Technical design	
Manufacturing and construction	
Handover	X
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	Level 1: 125 Level 2: 121	m^2
Number of stories (below ground level)	0	
Number of stories (above ground level)	2	
Height (top floor level)	3	m
Height (roof level)	6	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Smoke detectors	
Number of rooms	17	
Number of apartments (or independent units)	2	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	No	
Others		

H. Available models

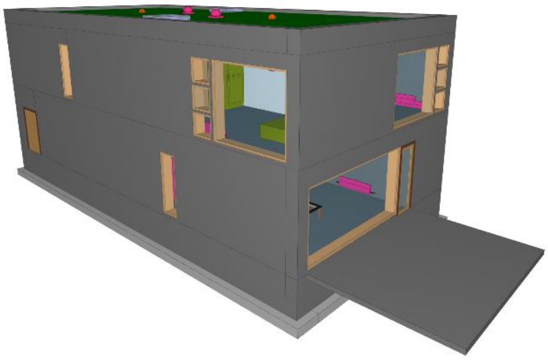
IFC *(Y/N)*	Y
IFC version	2x3
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph...) Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	N Architecture, MEP, Plumbing, Electricity

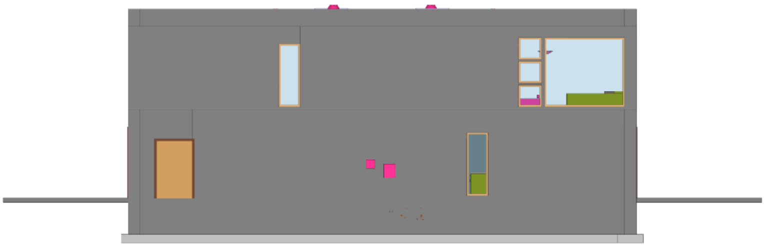
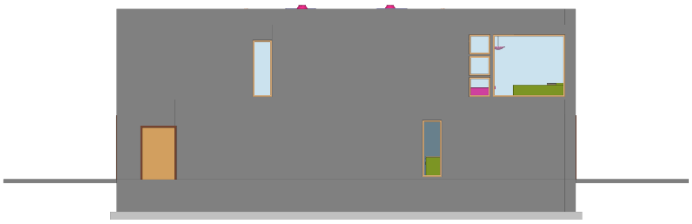
I. Model restrictions

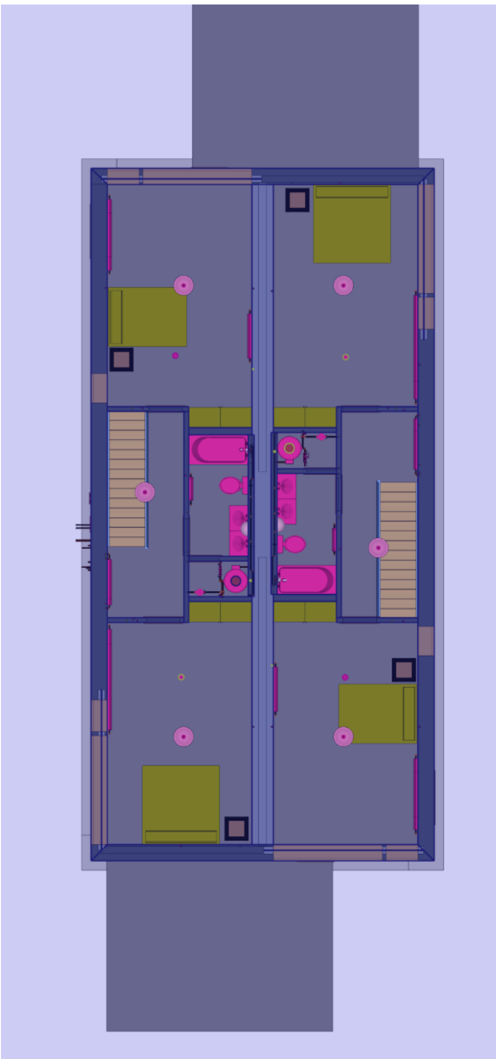
Confidentiality *(only internal use in the scope of the project, full open)*	Free to use (CC BY 4.0)
Others	These files were originally provided under Creative Commons License. These files are provided here under this same license. Creative Commons (CC BY 4.0). You are free (1) to copy and redistribute this material any way you like, (2) you may change the information any way you want, (3) you must identify the source of the information as "BSI (2020) "Duplex Apartment Test Files," buildingSMART International" and add this GitHub URL, and (4) if you may changes to these files you must indicate the types of changes made.

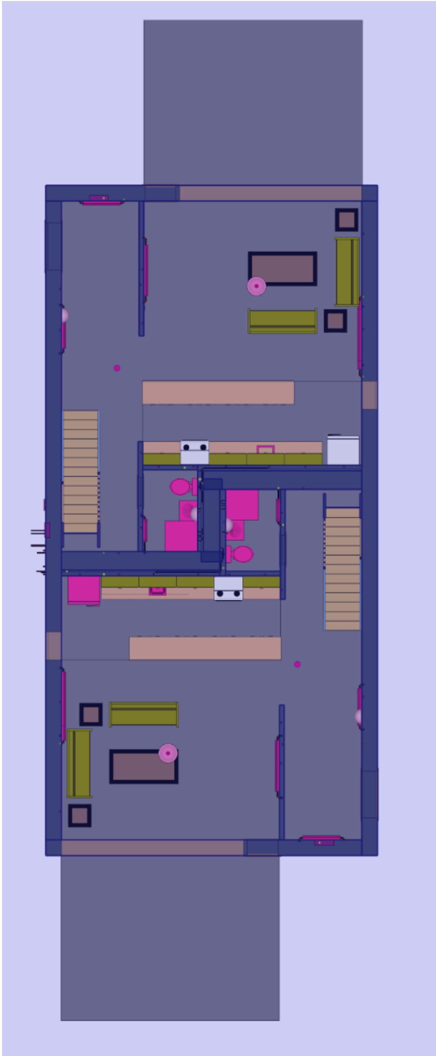
J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	
Plan view of the standard floor (at least 1)	
Cross section of the building (at least 1)	



3.8.2 Dataset 6 – Schependomlaan

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

This open dataset contains a complex set of models and related project files, donated to the community for academic and scientific purposes. Files from different design stages are available. Quite exceptionally, this dataset contains almost every document published for the project, including point cloud scans, coordination models, planning, and more. Basic information about compartmentation is available as annotated lines indicating fire rating. The data set is about 10 years old and is aligned to the Dutch building code. It was not specifically set up for fire safety.

https://github.com/buildingsmart-community/Community-Sample-Test-Files/tree/main/IFC%202.3.0.1%20(IFC%202x3)/Schependomlaan

B. Project location

(city, country)

Nijmegen (Netherlands)

C. Type of Building

(Residential, Office, Health Care, other - please specify)

Residential

D. Type of project

(synthetic, real project)

Real project

E. Responsible for delivering the model

(Contact person, e-mail, Company)

Publicly available from buildingSMART / original model by Root BV (NL).

Stefan Boeykens, sb@dstudio.be, D-studio gathered model information for FireBIM.

F. Design Stage

(according to RIBA, mark with a cross (X)) | + INFO

Strategic definition	
Preparation and briefing	
Concept design	X
Spatial coordination	
Technical design	X
Manufacturing and construction	X
Handover	
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	+0: 365 +1: 367 +2: 257 +3: 250 = 1.240 total	m^2
Number of stories (below ground level)	0	
Number of stories (above ground level)	4	
Height (top floor level)	9	m
Height (roof level)	13	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Fire rating (compartment boundary lines), user areas (“gebruiksoppervlakte”)	
Number of rooms	100	
Number of apartments (or independent units)	10	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*	Shared elevator/staircase	
Others		

H. Available models

IFC *(Y/N)*	Y
IFC version	2x3
Native software format *(Y/N)* Native software name and version Other formats (CAD, 3D, Graph...) Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Y Archicad 18 (*.PLA Archive) IFC, DWG, TBP, SP, XLSX, ... Architecture, Fit-out, planning, subcontractor models

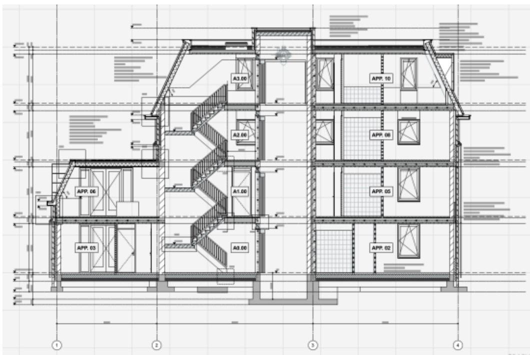
I. Model restrictions

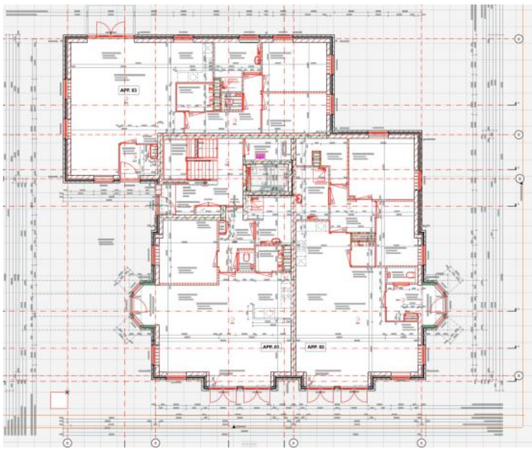
Confidentiality *(only internal use in the scope of the project, full open)*	Free to use for research and education
Others	Refer to original source

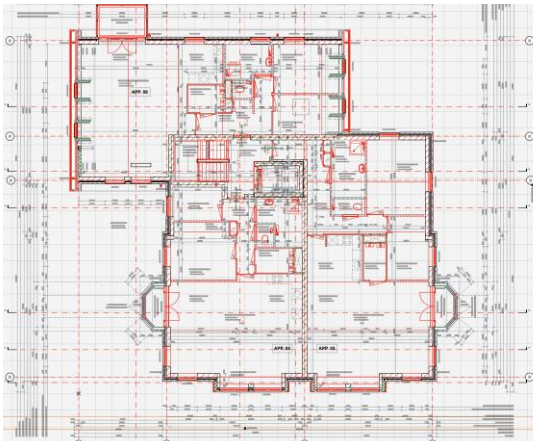
J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓

See images below. Floor plans, sections and elevations to scale are available as part of the dataset.







3.8.3 Dataset 7 – East Dormitory

A. General description

(framework, motivation to develop it, relevance/significance at national level, etc.)

Demo models for a fictious US Student Dormitory, with different reference models provided under a Create Commons license. It was mainly created to illustrate the COBie workflows, during design, execution and handover, by the author of the COBie standard and selected experts. The project files contain information about the fire safety design, including the sprinkler system. However, as it is a USA-based design, no adherence to regulations of the FireBIM partner countries is expected. More info: https://prairieskyconsulting.com/simulation.

B. Project location

(city, country)

University of Illinois, Champaing, Illinois (USA)

C. Type of Building

(Residential, Office, Health Care, other - please specify)

Residential

D. Type of project

(synthetic, real project)

Synthetic

E. Responsible for delivering the model

(Contact person, e-mail, Company)

Bill East, Prairie Sky Consulting

References for FireBIM project collected by Stefan Boeykens, sb@dstudio.be (D-studio BV).

F. Design Stage

(according to RIBA, mark with a cross (X)) | *+ INFO*

Strategic definition	
Preparation and briefing	
Concept design	X
Spatial coordination	
Technical design	
Manufacturing and construction	X
Handover	X
Use	

G. Key features of the project

GFA (Gross Floor Area) (per floor)	Level 1: 408 Level 2: 278	m^2
Number of stories (below ground level)	0	
Number of stories (above ground level)	2	
Height (top floor level)	3,8	m
Height (roof level)	7,3	m
Fire protection equipment (sprinklers, extinguishers, etc.) *Please specify*	Sprinklers, Zones, Control panels, fire and smoke alarm	
Number of rooms	44	
Number of apartments (or independent units)	7 student rooms; 3 shared rooms	
Is there any risk compartment in the building? *(e.g., technical rooms, boiler rooms, electrical rooms, etc.)*		
Others		

H. Available models

IFC *(Y/N)*	Y
IFC version	2x3
Native software format *(Y/N)*	Y
Native software name and version	Revit 2017
Other formats (CAD, 3D, Graph...)	COBie handover dataset (xlsx)
Specify the disciplines available in the provided dataset *(e.g., architecture, Structural, MEP, etc.)*	Architecture, Structure, MEP, Fire Safety

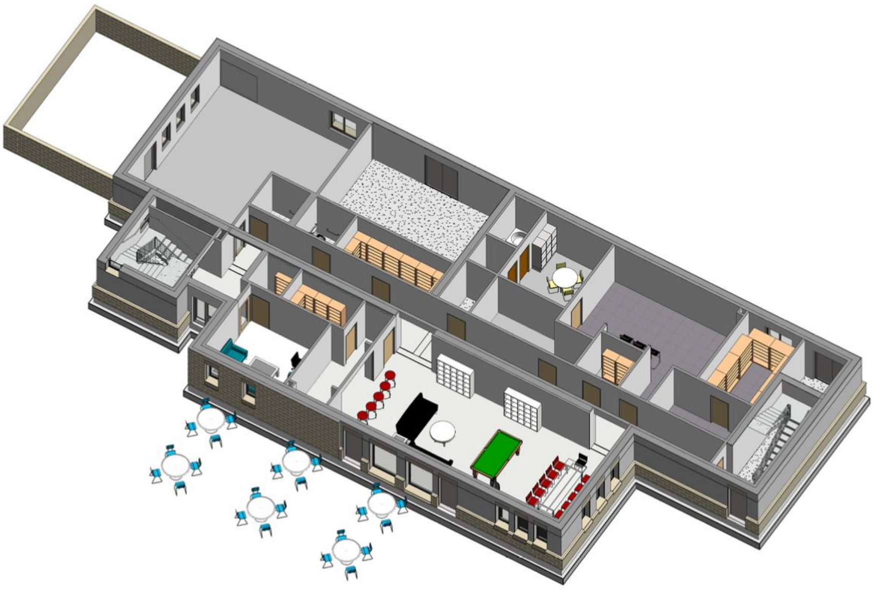
I. Model restrictions

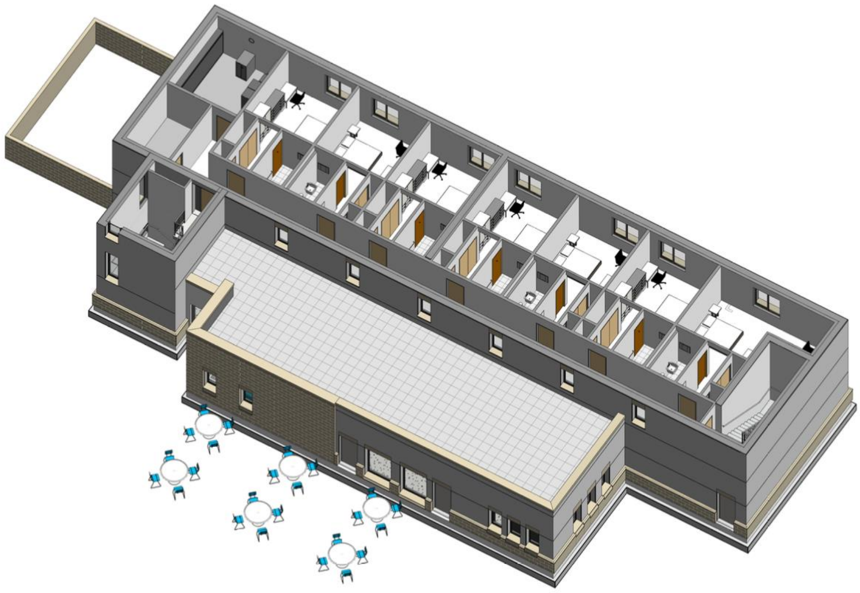
Confidentiality *(only internal use in the scope of the project, full open)*	Free to use, no distribution allowed
Others	LICENSING: Individuals may download and use the material for their own educational or research purposes free of charge. The material may not be redistributed. All uses must include the following attribution: East, Bill (2024) "Dormitory Project Simulation," Prairie Sky Consulting, www.prairieskyconsulting.com/. Qualified users with written preapproval may use the material for additional commercial and non-commercial purposes. Contact Prairie Sky Consulting for information on how to apply for approval.

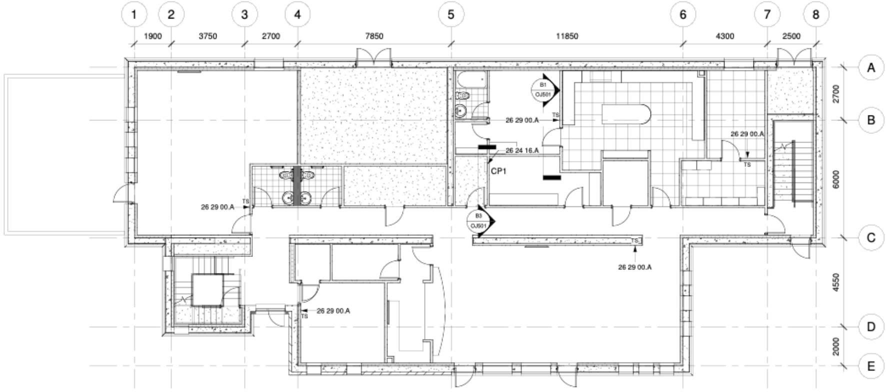
J. Figures/images & graphical animations

3D Perspective screen shot (at least 1)	✓
Lateral views (at least 2)	✓
Plan view of the standard floor (at least 1)	✓
Cross section of the building (at least 1)	✓

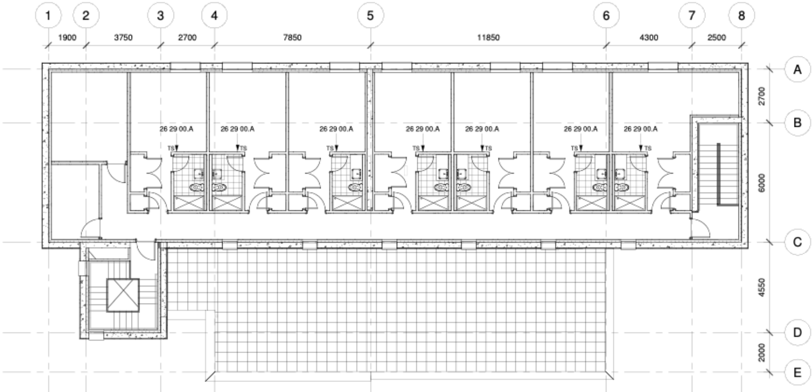
See images below. Floor plans, sections and elevations to scale are available as part of the dataset.



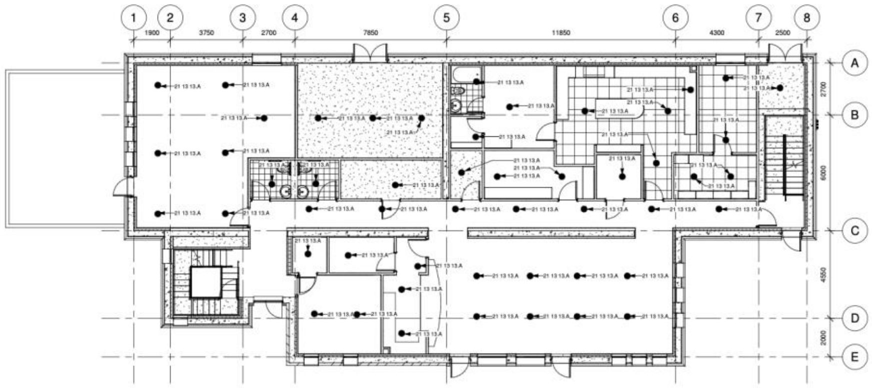




C1 Level 1 Floor Plan
1 : 100



C1 Level 2 Floor Plan
1 : 100



A2 Level 1-Sprinkler System
1 : 100

4 Validation Scenarios

4.1 Introduction

A validation scenario illustrates how the FireBIM framework generates value within a specific context. It demonstrates the practical relevance, applicability, and impact of the project's results by clearly defining what is being validated, why it is significant, and how it contributes to the improvement of fire safety practices. Moreover, the validation scenarios serve as a foundation for linking the relevant datasets described in Chapter 3 and for developing the demonstrators presented in Chapter 5, which showcase the project's tangible outcomes and added value.

4.2 Country-specific definitions

Each partner defines a validation scenario that illustrates how FireBIM can create value within their specific context. These scenarios focus on demonstrating the practical relevance and real-world impact of the project's results by clarifying what is being validated, why it is meaningful, and how it contributes to improving fire safety practices. The validation scenarios also serve as a starting point for linking datasets and for the development of project demonstrators.

To guide this process, partners were asked to reflect on the following questions:

- What do we aim to prove or demonstrate through this scenario?
- Why is this validation important or innovative in the given context?
- How does the scenario demonstrate the added value of FireBIM in real-practice situations?
- What storyline or narrative best communicates this validation to external audiences?

To systematically address these questions, the validation scenarios are structured into six blocks (A to F):

A. General Information
B. Objectives and Rationale
C. Scope and Context
D. Technical Components and Tools
E. Scenario Implementation
F. Evaluation and Risks

In total, all participating countries contributed two validation scenarios each, resulting in ten validation scenarios overall. Subsections 4.2.1 to 4.2.5 provide a detailed description of all validation scenarios.

4.2.1 Portugal

Validation Scenario 1

A. General Information	
a.1 Validation Scenario	Fire Compartmentation Compliance in Existing Buildings
a.2 Partners involved	VN2R | ISEP | Exactusensu
a.3 Fire Safety Domain(s)	Compartmentation
B. Objectives and Rationale	
b.1 Validation Objectives	To test the FireBIM ontology, application of modelling guidelines, scan-to-BIM and ACC platform in verifying fire compartmentation rules automatically in an existing building.
b.2 Rationale behind objectives	*(e.g., the analysis of validation scenarios can help identify conventions used in practice - such as rules or thresholds not explicitly written in regulations, detect inconsistencies, ….)*

	The criterion for measuring maximum compartmentation areas is not fully defined by the regulation, as it is unclear whether the area should be considered gross or net. In practice, fire safety experts usually assume gross area. On the other hand, the exception to the general compartmentation rule refers specifically to net area, resulting in a lack of consistency between the general criterion and the exception. Additionally, it allows the acquisition of data on existing buildings when no prior drawings or project documentation are available and provides quick and efficient assessment. The results of this fire compartmentation compliance in existing buildings will support the definition and implementation of mitigation strategies.
C. Scope and Context	
c.1 Scope of Validation	Requirements to verify compliance with compartmentation fire safety rules in existing buildings.
c.2 Applicable Datasets / Projects	*(e.g., if applicable select one or more datasets from section 4, or leave the possibility open to do the validation without data set or using a data set with manual overrides)* Dataset 18 / Existing hotel building (~3,800 m² gross area), standard bedrooms layout, core circulation zones, and fire compartmentation defined by the aggregation of risk areas — sleeping areas (EI30 / E15C), vertical evacuation routes (staircases) (EI60 / E30C), lifts (EI30 / E15), and technical areas (EI60 / E30C). Dataset 11 / hotel project | ~3,122 m² gross area of rehabilitation of existing facilities, including sleeping areas, lobbies and technical areas.
c.3 Regulatory Framework	Portaria n.º 135/2020; Lei n.º 123/2019; Technical Guidance Note SCIE 01.
D. Technical Components and Tools	
d.1 FireBIM Components Used	Ontology (for property linking and rule interpretation), Scan-to-BIM (for semi-automated digital model generation), Modeling Guidelines and process map (for attribute naming and structure); ACC Platform (for rule checking), Visualization (enable the geometric interpretation based on a GUI).
d.2 Relations to Use Cases/ Solutions / Applications (see last page of deliverable D4.1)	Use Case 1 (UC1) | Application 3.8 Use Case 2 (UC2) | Applications 3.4 and 3.11
E. Scenario Implementation	
e.1 Description of validation scenario	The laser scanner surveyor performs the reality capture of the existing building and based on a scan-to-BIM pipeline generates a simplified BIM model. Then, the architect or engineer apply the FireBIM Modeling Guidelines for model enrichment and tag compartments. Posteriorly, this enriched BIM model is exported in IFC format. Using the FireBIM ACC tool, the architect or fire safety expert check compartments according to national guidelines. The system flags non-compliant spaces and provides rule explanations. In case of non-compliance, mitigation strategies should be defined and implemented.
e.2 Design Stage (according to RIBA)	Use
e.3 Actors and Responsibilities	Laser scanner surveyors perform digital surveys and point-cloud processing. Architect/Engineer prepare and export the digital model. Architect/Fire Expert validate rules, visualize BIM model and review results. Fire Expert defines eventual mitigation strategies.
e.4 Required Input / data	Point cloud data in dedicated format. IFC model with compartments and building information data to feed the FireBIM platform.
F. Evaluation and Risks	
f.1 Challenges	Process of digitalization of existing buildings based on point clouds, including the physical constraints of the survey, are typically complex and time consuming.

	Developing the model requires application of the modelling guidelines, including necessary adaptations and addition of fire-specific data.
f.2 Evaluation Criteria / KPIs (at least 2)	- 80% accuracy in the comparison between the 3D geometric model generated form point cloud data and scan-to-BIM, with manual geometric surveys or original project drawings. - 70% positive feedback from fire experts by comparing regarding the performance of the FireBIM ACC in comparison with a manual approach of fire safety checks.
f.3 Main risks (technical, social)	*(e.g., limitations on software, covering a limited range of normative prescriptions, confidence level of the architects/fire safety, decreasing the influence of the existing technical profiles due to the adoption of automated digital tools, adaptation of the regulatory entities to validate digitals reports)* Typically, validation scenarios involving the renovation of existing buildings present specific technical risks due to a lack of knowledge about construction solutions (possible absence of drawings, supporting information, etc.), changes in the type of occupancy, or projects located in high-density urban areas. If any of these risks occur and the fire safety solution adopted is inadequate, the probability of the consequences of the fire will be more severe to the building, resulting in the relocation of many people and high financial and social costs.
f.4 Ethical or legal considerations	*(e.g., privacy, safety)* For datasets involving retrofitted buildings, all data was collected via laser scanning, and the occupants were informed of a priori that scanning would be performed. The process ensured safety, privacy, and the protection of people and property. In this type of project, architects and project teams were fully briefed on the use of the data within the scope of FireBIM. These measures address key ethical and legal considerations, ensuring informed participation, compliance with data protection requirements, and minimizing safety risks during data collection and processing. It is also considered that, in general, existing buildings used for residential purposes should ensure the privacy of the dwellings and their occupants. In the case of buildings with public access, it is assumed that they may be accessible to the public, except for technical areas and reserved areas.

Validation Scenario 2

A. General Information	
a.1 Validation Scenario	Fire Compartmentation and Evacuation Routes Compliance in the design of new buildings
a.2 Partners involved	VN2R | ISEP | Exactusensu
a.3 Fire Safety Domain(s)	Compartmentation and Evacuation Routes
B. Objectives and Rationale	
b.1 Validation Objectives	To test the FireBIM ontology, application of modelling guidelines and ACC platform in automatically verifying fire safety rules in new design projects of regular buildings.
b.2 Rationale behind objectives	*(e.g., the analysis of validation scenarios can help identify conventions used in practice - such as rules or thresholds not explicitly written in regulations, detect inconsistencies, ….)* Allow a quick-fire safety check in an early design stage considering that compartmentation and evacuation routes are critical components for fire safety design, and with potential to influence and constraint the architectural design solutions. Also, it will help the architects to take informed and more sustained design solutions, with more autonomy, and require less time and articulation with other stakeholders. This validation scenario is also representative of the most typical design situations that occur in the working journey of architects and fire safety experts.

C. Scope and Context	
c.1 Scope of Validation	Application of fire safety compliance checks, in terms of compartmentation and evacuation routes, in new design projects of regular buildings.
c.2 Applicable Datasets / Projects	*(e.g., if applicable select one or more datasets from section 4, or leave the possibility open to do the validation without data set or using a data set with manual overrides)* Dataset 14 / low-budget housing project | ~4,000 m² gross area including underground parking zones and housing floors. Dataset 11 / hotel project | ~3,122 m² gross area under renovation to accommodate hotel rooms, lobby, dining areas, and technical spaces. Dataset 10 / industrial warehouse | ~1,500 m² of gross area comprising predominantly storage areas.
c.3 Regulatory Framework	Portaria n.º 135/2020; Lei n.º 123/2019.
D. Technical Components and Tools	
d.1 FireBIM Components Used	Ontology (for property linking and rule interpretation), Modeling Guidelines and process map (for attribute naming and structure); ACC Platform (for rule checking), Visualization (enable the geometric interpretation based on a GUI).
d.2 Relations to Use Cases/ Solutions / Applications (see last page of deliverable D4.1)	Use Case 1 (UC1) | Applications 3.8 Use Case 2 (UC2) | Applications 3.4, 3.5 and 3.6
E. Scenario Implementation	
e.1 Description of validation scenario	The architect uses the FireBIM platform to get information about the applicable fire safety standards and FireBIM modelling guidelines. Then, the architect contacts the fire safety expert to validate the applicable legislative framework and starts the development of the architectural design model. Posteriorly, the architect or fire safety engineer confirms the FireBIM Modeling Guidelines and tag compartments. After, this BIM model is exported into IFC format. Using the FireBIM ACC tool, the architect or fire safety expert check compartments and means of escape according to national guidelines. The system flags non-compliant spaces and provides rule explanations. In case of non-compliance, mitigation strategies should be defined and implemented.
e.2 Design Stage (according to RIBA)	Preparation and briefing Concept design Technical design
e.3 Actors and Responsibilities	Architect is responsible for the general design and preparing and exporting the digital model. Architect/Fire Expert validate rules, visualize BIM model, perform compliance checking and review results. Fire Expert defines eventual mitigation strategies.
e.4 Required Input / data	FireBIM modelling guidelines. IFC model with compartments and building information data to feed the FireBIM platform.
F. Evaluation and Risks	
f.1 Challenges	The architect may need to interpret specific fire safety requirements and solutions. Developing the model requires application of the modelling guidelines, including necessary adaptations and addition of fire-specific data.
f.2 Evaluation Criteria / KPIs (at least 2)	- 20%-time reduction in the fire safety design process. - 70% positive feedback from fire experts by comparing regarding the performance of the FireBIM ACC in comparison with a manual approach of fire safety checks.
f.3 Main risks (technical, social)	*(e.g., limitations on software, covering a limited range of normative prescriptions, confidence level of the architects/fire safety, decreasing the influence of the existing*

	technical profiles due to the adoption of automated digital tools, adaptation of the regulatory entities to validate digitals reports) The checks regarding compartmentation and evacuation routes only cover a limited range of normative prescriptions. The architects/fire safety experts may have some lack of confidence and reluctance to the application of ACC tools. Also, the use of ACC tools may decrease the influence of the existing technical profiles. Additionally, the regulatory entities may have difficulties in the adaptation to validate digitals reports from ACC tools.
f.4 Ethical or legal considerations	*(e.g., privacy, safety)* In the ethical perspective, the early fire safety design tends to minimize the intervention and actions of the fire safety experts. Architects and project teams are aware of the use of data within the scope of FireBIM. These measures address key ethical and legal considerations, ensuring informed participation, compliance with data protection requirements, and minimizing safety risks during data processing.

4.2.2 Belgium

Validation scenario 1

A. General Information	
a.1 Validation Scenario	Fire Safety Compliance in Early Building Design
a.2 Partners involved	D-Studio, ASSAR, Buildwise
a.3 Fire Safety Domain(s)	Compartmentation & evacuation
B. Objectives and Rationale	
b.1 Validation Objectives	Validation of a start-to-finish workflow for automated compliance checking in early building design, including: - Project management (creation and initialization with building characteristics, assignment to regional regulations) - BIM model (uploading, extracting data, viewing and interacting, enriching, combining multiple models) - Ontology (mapping data onto FireBIM ontology (FBO), defining objects or properties that are not in the BIM model) - Automated checking (sanity and completeness checks, compliance checking) - Output (visual feedback to user, results report)
b.2 Rationale behind objectives	The validation scenario will demonstrate whether there is a viable proof of concept for automated compliance checking of compartmentation in early building design in Belgium. Each of the aspects listed above will be validated on feasibility ('Can it technically be achieved?'), accuracy ('Are the results correct?') and usability ('Does the solution meet the needs of the end users?')
C. Scope and Context	
c.1 Scope of Validation	Compliance checking of a building design with compartmentation rules in early design: - Max. compartment size - Min. number of exits - Max. distances o Max. distance to 1st exit

	o Max. distance to 2nd exit o Max length of dead ends in evacuation route.
c.2 Applicable Datasets / Projects	Main dataset: - 3.3.1 Dataset 1 – ‘t Huis (Kortrijk Care Campus) Additional: - 3.3.2 Dataset 8 – Buildwise Research Model (School in Rethel, France) - 3.3.3 Dataset 9 – D4C-DST - 3.3.4 Dataset 12 – ZIN The processing flow will be tested with selected other datasets as well, to validate the assumptions and to test against dataset differences, with limited data enrichment related to the Belgian regulations.
c.3 Regulatory Framework	The main legislative framework for fire safety in buildings in Belgium is the Royal Decree ‘AR/KB 07/07/1994’, commonly referred to as ‘basisnormen brand’. FireBIM specifically focusses on annex 2/1, which focuses on low rise buildings. The AR/KB covers all new buildings and new extensions to existing buildings, except for single-family housing and small buildings (<=100 m², max. 2 floors). Renovations of existing buildings are not covered by the AR/KB. An extensive refurbishment may, however, be classified as a ‘new building’ by the fire prevention officer responsible. Industrial buildings and car parks *are* covered by the AR/KB in Annex 6 & Annex 7 respectively, but will be excluded from the scope of the project. Certain specific categories of buildings covered by the AR/KB, are also subject to <u>additional federal and/or regional fire safety legislation and standards</u>: e.g. hospitals, schools, hotels, care facilities, etc. The additional legislation is currently out of scope for FireBIM but could be included later. <u>Belgian datasets</u> Dataset 9 is a simple lowrise building, fully within the scope of the AR/KB (annex 2/1) and the FireBIM project. Datasets 1 and 12 comply with the AR/KB (annex 2/1 and 4/1 respectively) as well as with additional legislation for their specific functions like healthcare facilities, hotel, car park, etc. The latter will not be considered for this validation scenario. The building in dataset 8 is in France and is not designed to comply with Belgian fire safety legislation. It can be used as a test case for non-compliance.
D. Technical Components and Tools	
d.1 FireBIM Components Used	Loading and hosting digital regulations (FireBIM Regulation Ontology FRO) and rules (SHACL shapes); dynamically parsing datasets in IFC-format into a graph according to the FireBIM Building Ontology (FBO); data quality checking, based on modelling guidelines and conventions and basic sanity checks (custom rules, IDS requirements); automatic compliance checking (ACC) of the building graph against the digital rulesets (using SHACL); issue reporting and visualization (using a 3D viewer component).
d.2 Relations to Use Cases/ Solutions / Applications (see last page of deliverable D4.1)	- UC1 – Scenario 2: Quality checking for fire-code exchange information requirements - UC2 – Scenario 1: Understanding a building in terms of fire safety - UC2 – Scenario 2: Automated compliance checks for prescriptive fire requirements - Solution 3.4: Early design guidance and compliance checker
E. Scenario Implementation	
e.1 Description of validation scenario	[See also D4.2 User Journey 1] The architect creates a BIM model of the building design (concept) which includes information on the fire safety design. The BIM model is exported to IFC using a mapping that can be interpreted by the platform. The architect creates a FireBIM project in the application and provides the general building characteristics. The BIM model is uploaded as dataset in IFC format (and interpreted by the application/platform). The architect selects a compliance check. The platform returns information about the

	completeness and validity of the provided data. The architect can enrich the data and/or change the mapping before proceeding to the compliance check. The compliance check is performed, and the results are returned to the user.
e.2 Design Stage (according to RIBA)	Concept design, Spatial coordination
e.3 Actors and Responsibilities	Architect/Engineer initiates data transfer, completes missing info, runs checks, generates reports. Architect/Fire Expert reviews results, validates waivers/justifications, advice on code interpretation. MEP/Structural modelers: provide discipline models, enrich object properties. Project owner: manages project, invites/removes users, controls access.
e.4 Required Input / data	- Building characteristics (to determine which fire safety legislation is applicable). - BIM model of the building design with information about the building layout and compartmentation. Initial testing will focus on BIM models in IFC format. Later, an integrated check in the modeling software will be validated. - Additional mapping and/or enrichment of the data extracted from the BIM model.
F. Evaluation and Risks	
f.1 Challenges	The IFC-model must be mapped against the FireBIM Building Ontology (FBO) in such a way that the BIM model can accurately be used for compliance checking. This mapping must be communicated to the user via IDS and modelling guidelines that are practical for many different users and building typologies. Developing the model requires application of the modelling guidelines, including necessary adaptations and addition of fire-specific data in the model. There should be an estimate of the required additional efforts, to better understand the cost of adopting FireBIM conventions as part of the design development process.
f.2 Evaluation Criteria / KPIs (at least 2)	- # of compliance checks implemented and validated by fire experts (5 total checks planned, see c.1) - # of compliance checks implemented and validated by end users (5 total checks planned, see c.1). The check is validated if the end user considers the automated check more practical than their current methods. - # of datasets processed In addition, the efforts and time required to prepare the dataset and the run through the whole validation scenario will be captured, to better understand the effectiveness of the approach.
f.3 Main risks (technical, social)	**Technical risks:** BIM models can contain a lot of data about a building and its building elements that are not immediately visible to the users. Architects often use standard components and templates filled with preset information that matches commonly used building materials and products. If not correctly managed, incorrect information can end up in the BIM model (and in FireBIM). This risk is especially present in renovation projects where limited verifiable information about the existing building is available. As a countermeasure, FireBIM applications should clearly communicate with the user what information is extracted from the model and used for analysis. **Social risk:** BIM models in Belgium are often modelled by architects who might not have advanced expertise in BIM and/or fire safety. To stimulate widespread adoption of FireBIM, the level of knowledge required to create a usable BIM model should not exceed the capability of the applications' primary users. Additionally, the effort needed to prepare a BIM model for a FireBIM application should be limited and/or justified by the value of its output.
f.4 Ethical or legal considerations	**Security:** In high security projects, it might not be allowed to upload a BIM model to an online application unless the application can demonstrate certain security guarantees. Note that this can be an unwritten expectation by the project client, who is

	potentially unaware that BIM models are shared with third parties. In any case, a data leak on the FireBIM platform, could have significant repercussions for its users. **Privacy:** Current or future occupants of a building might have concerns about which data is included in the BIM model and shared with third parties. Especially if the project involves surveying existing residential buildings with photographs or 3D scans. Special attention is required for projects in which the project client is not the same party as the future occupant, as they might have different views on the topic. **Copyright:** In Belgium, building designers (architects and/or engineers) typically own the copyright to the design of the building and its plans/BIM models. For a BIM model co-created by multiple parties, there will be multiple copyright holders. This copyright can be formalised in a contract but exists even without a written agreement. Depending on the limits of the copyright, processing and sharing the BIM model, as well as the creation of derivative works might be prohibited or restricted. <u>Belgian datasets:</u> • Dataset 1 can be used by the consortium partners, within the context and duration of the FireBIM project. • Datasets 8 and 9 were created specifically for research purposes and are free to use. • Dataset 12 is subject to a non-disclosure agreement. It can only be accessed and used by D-Studio.

Validation scenario 2

A. General Information	
a.1 Validation Scenario	Validation of the measures taken to restore the required fire resistance of compartment boundaries being intersected by service penetrations. Based on the creation of databases with clashes between services (ventilation ducts and other services) and compartment boundaries and a selection tool allowing the user to select certified solutions to restore the fire compartmentation.
a.2 Partners involved	Rf-Technologies, Stam+De Koning, BIM-connected, Peutz, DBI, VN2R, Exactusensu
a.3 Fire Safety Domain(s)	Compartmentation
B. Objectives and Rationale	
b.1 Validation Objectives	Build upon objectives from scenario 1 from the Netherlands (validation of the fire resistance of compartment boundaries). 1. Creation of a complete database of clashes (services (ducts and pipes) vs compartment boundaries), including information regarding the required fire resistance (scen. 1 NL), but also information about the wall/floor (material, thickness). Validation test: completeness of the database (all clashes) and availability of the required information. 2. Use the geometry engine to add information in the clash database about the distance between services or between services and floor or other walls. Validation test: checking the correctness of measurements. 3. Validate the solution selector. Validation test: correctness and completeness of proposed solution(s). 4. Enrichment of the model with selected solution (solution object, sealing method). Validation test: completeness of the output
b.2 Rationale behind objectives	See description use case. The objective is to allow the user to consider the restoration of fire resistance in advance, when MEP services are being designed. And give him the tools to select compliant solutions to restore fire resistance.

<table>
<tr><th colspan="2">C. Scope and Context</th></tr>
<tr><td>c.1 Scope of Valida-tion</td><td>Validate compliant solutions for service penetrations going through compartment boundaries</td></tr>
<tr><td>c.2 Applicable Da-tasets / Projects</td><td>Like validation scenario 1 from the Netherlands: models with MEP services as well as information about the compartment boundaries (walls, floors).</td></tr>
<tr><td>c.3 Regulatory Framework</td><td>National regulation, European product standards, European classifications</td></tr>
<tr><th colspan="2">D. Technical Components and Tools</th></tr>
<tr><td>d.1 FireBIM Compo-nents Used</td><td>An application to upload data (IFC)
A checking engine to validate the data and check for missing or incorrect data (IDS – see also scenario 1 NL)
A geometrical engine that can calculate clashes between sets of objects (see also scenario 1 NL)
3D viewer (?) showing 3D geometry, with 3D navigation, reference infor-mation
Application for a solution selector
“Validated solutions database”: centralized on FB platform or in application?</td></tr>
<tr><td>d.2 Relations to Use Cases/ Solutions / Applications (see last page of deliverable D4.1)</td><td>Linked to use cases UC4 scenario 1 & 2: compliance checking tool for ventilation and other service penetrations into compartment boundaries.
Linked to applications 7, 9 and 10:
Web – applications: IDS generator / ICF checker
Application: automated detection of ventilation duct and other service pen-etrations intersecting with compartment boundaries
Application / plug-in: Product selection and compliance checking tool for ventilation penetrations and other service penetrations into compartment boundaries
The IFC data can be enriched with the fire resistance in an automated way, such as described in solution 1 from the Netherlands. This is not a prerequisite as the user might manually add the information as well.</td></tr>
<tr><th colspan="2">E. Scenario Implementation</th></tr>
<tr><td>e.1 Description of validation scenario</td><td>Once the database of clashes is created, check if all clashes between ven-tilation ducts and compartment boundaries have been detected / included. Repeat the same process for other services.
Validate that all essential information is available for each clash: type ser-vice, type of compartment boundary, required for resistance of the boundary ((R)EI minutes), thickness and material of the boundary is available (infor-mation is correctly structured).
Validate the enrichment of the clash database with geometric information: distances to other structural elements (floor, wall (corner), beam...); dis-tances to other services passing through the same compartment boundary. (distances related to European standards).
Validation of the solutions database by fire experts. The validation includes checks of the fire resistance, allowed applications in different compartment boundaries, specific requirements for each sealing option (for example min-imal distances for the aperture).
Validation of the proposed solutions for each clash: are the solutions appli-cable, complete, correct? Are all available solutions mentioned?
Validation of the outputs, including the use of the 3D viewer engine.</td></tr>
<tr><td>e.2 Design Stage (according to RIBA)</td><td>Mainly stages 4 (technical design) and 5 (construction).</td></tr>
</table>

e.3 Actors and Responsibilities	• MEP designer: this is the main user, working for the MEP contractor. His responsibilities include a preliminary design for quoting to the main contractor, a detailed design and implementation plan for the execution phase. -> involved in validation scenario 1, 2, 3, 5 and 6 • Fire safety expert: can be involved in the design of the fire safety requirements in the building. Can also be asked to validate the design and choices of the MEP designer (extending the potential available solutions based on the specificities of the building project). Can be involved in the creation of the fire safety report for the owner/main contractor/controlling body/authorities. [Can be both responsible for input and user of the application]. --> Involved in validation scenario 2, 3 (validation according to national regulation), and 4 • Manufacturers: provide structured information about compliant solutions for different construction situations. [input for the solutions databases]. --> Involved in validation scenario 4 and 5 • Architect / structural engineer: defining and designing the compartments and defining the general fire safety requirements. Provide the aspect / discipline models and source for enrichment of object properties [Input for the MEP design]. --> Involved in validation scenario 1, 2 and 3

e.4 Required Input / data	• IFC models with compartment boundaries (floors and walls) - architectural model and structural models
	    o Information about fire resistance (REI XX)
	    o Structured information about boundary type (extended classification according to the European classifications)
	• IFC model for ventilation
	    o Information about type, size, material
	• IFC model for other services
	    o Information about type, size, material
	• Database of solutions

F. Evaluation and Risks	
f.1 Challenges	A compliant solution to restore the fire resistance requires a match between 3 elements: the type of service penetration and the product used, the characteristics of the compartment boundary and the sealing method. A compliant solution REQUIRES an alignment of the three elements. Challenges: • How to detect clashes when a structural includes openings for services? • The tool from NL scen 1 would add a lot of convenience for the user, as fire resistance of the compartment boundary could be automatically defined, in a structured way. The use of the tool is possible without it but requires manual filling in by the user (could be a multiple-choice drop-down menu in the clash database). • Is also valid for the typology of the wall. Uniformity of the input information (for example type of boundary – rigid wall, brick wall?). Could be solved with a manual input by the user, again with a drop-down menu. • How to include building project specific solutions that have been accepted by a fire expert / authority? Should it be possible for the user, for this specific project, to add a solution to the solution database? • How to update the solution database with new solutions, new types of walls, services...? How to make the information available to the (existing) users? • Often similar clashes in a building require similar solutions. How to group similar clashes to avoid repetitive work by the user? • How to cope with the use of “generic solutions”: what if the models already include brand agnostic fire dampers as a solution. These solutions must be deleted and replaced with compliant solutions.

	• How to cope with "no-solution" situations? What if the combination of boundary + solution + sealing does not allow for compliant solutions? We should somehow provide feedback to the user, explaining the issue and possibly offering alternatives. • What if the European standards are changed (new CPR expected in a few years)? Rules regarding (minimal) distances, (extended) field of applications, standardized walls, will require modifications to the solutions database. • Use of different languages: most terms have official translations. For Belgium specific multiple languages for a same solution should be considered. • Country-specific construction methods: some solutions are specific to certain countries and are not relevant for others (e.g., the use of different sealing methods, the use of different wall types...).
f.2 Evaluation Criteria / KPIs (at least 2)	• Geometry engine that can do clash detections and generate a database of clashes. Evaluation can be done using multiple tools for clash detections and comparing results. • Evaluation of the solutions database by comparing with manual work for several penetrations. • Involve end-users, preferably from several countries, and ask them to evaluate the solution, and especially the output.
f.3 Main risks (technical, social)	• The user must be able to rely on the tool to detect all clashes in the building • What if a user is using the application for a project in a country where local regulation might have an impact on compliance? Is mainly a risk for NL scen 1.
f.4 Ethical or legal considerations	The quality of the solution database is paramount to the success of the application. We must take great care to keep the quality of the database, as regular updates will be required. The user must be able to rely on the results of the tool to choose compliant, certified solutions. A disclaimer is required mentioning the responsibility of the user.

4.2.3 Lithuania

Validation scenario 1

A. General Information	
a.1 Validation Scenario	Fire Compartmentation compliance check in new buildings on various design stages
a.2 Partners involved	Poliprojektas| InnoBIM | VilniusTECH
a.3 Fire Safety Domain(s)	Compartmentation
B. Objectives and Rationale	
b.1 Validation Objectives	To test the FireBIM ontology, application of modelling guidelines, FireBIM automatic compliance checking (ACC) platform in verifying fire compartmentation rules automatically.
b.2 Rationale behind objectives	The regulations do not clearly define the rules for measuring the maximum area of a fire compartment. Specifically, the regulations do not clearly specify what should be included in the calculated area of a fire compartment, i.e. whether the area should be calculated including internal partitions, columns, etc., or whether these elements should be excluded (in practice, the gross area is used, which includes the areas of all internal elements). This problem becomes relevant when a building is very large and needs to be divided into several fire compartments. In addition, when dividing buildings into fire compartments, various solutions may be applied for separation, which are not always specifically described in legislation, e.g., the assignment of staircases to different fire compartments connected by staircases. The uniform

	application of fire safety rules in all BIM models would allow the creation of a database of standard solutions that would help to clarify ambiguities in legal regulation.
C. Scope and Context	
c.1 Scope of Validation	Requirements to verify compliance with compartmentation fire safety rules in new buildings
c.2 Applicable Datasets / Projects	Dataset 15 / VilniusTECH P1 LAB - VilniusTECH laboratory building (total building area 9186.5 m²), standard laboratory/classroom layout. The building has one fire compartment. The building complies with all fire safety regulations, including fire resistance, material flammability, evacuation requirements, and others. Dataset 16 / VIS34 - Production laboratory building. The building has one fire compartment, but multiple occupancy purposes: production and administration. Those areas are separated by firewalls. It is a one-floor building with a mezzanine. The ground floor and mezzanine are connected via open stairs.
c.3 Regulatory Framework	GAISRINĖS SAUGOS PAGRINDINIAI REIKALAVIMAI Nr. 1-338 (https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.388658/asr)
D. Technical Components and Tools	
d.1 FireBIM Components Used	Ontology (for property linking and rule interpretation), Modelling Guidelines and process map (for attribute naming and structure); FireBIM ACC Platform (for rule checking), Visualization (enable the geometric interpretation based on a GUI).
d.2 Relations to Use Cases/ Solutions / Applications (see last page of deliverable D4.1)	Use Case 1 (UC1) | 3.1 Template (visualisation of fire safety data in BIM) | Application 3.7 (IDS generator / IFC checker) | Application 3.8 (Modelling Guidelines) Use Case 2 (UC2) | Applications 3.4 (Early design guidance and compliance checker (compartment size check))
E. Scenario Implementation	
e.1 Description of validation scenario	First, the suitability of the model for verification on the FireBIM ACC platform is checked: -The model's compliance with EIR requirements is checked. - The building model creators begin modelling the building, which they will later verify on the FireBIM platform. It is already known that to perform the check, the model elements must have the appropriate/necessary parameters. On the FireBIM platform, the modelers choose what check they want to perform on the model (e.g., Compartmentation). Accordingly, the modelers select the country whose legislation the model must comply with. - Based on the selections, the FireBIM platform provides requirements for the model, specifying what should be modelled and how (according to EIR). The requirements are presented in an agreed format (ids or other). - BIM modelers create the building BIM model. - Then, with the model ready, they log back into the FireBIM platform, where they again select the country (and possibly other details) for which the BIM model was created, and run the model through the check. The FireBIM platform then provides a report in a specified format (bcf, pdf, xlsx, etc.) indicating which elements in the model have been modelled correctly and which elements are still missing information. Using the FireBIM ACC platform, a fire safety expert checks fire compartments in BIM models for compliance with legal requirements. The FireBIM ACC platform identifies non-compliance with legal requirements and marks them in the model.
e.2 Design Stage (according to RIBA)	Concept Design (2), Spatial Coordination (3), Technical design (4)
e.3 Actors and Responsibilities	BIM modeler/architect – will apply FireBIM modelling guidelines to supplement BIM models and mark fire compartments (or elements belonging to fire compartments) in the IFC model.

	Fire safety expert - checks fire compartments in BIM models for compliance with legal requirements.
e.4 Required Input / data	BIM models in IFC format supplemented with information required for verification on the FireBIM ACC platform
F. Evaluation and Risks	
f.1 Challenges	Modelling guidelines must be applied to the preparation of BIM models for verification on the FireBIM ACC platform to supplement the model with data related to fire safety requirements. Lack of an operational and validated FireBIM ACC Core platform solution.
f.2 Evaluation Criteria / KPIs (at least 2)	- Number of compliance checks implemented and validated by fire experts - Number of datasets processed - At least 70% positive feedback from clients, architects, designers, fire safety specialists, and other fire safety-related construction participants when comparing the use of the FireBIM ACC platform with the current fire safety requirements check.
f.3 Main risks (technical, social)	Technical risks worth mentioning include incomplete regulatory coverage, as existing regulations do not require BIM models to include necessary fire safety information. Therefore, existing datasets of demonstrators are not suitable for the FireBIM ACC platform and would require additional effort to amend them with the necessary information. In Lithuania, the fire safety designer remains outside the scope of BIM-based design. The developers of the fire safety part of the project (fire safety specialists) do not work in a BIM environment and do not know how a building should be modelled, what parameters and how should be added in the BIM model, etc. BIM objects from manufacturers (e.g. doors) may carry intellectual property (IP) restrictions. Open object libraries or requirements of clear IP licensing agreements could be alternative risk mitigation measures.
f.4 Ethical or legal considerations	The process will ensure safety, privacy, and the protection of people and property. In this type of project, Clients and main project team members are informed on the use of the data within the scope of FireBIM project and gave consent. These measures address key ethical and legal considerations, ensuring informed participation, compliance with data protection requirements, and minimizing safety risks during data collection and processing.

Validation scenario 2

A. General Information	
a.1 Validation Scenario	Evacuation routes in the early design of new buildings
a.2 Partners involved	Poliprojektas| InnoBIM | VilniusTECH
a.3 Fire Safety Domain(s)	Evacuation Routes
B. Objectives and Rationale	
b.1 Validation Objectives	To test the FireBIM ontology, application of modelling guidelines, and FireBIM automatic compliance checking (ACC) platform in verifying rules for evacuation routes automatically.
b.2 Rationale behind objectives	Enable a quick fire-safety check at the early design stage, recognizing that evacuation routes are critical elements of fire safety with the potential to shape architectural solutions. This will support architects in making more informed, consistent design decisions with greater autonomy, while reducing the time and coordination needed with other specialists.

C. Scope and Context	
c.1 Scope of Validation	Application of fire safety compliance checks, in terms of evacuation routes, in early design of new buildings
c.2 Applicable Datasets / Projects	Dataset 15 / VilniusTECH P1 LAB - VilniusTECH laboratory building (total building area 9186.5 m²), standard laboratory/classroom layout. The building has one fire compartment. The building complies with all fire safety regulations, including fire resistance, material flammability, evacuation requirements, and others. Dataset 16 / VIS34 - Production laboratory building. The building has one fire compartment, but multiple occupancy purposes: production and administration. Those areas are separated by firewalls. It is a one-floor building with a mezzanine. The ground floor and mezzanine are connected via open stairs.
c.3 Regulatory Framework	GAISRINĖS SAUGOS PAGRINDINIAI REIKALAVIMAI Nr. 1-338 (https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.388658/asr) VISUOMENINIŲ STATINIŲ GAISRINĖS SAUGOS TAISYKLĖS Nr. 1-14 (https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.391196?jfwid=)
D. Technical Components and Tools	
d.1 FireBIM Components Used	Ontology (for property linking and rule interpretation), Modelling Guidelines and process map (for attribute naming and structure); FireBIM ACC Platform (for rule checking), Visualization (enable the geometric interpretation based on a GUI).
d.2 Relations to Use Cases/ Solutions / Applications (see last page of deliverable D4.1)	Use Case 1 (UC1) | 3.1 Template (visualization of fire safety data in BIM) | Application 3.7 (IDS generator / IFC checker) | Application 3.8 (Modelling Guidelines) Use Case 2 (UC2) | Applications 3.4 (Early design guidance and compliance checker (evacuation routes))
E. Scenario Implementation	
e.1 Description of validation scenario	First, the suitability of the model for verification on the FireBIM ACC platform is checked: -The model's compliance with EIR requirements is checked. - The building model creators begin modelling the building, which they will later verify on the FireBIM platform. It is already known that to perform the check, the model elements must have the appropriate/necessary parameters. On the FireBIM platform, the modelers choose what check they want to perform on the model (e.g., evacuation routes). Accordingly, the modelers select the country whose legislation the model must comply with. - Based on the selections, the FireBIM platform provides requirements for the model, specifying what should be modeled and how (according to EIR). The requirements are presented in an agreed format (ids or other). - BIM modelers create the building BIM model and assign property (parameter) – fb:EvacuationRoute to the IFC entities (e.g., spaces, stairs, walls, doors and other elements) which belong or relate to evacuation routes. - Then, with the model ready, they log back into the FireBIM platform, where they again select the country (and possibly other details) for which the BIM model was created, and run the model through the check. The FireBIM platform then provides a report in a specified format (bcf, pdf, xlsx, etc.) indicating which elements in the model have been modelled correctly and which elements are still missing information. Using the FireBIM ACC platform, a fire safety expert and/or architect checks evacuation routes in BIM models for compliance with legal requirements. The FireBIM ACC platform identifies non-compliance with legal requirements and marks (flags) in the model.
e.2 Design Stage (according to RIBA)	Concept Design (2), Spatial Coordination (3), Technical design (4)

e.3 Actors and Responsibilities	BIM modeler/architect – will apply FireBIM modelling guidelines to supplement BIM models and mark evacuation routes (or elements belonging to evacuation routes) in the IFC model. Fire safety expert - checks evacuation routes in BIM models for compliance with legal requirements.
e.4 Required Input / data	BIM models in IFC format supplemented with information required for verification of evacuation routes on the FireBIM ACC platform
F. Evaluation and Risks	
f.1 Challenges	Modelling guidelines must be applied to the preparation of BIM models for verification on the FireBIM ACC platform to supplement the model with data related to fire safety requirements. Lack of an operational and validated FireBIM ACC Core platform solution.
f.2 Evaluation Criteria / KPIs (at least 2)	- Number of compliance checks implemented and validated by fire experts - Number of datasets processed - At least 70% positive feedback from clients, architects, designers, fire safety specialists, and other fire safety-related construction participants when comparing the use of the FireBIM ACC platform with the current fire safety requirements check.
f.3 Main risks (technical, social)	Technical risks worth mentioning include incomplete regulatory coverage, as existing regulations do not require BIM models to include necessary fire safety information. Therefore, existing datasets of demonstrators are not suitable for the FireBIM ACC platform and would require additional effort to amend them with the necessary information. In Lithuania, the fire safety designer remains outside the scope of BIM-based design. The developers of the fire safety part of the project (fire safety specialists) do not work in a BIM environment and do not know how a building should be modelled, what parameters and how should be added to the BIM model, etc. Architects/fire safety experts may lack confidence and reluctance in the application of the FireBIM ACC platform. Additionally, the regulatory entities may have difficulties in the adaptation to validate digitals reports from the FireBIM ACC platform. BIM objects from manufacturers (e.g. doors) may carry intellectual property (IP) restrictions. Open object libraries or requirements of clear IP licensing agreements could be alternative risk mitigation measures.
f.4 Ethical or legal considerations	The process will ensure safety, privacy, and the protection of people and property. In this type of project, Clients and main project team members are informed on the use of the data within the scope of FireBIM project and give consent. These measures address key ethical and legal considerations, ensuring informed participation, compliance with data protection requirements, and minimizing safety risks during data collection and processing.

Validation scenario 3

A. General Information	
a.1 Validation Scenario	Validation of the required fire resistance of MEP service penetrations through the fire-rated building structures
a.2 Partners involved	Poliprojektas, VilniusTECH, InnoBIM
a.3 Fire Safety Domain(s)	Penetrations
B. Objectives and Rationale	
b.1 Validation Objectives	1. Enrichment of the BIM model with the necessary information required for the check of penetrations through the fire-rated boundaries (walls, slabs, etc.).

	2. Creation of a complete database of clashes (services - ducts and pipes) through the fire-rated boundaries (walls, slabs, etc.), including information regarding the required fire resistance. 3. Add information to the clash database about the distance between services or between services and floor or other walls, and check the correctness of measurements.
b.2 Rationale behind objectives	The objective is to allow the user to maintain fire resistance when ducts and pipes of designed MEP services intersect with fire-rated building structures.
C. Scope and Context	
c.1 Scope of Validation	Validate compliant solutions for MEP service penetrations through fire-rated building structures.
c.2 Applicable Datasets / Projects	Dataset 15 / VilniusTECH P1 LAB - VilniusTECH laboratory building. Dataset 16 / VIS34 - Production laboratory building. BIM models with MEP services as well as information about the fire-rated building structures (walls, floors, roof, etc.).
c.3 Regulatory Framework	National regulations, e.g. GAISRINĖS SAUGOS PAGRINDINIAI REIKALAVIMAI Nr. 1-338 (https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.388658/asr)
D. Technical Components and Tools	
d.1 FireBIM Components Used	Ontology (for property linking and rule interpretation), Modelling Guidelines and process map (for attribute naming and structure); FireBIM ACC Platform (for rule checking), Visualization (enable the geometric interpretation based on a GUI). • An application to upload data (IFC) • A checking engine to validate the data and check for missing or incorrect data • An engine that can identify clashes between sets of objects • 3D viewer showing 3D geometry, with 3D navigation, reference information • Validated solutions database structure (for further implementation after project completion).
d.2 Relations to Use Cases/ Solutions / Applications (see last page of deliverable D4.1)	Use Case 4 (UC4) | 4.1 Compliance checking tool for ventilation penetrations (into compartment boundaries) Use Case 4 (UC4) | 4.2 Compliance checking for other penetrations (into compartment boundaries) Linked to applications 7 and 9: • Application 7: Web – applications: IDS generator / ICF checker • Application 9: automated detection of ventilation duct and other service penetrations intersecting with compartment boundaries
E. Scenario Implementation	
e.1 Description of validation scenario	1. Validate that all essential information is available in the BIM model: type of service, type of fire-rated building structures, required fire resistance of the boundary. 2. Once the database of clashes is created, check if all clashes between ventilation ducts and fire-rated building structures have been detected. 3. Check the material property in the penetration zone (fire resistance class).
e.2 Design Stage (according to RIBA)	Concept Design (2), Spatial Coordination (3), Technical design (4)
e.3 Actors and Responsibilities	• MEP designer is responsible for a preliminary design, a detailed design, and a MEP part in the implementation plan for the execution phase. Involved in validation scenarios 1, 2, 3. • Architect / Structural engineer: designing the compartments and transferring the general fire safety requirements to the BIM model. Provide the input for the MEP

	design, the models and sources for enriching object properties. Involved in validation scenarios 1, 2 and 3. ● Fire safety expert: defining the compartments and general fire safety requirements. Validate the MEP designer's design and create the fire safety report for the client. Involved in validation scenarios 1 and 3 (validation according to national regulation).
e.4 Required Input / data	BIM models in IFC format supplemented with information required for verification on the FireBIM ACC platform: ● architectural model and structural models with information about compartment boundaries (floors, slabs and walls), fire resistance, and structured information about boundary type; ● IFC model for ventilation with Information about type, size, and materials; ● IFC model for other services with Information about type, size, and materials.
F. Evaluation and Risks	
f.1 Challenges	● Enrichment of the BIM model with the necessary information required for the check of penetrations through the fire-rated boundaries. This will require additional manual work and time. ● The MEP part of the BIM model is necessary, and to supplement the project team with additional MEP competencies.
f.2 Evaluation Criteria / KPIs (at least 2)	● An engine that can do clash detections and generate a database of clashes. Evaluation can be done using multiple tools for clash detection and comparing results.
f.3 Main risks (technical, social)	● The tool must be sufficiently reliable to detect all clashes. This requires an additional reliability assessment (which can possibly be solved by applying different tools and comparing their outputs).
f.4 Ethical or legal considerations	Not applicable

4.2.4 Denmark

Validation scenario 1

A. General Information	
a.1 Validation Scenario	Verify the escape route conditions and the maximum of fire compartments of buildings in the early design stage that contain general rules, defined in the Danish building regulations (BR18)
a.2 Partners involved	Sweco | DTU | DBI
a.3 Fire Safety Domain(s)	Escape and evacuation routes and fire compartments size
B. Objectives and Rationale	
b.1 Validation Objectives	Evaluate whether FireBIM can automatically identify exits, escape routes, escape openings, and critical geometric conditions directly from the IFC model. Validate the platform's capability to compute travel distances, including the application of the blind-end correction factor. Verify the compliance of exit capacity, door or windows widths and heights, opening directions, and required number of exits or escape openings. Validate the platform's ability to find and calculate areas belonging to the same fire compartment, including separating Fire safety unit that do not belong to the fire compartment. Verify the maximum fire compartments size. Automatically flag non-compliant conditions and provide explanatory reasoning.

<table>
<tr><td>b.2 Rationale behind objectives</td><td>Danish fire safety regulations are characterized by detailed and geometry-driven requirements for building design. Manual verification of these requirements is time-consuming and prone to inconsistencies, particularly concerning:
Travel distance calculations and identification of blind ends.
The number of exits in relation to the room's capacity
Door orientation and minimum width requirements.
Escape openings placement, minimum width and height
Calculation of areas
The division of Fire Compartments and the recalculation of areas
Several rules are based on prescriptive solutions where there is a fixed measurable size or where the size of the room or the number of occupants is definitive for the number of escape routes, doors or escape openings.

The FireBIM project may provide an opportunity to:
Harmonize interpretations of regulatory requirements based on the regulations of the country
Reduce errors introduced through manual modelling
Improve the consistency and efficiency of early design decisions.</td></tr>
<tr><td colspan="2">C. Scope and Context</td></tr>
<tr><td>c.1 Scope of Validation</td><td>The validation focuses exclusively on automated compliance checking of building design
Calculation of maximum allowable travel distances
Identification and evaluation of blind-end travel distance conditions
Verification of the number and distribution of exits
Verification of exits widths and escape route capacity
Verification of exit door swing direction relative to occupant loading
Analysis of the geometric configuration of escape routes and associated circulation spaces.
Calculation of maximum allowable fire compartments size
Other fire safety aspects such as fire compartmentation (boundaries, materials, etc.) or structural fire protection fall outside the scope of this scenario.</td></tr>
<tr><td>c.2 Applicable Datasets / Projects</td><td>Dataset 17 DTU Space – Laboratories and offices, five floors and a total gross floor area of 8,300 m². The processing flow will be tested with selected other datasets as well, to validate the assumptions and to test against dataset differences, with limited data enrichment related to the Danish regulations.</td></tr>
<tr><td>c.3 Regulatory Framework</td><td>The regulatory framework for this scenario consists of:
BR18, Chapter 5: Fire Safety
Appendix 3 - Prescriptive fire safety solutions for offices (BR18-VK5-B03)
Appendix 4 - Prescriptive fire safety solutions for assembly Rooms, shops, etc. (BR18-VK5-B04)
Appendix 5 – Prescriptive fire safety solutions for classrooms etc. (BR18-VK5-B05)
The above-mentioned prescriptive solutions vary depending on the specific use of the building's section, where the decisive factors are people's ability to escape to safety without help, whether they are aware of the escape routes and the number of people in the room/area.</td></tr>
<tr><td colspan="2">D. Technical Components and Tools</td></tr>
<tr><td>d.1 FireBIM Components Used</td><td>Digital representation and coordination of the Danish building requirements.
Modelling Guidelines: ensuring correct IFC structure and consistent classification of doors, windows, areas/rooms and occupancy capacity
ACC Platform :
Automatic generation of travel-path calculations.
Detection of exits and escape route.
Verification of door widths, swing directions, and capacity requirements.
Verification of windows (rescue openings) widths and heights</td></tr>
<tr><td>d.2 Relations to Use Cases/ Solutions / Applications (see last</td><td>Use Case 1 scenario 1, section 3.8: Modelling guidelines, and sample Bim models for fire safety compliance.

Use Case 1 scenario 2, section 3.3: SmartView fire safety design assistance.</td></tr>
</table>

<table>
<tr><td>page of deliverable D4.1)</td><td>Use Case 2 scenario 1 and 2, section 3.4 and 3.12: Solution 3.4: Early design guidance and automated compliance checker; Solution 3.12: comparing fire safety compliance between countries.</td></tr>
<tr><td colspan="2">E. Scenario Implementation</td></tr>
<tr><td>e.1 Description of validation scenario</td><td>a. The architect/ engineer prepares an IFC model of the datasets/project.
b. The model uses the following modelling guidelines, including:
    a. The use and size of the room
    b. Classification of exit doors
    c. Classification of rescue openings
c. The BIM model is exported in IFC format.
Using the FireBIM ACC tool system performs automated processes:
d. The architect or fire safety expert checks the rules according to national guidelines.
    a. Generation of a travel-distance graph throughout the fire cell or escape route.
    b. Identification of blind ends and application of the 1.5 correction factor.
    c. Detection of exits and escape route networks.
    d. Measurement of maximum travel distances from all points.
    e. Detection of rescue openings.
    f. Measurement of maximum Fire Compartments
e. The platform evaluates compliance with the regulatory, in this case, the earlier mentioned Appendix 3-5 requirements:
    a. Maximum travel distances for assembly occupancy.
    b. Required number of exits based on occupant load.
    c. Minimum clear width of exits and escape routes.
    d. Correct door swing direction where applicable.
    e. Proper distribution of exits.
    f. Maximum Fire Compartments
f. Non-compliant conditions are automatically highlighted, and rule explanations are provided.
g. A digital compliance report is generated for design teams and authorities.
h. The design team revises the model based on FireBIM feedback.</td></tr>
<tr><td>e.2 Design Stage (according to RIBA)</td><td>Concept Design (2), Spatial Coordination (3), Technical design (4)</td></tr>
<tr><td>e.3 Actors and Responsibilities</td><td>Architect: Prepares the IFC model. Fire Safety Engineer: Enriches data according to FireBIM guidelines and points out the design based on results. Reviews FireBIM outputs, evaluates compliance, and assesses flagged deviations. FireBIM Platform: Performs automated geometric analysis, rule interpretation, and compliance evaluation.</td></tr>
<tr><td>e.4 Required Input / data</td><td>IFC model, including:
• Number of doors with correct geometric parameters (width, swing direction, heights)
• Rescue openings with correct geometric parameters (width and height)
• Size of the room to calculate travel distance and determine the amount of exit doors or rescue openings
• Occupant load or area parameters necessary to determine the required exit capacity.
• Rooms</td></tr>
<tr><td colspan="2">F. Evaluation and Risks</td></tr>
<tr><td>f.1 Challenges</td><td>It is crucial to follow the correct guidelines, as the usage of the space and the individuals occupying the rooms form the basis for which legal framework should be applied. Inconsistencies with applicable regulations can have implications for the process and safety. Therefore, accurate identification and application of relevant rules are essential to ensure that the building's design is both compliant and safe.</td></tr>
<tr><td>f.2 Evaluation Criteria / KPIs (at least 2)</td><td>Reduction in time required for validation processes when using FireBIM compared to traditional manual methods. It is easier and faster to get the correct identifications and validations of exits, escape routes, and critical geometric conditions compared to manual checks in the design phase.</td></tr>
</table>

f.3 Main risks (technical, social)	• Incorrect or incomplete input models may cause inaccuracies in rule-checking results. • Limited compatibility with non-standard or older BIM models. • Not user friendly, ensuring the system is intuitive and accessible for all users to prevent misuse or errors due to misunderstanding the platform
f.4 Ethical or legal considerations	Copyright: Dataset 17, cannot be published or shared with partners and institutions outside the FireBIM project

Validation scenario 2

A. General Information	
a.1 Validation Scenario	Verify the fire compartments size, boundaries and classification of buildings in the technical design stage that contain general rules, defined in the Danish building regulations (BR18)
a.2 Partners involved	Sweco | DTU | DBI
a.3 Fire Safety Domain(s)	Fire Compartments
B. Objectives and Rationale	
b.1 Validation Objectives	Building (IfcBuilding). Fire compartments (IfcZone). Fire classification of the building assemblies defining the fire compartment boundaries. Automatically flag non-compliant conditions and provide explanatory reasoning
b.2 Rationale behind objectives	Danish fire safety regulations define the maximum allowable areas of fire compartments (*brandsektioner* and *brandceller*) as well as the fire classification requirements for the building assemblies that form the boundaries of these compartments.It is important during the design to subdivide the building into appropriate fire compartments, as failing to do so may lead to major design revisions later and significant disruption on the construction site. As the design develops, fire compartments may unintentionally become too large, or building elements may be changed to materials with different—and potentially non-compliant—fire classifications. Therefore, it is necessary to regularly verify that both the size of the fire compartments and the fire-classified building assemblies forming their boundaries continue to comply with the fire safety regulations throughout the design process.
C. Scope and Context	
c.1 Scope of Validation	The validation focuses exclusively on automated compliance checking of building design • Calculation of areas • Identification and evaluation of sprinklers • Identification of use of building • Identification of materials • Identification of fire compartments • Identification of fire sub-compartments • Identification of fire compartments boundary • Identification of openings in fire compartments boundaries
c.2 Applicable Datasets / Projects	Dataset 17 DTU Space – Laboratories and offices, five floors and a total gross floor area of 8,300 m². The processing flow will be tested with selected other datasets as well, to validate the assumptions and to test against dataset differences, with limited data enrichment related to the Danish regulations.
c.3 Regulatory Framework	The regulatory framework for this scenario consists of: • BR18, Chapter 5: Fire Safety (BR18- § 82 - § 158) • Appendix 3 - Prescriptive fire safety solutions for offices (BR18-VK5-B03)

	• Appendix 4 - Prescriptive fire safety solutions for assembly Rooms, shops, etc. (BR18-VK5-B04) • Appendix 5 – Prescriptive fire safety solutions for classrooms etc. (BR18-VK5-B05) The above-mentioned prescriptive solutions vary depending on the specific use of the building's section,
D. Technical Components and Tools	

d.1 FireBIM Components Used	• Digital representation and coordination of the Danish building requirements.
	• Modelling Guidelines: ensuring correct IFC structure and consistent classification of walls, doors, windows, areas/rooms and occupancy capacity
	• ACC Platform:
	    • detection of compartment boundaries
	    • gross/net area calculations
	    • detection of openings in fire-rated walls

d.2 Relations to Use Cases/ Solutions / Applications (see last page of deliverable D4.1)	UC1 – Scenario 2: Quality checking for fire-code exchange information requirements UC2 – Scenario 1: Understanding a building in terms of fire safety UC2 – Scenario 2: Automated compliance checks for prescriptive fire requirements Solution 3.5 Plug-in: Early design: from compliant spaces to building elements Solution 3.6 Application/Plug-in: technical design compliance checker
E. Scenario Implementation	

e.1 Description of validation scenario	1. The architect/engineer prepares an IFC model of the datasets/project.
	2. The model is using following the modelling guidelines, including:
	    a. The use and size of the room
	3. The BIM model is exported in IFC format.
	Using the FireBIM ACC tool system performs automated processes:
	4. the architect or fire safety expert checks the rules according to national guidelines.
	    a. Size of the fire cells and sections
	    b. Sprinklers
	    c. Materials
	    d. Boundaries
	5. The platform evaluates compliance with the regulatory, in this case, the earlier mentioned Appendix 3-5 requirements.
	6. Non-compliant conditions are automatically highlighted, and rule explanations are provided.
	7. A digital compliance report is generated for design teams and authorities.
	8. The design team revises the model based on FireBIM feedback.

e.2 Design Stage (according to RIBA)	Concept Design (2), Spatial Coordination (3), Technical design (4)
e.3 Actors and Responsibilities	Architect: Prepares the IFC model. Fire Safety Engineer: Enriches data according to FireBIM guidelines and points out the design based on results. Reviews FireBIM outputs, evaluates compliance, and assesses flagged deviations. FireBIM Platform: Performs automated geometric analysis, rule interpretation, and compliance evaluation.
e.4 Required Input / data	IFC model, including: • Walls • Materials • Doors • Windows • Rooms

F. Evaluation and Risks	
f.1 Challenges	It is crucial to follow the correct guidelines, as the compartmentation implies a stop of the spread of the fire. Inconsistencies with applicable regulations can have implications for the process and safety. Therefore, accurate identification and application of relevant rules are essential to ensure that the building's design is both compliant and safe.
f.2 Evaluation Criteria / KPIs (at least 2)	Enable and motivate to take these permanent decisions as compartmentation with respect to fire safety, throughout the design phase
f.3 Main risks (technical, social)	• Incorrect or incomplete input models may cause inaccuracies in rule-checking results. • Limited compatibility with non-standard or older BIM models. Not user friendly, ensuring the system is intuitive and accessible for all users to prevent misuse or errors due to misunderstanding the platform
f.4 Ethical or legal considerations	Copyright: Dataset 17, cannot be published or shared with partners and institutions outside the FireBIM project

4.2.5 The Netherlands

Validation scenario 1

A. General Information	
a.1 Validation Scenario	Fire Safety Compliance and Generation in Early Building Design
a.2 Partners involved	Peutz, TU Eindhoven, BIM-Connected, Stam + de Koning
a.3 Fire Safety Domain(s)	Compartmentation, Escape Routes, Visualization
B. Objectives and Rationale	
b.1 Validation Objectives	Main objectives: - Use available IFC data for the geometry of early design stage building. - Support manual user input regarding compartmentation and escape routes (lengths and numbers) into the data collection (e.g. assign a selection of spaces to each fire compartment). - Convert the user input to FireBIM ontology and the building geometry. - Perform automated compliance checks on compartmentation and escape routes. - Generate a results report to user (e.g. “the collections of spaces in FC1 exceeds the legal limits”) - Support a redo on the manual user input. If everything complies, then: - Enrich the IFC model (spaces) with the user input. - Generate 2D and 3D output of the fire compartments and escape routes information, combined with the building geometry. - Determine the requirements for boundary walls, floors and roofings of fire compartments and escape routes. - Generate 2D and 3D visualization of those requirements. If possible: - Add occupancy and capacity of escape routes to the fire related input and compliance checks.

b.2 Rationale behind objectives	In the Netherlands, early stage building design is done by architects with minimal fire safety knowledge. To improve compliance with fire safety regulations, a quick (and dirty) check should be possible to ensure the design is on the right track. Furthermore, fire safety experts could use it to quickly generate drawings for permits or generate (fire safety) enriched BIM models for further building development stages (see also Validation scenario 2).
C. Scope and Context	
c.1 Scope of Validation	Compliance checking of a building design (for each function type) with compartmentation and escape route rules in early design: - Max. compartment size - Min. number of exits (incl. dimensions) - Min. number of staircases (incl. dimensions) - Max. distance to next fire compartment - Locations of doors (incl. dimensions) - Dimensions of escape routes
c.2 Applicable Datasets / Projects	- Dataset 1 – 't Huis (Kortrijk Care Campus) (although it is based on Belgium legislation) - Dataset 2 – Eurostaete - Dataset 4 – De Tribune It would be even best to have datasets available in an early design stage.
c.3 Regulatory Framework	Dutch regulations: - Besluit bouwwerken leefomgeving, par.4.2.8 through par.4.2.11 - NEN 2580:2007+C1:2008 - NEN 6068:2020 - NEN 6069+A1+C1:2019 - NEN 6075:2020
D. Technical Components and Tools	
d.1 FireBIM Components Used	The BIM-Connected Wistor software stack will be used for the user-interface and the conversion of IFC to LD. The 'geometry' engine that enables to load IFC files and is able to query geometric relations using the Sparql query engine. This engine is under development within the FireBIM project and will be heavily used for this validation scenario.
d.2 Relations to Use Cases/ Solutions / Applications (see last page of deliverable D4.1)	- UC1 – Scenario 2: Quality checking for fire-code exchange information requirements - UC2 – Scenario 1: Understanding a building in terms of fire safety - UC2 – Scenario 2: Automated compliance checks for prescriptive fire requirements - Solution 3.4: Early design guidance and compliance checker
E. Scenario Implementation	
e.1 Description of validation scenario	In the Netherlands, early stage building design is done by architects with minimal fire safety knowledge. To improve compliance with fire safety regulations, a quick (and dirty) check should be possible to ensure the design is on the right track. Furthermore, fire safety experts could use it to quickly generate drawings for permits or generate (fire safety) enriched BIM models for further building development stages (see also Validation scenario 2).
e.2 Design Stage (according to RIBA)	Stage 2: Concept Design Stage 3: Spatial Coordination Stage 4: Technical Design

e.3 Actors and Responsibilities	- BIM-Connected: Develops the geometry engine, builds rules and builds the end user application. - Peutz: provides the use case, provides fire experts assistance in the development of the rules, provides fire safety related input and evaluates the result. - TU Eindhoven: Provides the FireBIM ontologies and helps in the development of the rules. - Stam + de Koning: Provides the dataset.
e.4 Required Input / data	IFC model with IFCSpaces and a manual input tool.
F. Evaluation and Risks	
f.1 Challenges	The current exploration of rules is only done for buildings with highest floor of a staying area with a maximum of 70 m. Above that height, additional requirements could be set by local government. The scenario should work for all types of buildings below that height. The build of a geometry engine that implements Sparql queries on IFC models including an extension of Sparql functions that enables spatial analyses.
f.2 Evaluation Criteria / KPIs (at least 2)	- User friendly app that enables architects and fire safety experts to create compartments and add other fire related information. - Geometry Engine that can read all the Dutch IFC files - Usage of the FireBIM ontologies. Do they contain enough relevant information for this particular scenario
f.3 Main risks (technical, social)	Risks are on the geometry engine although first versions are working. Also risks on the system level and that is mainly about putting it all together. Another risk is the completeness of the FireBIM ontologies regarding this case. Risk that the evaluated model is not checked with all the fire safety related regulations, but only a part of it.
f.4 Ethical or legal considerations	Experts and non-expert users can use the tool. The responsibility of the results is (still) with the experts.

Validation scenario 2

A. General Information	
a.1 Validation Scenario	Automatic data selection for fire safety boundary penetrations in Technical Design
a.2 Partners involved	BIM-Connected, Stam de Koning, TU Eindhoven, Peutz, Rf-Technologies (BE)
a.3 Fire Safety Domain(s)	Compartmentation, Resistance against fire penetration, fire spread and smoke penetration
B. Objectives and Rationale	
b.1 Validation Objectives	Main objectives: - Use IFC data enriched with fire safety information and -requirements of a late design stage building. - Validate whether the enriched IFC-model meets the EIR. - Understand the building in terms of the FireBIM ontology. - Use clash-test information on whether a fire safe boundary (wall, floor, roof) is penetrated. - Determine the requirements of the boundary penetration based on the fire safety information and the regulations. - Generate a BCF of the penetrations/clashes where an installation component goes through a compartment wall/floor, enriched with the fire safety requirements.

	- Generate a 2D drawing where the penetration/clashes are labeled. - Generate a list of possible measures (products) based on various information, such as geometry, position, fire safety requirements, using linked data. - Provide additional information to the user about the suggested measures, such as manufacturer, type, cost, technical information (e.g. flow), using linked data. - Support open data standards so that manufacturers can add their own products.
b.2 Rationale behind objectives	In current construction practice, fire measures/sealing for penetrations are addressed too late in the process. During the cost estimation phase, contractors usually include a fixed provisional sum for fire stopping without insight into the actual number, location, and complexity of penetrations. Only in the work preparation phase are penetrations manually identified and counted, a process that typically takes several weeks. After this inventory, a fire safety specialist assesses the penetrations and specifies the required measures. At that stage, the design is already fixed, while penetrations are often unfavorably positioned from a fire safety perspective. Design adjustments are no longer feasible, resulting sometimes in complex fire prevention/sealing solutions. In practice, fire measure/sealing costs almost always exceed the original estimate. In this scenario, the "tool" significantly reduces preparation time, improves cost predictability, and provides early insight into feasible fire stopping solutions, enabling better-informed decisions during the Technical Design stage.
C. Scope and Context	
c.1 Scope of Validation	Determine the requirements for penetrations through fire safety boundaries: - Resistance against fire penetration - Resistance against fire spread - Resistance against smoke penetration - Applicability by test reports
c.2 Applicable Datasets / Projects	Dataset 2 – Eurostaete Some datasets need to be extended with IFCSpaces and IFC ducts and pipes.
c.3 Regulatory Framework	Dutch regulations: - Besluit bouwwerken leefomgeving, par.4.2.8 through par.4.2.11 - NEN 2580:2007+C1:2008 - NEN 6068:2020 - NEN 6069+A1+C1:2019 - NEN 6075:2020
D. Technical Components and Tools	
d.1 FireBIM Components Used	The BIM-Connected Wistor software stack will be used for the user-interface and the conversion of IFC to LD. The 'geometry' engine that enables us to load IFC files and is able to query geometric relations using the Sparql query engine. This engine is under development within the FireBIM project and will be heavily used for this use-case.
d.2 Relations to Use Cases/ Solutions / Applications (see last page of deliverable D4.1)	Linked to use cases UC4 scenario 1 & 2: Compliance checking tool for ventilation and other service penetrations into compartment boundaries. Linked to applications 7,9 & 10: - Web – Application: IDS generator / IFC checker - Application: automated detection of ventilation duct and other service penetrations intersecting with compartment boundaries - Application / plug-in: Product selection and compliance checking tool for ventilation penetrations and other service penetrations into compartment boundaries

E. Scenario Implementation	
e.1 Description of validation scenario	After a spatial building design is finished and the building permit is approved a contractor (together with sub-contractors) starts its preparation in the Technical Design stage. One of these tasks is to select products for every part of the building's design. For selecting the right products in terms of fire safety boundary penetrations (such as valves), there is often a lack of fire safety knowledge. This scenario allows the (sub)contractor to select the most suitable measure/product out of an automatically pre-filtered list based on the fire safety requirements. The big advantage of this automatically generated digital list is that the (sub)contractor no longer must browse through all kinds of catalogues.
e.2 Design Stage (according to RIBA)	Stage 4: Technical Design Stage 5: Manufacturing and Construction
e.3 Actors and Responsibilities	- BIM-Connected: Develops the geometry engine, builds requirements generator and builds the end user application. - Peutz: provides fire experts assistance in the development of the requirements generator, provides fire safety related input. - TU Eindhoven: Provides the FireBIM ontologies and helps in the development of the requirements generator. - Stam + de Koning: Provides the dataset and evaluates the result as an end user.
e.4 Required Input / data	IFC model with IFCSpaces and IFC models with pipes and ducts
F. Evaluation and Risks	
f.1 Challenges	The geometry engine that implements Sparql queries on IFC models includes an extension of Sparql functions that enables spatial analyses. Another challenge is the connection and usefulness of the FireBIM ontologies in this scenario
f.2 Evaluation Criteria / KPIs (at least 2)	- Geometry Engine that can read IFC files. - Geometry Engine that can do clash detection. - Usage of FireBIM ontologies. Do they contain enough relevant information for this scenario?
f.3 Main risks (technical, social)	Risks are on the geometry engine although first versions are working. Also risks on the system level and that is mainly about putting it all together. Another risk is the completeness of the FireBIM ontologies regarding this case. The product data on the other hand is based on the completeness, reliability and applicability of the product information submitted by the manufacturer.
f.4 Ethical or legal considerations	Usually, there is no more verification by a fire safety expert in this building phase, so the quality chosen products, and therefore the fire safety of the building, relies completely on the quality of the stored data and the performance of the automated determination of the fire safety requirements.

5 Proposed demonstrators

The validation scenarios presented in Chapter 4 can be grouped into two main clusters, which are clearly identified and illustrated in Table 3. These clusters, defined according to the partners' objectives, are Fire Compartmentation Compliance (Cluster 1) and Evacuation and Escape Routes (Cluster 2).

Table 3 – Proposed demonstrators by clusters

Fire Compartmentation Compliance (Cluster 1)	**New Buildings**	- Automated checking of max. fire compartment size - Fire resistance requirements - Ambiguity of net vs gross areas - Early-stage feedback
	Existing Buildings / Retrofit	- Scan-to-BIM accuracy - Identification of hidden non-compliances
	Service Penetrations	- Clash detection of services vs fire-rated walls/floors - Solution selection correctness - Product compliance standards
Evacuation and Escape Routes (Cluster 2)	**Early Design Validation**	- Travel distances - Blind ends / dead ends - Number of exits - Architect feedback
	Advanced / Geometry-Driven	- Travel path graphs - Blind end detection - Rescue openings

5.1 Fire compartmentation compliance

The subsections below give more details about each one of the subclusters: i) new buildings, ii) existing buildings, and iii) service penetrations.

5.1.1 New buildings (early-stage design)

<table>
<tr><td>A. Countries & Partners</td><td>Portugal: VN2R, ISEP, Exactusensu
Belgium: D-Studio, ASSAR, Buildwise
Lithuania: Poliprojektas, InnoBIM, VilniusTECH
Denmark: DTU, Sweco, DBI
Netherlands: BIM-Connected, Peutz, Stam de Koning, TU Eindhoven</td></tr>
<tr><td>B. Common Validation Focus</td><td>Automated checking of maximum fire compartment size
Identification of fire compartments (IfcZone / aggregated IfcSpaces)
Verification of fire resistance requirements of bounding elements
Early-stage feedback to avoid late-stage redesign
Use of IFC → ontology → ACC (often SHACL-based) workflows</td></tr>
<tr><td>C. Key Differences</td><td>Area calculation ambiguity
Portugal & Lithuania explicitly validate gross vs net area interpretation inconsistencies, which are not clearly defined in regulation but resolved via professional convention.
Denmark focuses on explicit prescriptive limits defined in BR18, with less ambiguity but higher geometric precision.
Regulatory scope
Belgium and Denmark strictly scope to new buildings, while Portugal and Lithuania also reuse datasets from renovation projects as “new design analogues”.
Ontology maturity
Netherlands explicitly validates Linked Data–based geometry inference and ontology completeness as part of the scenario, beyond rule checking.
Design stages
Belgium and Denmark concentrate on concept/spatial coordination, while Lithuania and Portugal span concept → technical design.</td></tr>
</table>

5.1.2 Existing buildings / retrofit

<table>
<tr><td>A. Countries & Partners</td><td>Portugal: VN2R, ISEP, Exactusensu
Belgium (partial): D-Studio, Buildwise
Netherlands (implicit): BIM-Connected, Peutz</td></tr>
<tr><td>B. Common Validation Focus</td><td>Compartmentation compliance when:
No reliable drawings exist
Building information must be reconstructed
Testing scan-to-BIM → IFC → ACC pipelines
Identification of hidden non-compliances in legacy buildings</td></tr>
<tr><td>C. Key Differences</td><td>Data acquisition
Portugal uniquely validates laser scanning + scan-to-BIM accuracy KPIs (≥80% geometric accuracy) .
Belgium and Netherlands assume BIM availability but flag renovation data uncertainty as a risk.
Regulatory applicability
Belgium explicitly notes that renovations may not fall under the main fire decree unless reclassified.
Mitigation strategy linkage
Portugal explicitly validates decision support for mitigation strategies, not just detection.</td></tr>
</table>

5.1.3 Service penetrations through compartment boundaries

A. Countries & Partners	• **Belgium**: Rf-Technologies • **Denmark**: DBI • **Netherlands**: BIM-Connected, Peutz, Stam de Koning, TU Eindhoven • **Portugal**: VN2R, Exactusensu • **Lithuania**: Poliprojektas, InnoBIM, VilniusTECH

B. Common Validation Focus	• Detection of **clashes between MEP services and fire-rated walls/floors**
	• Validation of **fire resistance restoration measures**
	• Use of **geometry engines** to compute:
	    o Intersections
	    o Distances between services
	    o Applicability of sealing solutions
	• Integration of **certified solution databases**

C. Key Differences	• **Validation depth**
	    o Belgium explicitly validates:
	        ▪ Completeness of clash databases
	        ▪ Correctness of geometric distance calculations
	        ▪ Solution selection correctness
	    o Netherlands focuses more on **semantic enrichment and inference** using Linked Data.
	• **Product compliance**
	    o Belgium strongly emphasises **European product standards, CPR evolution, multilingual solutions**, and manufacturer involvement.
	• **Workflow stage**
	    o Belgium targets **technical design & construction (RIBA 4–5)**,
	    o Netherlands spans **early to detailed design**.

5.2 Evacuation and escape routes

The subsections below give more details about each one of the subclusters: i) early design validation and ii) advanced / geometry-driven escape analysis.

5.2.1 Early design validation

A. Countries & Partners	• **Portugal**: VN2R, ISEP, Exactusensu • **Belgium**: D-Studio, ASSAR, Buildwise • **Lithuania**: Poliprojektas, InnoBIM, VilniusTECH • **Denmark**: Sweco, DTU, DBI

B. Common Validation Focus	• Automated checking of:
	  o **Travel distances**
	  o **Number of exits**
	  o **Dead ends / blind-end corrections**
	• Early feedback to **architects**, reducing reliance on manual fire engineering checks
	• IFC-based geometric reasoning over **spaces, doors, stairs**

C. Key Differences	• **Geometric strictness**
	  o Denmark uniquely validates **blind-end correction factors**, door swing direction, rescue openings, and capacity-based exit widths in detail.
	• **Semantic tagging**
	  o Lithuania explicitly validates the assignment of **fb:EvacuationRoute properties** to IFC elements.
	• **Scope coupling**
	  o Portugal and Belgium often combine evacuation with compartmentation in a single scenario.
	• **Occupancy modelling**
	  o Denmark heavily relies on **occupant load classification**, while others treat it more implicitly.

5.2.2 Advanced / geometry-driven escape analysis

A. Countries & Partners	• **Denmark** (primary)

B. Common Validation Focus	• Automatic generation of **travel path graphs**
	• Detection of:
	  o Blind ends
	  o Maximum distances from any point
	• Verification of **door/window dimensions** as rescue openings

C. Key Differences	• Denmark is the **only country** where:
	  o Escape route validation is **fully geometry-driven**
	  o Rules are highly prescriptive and numerically exact
	• Other countries remain at **rule-based distance checks**, not full graph traversal.

5.3 Cross-cutting validation themes (meta-clusters)

Across all validation scenarios, the following **shared validation dimensions** emerge:

1. **Regulatory ambiguity resolution**
    - Gross vs net areas (PT, LT)
    - Staircase and mixed-use compartment logic (LT)
2. **BIM data readiness & modelling guidelines**

    - IDS, EIR-driven enrichment (BE, LT, NL)
3. **Ontology fitness-for-purpose**
    - Explicitly validated in NL and BE
4. **Trust, usability, and adoption risks**
    - Confidence of architects and authorities (all countries)
5. **Legal & ethical constraints**
    - Privacy (scan-to-BIM)
    - Copyright (BE, DK)
    - Liability disclaimers (BE, NL)

6 Final considerations

The work carried out within WP5.1 demonstrates a structured, hierarchical, and holistic approach to developing FireBIM demonstrators. Central to this approach is the integration of **datasets**, **validation scenarios**, and **demonstrators**. Real-world and synthetic BIM datasets collected from partner entities form the foundation for the validation scenarios, which in turn support the creation of demonstrators that showcase the practical relevance and added value of the project's solutions.

Validation scenarios ensure that the demonstrators effectively test the applicability, interoperability, and performance of FireBIM tools in realistic contexts. The scenarios are organized around key fire safety aspects, including fire compartmentation compliance and evacuation and escape routes, and consider both new constructions and existing buildings. This approach allows for systematic evaluation of regulatory compliance, design effectiveness, and safety improvements.

The demonstrators, built on these scenarios, translate the technical knowledge and semantic resources developed in WP2 and the functional requirements defined in WP4 into operational, deployable solutions. This alignment ensures that the tools are technically sound, practically feasible, and closely aligned with real industry needs. Cross-country collaboration further strengthens knowledge exchange, stakeholder engagement, and innovation potential.

Overall, the hierarchical strategy adopted in WP - linking datasets, validation scenarios, and demonstrators - provides a robust and transparent framework that validates the FireBIM solutions against user needs and regulatory requirements. The results confirm the feasibility, relevance, and effectiveness of the project outputs, providing a solid foundation for future development, broader industrial adoption, and continuous improvement of fire safety practices.