



Attachment 1

BIM Execution Plan for residential deep renovation
BIM-SPEED demonstration site #1: Vitoria-Gasteiz

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1. Project Information

Table 1 – Project information

Project Name	ALDABE 26 & MANUEL DÍAZ DE ARCAYA 5: energy retrofitting and district heating connection of two multi-storey buildings with 18 dwellings.
Asset Owner	Several private owners (two multi storey private building).
Project Owner/ Client	Several private owners (two multi storey private building). Visesa acts as Delegate Promoter on behalf of the owners.
Appointing Party	Visesa
Project Location and Address	26 Aldabe Street and 5 Manuel Díaz de Arcaya Street. Coronación District. Vitoria Gasteiz (Spain)
Contract Type / Delivery Method	Design and renovation
Brief Project Description	Renovation of two multi-storey buildings (18 dwellings) with no insulation, poor energy performance and condensation and humidity/damp problems. The renovation activities consisted of insulation of the building envelope with focus on façades and roof and dwellings connection to a new District Heating system based on biomass energy
Additional Project Description	The buildings are at the same time demonstrator for BIM Speed and part of Lighthouse demonstrator in SmartEnCity project funded under the European Union’s Horizon 2020 research and innovation programme (grant agreement No 691883). It aims to develop a systemic approach for transforming European cities into sustainable, smart and resource-efficient urban environments in Europe.
Design Start Date	24.01.2019
Construction Start Date	18/05/2020
Handover Date	19/05/2021
Estimated Asset Area (Net)	682,2 m ² (ALD26) 753,4 m ² (MDA5)



2. Introduction

2.1 Purpose

This BIM Execution Plan (BEP) was carried out with the aim of developing a pilot project in Vitoria Gasteiz consisting of an energy retrofitting process to be developed over two multi-story private buildings. The abovementioned execution plan allowed to take advantage of BIM methodology during the rehabilitation process, reducing delivery time, cost and improving the retrofitting works result in terms of energy efficiency.

The two demo case buildings were built in 1958. They are located in the city of Vitoria-Gasteiz, in the North of Spain. First demonstration site is a four storeys residential building with eight flats, with a garage and a bar on the ground floor. The second demonstration site is a 5 storeys residential building with 12 flats, with a storage room and a bar on the ground floor. In both buildings, most of the main external walls are made from double layer of brick an air-camera in between, cavity-wall. Others just are composed of a simple layer of brick without any air-camera. Both buildings are not insulated and have poor energy performance with condensation and humidity problems.

The buildings are part of Lighthouse demonstrator in SmartEnCity European Project funded under the European Union's Horizon 2020 research and innovation programme (grant agreement No 691883). This project aims to develop a systemic approach for transforming European cities into sustainable, smart and resource-efficient urban environments in Europe. The renovation activities within SmartEnCity project will contain insulation of the building envelope with focus on façades and roof and connecting the dwellings to a new District Heating system based on local biomass. During BIM-SPEED project new tools and solutions supporting as-built data acquisition, designing, energy simulation and construction works have been implemented guided by the BEP here described.



2.2 Definitions and abbreviations

Table 2 –Definitions and abbreviations

Names	Abbreviations (if applicable)	Definitions
The Employer		Visesa, as Delegate Promoter on behalf of dwelling owners.
The Contractor		Facultative Direction implementing a comprehensive design and execution plan of the project, according to the Contract.
The Contract		The contract between the Employer and the Contractor concluded as a result of the tender “Retrofitting works execution in Coronación District Owner’s Community. Batch 1: Aldabe 26 and Manuela Díaz de Arcaya 5”
Building Information Modelling	BIM	A set of technologies, processes and policies enabling multiple stakeholders to collaboratively design, construct and operate a facility in virtual space.
BIM Execution Plan	BEP	The "plan that explains how the Information Management aspects of the Appointment will be carried out by the Delivery Team" ISO 19650-2 (3.1.3.1). The term Plan in BIM Execution Plan (BEP) refers to a response to the Exchange Information Requirements and is delivered either as online input or as a compiled Document to the Appointing Party.
Point Cloud		A set of data points in 3D created by 3D Laser Scanners to capture an object, space or a whole building. Point Clouds can be transformed into meshes, surfaces and even 3D objects using specialised tools.
Documentation		All documents including BIM models and other electronic documents outlined within the BIM execution plan.
Model Element (Element, component)		A virtual element representing a physical or abstract object.
Calibration stage		The stage in which the BEP will be configured by the Contractor and Employer, the duration of which was outlined in the Contract.



Global Coordinate System		A common coordinate system defined for all objects of the Project embedded in ETRS89 Spanish Official Geodetic Coordinate System.
Industry Foundation Classes	IFC	IFC refers to a neutral/open specification (schema) and a non-proprietary 'BIM file format' developed by buildingSMART. Major BIM Software Tools support the import and export of IFC.
*.ifc 2x3		A digital file format for BIM Models that provides universal approaches to collaboration in the design, construction and operation of buildings, based on open standards and workflow (so-called Open BIM).
BIM Model		An object -based, data-rich, 3D digital model generated by a Project Participant using a BIM Software Tool. Each discipline will produce a BIM model according to the standards outlined within this BIM execution plan.
Discipline Model		A BIM model pertaining to a single discipline,
Native BIM Model		BIM model created in a program's native file format.
Common Data Environment	CDE	An "agreed source of Information for any given project or Asset, for collecting, managing and disseminating each Information Container through a managed process".
Base point of reference		A point defined in geodetic coordinates that is the reference point for the local coordinate systems of 3D models.
Level of Information	LOI	A description of non-graphical content of Model Components at different project phases/stages. The Level of Information (LOI) term is used interchangeably with Level of Information Detail.
Level of Detail	LOD	A description of graphical content of models at each of the stages.
Data Drops		An Information Exchange milestone, where data extracted from the BIModel is delivered to the client/employer at predefined intervals.
3D		The 3D model contains geometric and physical parameters. A 3D model may be mono or multi-disciplined. A 3D BIM model is a complete multi-disciplinary model, however it may be divided into separate files.



2.3 Norms, standards and guides

Table 3 –Norms, standards, and guides

No.	Document	Scope of use	No of att.
1	BIM Project Execution Planning Guide and Templates (CIC Pennsylvania State)	BIM Uses	nd
2	BS 1192:2007+A2:2016	File Codes	nd
3	User’s BIM guide (Spanish Chapter from Building Smart)	User guide	nd
4	BIM Project Execution Guide (National esBIM comission, 2018)	BIM Uses	nd
5	GuBIMclass	Constructive elements calssification system	nd
6	GDO-BIM – 2019-V01 (Bimetica Parametric Desing Service, S.L.)	BIM objects creation standard	nd
7	PAS 1192-6:2018	Information management requirements	nd
8	AEC (UK) BIM Protocol	BIM Protocol	nd
9	Level of Development Specification for Building Information Models (BIMForum, http://bimforum.org/lo/).	Level of Development	nd

2.4 BIM Goals

Table 4 –BIM Goals

PRIORITY (high/med./low)	GOAL (CoS) DESCRIPTION	BIM USES
High	BIM model will be a useful input to support retrofitting execution	PRE – Retrofitting As-built modelling
High	BIM model will be a useful input to improve future maintenance tasks and to serve as witness of the result of the actuation for dissemination purposes.	POST – Retrofitting As-built modelling



High	BIM model 3D visualization will facilitate the execution process and communication & dissemination tasks	3D visualization
Medium	BIM model will facilitate document verification at every stage of the project.	Coordination
Medium	The BIM model should improve team coordination at every stage of the project.	Coordination
High	BIM models (PRE-retrofitting and POST-retrofitting) will serve as demos for energy simulations.	Energy analysis

2.5 The intended purpose

Below is a more detailed description of how the BIM goals will be achieved:

1. PRE-retrofitting BIM model will be a useful input to support retrofitting execution and POST-retrofitting BIM model will record interventions and show the exact result of the retrofitting works:
 - Enable effective communication between project team members.
 - Enable smooth coordination between Contractor and Employer/Client.
 - Enable the formation of a PRE-retrofitting model based on the point cloud of the existing state previous to the intervention.
 - Enable the formation of a POST-retrofitting model based on the intervention documentation (i.e.: drawings of executed works) after the retrofitting process.
 - BIM model will facilitate document verification.
2. BIM model visualization 3D will facilitate the execution process and communication & dissemination tasks:
 - BIM model allows to check architectural information, elements' location, type and material
 - BIM model supports correct execution and verification of carried out actions
 - BIM model facilitates communication with Employer during design and execution phases and fosters commitment between parts.
 - Allows effective communication and dissemination of intervention results with Employer and within BIM Speed and SmartEnCity communities
3. The BIM model will facilitate document verification at every stage of the project while improves team coordination.
 - Allows effective coordination with Employer and between partners to take decisions in every stage of the project.
4. BIM models (PRE-retrofitting and POST-retrofitting) will serve as demos for energy simulations.
 - They will enable the creation of a BEM model and an energy analysis of the existing state.



- They will allow testing solutions that will reduce primary energy, energy demand, environmental impact, reduce LCC costs and global warming potential.

2.6 BIM uses

Table 5 -BIM uses

BIM Use	Description	Responsible
As-built modelling PRE - Retrofitting & POST - Retrofitting	The process of creation a BIM model of the existing state before the building renovation and of the final state after retrofitting intervention	The Contractor
3D visualization	The spatial presentation of the building in a realistic manner.	The Contractor The Employer
Coordination	BIM model will facilitate document verification and team coordination, allowing effective coordination with Employer and between partners.	The Contractor The Employer
Energy analysis	The process of analyzing a building's energy performance	The Contractor



Table 6 –BIM-Speed uses

BIM-Speed Use	Description	Responsible
BIM-to-BEM (Cybertherm procedure)	Modelling and energy simulation of buildings with EnergyPlus™, integrated in the Open BIM workflow via IFC. EnergyPlus™ is a calculation engine developed by the Department of Energy of the United States of America (DOE), is one of the most used, powerful and recognized energy simulation engines of today. Thanks to its integration in CYPETHERM EPlus the application becomes a powerful tool for the energy simulation of buildings, allowing to know the energy demand, as well as the energy performance of AC systems, energy consumption by system and energy vector used.	The Contractor
3DASH tool (3D Scan-to-BIM)	The 3DASH tool automatically detects and creates BIM entities from 3D point clouds acquired by laser scanning or photogrammetry systems. The tool can be used by any professional who needs to quickly model a building in BIM from point clouds. This tool is better suited for the Collection of existing building data phase.	The Contractor
BIM Passport	This tool offers building owners a view on what data they have available in relation with their building.	The Contractor The Employer
BIM-based Life Cycle Cost and Asset Management	The BIMSPEED database is composed of a number of materials and components used for deep renovation of buildings. Building renovation components are defined as the building elements that can provide a contribution to the reduction of the overall energy consumption and/or to an enhanced environmental and economic sustainability.	The Employer
BACN2BIM	The tool allows users to collect information from sensors (dynamic data) installed in buildings and download this data from the BIM-Speed platform. This tool can be used by any professional who wants to collect dynamic data from sensors installed in buildings following the IFC standards. This tool is better suited for the Collection of existing building data phase.	The Employer



<p>Multicriteria decision making tool</p>	<p>The multicriteria decision-making methodology and tool assist the selection of a suitable renovation alternative considering the inputs of all involved in the decision-making process. In the tool, you can establish the assessment criteria for all proposed alternatives, collect the preferences from all involved in the decision process regarding all criteria proposed. The result is a ranking showing the alternatives according to their performance in relation to the preferences collected.</p>	<p>The Employer</p>
<p>VR/AR visualisations</p>	<p>A methodology for creating VR models from BIM and photogrammetric models to visualize by VR Box and Android device or iPhone different renovation scenarios, comparing the existing building with the variants of design solutions.</p>	<p>The Employer</p>



3. Management

3.1 Roles, responsibilities and authorities

Note: the following table is for educational purposes and shows as an example of what should be included in a typical BIM execution plan. For the purposes of this report, the authors have decided that this information does not need to be shared due to the public availability of this report and to protect the personal information of participants. At the start of a project it is important to identify the roles and responsibilities of the design teams. Table 7 is used to record the names and contact details of the individuals fulfilling the necessary project roles.

Table 7 –Roles and responsibilities

Role Company	Name	Email Phone
Lead Designer INDENORT PV SLU - PROVIDER IBERICA SLU	Confidential	Confidential
Project Delivery Manager INDENORT PV SLU - PROVIDER IBERICA SLU	Confidential	Confidential
Construction Manager INDENORT PV SLU - PROVIDER IBERICA SLU	Confidential	Confidential
Project Information Manager Visesa	Confidential	Confidential
Task Team Manager * Visesa	Confidential	Confidential

3.2 Major project milestones

Table 8 –Major project milestones

Milestone	Date
Laser Scan & Point Cloud	02.05.2019
PRE-retrofitting model	16.06.2020
Handover Date	19.05.2021
POST-retrofitting model	TBD



3.3 Survey strategy

Table 9 –Survey strategy

Survey Method	Delivery Format	Survey Origin	Details, notes
Light detecting and ranging (LIDAR)	.rcp (point cloud) .dwg (planimetry)	Light detecting and ranging (LIDAR)	Scanning overlap > 30%. Proportion of existing data in x-y-z (balance) > 10% Number of points added to the existing cloud within 6mm threshold > 95% ETRS89 georeferenced

3.4 Existing legacy data use

Table 10 –Existing legacy data use

No	Description	Format	Author	Location of the files	Comment
1	Tender documentation	doc, pdf, dwg	Visesa	Attachment to tender contract	N.A.



4. Planning and documentation

4.1 Revised Project Implementation Plan

The employer will present and clarify the rules outlined in this BEP for the use of the BIM-SPEED platform and e-mail communication and will be obligatory to all project participants.

4.2 Mobilization

Table 11 -Mobilization Plan

N°	Description	Status	Point in BEP	Comments
1	Mobilize resources			
1.1	Training of project team members in the required skills	Pending	4.3	
2	Mobilize information technology			
2.2	Configure and test the project's CDE (BIM-SPEED Platform)	Pending	6.1	

4.3 Trainings

Table 12 -Trainings

N°	Description	Organizer	Form	Participants	Frequency	Status
1	BIM-SPEED Platform	The Employer	online	Project team members, the contractor	One-time	Accomplished



4.4 Agreed project processes for collaboration and information modelling - communication

The following table contains information on the types and frequency of BIM-related meetings.

Table 13 –Types and frequencies of BIM-related meetings

Meeting type	Description	Organizer	Participants	Frequency	Location
BIM Strategy	To establish project aims and ambitions	The Contractor	The Employer The Contractor	Monthly	Online/in-person
BIM kick-off	To confirm BEP	The Contractor	The Employer The Contractor	Once	In person

5. Standard method and procedure

5.1 Federation strategy

For Vitoria Gasteiz demo buildings there is a unique architectural model per building with no federation required. The size and complexity of this demo was sufficiently narrow that it was not necessary to implement any federation strategy.

5.2 Origin and orientation

All coordinates will be based on the coordinate system ETRS89. One of the survey points will serve as the origin and define it within the aforementioned coordinate system.

5.3 File naming convention

File naming convention should be based on the British standard BS 1192:2007+A2:2016. In any case, for this BEP, is not necessary to fulfil with file naming convention as there will be just one single model without any additional disciplines. The file naming process can be simplified as long as a coherent naming protocol is chosen.

5.4 Agreed construction tolerances for all disciplines

Modelling tolerances for the construction phase of the project for each discipline should fall within the range permitted by the current Spanish Building Technical Code (CTE 2019).



5.5 Drawing sheet templates

For the permit and construction design projects, documentation for drawings as well as tables should be generated from 2D drawings and be in accordance with the requirements set out in the Contract.

5.6 Units

Table 14 -Project units

Units	Format	Accuracy
Linear*	cm	2 decimal places
Surface	m2	2 decimal places
Surface	m3	2 decimal places
Angles	°	2 decimal places
Weight / weight	kg	2 decimal places

*Site development plan units should be in [m].

5.7 Level of information needed (LOIN)

The LOIN is determined in the following tables.

5.7.1 Geometrical Data - (LOD)

The table below shows the required level of detail (LOD) required for each phase of the project.

Table 15 -LOD requirements for each project phase

Stage	LOD	Description
PRE-retrofitting Model POST-retrofitting Model	300	The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the Model Element. The project origin is defined and the element is located accurately with respect to the project origin.



5.7.2 Metadata (LOI)

The table below shows the required level of information (LOI) required for each phase of the project.

Table 16 –LOI requirements for each project phase

Stage	LOI	Description
PRE-retrofitting Model POST-retrofitting Model	200	Model may contain generalized parameters and additional metadata regarding information related to energy figures (i.e.: façade materials thermal performance, heat transfer coefficients) and other parameters.

5.7.3 Classification systems

This project will make use of GuBIMClass classification system for elements.

<https://www.bimcommunity.com/technical/load/140/gubimclass>

5.8 Task Information Delivery Plan

See master information delivery plan.

5.9 Master Information Delivery Plan

BIM models and documentation will be delivered by the dates shown in the table below. The information contained in the documentation should be complete and sufficient.

Table 17 –Master Information Delivery Plan

BIM Model by discipline	Stage		
	Project model	PRE-retrofitting Model	POST-retrofitting Model
Architectural	09/09/2019	18/05/2020	TBD



5.10 Responsibility matrix

Each involved partner's responsibilities are described in the table below. The following responsibilities have been outlined: R- party responsible for task, A- authorizing/decision-making party, C- contributing party, I- informed party.

Table 18 -Responsibility Matrix

Category	Task description	Owners	Visesa	Contractor
Organizational	BEP draft preparation	I	R	C
	BEP acceptance and coordination	I	R	A
	Submitting proposed changes to the BEP	I	A	R
	Introducing changes to the BEP	I	A	R
	Distribution of BEP findings within each organization	I	A	R
	Conducting trainings for the Employer in the scope specified in BEP	I	R	R
CDE Platform	Delivery and configuration of the CDE platform for the transfer of BIM models		R	I
	Training users on the use of the CDE platform		R	I
	Administration of the CDE platform		R	I
	Uploading BIM models to the CDE platform as agreed upon in the BEP		A	R
	Archiving of BIM models on the servers of each own organization		R	R

5.11 Acceptance criteria

All project documentation and particularly BIM models should fulfil the following requirements in order to be accepted by the Employer:

- Models will be presented in IFC 2x3 format and the native format of the modelling software used. Drawings will be presented in dwg format.
- Models will contain properly defined coordinate systems (according to ETRS89) and project units
- Models should not contain additional information linked to other files
- Models should be produced in Spanish or English
- BEM model and energy analysis will be performed for PRE-retrofitting as-built model and POST-retrofitting as-built model
- Naming convention compliance or alternative protocol as long as it is coherent



5.12 Risk mitigation

Table 19 –Possible risks and mitigation strategies

No.	Risk	Impact on project ¹	Probability of occurrence ¹	Prevention methods
1	Lack of experience in the use of BIM models during all project stages.	High	High	Training will be conducted for relevant parties.

Legend:

¹ High/medium/low

5.13 Coordination Process

BIM models, drawings, text documents, meeting minutes, document scans, and all data drops regarding the project should be done through BIM Speed Platform and archived.

The Contractor shall deliver all design documentation to the Employer in accordance with the Master Information Delivery Plan. Before delivery, the Contractor shall ensure that the documentation is complete and in accordance with the requirements set out in the BEP and the Contract. The Employer should only have access to up-to-date BIM models provided by the Contractor and shared through BIM Speed Platform.

6. IT solutions

6.1 CDE

The model and documentation provided by the Contractor to the Employer during the process of coordination or tasks defined by the master information delivery plan should be found in the locations defined and administered by the Contractor through the use of the chosen CDE: BIM Speed Platform, with access to it available at all times to the Employer. All relevant communication should occur within BIM Speed platform as outlined in section 5.13.

All changes carried out in any file contained in BIM Speed Platform should be tracked and registered, specifying date, person and nature of the change.

Seamless communication between users should be ensured by the Contractor, including messages or posts related to specific files and data contained in BIM Speed Platform.



6.2 Software versions

Table 20 –Software versions to be used

Purpose	Name of software	Version of software	Native format of files	Comments
Modelling	Autodesk Revit	2019	.rvt	
Point Cloud	Autodesk ReCap		.rcp	
Text Files	Microsoft Office	2003 and later	.docx	
Text Files	Adobe Acrobat Reader		.pdf	
Coordination, communication, file repository, CDE platform	BIM Speed Platform			
Coordination platform and collision detection	BIMcollab Zoom	V5.2	.ifc .bcf	



6.3 Exchange formats

The following are the agreed upon formats for model and drawing file exchange:

Table 21 –Exchange file formats

	Frequency	DWG	DGN	DWF	PDF	IFC 2x3	Other
Models	As defined in delivery plan					X	X
Drawings	Included in each stage data drop	X			X		
Final drawing format	Included in each stage data drop	X			X	X	
Schedules or spreadsheets	Included in each stage data drop						X

6.4 Data safety

The Contractor ensures access to the BIM Speed platform for all parties involved. Every user will have their own, named account created on their own. No unauthorized person will have access to the platform. Changes may only be made through the mutual acceptance of both the Contractor and Employer.

The contractor should ensure access to the BIM Speed Platform for all involved partners. Despite of that, for the present project, no security needs are identified beyond the basic security measures, which guarantee that unauthorized persons will not have the access to data contained in BIM Speed Platform. Changes may only be made through the mutual acceptance of both the Contractor and Employer.

