



Education for zero energy

Buildings using Building

Information Modelling

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03.2 Learning Material



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1. Object

The purpose of the following document is to compile the training resources that have been created for the different BIMzeED teaching units.

The educational resources package makes available to the teacher a series of educational materials designed by BIM and nZeB subject matter experts for the correct assimilation and accommodation of the concepts.

2. Introduction

The following guide is divided into the 12 teaching units that have been created for BIMzeED.

(PHOTO 12 units)

The LU teaching modality is b-learning, i.e. blended learning between face-to-face and online teaching. This education trend combines two pedagogical approaches that develop both efficiency and socialization opportunities for participants through the technological advances offered by online learning. It develops better use of resources and learning content by offering the learner greater flexibility of access.

Each LU has a series of items that we will explain below and that allow, among all, the acquisition of the fundamental concepts of the BIM and NZEB methodology.

For the development of these trainings we have taken into account the [report on gap analysis and learning outcomes](#) and the different materials and resources have been developed on the basis of the competences established for each learning unit.

2.1 Objectives

The didactic objectives are the results we expect to achieve once the learning process has been completed. At the same time, they provide criteria for evaluating the teaching process and its results. They must be measurable by any evaluation method and refer to real processes that can be observed.

2.2 Resources

For the correct assimilation of the concepts related to BIM and NZEB, the different project partners have carried out activities or developed a series of teaching materials available on the Moodle platform, using gamification as an educational strategy.

Gamification is a learning technique that transfers the mechanics of games to the educational-professional environment. Its implementation helps to acquire knowledge in a more meaningful and functional way.

On the other hand, each teaching resource has been created taking into account the objectives and skills to be acquired for the correct professional performance.

All teaching units have common resources and materials at the beginning and end of Moodle.

- Pre-Module Survey (Students and Workers) Feedback and Pre-Module Survey (Educators/Trainers)

Feedback

These surveys aim to assess the relevance and quality of the training action in relation to demand or need. It will help us to know what both students and trainers expect in relation to the training.

- Discussion Forum

This discussion forum is for news, debates or questions related to the course in general.

Each section of the course units also has its own discussion forum on the topic in question.

- Glossary

A glossary is an ordered catalogue of words, which are listed with their definition or explanation. It sets out important NZEB and BIM definitions and terminology.

- Learning Unit Descriptor

Descriptor with the key elements of the subject, such as objectives, EQF level, competences, among others.

- Trainers resources

Resources and didactic materials for the trainer to take into account during the course.

- Post-Module Survey (Students and Workers) Feedback and Post-Module Survey (Educators/Trainers)

Feedback

Surveys located at the end of the course with the aim of finding out the level of satisfaction with the course and whether the course has met the proposed goals. .

The different materials that have been produced specifically for the teaching units can be found below the document.

2.3 Competencies

Competencies encompass the knowledge, procedures and attitudes that we achieve for the performance of work practice and that allow us to act effectively and efficiently in different professional situations and contexts. In the teaching plans developed for the 12 learning units, we found two different classifications according to whether they are generic or specific competencies.

Generic competencies refer to those skills that are transferable to a variety of performance areas.

Specific competences refer to the skills required for the correct development of the work environment and which we can see detailed in each subject of this report by means of a table. This contains the following elements:

- In the report on the gap analysis and learning outcomes we were able to conclude the strengths and weaknesses in the current BIM and Nzeb training. This resulted in a number of topics that should be strengthened in order to reach an intermediate - advanced level (3.5).

Level of skills:

- [1] - Fundamental Awareness (basic knowledge)
- [2] - Novice (limited experience / Basic Level of Competency)
- [3] - Intermediate (practical application / Proficient)
- [4] - Advanced (applied theory)
- [5] - Expert (recognised authority)

In the table we can see the training provision, which refers to the current level of knowledge, and the training gap to upskill, the figure that has to be increased to reach the level required by the project.

- In vertical we find the topics of the subjects and in horizontal the resources that have been created for the implementation of the project.

	Results of report on the gap analysis		Topics of the subjects				
	Training provision	Training Gap to upskills	Topic 1 Introduction	Topic 2 From As-built to FM	Topic 3 Data Structure BIM Models	Topic 4 Data Structure of CMMS' s	Topic 5 Relation between Databases
<i>Specific competences</i>							
Linking asset data to the model for facility management.	2,75	0,75	✓		✓		

Collect, manage and disseminate documentation, graphical models and non-graphical data for the whole facility team in a Common Data Environment (CDE)	2,83	0,67		✓			✓
Establish the information framework required to assist communication and collaboration from Construction –Operation for asset management	2,95	0,55	✓			✓	

3. Learning unit 1 – Collaborative BIM to achieve nZEB

3.1 Objectives

The objectives of this learning unit are:

- Create a collaborative workflow between all construction agents using BIM.
- Identify the role and responsibilities of each construction agent.
- Identify the regulations applicable and generate all documents needed in nZEB buildings' design.

3.2 Resources

	Theory					Assessment				Others	
	PowerPoint	PDF File	Another	Resources for learn more	Required software's	Kahoot test	Sli.do	Quiz	Discussion	Task	Q&A
Topic 1.1 – Introduction	✓	✓				✓	✓				✓
Topic 1.2 – nZEB Fundamentals	✓	✓			✓			✓			✓
Topic 1.3 – BIM Fundamentals	✓	✓	✓	✓				✓	✓	✓	✓
Topic 1.4 – nZEB & BIM	✓	✓								✓	✓
Topic 1.5 – BIM Collaboration	✓	✓		✓				✓		✓	✓



Presentation

Topic 1.1 Introduction and required Software

Introduction to the course with explanation of the course unit and some questions to get to know each other through sli.do

Required Software topic deals with downloading the software which is needed to follow Learning Unit 1. The software is to be downloaded.

Activities and self-study are to be completed using this software during the learning unit. Students can download this software with the following instructions.

Topic 1.2 nZEB Fundamentals

Basis for understanding the need for nZEB, regulatory framework and key terms.

Topic 1.3 BIM fundamentals

Introduction to BIM fundamentals, how the methodology applies to projects, standards, and basic concepts for a successful implementation.

Topic 1.4 nZEB & BIM

Response to how can NZEB join BIM to improve the results regarding energy efficiency? And what responsibilities are there and who must take the responsibilities to integrate NZEB within a BIM project workflow?

Topic 1.5 BIM achieve nZEB

This section contains collaboration fundamentals, roles and responsibilities, workflows, exchanging formats, visualization platforms and CDE tool.



Activity

Topic 1.1 Introduction and required software

- Q&A – Softwares: forum to ask questions and share answers about software related topics or ask for help

Topic 1.2 nZEB fundamentals

- Q&A – forum to ask questions and share answers.
- To learn more - Reading Resources
 - EPBD_recast_19May2010.pdf
 - Handbook of Energy Efficiency in Buildings.pdf
 - Levels_EU_framework_of_building_indicators_Parts.pdf
 - Net Zero Energy Buildings.pdf
 - nZEB strategy 2020.pdf
 - NZEB Sustainable Technologies for Nearly Zero Energy Buildings.pdf
 - NZEB-design_principles_zeb.pdf

Topic 1.3 BIM fundamentals

- Sample model – link to download ArchiCAD sample file for demo and Autodesk Revit sample project.
- Videos
 - What is BIM?
 - Revit for Architectural Design
 - Design Authoring Tools
- Document pdf with BIM project execution Planning
- To learn more:
 - Video Revit to Navisworks
 - Pdf Level of Development (LOD) specification
 - Building information modelling (BIM) protocol
 - The uses of BIM

- Q&A BIM fundamentals

Topic 1.4 nZEB & BIM

- Q&A nZEB & BIM – forum to ask questions and share answers.

Topic 1.5 BIM achieve nZEB

- To learn more:
 - Specification for information management for the capital/delivery phase of construction projects using building information modelling.
 - Employer's information requirements
- Q&A BIM Collaboration - forum to ask questions and share answers.



Assessment / Exam

Topic 1.1 Introduction

- Kahoot test
- Sli.do

Topic 1.2 nZEB fundamentals

- Quiz 1 nZEB fundamentals

Topic 1.3 BIM fundamentals

- Discussion – LOD level.
- Task 1 BIM fundamentals
- Task 2 BIM fundamentals (Business case)
- Quiz 2 BIM fundamentals

Topic 1.4 nZEB & BIM

- Quiz 3 nZEB & BIM
- Task BIM and BEM

Topic 1.5 BIM achieve nZEB

- Quiz 4 BIM collaboration
- Task BIM collaboration

3.3 specific competences

	Training provision	Training Gap to upskills	Topic 1.1.1 Introduction	Topic 1.2 nZEB Fundamentals	Topic 1.3 BIM Fundamentals	Topic 1.4 nZEB & BIM	Topic 1.5 BIM Collaboration
<i>Develop and define the Statement of Requirements (SOR) or Statement of Work (SOW) describing the BIM deliverables, essential requirements, and specifications.</i>	2.93	0.57		✓	✓	✓	✓
<i>Identify BIM Project Collaboration requirements based on the Project Performance Requirements (BIM Uses), and Project Roles and Responsibilities – Contractual Hierarchy.</i>	3.21	0.29			✓	✓	✓
<i>Establish the information framework required to assist communication and collaboration from Design - Construction - Operation for asset handover.</i>	2.95	0.55		✓		✓	
<i>Utilize data from classification systems such as Omni Class, UniFormat etc.</i>	2.89	0.61			✓		
<i>Strategically map the project workflow.</i>	2.67	0.83					✓
<i>Understand integrated design processes and concepts.</i>	2.91	0.59					✓
<i>Understand effective communication within projects aimed to achieve nZEB.</i>	2.64	0.86				✓	
<i>Understand interdisciplinary teamwork towards common goals.</i>	2.9	0.6					✓
<i>Use of information modelling in design teams and management of information modelling within the nZEB design.</i>	2.44	1.06			✓	✓	

<i>Specify energy reduction systems and performance in materials in tender documents.</i>	2.44	1.06						✓
<i>Communicate in contracting phase, understand and respect the role of all actors involved.</i>	2.44	1.6						✓
<i>Coordinate the project team, contractors and suppliers to ensure building quality by effective communication.</i>	2.57	0.93						✓
<i>Recognise and illustrate effective communication within projects aimed to achieve nZEB.</i>	2.64	0.86						✓
<i>Identify interdisciplinary teamwork towards common goals.</i>	2.9	0.6					✓	✓
<i>Illustrate the use of information modelling in design teams and management of information modelling within the nZEB design.</i>	2.44	1.06			✓	✓		

4. Learning unit 2 BIM & nZEB for Workers

4.1 Objectives

The objectives of this learning unit are:

- Carry out communication between design and construction teams.
- Use the BIM methodology on site to apply problem solving workflow.
- Evaluate the situation and apply the necessary prior actions to prevent setbacks using BIM methodology.
- Understand and apply the nZEB principles on site.

4.2 Resources

	Theory					Assessment					Others
	PowerPoint	PDF File	Another document	Resources for	Required software's	Kahoot test	Sli.do	Quiz	Discussion	Task	Q&A
Topic 2.1 – Introduction	✓	✓		✓				✓			✓
Topic 2.2 – Navigate BIM	✓	✓	✓	✓						✓	✓
Topic 2.3 – BIM and nZEB procedure	✓	✓	✓	✓						✓	✓
Topic 2.4 – Communication and responsibilities	✓	✓								✓	✓
Topic 2.5 – Digitalization in site	✓	✓		✓				✓			✓
Topic 2.6 – Personal development										✓	✓



Presentation

Topic 2.1 Introduction and requirement software

Introduction to the course with explanation of this and what required Software if the teaching unit requires it.

Topic 2.2 Navigate BIM

Review the BIM-Viewer and access and Navigate Data.

Topic 2.3 BIM and nZEB procedure

In this topic you will learn CDE - Common Data Environment and CTM – cost and time management.

Topic 2.4 Communication and responsibilities

- Collaboration and System Thinking (onsite)
 - How relevant is this to on-site construction.
- Collaborative Workflows
 - How relevant is this to on-site construction, Storage and Recording.
- Knowledge Transfer
 - CDE – How relevant is this to on-site construction.

Topic 2.5 Digitalization in site

Digital tools, automation on site, artificial Intelligence and extended reality and other digital impacts on site.

Topic 2.6 Personal Development

This topic talks about the summary of lesson 2 and personal development



Activity

Topic 2.1 Introduction

- To learn more:
 - New Energy Performance in Buildings Directive comes into force
 - EU reading resources
 - EPBD Recast 2018.pdf
 - EU Commission Report - NZEB in Europe.pdf
 - The European Green Deal 2019.pdf
 - Irish resources
 - National Energy and Climate Plan.pdf
 - TGD Ventilation 2019.pdf
 - TGD for Dwellings 2019.pdf
 - TGD Other than Dwellings 2017.pdf
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 2.2 Navigate BIM

- Videos:
 - Navisworks refresh
 - Navisworks and Revit
- To learn more:
 - BIM Guide – ACE 2019
- Q&A Navigating BIM

Topic 2.3 BIM and nZEB procedure

- Videos:
 - Federated model
 - Viewpoint
 - Item selection

- Clash detection
- Timeliner
- Quantification
- To learn more:
 - EU Construction and demolition waste management 2019
- Q&A BIM tutorials

Topic 2.4 Communication and responsibilities

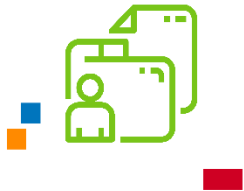
- Q&A

Topic 2.5 Digitalization in site

- To learn more:
 - Construction Industry and BIM benefits
 - EU construction industry manifest on digitalization
 - The digital groundwork reports
- Q&A Digital tools on site

Topic 2.6 Personal Development

- Q&A Reflective Study



Assessment / Exam

Topic 2.1 Introduction

- Quiz 1 – nZEB and BIM crossword

Topic 2.2 Navigate BIM

- Task Navisworks
- Task from videos

Topic 2.3 BIM and nZEB procedure

- Task Navisworks 2
- Task powerpoint poster

Topic 2.4 Communication and responsibilities

- Task Trello tutorial
- Task Trello - Complete an exercise using Trello related to your work/trade or develop a new air tightness strategy for a specific project on site.

Topic 2.5 Digitalization in site

- Quiz Digitalization Hangman

Topic 2.6 Personal Development

Task reflective study - reflective Study in relation to LU2 and how nZEB and BIM affect your work and onsite activities with others.

4.3 Specific competences

	Training provision	Training Gap to upskills	Topic 2.1. Introduction	Topic 2.3 BIM and nZEB	Topic 2.4 Communication and	Topic 2.5 Digitalization on site	Topic 2.6 Personal Development
<i>Recognise variety of methods that can be utilized to optimize construction on site.</i>	2.94	0.56	✓	✓	✓	✓	
<i>Apply construction progress tracking to monitor from cost control to defects and safety.</i>	2.94	0.56		✓	✓	✓	
<i>Design and establish solutions for collaborative workflows with native BIM projects (using the same software) or open BIM projects (using more than one vendor software).</i>	2.67	0.83	✓	✓	✓	✓	
<i>Compare 2D plans / drawings (contractual precedence) to BIM model though a diligence checking.</i>	3	0.5	✓		✓	✓	

<i>Export 2D plans and other documentation from the BIM model in site.</i>	2.83	0.67			✓	✓	
<i>Assess systems related to building function and architecture.</i>	2.65	0.85	✓		✓	✓	
<i>Communicate in contracting phase, understand and respect the role of all actors involved.</i>	2.44	1.06				✓	
<i>Communicate with customers on construction progress and effectuation of building performance.</i>	2.6	0.9		✓	✓	✓	
<i>Manage data, keep records of implementation, monitor outcome.</i>	2.39	1.11			✓		
<i>Financial management.</i>	2.11	1.39			✓		
<i>Monitor project realization and handle deviations.</i>	2.39	1.11		✓	✓		

5. Learning unit 3 nZEB Realization and commissioning: Building Envelope air Tightness

5.1 Objectives

The objectives of this learning unit are:

- Use tools for BIM object creation (foundations, walls, roofs...)
- Understand the principles that affect an element to be suitable in an nZEB building design.
- Guarantee a correct nZEB design through the application of a quality control of the construction model.
- Base nZEB building design on suitable BIM objects.

5.2 Resources

	Theory					Assessment					Others
	PowerPoint and	Videos	Another	Resources for	Required software's	Kahoot test	Slido	Quiz	Discussion	Task	Q&A
Topic 3.1 – Introduction	✓	✓		✓	✓						✓
Topic 3.2 – Basics of Building Physics	✓	✓		✓							✓
Topic 3.3 – Building envelope	✓			✓							✓
Topic 3.4 – Thermal Bridges	✓			✓						✓	✓
Topic 3.5 – Airtightness & windtightness	✓									✓	✓



Presentation

Topic 3.1 Introduction

Introduction to the course with explanation of this and what required Software if the teaching unit requires it.

Topic 3.2 Basics of Building Physics

This topic is divided into the following themes

3.2.1 Basics of Building Physics - This section will introduce heat, air and moisture transfer in building envelope. Basic principles of NZEB design will be presented and the differences between the NZEB in hotter and colder climates will be discussed. The use of passive technologies and interdisciplinary approach to achieve NZEB will also be presented in this unit.

3.2.2 Building envelope & comfort - This section deals with optimization of the building form and will discuss all aspects of thermal envelope. This will include sustainable materials and systems & evaluation of the influence of envelope parameters on building performance. Designing a moisture safe building envelope will also be in the focus of this unit. Comfort aspects of building envelope, behavior in fire and the importance of appropriate installation will be stressed. How to achieve airtightness will also be discussed in this unit. Special importance will be given to the design and installation of an airtight envelope.

Topic 3.3 Building envelope

This topic is divided into the following themes

3.3.1 Installation of thermal insulation - Technology of common insulation systems is presented in brief.

3.3.2 Windows – efficient windows

3.3.3 Construction damage-failure

3.3.4 Facades in fire

3.3.5 Creating suitable BIM objects - How to create suitable BIM objects, general approaches in creating BIM objects and best practices for BIM objects creation.

Topic 3.4 Thermal Bridges

This topic is divided into the following themes

3.4.1 thermal bridges & calculation - This topic deals with types, quantification and minimization of thermal bridges. Special focus will be given to numerical calculation of thermal bridges.

3.4.2 minimizing thermal bridges

Topic 3.5 Airtightness & wind tightness

Optimal hygrothermal performance. Airtightness, Windtightness, Assessment of hygrothermal performance and possibilities of hygrothermal simulations.



Activity

Topic 3.1 Introduction and required software

- Videos:
 - BIM tools for LU3 lessons and topics
 - How to use CRORAL
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 3.2 Basics of Building Physics

- Videos
 - Relative compactness
 - U-value calculator opaque building elements
 - Thermal transmittance opaque
 - Thermal mass
 - Thermal insulation placing
- To learn more (videos)
 - Hygrothermal worst case simulation
 - Details of the envelope
 - Understanding Permeability
 - Envelope definitions

- Sources of moisture and movements of energy
- Moisture Storage Capacity
- Air tightness – Implementing Envelope Details
- Air tightness – Just not that hard to do
- Thermal Bridging and Mold
- Basic Physics – Hygrothermal
- Know your building before insulating
- Insulation materials for internal insulation systems
- Understanding Air and Vapor Barriers INSIDE your House
- Fundamentals of Building Physics and Environmental Design – Arup
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 3.3 Building envelope

- Videos
 - Thermal transmittance of transparent building elements U_w - value calculator
 - Transparent elements
 - Facades in fire
- To learn more
 - Revit Architecture/Green Building Studio - Designing Architectural Shading Features
 - Facade Energy Optimization using with Building Energy Simulation & Computational Fluid Dynamics
 - Autodesk_ Fractal Project: Minimizing total building energy use through generative facade design
 - Net Zero Generative Design
 - Facade Design Grasshopper/Ladybug
 - Digital Facade Design Process
 - Grasshopper Tutorial: Changing facade depending on sun (with Ladybug)+
 - Ladybug Grasshopper Tutorial
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 3.4 Thermal Bridges

- Videos
 - Example 1 - This is a video in which we will show the numerical procedure for determining the impact of thermal bridges.
 - Example 2 - This video refers to the water vapor analysis in case of thermal bridges.

- To learn more
 - What defines thermal bridge free design?
 - AnTherm example results
 - Flixo examples
 - AnTherm Quick Start / Graphical Evaluation / Visualization of Thermal Heat Bridge
 - Thermal bridging explained
 - Thomas O'Leary Talk about Quinn Lite and Thermal Bridging
 - The causes of thermal bridging
 - Definition and effects of thermal bridges
 - Third-party video tutorials for Htflux
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 3.5 Airtightness & Wind tightness

- Videos
 - P1 Full example task internal insulation - In this exercise, we will investigate the influence of thermal insulation position on hygrothermal performance of building envelope elements.
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.



Assessment / Exam

Topic 3.4 Thermal Bridges

- Task 1 - Minimize Psi-value of the thermal bridge and determine the distribution of relative humidity
- Task 2 - Minimize Psi-value - Unheated attic
- Task 3 - Determine the coupling coefficient L2D - Window in thermal insulation
- Students can manually mark this item complete: Task 3 - Determine the coupling coefficient L2D - Window in thermal insulation
- Task 4 - Determine the coupling coefficient L2D - Window in load bearing layer

Topic 3.5 Airtightness & Wind tightness

- Task 5 - HAM modeling - Wufi - Internal insulation
- Task 6 - HAM modeling - Wufi - Influence of material selection

- Task 7 - HAM modeling - Wufi - Influence of airtightness
- Task 8 - Development of an initial model for the analysis of the impact of individual elements of the building envelope on the required annual energy for heating and cooling
- Task 9 - Parametric analysis of the impact of the building envelope elements on the required annual energy for heating and cooling.

5.3 Specific competences

	Training provision	Training Gap to upskills	Topic 3.1. Introduction	Topic 3.2 Basics of Building Envelope	Topic 3.3 Building Envelope	Topic 3.4 Thermal Bridges	Topic 3.5 Airtightness & Wind
<i>Create BIM elements for nZEB design considering parameters such as transmittance and orientation.</i>	3.29	0.21		✓			
<i>Recognise the impact of architectural design on sustainability and energy performance.</i>	2.96	0.54	✓				
<i>Identify the interaction of building location, design, use and outdoor climate.</i>	2.83	0.67	✓	✓			
<i>Identify sustainable materials and the importance of its appropriate application.</i>	3.17	0.33		✓	✓	✓	✓
<i>Recognise design methods for passive energy technologies.</i>	2.81	0.69			✓	✓	✓
<i>Assess systems related to building function and architecture.</i>	2.65	0.85			✓	✓	✓
<i>Select sustainable constructions technologies and materials.</i>	3.14	0.36			✓	✓	✓
<i>Knowledge on various installation materials, their performance, benefits versus costs.</i>	2.82	0.68		✓			
<i>Recognise application of passive or active technologies.</i>	2.89	0.61	✓				
<i>Design and engineer energy reduction systems to reach nZEB-in respect to building envelope.</i>	2.6	0.9			✓		

<i>Design of an architectural sustainable building (including sustainable and flexible floorplan).</i>	2.65	0.85			✓	✓	✓
<i>Evaluate the integrated design.</i>	2.45	1.05		✓			
<i>Evaluation and assessment of risks of mould formation and condensation.</i>	3.06	0.44			✓		✓
<i>Select sustainable materials and technologies in nZEB design.</i>	3.14	0.36			✓	✓	✓
<i>Demonstrate the use of airtightness of building envelope.</i>	2.4	1.1			✓		✓
<i>Design and engineer the airtight layer</i>	2.5	1					✓

6. Learning unit 4 nZEB Realization and commissioning. Building Services and Smart Technologies

6.1 Objectives

- Use tools for BIM object creation (energy systems, mechanical ventilation...).
- Identify the principles that affect an element to be suitable in an nZEB building design.
- Guarantee a correct nZEB design through the application of a quality control of the construction model.
- Base nZEB building design on suitable BIM objects.
- Perform analyze energy demand calculation for building services design.
- Compare and contrast different technologies to facilitate selection of an appropriate solution or solutions.

6.2 Resources

	Theory						Assessment				Others
	PowerPoint/PDF	Videos	Another document	Resources for learn more	Required software' s	Kahoot test	Sli.do	Quiz	Discussion	Task	Q&A
Topic 4.1 – Introduction	✓										✓
Topic 4.2 – Lighting system	✓										✓
Topic 4.3 – Cooling ventilation system	✓			✓							✓
Topic 4.4 – Heating Systems & heat pumps	✓			✓				✓			✓
Topic 4.5 – Safety systems	✓							✓			✓
Topic 4.6 – Energy Performance	✓			✓				✓			✓

**Presentation**Topic 4.1 – Introduction

Introduction to the course with explanation of this and what required Software if the teaching unit requires it.

Topic 4.2 – Lighting system

With the acquired knowledge, the student is able to design the type of lighting tests required for the room to be illuminated and the parameters of the corresponding control units.

Topic 4.3 – Cooling & Ventilation system

The student acquires basic knowledge in the design of ventilation systems in buildings.

Topic 4.4 – Heating system & heat pumps

The student will learn in detail about the heating systems used today.

By learning about the BIM system, the student gets closer to the practical application of simulation programs.

To present and analyze the modern heating system of an office building through its model BIM HVAC.

To learn about energy savings and costs.

Topic 4.5 – Safety system

Acquisition of integrated design aspects. Student acquires basic knowledge for safe building operation.

Topic 4.6 – Energy performance

By learning the principles of energy modeling, you can get closer to the practical application of simulation programs.

**Activity**

Topic 4.1 – Introduction

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 4.2 – Lighting system

- Q&A Lighting systems: forum for announcements related to this specific topic and/or for discussing content of this topic or related reading materials.

Topic 4.3 – Cooling & Ventilation system

- Q&A Cooling systems: forum for announcements related to this specific topic and/or for discussing content of this topic or related reading materials.
- To learn more
 - Finalised NZEB Ventilation Training Programme
 - Ventilation module-IE
 - Ventilation Testing Scheme Master Document Rev 5
 - Ventilation Testing Validation Scheme NSAI sheet Rev D

Topic 4.4 – Heating system & heat pumps

- Q&A Heating systems & heat pumps: forum for announcements related to this specific topic and/or for discussing content of this topic or related reading materials.
- To learn more
 - case study - ASHP and radiant panels
 - Case Study-Biomass
 - fuel comparison
 - Heat Pump Presentation
 - HPAI Heat Pump Code of Practice
 - LIT-Low carbon Technologies

Topic 4.5 – Safety system

- Q&A Safety systems: forum for announcements related to this specific topic and/or for discussing content of this topic or related reading materials.

Topic 4.6 – Energy performance

- Q&A Energy performance: forum for announcements related to this specific topic and/or for discussing content of this topic or related reading materials.

- To learn more
 - 2019 EE SEAI-Renewable Energy in IrelandFile
 - QualiBuild Services Module 3 Final



Assessment / Exam

Topic 4.4 – Heating system & heat pumps

- Quiz: Heating systems
- Quiz: Heat pump systems

Topic 4.5 – Safety systems

- Quiz: Fire Protection Systems

Topic 4.6 – Energy performance

- Quiz: Building Energy Performance Modelling & Simulation

6.3 Specific competences

	Training provision	Training Gap to upskills	Topic 4.1 Introduction	Topic 4.2 Lighting systems	Topic 4.3 Cooling & Ventilation systems	Topic 4.4 Heating systems & heat pumps	Topic 4.5 Safety systems	Topic 4.6 Energy performance
Create BIM elements for nZEB design considering parameters such as power, consumption and performance.	3.29	0.21						✓

Identify influence of heating and cooling generation on energy performance	2.82	0.68			✓	✓		
Apply specifics and basic parameters of heating and cooling	2.82	0.68			✓	✓		
Recognise different energy production systems in relation to energy performance	2.87	0.63	✓					
Identify importance of energy reduction systems in relation to energy performance	3.09	0.41		✓	✓	✓		✓
Recognise sustainable building technologies and appropriate application	3.09	0.41	✓					
Identify the interaction between energy performance and IEQ	2.78	0.72						✓
Assess systems related to building function and architecture	2.65	0.85		✓	✓	✓		✓
Investigate, determine and advise on energy reduction systems to reach nZEB	2.95	0.55						✓
Select sustainable constructions technologies and materials	3.14	0.36		✓	✓	✓	✓	
Identify performance, benefits and costs of various technologies	2.82	0.68		✓	✓	✓		✓
Recognise application of active technologies	2.89	0.61	✓					
Design and engineer energy reduction systems to reach nZEB	2.6	0.9			✓	✓		✓
Evaluate the integrated design	2.45	1.05						✓
Select sustainable materials and technologies in nZEB design	2.91	0.59		✓	✓	✓	✓	
Design and integration of smart measurement: types, data management, visualization in a BIM model.	2.83	0.67						✓
Design self-assessed and self-optimized systems.	2.67	0.33						✓
Definition of BEMS systems: requirements, principles, solutions	2.4	1.1						✓
Design and implement RES technologies, smart systems, automation and energy efficient lighting.	2.5	1						✓

7. Learning unit 5 nZEB Realization and commissioning. Quality assurance

7.1 Objectives

- Guarantee energy saving systems and sustainable materials quality.
- Determine different quality controls and verify their good implementation.
- Coordinate the project team to ensure the quality control in the construction site.

7.2 Resources

	Theory					Assessment					Others
	PowerPoint/PDF	Videos	Another	Resources for	Required software' s	Kahoot test	Crossword	Quiz	Discussion	Task	Q&A
Topic 5.1 – Introduction	✓			✓	✓						✓
Topic 5.2 – Achieving nZEB compliance	✓			✓				✓		✓	✓
Topic 5.3 – Quality Controls and Checks	✓			✓			✓			✓	✓
Topic 5.4 – Certification of products and materials	✓			✓						✓	✓
Topic 5.5 – Coordination of quality in construction	✓									✓	✓
Topic 5.6 – Personal development	✓		✓								✓



Presentation

Topic 5.1 Introduction

Introduction to the course with explanation of the course unit and some questions to get to know each other through sli.do

Required Software topic deals with downloading the software which is needed to follow Learning Unit 1. The software is to be downloaded.

Activities and self-study are to be completed using this software during the learning unit. Students can download this software with the following instructions.

Topic 5.2 Achieving nZEB compliance

In this topic you will learn building Regulations, national Energy Assessment, procedures, building Control and sustainable Rating Systems.

Topic 5.3 – Quality Controls and Checks

This topic is divided into the following themes

5.3.1 Quality Controls and Checks

5.3.2 Building Envelope Checks

5.3.3 Building Services Checks

Topic 5.4 – Certification of products and materials

In this topic you will learn sustainable materials and products, specifications and certification for compliance.

Topic 5.5 – Coordination of quality in construction

In this topic you will learn Commissioning and Monitoring, maintaining Knowledge Transfer and systems Thinking.

Topic 5.6 – Personal development

In this topic you will learn summary of LU5, upskilling next stages and personal development.



Activity

Topic 5.1 Introduction

- To learn more
 - EU Resources
 - 2018 EPBD Recast PDF
 - 2019 The European Green Deal pdf
 - 2020 Renovate Europe-BPIE-Research-Layout PDF
 - Irish resources (technical guidance documents)
 - Heat producing appliances 2014
 - Structure
 - Fire Safety - Volume 2 Dwelling Houses
 - Fire Safety
 - Site Preparation and Resistance to Moisture
 - Materials and Workmanship
 - Sound.
 - Ventilation 2019
 - Hygiene
 - Drainage and Waste Water Disposal
 - Stairways, Ladders, Ramps and Guards.
 - Conservation of Fuel and Energy Dwellings_2019
 - Conservation of Fuel and Energy Dwellings_2019
 - Conservation of Fuel and Energy Other than Dwellings
 - Conservation of Fuel and Energy Other than Dwellings 2017
 - Access and Use
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 5.2 Achieving nZEB compliance

- To learn more
 - nZEB and retrofit DHPLG 2020
 - Irish resources
 - Code of Practice_for_inspecting_and_certifying_buildings_and_works_2016
 - Doc A structure 2012.pdf
 - Doc B Fire Safety Part 1 2006
 - Doc B Fire Safety Part 2 Dwelling Houses 2017
 - Doc C Site Preparation Resistance to Moisture 2005(reprint)
 - Doc D Materials 2013
 - Doc E Sound 2014
 - Doc F Ventilation 2019
 - Doc G Hygiene 2008 (Reprint July 2011)
 - Doc H Drainage and Waste Water Disposal (Reprint 2016)
 - Doc J heat producing appliances 2014
 - Doc K Stairways, Ladders, Ramps and Guards 2014
 - Doc L Dwellings_2019
 - Doc L Other than Dwellings 2017
 - Doc M access 2010
 - Doc M access flowchart 2010
 - Doc M access training manual 2010
 - Doc M BC training access 2010
 - Videos resources – Dialux videos
 - What is DIALux

- Importing a CAD plan
 - Constructing a buildings
 - Adding colour, texture and furniture
 - Find insert and place luminaires
 - Arranging lights
 - Raytracer
 - Output function
 - view options
 - Street lighting
 - Daylight calculation
 - Simple indoor planning
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 5.3 – Quality Controls and Checks

- To learn more
 - Videos
 - QR code tutorial
 - BIM on site specification tutorials
 - PDF
 - 2018_EU Construction Demolition Waste Management Protocol
 - 2019 ACE_BIM_GUIDE_2019_A4_EN_WEB
 - 2020_EU Circular Economy Principles for buildings design
 - 2020_SME strategy for sustainable and Digital Europe EU
 - HPAI Heat Pump Code of Practice
 - Reducing the performance gap
 - BIMplement – are we ready for BIM in construction sites?
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 5.4 – Certification of products and materials

- To learn more
 - Videos
 - BUSI Build Up Skills App - Start to Skill Up
 - How to use Build Up Skill Advisor App
 - Build Up Skills App Video demo
 - Reading
 - Building-Passport-Report.pdf
 - Contractors Code of Practice 2020-SEAI
 - Digital Journey infographic-CIOB
 - Statutory inspection frequencies
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 5.5 – Coordination of quality in construction

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 5.6 – Personal development

- To learn more
 - ProfTac – Tools and training contents for building companies
 - ProfTrac – BIMplement methodology guide
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.



Assessment / Exam

Topic 5.2 Achieving nZEB compliance

- Quiz
- Poster Activity

Topic 5.3 – Quality Controls and Checks

- Crossword
- DIALux activity

Topic 5.4 – Certification of products and materials

- BIM and QR activity

Topic 5.5 – Coordination of quality in construction

- Compliance checklist activity

7.3 Specific competences

	Training provision	Training Gap to upskills	Topic 5.1 Introduction	Topic 5.2 Achieving nZEB	Topic 5.3 Quality Controls and	Topic 5.4 Certification and	Topic 5.5 Coordination of Quality in Construction
Establish the coordination framework required from Design - Construction -Operation by using data inputs and model structure to organize modelling elements efficiently.	2.83	0.67	✓				✓
Quality checking procedures for construction standards and compliance including safety with the model.	2.78	0.72			✓		
Explain how act influence of heating and cooling generation on energy performance	2.73	0.77	✓	✓			
Identify specifics and basic parameters of heating and cooling	2.82	0.68		✓			
Determine different energy production systems in relation to energy performance	2.87	0.63		✓		✓	
Recognise importance of energy reduction systems in relation to energy performance	3.09	0.41	✓				
Identify sustainable building technologies and appropriate application	3.09	0.41			✓		
Identify the interaction between energy performance and IEQ	2.78	0.72			✓		
Assess systems related to building function and architecture	2.65	0.85		✓			

Investigate, determine and advise on energy reduction systems to reach nZEB	2.95	0.55				✓	
Select sustainable construction technologies and materials	3.14	0.36				✓	
Determine performance, benefits and costs of various technologies	2.82	0.68			✓		
Identify application of passive or active technologies	2.89	0.61		✓	✓		
Design and engineer energy reduction systems to reach nZEB	2.6	0.9	✓				
Evaluate the integrated design	2.45	1.05			✓		
Select sustainable materials and technologies in nZEB design	2.91	0.59				✓	

8. Learning unit 6 BIM Model uses during construction

8.1 Objectives

- Implement and design a digital twin of the building.
- Optimize the BIM model and create models with zero clashes.
- Implement an active working methodology in the use of BIM for constructive design.
- Generate structure and systems calculations from the BIM model.
- Audit the BIM model project provided by the client (Clash detection, technical issues, LOD)

8.2 Resources

	Theory					Assessment					Others
	PowerPoint	Videos	Another	Resources for	Required software' s	Kahoot test	Sli.do	Quiz	Discussion	Task	Q&A
Topic 6.1 – Introduction	✔				✔						✔
Topic 6.2 – BEP on site	✔			✔					✔		✔
Topic 6.3 – 3D coordination	✔	✔		✔						✔	✔
Topic 6.4 – Deliverables & As-built	✔									✔	✔



Presentation

Topic 6.1 – Introduction

Introduction to the course with explanation of this and what required Software if the teaching unit requires it.

Topic 6.2 – BEP on site

What makes it different from Design Phase and which are the main issues to be addressed. What key points should the “BIM Execution Plan” consider?

Topic 6.3 – 3D coordination

This topic is divided into the following themes

- 6.3.1 3D coordination: In this section you will find key aspects for the 3D coordination during construction stage: clash matrix, federated models, clash detection software, false positives and so on.
- 6.3.2 Clash detective: In this section you will find key aspects for the 3D coordination carried out with Navisworks. In this additional PPT we will emphasize in some aspects related to the Navisworks’ tool Clash Detective.

Topic 6.4 – Deliverables & As-built

This topic is divided into the following themes

- Deliverables and As-built: to ensure a correct information delivery at the end of the construction phase it is important to create and collect all the information related to the building through some procedures and strategies that will enable the project members to do it in a collaborative way. It is the only way to guarantee consistency and quality in all the information developed and collected by the project members during the construction stage. In this section we will see some of these procedures and strategies.
- AIM: AIM serves as a single source of approved information of the built asset and it is used during the O&M phase (operations and maintenance). In this section, we will learn some considerations to create Asset Information Models.
- CDE during construction: CDE is the process that we use to manage collaboration during design phases but also in construction phase. It is also used to manage all the information that structures an

AIM that will be delivered to the end user or client. In this section we will see some considerations regarding CDE to be organized according to ISO 19650.



Activity

Topic 6.1 – Introduction

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 6.2 – BEP on site

- To learn more: collaborative process to facilitate BIM – based clash detection tasks for enhancing constructability.
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 6.3 – 3D coordination

- Videos
 - Federated model within Navisworks
 - Clash types
 - Search sets
 - Tests
 - Reports & NWD
 - Following clash detection
- To learn more
 - Application of BIM in design conflict detection: a case study of Vietnam
 - Reading resources
 - A Navisworks Template to Clash Them All - Class Handout
 - HotClashTutorial
 - hw-3-report
 - NZ-BIM-Handbook-Appendix+I-Model-coordination-April-19

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 6.4 – Deliverables & As-built

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.



Assessment / Exam

Topic 6.2 – BEP on site

- Discussion group and develop the indicated key points of a hypothetic BEP on Site of a new building, considering some particularities.

Topic 6.3 – 3D coordination

- Clash detection analysis.

Topic 6.4 – Deliverables & As-built

- AIM delivery strategies

8.3 Specific competences

	Training provision	Training Gap to upskills	Topic 6.1 Introduction	Topic 6.2 BEP on site	Topic 6.3 3D Coordination	Topic 6.4 Deliverables & As-built
Interpret and interrogate a design model for constructability purposes.	3.12	0.38			✓	

Utilise the model and technologies to assist with value engineering testing and validation procedures.	3.1	0.4		✓		
Utilise the design model to issue expected materials and construction methodologies for trade tendering / pricing.	3.12	0.38		✓		
Map Design meetings that match the BIM and project deliverables and include live model review processes and mark-up procedures.	2.95	0.55			✓	✓
Quality checking procedures for design standards and compliance within BIM.	2.78	0.72			✓	✓
Compare 2D plans / drawings (contractual precedence) to BIM model through a diligence checking.	3.06	0.44			✓	
Demonstrate the impact that a work breakdown structure has on the clash coordination and segregation checking for constructability.	2.47	1.03		✓	✓	
Design a federation map for model aggregation processes and techniques within the BIM Management Plan.	2.94	0.56		✓	✓	
Illustrate the use of information modelling in design teams and management of information modelling within the nZEB design.	2.44	1.06				✓
Define workflow of change orders and cycle of approvals.	2.67	0.83		✓		
Define the LOI (Level of Information) that is to be achieved in construction phase (this link with EIR of the client).	2.89	0.61		✓	✓	✓

9. Learning unit 7 BIM model uses for specification and quantification

9.1 Objectives

- Design construction models based on the effectiveness and efficiency provided by the BIM methodology.
- Analyse model data to minimize costs, time and clashes in site planning.
- Conceptualize and apply the BIM dimensions (4D, 5D and 6D).

9.2 Resources

	Theory						Assessment				Others
	PowerPoint/PDF	Videos	Another document	Resources for learn more	Required software's	Kahoot test	Slido	Quiz	Discussion	Task	Q&A
Topic 7.1 – Introduction	✓			✓							✓
Topic 7.2 – Project time and cost planning	✓			✓					✓	✓	✓
Topic 7.3 – Benefits of BIM 4D and 5D modelling	✓			✓				✓	✓		✓
Topic 7.4 – Specification, quantification and quality check	✓			✓				✓	✓		✓
Topic 7.5 – Developing 4D and 5D model with Vico office	✓	✓		✓				✓	✓		✓
Topic 7.6 – Vico office	✓	✓		✓						✓	
Topic 7.7 – Bixel manager software	✓	✓		✓						✓	



Presentation

Topic 7.1 Introduction

Introduction to the course with explanation of this and what required Software if the teaching unit requires it.

Topic 7.1 Project time and cost planning

Planning and scheduling, challenges, cost calculation, time-cost scheduling, resource planning and optimisation, planning techniques, scheduling process

Topic 7.2 Benefits of BIM 4D and 5D modelling

Challenges of traditional planning, benefits of 4D and 5D

Topic 7.3 Specification, quantification and quality check

Measurements rules, BoQ, codification and calculation of quantities (take-off), traditional vs. BIM take-off, collisions and quality checks

Topic 7.4 Developing 4D and 5D model with Vico office

Step-by-step developing 4D and 5D BIM model in Vico Office

Topic 7.6 – Vico office

Step-by-step developing 4D and 5D BIM model in Vico Office

Topic 7.7 – Bexel manager software

Step-by-step developing 4D and 5D BIM model in Bexel Manager



Activity

Topic 7.1 Introduction

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.
- To learn more
 - Quantity “takeoff”
 - RICS new rules of measurement - NRM 1: Order of cost estimating and cost planning for capital building works
 - RICS new rules of measurement - NRM 2: Detailed measurement for building works
 - RICS new rules of measurement - NRM 3: Order of cost estimating and cost planning for building maintenance works
 - Time schedule as a tool for project management - purpose and subject of scheduling

Topic 7.2 Project time and cost planning

- Q&A Project Time & Cost Planning: forum for announcements related to this specific topic and/or for discussing the content of this topic or related reading material.

Topic 7.3 Benefits of BIM 4D and 5D modelling

- Q&A Benefits of BIM 4D and 5D modelling: forum for announcements related to this specific topic and/or for discussing the content of this topic or related reading material.

Topic 7.4 Specification, quantification and quality check

- Q&A Specification, quantification and quality check: forum for announcements related to this specific topic and/or for discussing the content of this topic or related reading material.

Topic 7.5 Developing 4D and 5D model with Vico office

- Q&A Developing 4D and 5D model with Vico office: forum for announcements related to this specific topic and/or for discussing the content of this topic or related reading material.
- Videos
 - 4D Construction simulation with Vico office
 - Videos - How to Solve an Assignment using Vico Office

Topic 7.6 – Vico office

- Videos
 - Videos - How to Solve an Assignment using Vico Office
 - Vico Office Online Video Resources

Topic 7.7 – Bexel manager software

- Videos
 - Videos - How to Solve an Assignment using Bexel Manager
 - Bexel Manager Online Video Resources



Assessment / Exam

Topic 7.2 Project time and cost planning

- Assessment 1: Project Time & Cost Planning.

Topic 7.3 Benefits of BIM 4D and 5D modelling

- Quiz: Benefits of BIM 4D and 5D modelling.

Topic 7.4 Specification, quantification and quality check

- Quiz: Specification, quantification and quality check.

Topic 7.5 Developing 4D and 5D model with Vico office

- Quiz: Developing 4D and 5D model with Vico office.

Topic 7.6 – Vico office

- Assignments 5-8
- Input model

Topic 7.7 – Bexel manager software

- Assignments 5-8
- Input model

9.3 Specific competences

	<i>Training provision</i>	<i>Training Gap to upskills</i>	Topic 7.1 Introduction	Topic 7.2 Project time and cost planning	Topic 7.3 Benefits of BIM 4D and 5D modelling	Topic 7.4 Specification, quantification and quality check	Topic 7.5 Developing 4D and 5D model with Vico office	Topic 7.6 – Vico office	Topic 7.7 – Bexel manager software
Validate the model changes or differences that effect pricing based on combining information from the model and the attached databases.	2.6	0.9		✓	✓	✓	✓		
Define program breakdown structure and trade breakdown structure to define the program forecasting.	2.6	0.9			✓		✓		
Requirements of each formal cost plan to interpret the modelling and information requirements at each stage.	2.33	1.17	✓	✓					
Measurement rules definition for all stakeholders to apply within the project to ensure cost control is maintained.	2.67	0.83				✓			
Technology utilized to complement and assist in the quality checking of model information and elements with existing cost planner's data schemas or ERP systems.	2.33	1.17					✓	✓	✓
Link modelling data to validate trade / construction costs.	2.56	0.94			✓	✓	✓		
Material and element tracking during site construction.	3	0.5		✓			✓	✓	✓
Apply construction progress tracking to monitor from cost control to defects and safety.	2.94	0.56					✓		
Utilize the technology to drive sustainability reporting and testing.	2.4	1.1					✓	✓	✓

<p>Illustrate the use of information modelling in design teams and management of information modelling within the nZEB design.</p>	<p>2.44</p>	<p>1.06</p>	<p>✓</p>					
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10. Learning unit 8 BIM Model standardization for nZEB design

10.1 Objectives

- Standardize the BIM model data structure to accomplish nZEB goals based on European directives and national requirements.
- Generate the required documentation for nZEB validation.
- Optimize the design workflow based on the standardized BIM model.

10.2 Resources

	Theory					Assessment					Others
	PowerPoint/PDF	Videos	Another document	Resources for learn more	Required software' s	Kahoot test	Sli.do	Quiz	Discussion	Task	Q&A
Topic 8.1 - Introduction	✓				✓						
Topic 8.2 - Project delivery models	✓	✓								✓	
Topic 8.3 – International standards	✓	✓								✓	
Topic 8.4 – Project and office standards	✓									✓	
Topic 8.5 – BIM project deliverables	✓			✓					✓	✓	



Topic 8.1 – Introduction

Introduction to the course with explanation of this and what required Software if the teaching unit requires it.

Topic 8.2 – Project delivery models

This section has been divided in three topics with the following contents:

8.2.1: Project delivery models: project stakeholders, project lifecycle, types of delivery models, traditional model - design-bid-build, design-build, management contracting, construction management, risk distribution

8.2.2: Integrated project delivery: Integrated vs. Traditional, IPD and BIM, IPD and Agile, IPD principles, green building challenge's, BIM and IPD

8.2.3: Effects of BIM on project lifecycle phases: Succor's approach and impact on nzeb

Topic 8.3 – International standards

In this section you will learn ISO 19650 'Part 1: Concepts and principles and ISO 19650 'Part 2: Delivery phase of the assets and standardizing data and data exchange, open BIM, IFC, MVD

Topic 8.4 – Project and office standards

Content:

Project and office standards

Project preferences – units, dimensions, reference levels, project info

Attributes - layers, pens, lines, fills, surfaces, materials, composites, profiles, zones...

Project and office standards – data management: Classifications, properties, translators, schedules, indexes...

Project and office standards – display options: Model view options, graphic overrides, renovation filters

Topic 8.5 – BIM project deliverables

This section has been divided in two topics with the following contents:

- BIM project deliverables EIR: Client information model, organizational information requirements, asset information requirements and content of EIR.
- BIM project deliverables BEP: Pre-contract BEP, post-contract BEP and MIDP/TIDP/RACI.



Activity

Topic 8.2 - Project delivery models

- Videos
 - Project delivery models
 - Integrated project delivery
 - Effects of BIM on project lifecycle phases

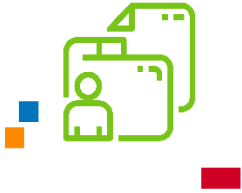
Topic 8.3 – International standards

- Videos
 - International standards
 - What is a Common Data Environment
 - IFC Schema basics
 - BIM Interoperability Expert Group – IFC and COBie – Part 5 – IFC
 - BIM Interoperability Expert Group – IFC and COBie – Part 6 – IFC
 - BIM Interoperability Expert Group – IFC and COBie – Part 7 – COBie
 - BIM Interoperability Expert Group – Part 8 – In the Context of ISO 19650

Topic 8.5 – BIM project deliverables

- Groupwork 1: Create EIR for nZEB design using previous work on Assignments
- Groupwork 2: Create BEP using previous work on Assignments
- Pre-Contract BIM Execution Plan
- Post-Contract BIM Execution Plan
- To learn more
 - IFC Reference Guide for ARCHICAD 23
 - IFC Exchange Best Practices
 - Integrated methods for delivery of construction
 - Template MIDP
 - Template MPDT

- RIBA Plan of Work



Assessment / Exam

Topic 8.2 - Project delivery models

- Assessment 1 – Project delivery models
- Assessment 2 – Integrated project delivery
- Assessment 3 – Effects of BIM on project lifecycle phases

Topic 8.3 – International standards

- Assessment 4 – International standards and data standardization

Topic 8.4 – Project and office standards

- Assignment 1:
Set up Project standards for layers, composites, materials and classifications for other team members.
 - Define the policy how the other team members will use layers and group of layers.
 - Define an unique syntax and code for materials and composites.
 - Define which classification will be used in project.Input files intended for use in BIM tools are available as .PLN and .RVT files.
- Assignment 2:
Make changes in BIM model provided according to nZEB standards to be able to perform energy evaluation according to Project standards
 - Define composites and materials according to Project standards
 - Use them to make the model that can be used by structural engineer and energy evaluatorInput files intended for use in BIM tools are available as .PLN and .RVT files.
- Assignment 3:
Create IFC for structural engineer to receive concept of structural model for design detailing.
 - Define the MVD using translator for creating IFC for structural engineer
 - Make the quality check points which will be used for checking the IFC
 - Create the IFC and check the result in IFC viewer

Input files intended for use in BIM tools are available as .PLN and .RVT files.

- Assignment 4:

Create IFC for collaboration with energy evaluators

- Define the MVD using translator for creating IFC for energy evaluator (be careful about how will the composite layers be transferred in IFC)
- Make the quality check points which will be used for checking the IFC
- Create the IFC and check the result in IFC viewer

Input files intended for use in BIM tools are available as .PLN and .RVT files.

Topic 8.5 – BIM project deliverables

- Quiz: EIR
- Quiz: BEP

10.3 Specific competences

	Training provision	Training Gap to upskills	Topic 8.1 - Introduction	Topic 8.2 - Project delivery models	Topic 8.3 – International standards	Topic 8.4 – Project and office standards	Topic 8.5 – BIM project deliverables
<i>Identification of the BIM Project Collaboration requirements based on the Project Performance Requirements (BIM Uses), and Project Roles and Responsibilities – Contractual Hierarchy.</i>	3,21	0,29	✓				
<i>Identification and selection of the Project Procurement Model requirements in the form of the Delivery Model (Contract) and Procurement Strategy</i>	3,11	0,39					✓
<i>Develop and define the Statement of Requirements (SOR) or Statement of Work (SOW) describing the BIM deliverables, essential requirements, and specifications</i>	2,93	0,57		✓	✓	✓	
<i>Ability to specify the BIM Dimensions, Uses, Roles and Responsibilities of each agent.</i>	3,65	0,15	✓		✓	✓	
<i>Understand the best practices used in nZEB design and apply them to a project.</i>	2,91	0,59	✓				
<i>Establish the information framework required to assist communication and collaboration from Design - Construction - Operation for asset handover</i>	2,95	0,55			✓	✓	
<i>Apply BIM quality standards for the project's delivery.</i>	2,72	0,78					✓
<i>Collect, manage and disseminate documentation, graphical models and non-graphical data for the whole project team in a Common Data Environment (CDE).</i>	2,83	0,67			✓	✓	

<i>Design and establishment of solutions for collaborative workflows with native BIM projects (using the same software) or open BIM projects (using more than one vendor software).</i>	2,67	0,83	✓	✓		✓	
<i>Describe integrated design processes and concepts.</i>	2,91	0,59	✓				
<i>Illustrate the use of information modelling in design teams and management of information modelling within the nZEB design.</i>	2,44	1,06				✓	✓

11. Learning unit 9 Building energy modelling (BEM) design and export

11.1 Objectives

The following learning unit will teach you how to develop a Building Energy Model (BEM) and how it affects the design of nZEB buildings. BEM grants advantages to thermomechanical and energy performance fields. Export properties and functionalities will be explained to deliver a BEM to an energy simulation tool. Considering the knowledge acquired in this training you will speed up your work, be able to prevent future needs and provide a preventive solution.

11.2 Resources

	Theory					Assessment					Others
	PowerPoint/PDF	Videos	Another	Resources for	Required software' s	Kahoot test	Sli.do	Quiz	Discussion	Task	Q&A
Topic 9.1 – Introduction	✓				✓						✓
Topic 9.2 – Energy analysis workflow	✓		✓	✓				✓			✓
Topic 9.3 – Export to GBXML	✓										✓
Topic 9.4 – Export to IFC	✓			✓							✓



Presentation

Topic 9.1 Introduction

Introduction to the course with explanation of this and what required Software if the teaching unit requires it.

Topic 9.2 Energy analysis workflow

In this section, students will learn key issues to integrate Building Energy Modelling into the BIM workflow. Responsibilities, types of software and also what type of information exchange formats can we use to ensure the information transfer between BIM and BEM tools.

Topic 9.3 Export to GBXML

Exporting gbXML file from REVIT. This section contains REVIT BIM Model, create an Analytical Model (AM) or an Energy Analytical Model (EAM) and export a Green Building (gbXML) data from the Analytical Model

Topic 9.4 Export to IFC

This section contains the difference between gbXML vs IFC format, modelling software vs energy simulation software and how to export IFC dialog.



Activity

Topic 9.1 Introduction

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 9.2 Energy analysis workflow

- To learn more

- BIM_FOR_ENERGY_EFFICIENCY_REQUIREMENTS_CAPTURE (1).pdf
- BIM-based EU -wide Standardized Qualification Framework
- cobim_10_energy_analysis_v1
- D3.1_BIMEET_EQF_v2.0_DL
- ENERGY MODELING AT EACH DESIGN PHASE_Tuppe
- Energy-Modeling-Design-Process-Guide
- Supporting data transparency from BIM to BEM_Hijazi
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 9.3 Export to GBXML

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 9.4 Export to IFC

- To learn more:
 - Additional resources
 - Case documentation in .ZIP
 - INTEGRATED BUILDING DESIGN, INFORMATION AND SIMULATION MODELLING: THE NEED FOR A NEW HIERARCHY
 - A comparative study of the IFC and gbXML informational infrastructures for data exchange in computational design support environments
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.



Assessment / Exam

Topic 9.2 Energy analysis workflow

- Evaluable Questionnaire

11.3 Specific competences

	Training provision	Training Gap to upskills	Topic 9.1 – Introduction	Topic 9.2 – Energy analysis workflow	Topic 9.3 – Export to GBXML	Topic 9.4 – Export to IFC
<i>Anticipate the future need to create an energy model of the building.</i>	2,94	0,56		✓		
<i>Utilise the technology to drive sustainability reporting and testing.</i>	2,4	1,1		✓		
<i>Understand effects software has to workflows and what mapping needs to occur to ensure project coordination and collaboration.</i>	2,75	0,75		✓	✓	✓
<i>Quality checking procedures for design standards and compliance within BIM</i>	2,78	0,72		✓		
<i>Utilise the model and technologies to assist with value engineering testing and validation procedures.</i>	2,4	1,1		✓		
<i>Utilise the technology to drive systems analysis for performance-based solutions.</i>	2,5	1			✓	✓
<i>Understand integrated design processes and concepts</i>	2,91	0,59		✓		
<i>Understand interdisciplinary teamwork towards common goals</i>	2,9	0,6		✓		
<i>Assess systems related to building function and architecture</i>	2,65	0,85		✓		
<i>Design and engineer passive energy measures and energy reduction systems to reach nZEB.</i>	2,79	0,71			✓	
<i>Design of an architectural sustainable building (including sustainable and flexible floorplan)</i>	2,65	0,85			✓	
<i>Evaluate the integrated design</i>	2,45	1,05		✓		

12. Learning unit 10 Energy simulation with BIM tools

12.1 Objectives

The following learning unit focuses on the analysis and interpretation of a Building Energy Model (BEM). In order to guarantee economic viability and to provide solutions, advanced knowledge in BEM analysis is indispensable in the first steps of the construction design process. Aspects and parameters involved in a nZEB qualification will be studied and analyzed to ensure nZEB values before construction. Preventing and anticipating future problems will speed up your work and all the agents involved.

12.2 Resources

	Theory					Assessment					Others
	PowerPoint/PDF	Videos	Another document	Resources for learn more	Required software' s	Kahoot test	Sli.do	Quiz	Discussion	Task	Q&A
Topic 10.1 – Introduction	✓				✓						✓
Topic 10.2 – Basics of CAAD features related to simulation	✓	✓						✓			✓
Topic 10.3 – Energy balance simulation	✓							✓			✓
Topic 10.4 – Energy saving option simulation	✓							✓			✓
Topic 10.5 – Complex simulation & data-exchange between BIM-capable CAAD system	✓	✓						✓			✓



Presentation

Topic 10.1 Introduction

This section aims to introduce the subject through the objectives, competencies, goals and required software.

Topic 10.2 Basics of CAAD features related to simulation

In this section, we present examples of energy simulation (BEM) model derived from the BIM-capable CAD model.

GRAPHISOFT ARCHICAD 24 application will be used to demonstrate BIM to BEM process.

Topic 10.3 Energy balance simulation

In this section, ARCHICAD 24 and project (pln) files will be used.

A detailed description of how to obtain BEM results from the BIM building-object and a description of a simulation process are presented.

Topic 10.4 Energy saving option simulation

By following this section, you can learn about energy analysis without having to know BIM-capable software at the level of architectural design.

Topic 10.5 Complex simulation & data-exchange between BIM-capable CAAD system

If you follow this section, you will learn about the environmental and usage data that greatly influence energy efficiency.

With the analysis presented in the curriculum, you can make sure that the BIM-based program actually contains the input data needed for energy analysis.

**Activity**Topic 10.1 Introduction

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 10.2 Basics of CAAD features related to simulation

- Q&A Basics of CAAD Features Related to Simulation: forum for announcements related to this specific topic and/or for discussing the content of this topic or related reading materials.
- Videos
 - Energy Simulation Basics Flight Through

Topic 10.3 – Energy balance simulation

- Q&A Energy Balance Simulation: forum for announcements related to this specific topic and/or for discussing the content of this topic or related reading materials.

Topic 10.4 – Energy saving option simulation

- Q&A Energy Saving Option Simulation: forum for announcements related to this specific topic and/or for discussing the content of this topic or related reading materials.

Topic 10.5 – Complex simulation & data-exchange between BIM-capable CAAD system

- Q&A Complex simulation & data-exchange between BIM-capable CAAD system: forum for announcements related to this specific topic and/or for discussing the content of this topic or related reading materials.
- Videos
 - Small Office Energy Simulation Mass Model Flight Through



Assessment / Exam

Topic 10.2 Basics of CAAD features related to simulation

- Quiz: Basics of CAAD features related to simulation

Topic 10.3 Energy balance simulation

- Quiz: Energy Balance Simulation

Topic 10.4 Energy saving option simulation

- Quiz: Energy Saving Option Simulation

Topic 10.5 Complex simulation & data-exchange between BIM-capable CAAD system

- Quiz: Complex simulation & data-exchange between BIM-capable CAAD system

12.3 Specific competences

	Training provision	Training Gap to upskills	Topic 10.1 Introduction	Topic 10.2 Basics of CAAD features related to simulation	Topic 10.3 Energy balance simulation	Topic 10.4 Energy saving option simulation	Topic 10.5 Complex simulation & data-exchange between BIM-capable CAAD
<i>Utilise the technology to drive sustainability reporting and testing.</i>	2,4	1,1			✓	✓	✓
<i>Understand effects software has to workflows and what mapping needs to occur to ensure project coordination and collaboration.</i>	2,67	0,83		✓			
<i>Identify the different existing tools for energy simulation.</i>	2,43	1,07	✓				
<i>Quality checking procedures for design standards and compliance within BIM.</i>	2,78	0,72			✓	✓	
<i>Utilise the model and technologies to assist with value engineering testing and validation procedures.</i>	2,4	1,1		✓			
<i>Utilise the technology to drive systems analysis for performance-based solutions.</i>	2,5	1				✓	
<i>Understand the interaction between energy performance and IEQ</i>	2,78	0,72	✓				
<i>Perform energy simulations and feasibility studies</i>	2,53	0,97			✓	✓	✓
<i>Assess systems related to building function and architecture</i>	2,65	0,85			✓	✓	
<i>Design and engineer energy reduction systems to reach nZEB</i>	2,95	0,55				✓	
<i>Design of an architectural sustainable building (including sustainable and flexible floorplan).</i>	2,65	0,85		✓	✓		
<i>Evaluate the integrated design.</i>	2,45	1,05			✓	✓	✓

13. Learning unit 11 Nearly zero energy building facility management

13.1 Objective

The following learning unit provides you with knowledge to improve efficiency during facility management. Preventing and anticipating future problems or improvements and documenting them in a digital communication system between the design team and the facility team is essential. This learning unit will give you the knowledge to understand the building parameters to consider in order to guarantee its nZEB qualification during its use, like spaces and users schedules, climate control changes, etc.

13.2 Resources

	Theory					Assessment					Others
	PowerPoint/PDF	Videos	Another	Resources for	Required software's	Crossword	Group activity	Quiz	Discussion	Task	Q&A
Topic 11.1 – Introduction	✓			✓							✓
Topic 11.2 – Introduction to facilities management	✓			✓			✓				✓
Topic 11.3 – BIM and facilities management integration	✓	✓		✓		✓				✓	✓
Topic 11.4 – Implementation of BIM for FM	✓			✓		✓					✓
Topic 11.5 – Digitalized facilities management	✓			✓			✓				✓
Topic 11.6 – Personal development	✓										✓



Presentation

Topic 11.1 – Introduction

Introduction to the course with explanation of the course unit and some questions to get to know each other through sli.do

Required Software topic deals with downloading the software which is needed to follow Learning Unit 1. The software is to be downloaded.

Activities and self-study are to be completed using this software during the learning unit. Students can download this software with the following instructions.

Topic 11.2 – Introduction to facilities management

This topic contains prerequisites for being a Facilities manager, compliance with NZEB-Design, performance energy Simulation and requirements for maintenance aspects

Topic 11.3 – BIM and facilities management integration

This topic contains the summary of BIM, application of BIM in the facility management (FM) and finally introduce sustainable assessment methods.

Topic 11.4 – Implementation of BIM for FM

This topic divided in:

- Integrate into existing FM Systems
- Set up Maintenance Activities
- Improved Space Management
- Sustainability & Efficient use of Energy
- Making sense of BIM data

Topic 11.5 – Digitalized facilities management

This topic divided in:

- Computerized Maintenance Management Systems (CMMS)
- Computer Aided Facilities Management (CAFM)

- Implementation Challenges
- System Thinking

Topic 11.6 – Personal development

This last topic contains the summary of LU11 and introduce LU12



Activity

Topic 11.1 – Introduction

- To learn more: Case study UNITEC
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 11.2 – Introduction to facilities management

- To learn more
 - Revit modeling for successful facilities management web
 - Reading resources
 - FM intro
 - Energy modelling retrofit
 - Revit modeling for successful facilities management
 - Future of FM
 - FM LEED book.
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 11.3 – BIM and facilities management integration

- Videos
 - BIM for FM
 - Dasher 360 intro

- To learn more
 - ISO 19650-3 Guidance Operational phase of the asset life cycle
 - BIM-Handbook
 - Sustainability core principles
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 11.4 – Implementation of BIM for FM

- To learn more
 - Reading resources
 - Self study landings UK
 - BIM to FM
 - Predictive maintenance of physical assets use case
 - Reimagining facility management for the digital age
 - Zero energy buildings
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 11.5 – Digitalized facilities management

- To learn more
 - Reading resources
 - Benefits of CMMS
 - Deriving meaningful data from CAFM and BIM integration
 - BIM for FM challenges and research
 - Mobile transforming FM
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 11.6 – Personal development

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.



Assessment / Exam

Topic 11.2 – Introduction to facilities management

- Group interactive activity

Topic 11.3 – BIM and facilities management integration

- Crossword
- BIM 360 poster activity

Topic 11.4 – Implementation of BIM for FM

- Crossword

Topic 11.5 – Digitalized facilities management

- Group interactive poster activity

13.3 Specific competences

	Training provision	Training Gap to upskills	Topic 11.1 – Introduction	Topic 11.2 – Introduction to facilities management	Topic 11.3 – BIM and facilities management integration	Topic 11.4 – Implementation of BIM for FM	Topic 11.5 – Digitalized facilities management	Topic 11.6 – Personal development
<i>Facility or asset performance checking to confirm it is working at optimal expectations and as designed.</i>	2,19	1,31			✓		✓	
<i>Linking asset data to the model for facility management.</i>	2,75	0,75				✓	✓	
<i>Collect, manage and disseminate documentation, graphical models and non-graphical data for the whole facility team in a Common Data Environment (CDE).</i>	2,83	0,67		✓	✓			
<i>Utilise validation tools and processes to establish field verified models for facility management</i>	2,36	1,14				✓	✓	
<i>Establish the information framework required to assist communication and collaboration from Construction – Operation for asset management.</i>	2,67	0,83	✓	✓				
<i>Establish the coordination framework required from Construction – Operation by using data inputs and model structure to organise modelling elements efficiently.</i>	2,79	0,71	✓	✓				
<i>Identify interdisciplinary teamwork towards common goals.</i>	2,9	0,6	✓					✓
<i>Ensure optimal use of different energy production systems.</i>	2,19	1,31				✓		
<i>Communicate the appropriate use and maintenance of different energy production systems.</i>	2,36	1,14	✓					✓
<i>Instruct the facility manager on running and maintaining the buildings energy performance.</i>	2,36	1,14		✓				
<i>Ensure optimal maintenance of materials and technologies.</i>	2,48	1,02		✓				

<i>Communication with suppliers and facility employers on energy performance.</i>	2,48	1,02	✓	✓				✓
<i>Instruct users and facility managers on energy performance of the building.</i>	2,48	1,02	✓	✓				✓
<i>Monitor building performance</i>	2,19	1,31				✓	✓	

14. Learning unit 12 BIM in Facility Management Software (CMMS)

14.1 Objectives

The following learning unit focuses on the object classification, data structure and model generation in order to create a correct BIM model for facility management systems. This unit will focus on standards like COBie and best practices documents.

A facility management software (CMMS) with the support of a BIM model is essential to speed up urgent interventions and to communicate issues to other agents detailing placement and situation in the building.

14.2 Resources

	Theory					Assessment					Others
	PowerPoint/PDF	Videos	Another format	Resources for	Required software's	Kahoot test	Slido	Quiz	Discussion	Task	Q&A
Topic 12.1 – Introduction	✓				✓						✓
Topic 12.2 – From As-built to FM	✓			✓					✓		✓
Topic 12.3 – Data Structure BIM Models	✓			✓					✓		✓
Topic 12.4 – Data Structure of CMMS's	✓										✓
Topic 12.5 – Relation between Databases	✓	✓							✓	✓	✓
Topic 12.6 - PracticalEx	✓			✓						✓	✓



Presentation

Topic 12.1 Introduction

Introduction to the course with explanation of the course unit and some questions to get to know each other through sli.do

Required Software topic deals with downloading the software which is needed to follow Learning Unit 1. The software is to be downloaded.

Activities and self-study are to be completed using this software during the learning unit. Students can download this software with the following instructions.

Topic 12.2 From As-built to FM

Rationalizing the process for the maintenance and operations of a facility has always been a challenge due to the lack of communication between the main stakeholders of the construction process and the future facility maintenance teams. As the evolution of Building Information Modelling (BIM) has proven to increase efficiency and improve building construction, it is also improving processes and decreasing facility management costs.

Topic 12.3 Data Structure BIM Models

In order for organizations to increase the accuracy and completeness of the BIM models used to complete facility portfolio management activities, they need the application of their organization's modelling and data standards.

These standards include naming conventions, formats and Classification Systems.

Topic 12.4 Data Structure of CMMS's

A brief introduction to basic concepts applied to asset operation and maintenance management.

Topic 12.5 Relation between Databases

The relationship between BIM and the various FM systems must be preceded by important considerations such as the organization's current processes for managing BIM FM or the data to be handled between the systems.

Topic 12.6 PracticalEx

The following section will explain the assessment based on the export of a model to Cobie.
In the following sections, a set of guidelines will be given in order to carry out the activity.



Activity

Topic 12.1 Introduction

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 12.2 From As-built to FM

- To learn more
 - BIM for Owners and Facility ManagersFile
 - The Role of FM in Preparing a BIM Strategy and Employer's Information Requirements (EIR) to Align with Client Asset Management Strategy File
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 12.3 Data Structure BIM Models

To learn more: BIM for FM The MediaCity case study approach File

- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 12.4 Data Structure of CMMS's

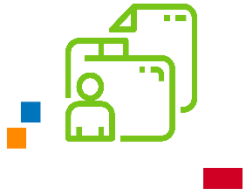
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 12.5 Relation between Databases

- Videos
 - Exporting and importing geometry
 - Exporting from Revit
 - Mapping between Ecodomus & Revit
 - Edit and export from Ecodomus
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.

Topic 12.6 PracticalEx

- To learn more: COBie and Classification Systems in RevitFile
- Q&A Software: forum to ask questions and share answers about software related topics or ask for help.



Assessment / Exam

Topic 12.2 From As-built to FM

- Discussion of BIM FM issuesAssignment

Topic 12.3 Data Structure BIM Models

- Argumentation keeping the end in mind Assignment

Topic 12.5 Relation between Databases


- Non-geometric Data Discussion Assignment

Topic 12.6 PracticalEx

- Task finally activity

14.3 Specific competences

	Training provision	Training Gap to upskills	Topic 12,1 Introduction	Topic 12,2 From As-built to FM	Topic 12,3 Data Structure BIM Models	Topic 12,4 Data Structure of CMMS' s	Topic 12,5 Relation between Databases	Topic 12,6 Practical/Ex
Linking asset data to the model for facility management.	2,75	0,75			✔			
Collect, manage and disseminate documentation, graphical models and non-graphical data for the whole facility team in a Common Data Environment (CDE)	2,83	0,67					✔	
Establish the information framework required to assist communication and collaboration from Construction –Operation for asset management	2,95	0,55		✔				
Establish the coordination framework required from Construction –Operation by using data inputs and model structure to organise modelling elements efficiently.	2,75	0,75		✔				
Understand the impact of BIM to Asset and Facilities Management and how this transforms interaction within the project.	3,06	0,44		✔				
Understand effects software has to workflows and what mapping needs to occur to ensure project coordination and collaboration.	2,67	0,83		✔				
Build a model of new or existing building for hand over with a common data environment for the operation and maintenance of the facility or asset.	2,36	1,14						✔
Ensure optimal use of different energy production systems	2,19	1,31				✔		
Instruct the facility manager on running and maintaining the buildings energy performance	2,36	1,14				✔		
Ensure optimal maintenance of materials and technologies	2,5	1				✔		
Instruct users and facility managers on energy performance of the building	2,48	1,02				✔		

Monitor building performance	2,19	1,31						
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