



Accelerating Energy renovation solution for Zero Energy buildings and Neighborhoods

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1. Introduction

Following the Training Plan (TP) developed in task "9.1. Branding and Planning", this task will develop training materials, and e-learning platform, a training the trainers session in Brussels and two national training and dissemination workshops focused on companies and professionals in the construction renovation value chain including the companies who will participate in the demonstrate buildings in Spain and Estonia.

So far the task is on track. The first online courses for the eLearning platform have already been developed.

1.1. Objectives of the report.

The objective of this report is to provide a training plan for all the activities proposed in task 9.6. This plan should create a guideline to the development of the training material and activities. This guideline will address the four main aspects of the task:

1. **Training materials:** A comprehensive set of courses with the components and the business model of the RenoZEB solution will be provided to fit different media formats.
2. **The eLearning platform:** It will accommodate interactivity, self-evaluation and self-testing so that the user will be able to enhance his/her training process.
3. **Training the trainers session.** The main objective of this action will be to "spread the news" about the RenoZEB solution in appropriate academic/educational institutions and training organisations in the EU construction domain. Additionally it will be used to obtain feedback and adjust or improve the training materials, if necessary.
4. **Two national training and dissemination workshops** including all practical aspects of training in the relevant countries. The two workshops will be focused on companies and professionals in the construction renovation value chain with special attention the involvement of SMEs.

1.2. Connection with other deliverables.

This deliverable has a special connection with the whole workflow of the RenoZEB project from BIM modelling to product installation of plug and play façades. Dissemination of the project outcomes through training is an easy and simple way to spread the news and make the results from the projects useful for practitioners and industry.



The deliverable will mainly be connected with WP3, WP4 and WP5 and will gather a resume of the final output of these WPs.

2. Definition of training materials.

A clear definition of the training materials for the RenoZEB project must be detailed at this point. The materials provided in this task should be useful and allow the different stakeholders of the project to have a general overview of the main features of the RenoZEB project: software tools, platform, workflow and the “plug and play” façade system.

The training materials will provide a comprehensive overview of the project tools and business model of the RenoZEB project.

Training materials will be produced mainly in two formats: pdf documents and videos, these are most used due to their usefulness and ease to teach students from all different backgrounds and the easiness of this format to learn step by step. The courses will be divided into short videos, between two and eight minutes, which will allow the users to complete the training in short sessions.

These materials will be accessible for free in the 7 languages of the consortium making the dissemination of the project easier due to its adaptability to different users that may not speak English. All this courses will be available for free in the online platform for eLearning www.udemy.com .

2.1. Software training.

Software training will allow construction stakeholders to understand the following features of the RenoZEB project: create a BIM model of the building with all the necessary information for simulation, develop a simulation for the current performance of the building, display the “plug and play” façade and the RenoZEB e-catalogue on the BIM model for renovation, develop a simulation to predict renovation upgrades, compare “old and new” performance of the building.

For these purposes four courses will be developed for the training:

- **IFC Builder:** IFC Builder (figure 4) is a free CYPE application designed for the creation and maintenance of IFC building models. Simple to use and accessible, IFC Builder is integrated in the Open BIM workflow via the import and export of IFC models.
- **CYPETherm EPlus** (figure 1,2): modelling and energy simulation of buildings with EnergyPlus™, integrated in the Open BIM workflow via IFC and gbXML.

- **Open BIM – RenoZEB Focchi Facades** (Figure 3): the main functionality of the program is the BIM display and subsequent quartering of the facades for rehabilitation of Focchi.
- **CYPETHERM Improvements:** is a tool for energy audits and analysis of improvement measures in buildings.

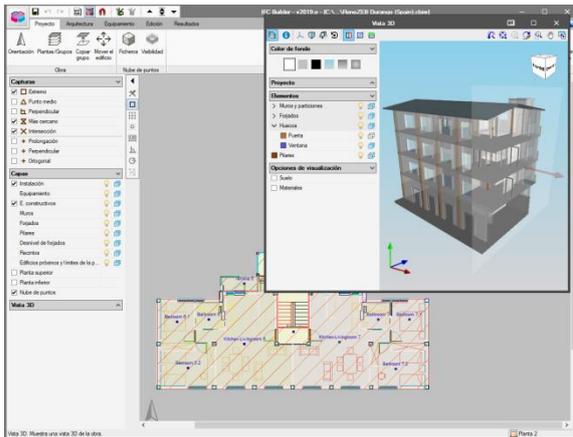


Figure 4 IFC Builder

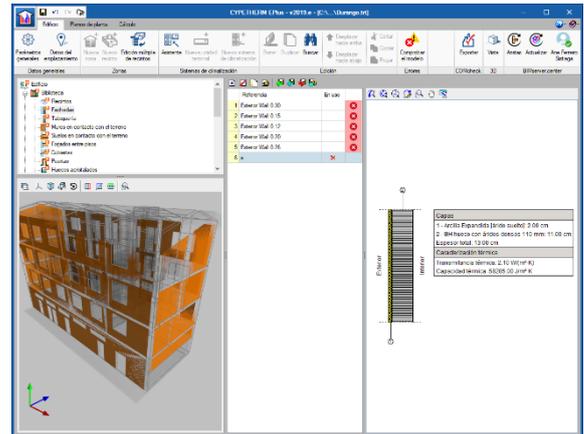


Figure 1 CYPETHERM Eplus

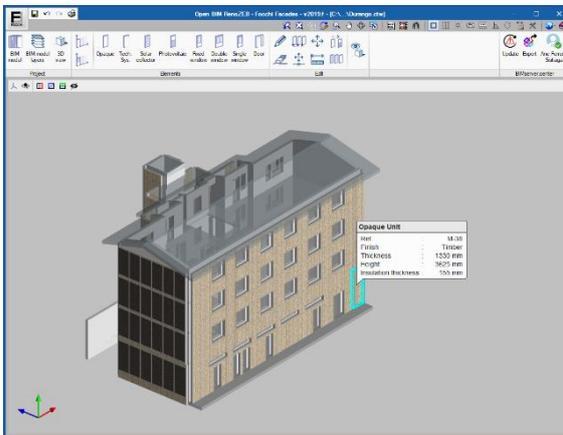


Figure 3 Open BIM RenoZEB - Focchi Facades

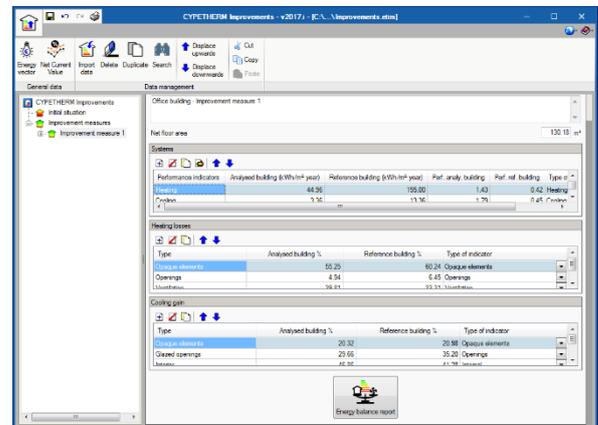


Figure 2 CYPETHERM Improvements

2.1.1. IFC Builder

Duration: 1h 30 min

Introduction

1. About IFC Builder
2. Download and installation of IFC Builder

First steps

3. How to create a new project
4. New project coming from an IFC file



5. Import CAD as templates
6. Graphic environment

Program commands

7. Project commands
8. Architecture command – Walls and Partitions
9. Architecture command – Ceilings
10. Architecture command – Windows and Doors
11. Architecture command – Spaces and groups of spaces
12. Architecture command – Near buildings and obstacles

Example: Durango Residential Building

13. Modelling with CAD templates
14. Adjusting the building to Point Clouds
15. Modelling Durango: Ground Floor
16. Modelling Durango: First Floor
17. Modelling Durango: Second Floor
18. Modelling Durango: Third Floor

Export to the cloud:

19. Export to bimservers.center
20. Export to the RenoZEB platform

2.1.2. CYPETHERM Eplus

Duration: 1h 30 min

Introduction

1. About CYPETHERM Eplus
2. Download and installation of CYPETHERM Eplus
3. Scope of the program
4. Collaboration request in a BIM project.

First steps

3. How to create a new project
4. Graphical environment, general parameters and site data
5. Units of use and enclosures multiple edition
6. Zones

Menu: Description of layers.

7. Building - Enclosures
8. Building - Facades
9. Building - Partitions
10. Building – Floors in contact with the ground
11. Building – Roofs
12. Building – Doors and Windows
13. Building – Thermal Bridges
14. RenoZEB - E-catalogue



Zones and Systems

15. Thermal zones
16. Terminal Units
17. Enclosures
18. Domestic Hot Water
19. Water systems
20. Refrigerant systems
21. Air conditioning systems
22. Condensation systems
23. Energy Plus Manual

Verification of regulations:

24. Calculation
25. Listings and exportation

Example: Durango Residential Building

26. Create a new project
27. E-catalogue constructive solutions
28. Calculation and regulations.
29. Listings

2.1.3. Open BIM RenoZEB – Focchi Facades

Duration: 1h

Introduction

1. About RenoZEB – Focchi Facades
2. Download and installation of RenoZEB – Focchi Facades

Focchi Facades

3. Graphic environment
4. Types of panels and its definition
5. Assistant for panel disposition
6. Corner solution
7. Copy, change material and type of panel.

Example: Durango Residential Building

8. Modelling standardized facades.
9. Modelling windows and door panels

Export and Import Thermal properties:

10. Export to the cloud
11. Import in CYPETHERM Eplus



2.1.4. CYPETHERM Improvements

Duration: 1h

Introduction

1. About CYPETHERM Improvements
2. Download and installation of CYPETHERM Improvements
3. CYPETHERM Improvements
4. Graphic Environment

Example: Durango Residential Building

3. Generation of the initial situation of the Residential Building
4. 1st improvement: insulation
5. 2nd improvement: insulation + windows and shades
6. 3rd improvement: insulation + windows and shades + solar thermal
7. 4th improvement: insulation + windows and shades + aerothermy

2.2. RenoZEB: Platform and Workflow training.

The RenoZEB Platform will be the central hub of all the renovation process. It will be a web-based environment where different actors and software tools can work together in a renovation project, sharing the data and the BIM models, centralizing the files, assigning tasks and issues and setting targets and KPI objectives, managing renovation alternatives and automatically connecting to external tools (such as CYPE) for importing KPI results which cannot be directly calculated in the platform.

The training course of the RenoZEB platform will consist on these topics:

Duration: 1h 30 min

Introduction

1. About RenoZEB Platform
2. Two approaches: for end users (web application) vs for software developers (web services to allow the connection between tools and systems).
3. Supported user types and roles
4. Quick overview of the web application: navigation menus, pages and user forms, Web 3D visualization (building & district), charts and reports, etc.

System administration

5. Management of companies & users
6. Management of the KPI dictionary
7. Management of the product catalogue and synchronization with external catalogues (e.g. from CYPE)



Management of a renovation project

8. Creating a new project and assigning users to the project with different roles
9. Selecting and prioritizing the applicable KPIs in the project
10. Workflow management: phases, tasks, issues and request...
11. File management
12. Status management for every concept: open/closed, accepted/in progress/rejected, on time/delayed, etc.
13. Creation of scenarios (current vs different renovation scenarios). Send KPI requests to external tools and collect results
14. Compare different scenarios (tables, charts, etc.) and score them.

Support to BIM/IFC during the renovation process

15. Upload and web visualization of IFC files: navigation options and other potential functionalities (queries, filters, selection of specific layers...)
16. Georeferenced view of the building (GIS context, using Cesium)
17. Create issues, requests inside the BIM model
18. Compare two IFC models (e.g. two renovation alternatives)
19. Associate KPIs or other data to the model

Sample workflow through a real project: Durango demo case

20. Quick description of the demo project
21. Quick description of the workflow: actors involved and their role
22. Execution of the demo case

2.3. Installation of “plug and play” solutions.

The RenoZEB provide cost-effective ‘plug and play’ solutions for a large scale deep nZEB rehabilitation schemes, ensuring integration and adaptation of multifunctional insulation system.

The system design of RenoZEB envelope is realized by unitized system prefabricated off site, integrated with external panel finishing or water thermal collector or PV panel together the pipes/wires on the back-side on the unit in order to guarantee the connection of the electrical/water pipes between the unit and the building.

The training of the “plug and play” façade solution should be supported by the use of specific videos (to be recorded during installation phases in demo buildings). The present chapter synthetizes the main phases will be introduced and registered in the videos, for the RenoZEB installation, to be learn by the façade installers.

The main on-site installation steps of the units to be shown in the video will be:

1. Brackets installation (Figure 5)

- 1.1. Drill the slab using a hammer drilling in order to allow the installation of chemical anchor bolts;
- 1.2. Locate and set out the brackets and chemical anchor bolts for the connection of the façade system;

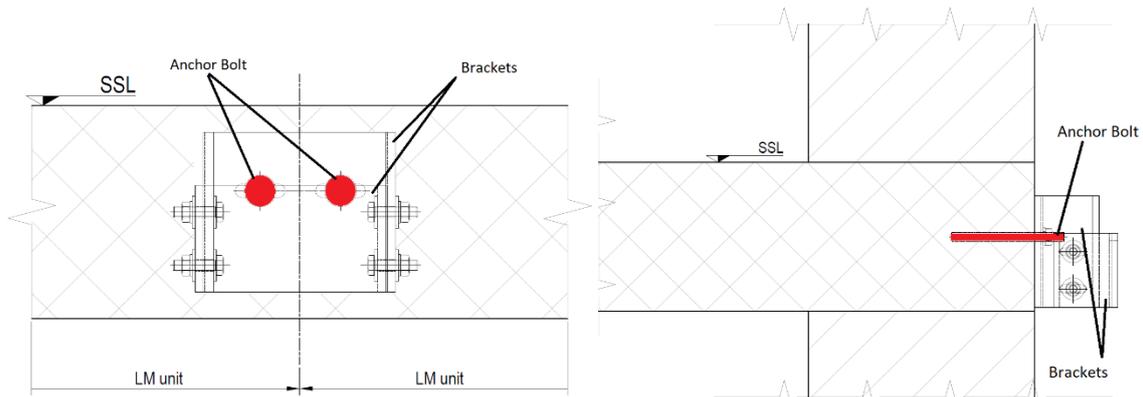


Figure 5 Front and vertical detail of bracket setting out for the connection units

2. Unit lifting operation

- 2.1. Place the lifting bracket on the unit.
- 2.2. Connect the hook of the lifting bracket to a floor crane or other lifting considering also the utilization of a double safety device (chains/slings).

3. Typical unit installation

- 3.1. Install the unit following the movements 1 and 2 indicated in the figure 6.

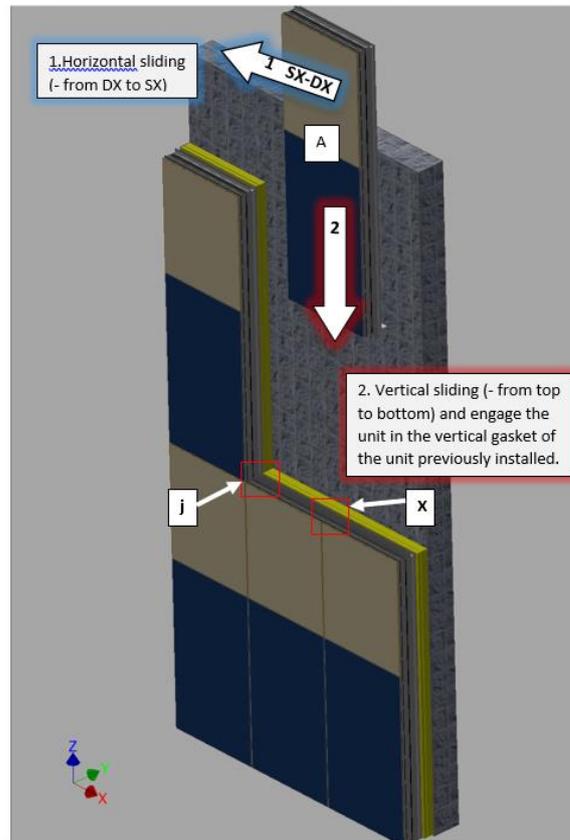


Figure 6 Sequence of the movements for the installation of the unit of the same level

- 3.2. Only in the unit with PV or solar thermal collector, connect the pipe/wires on the unit with the ones installed on the existing building envelope.
- 3.3. Insert the panel of mineral wool in the cavity between the wall and the unit on the right side, as showed in figure 7.

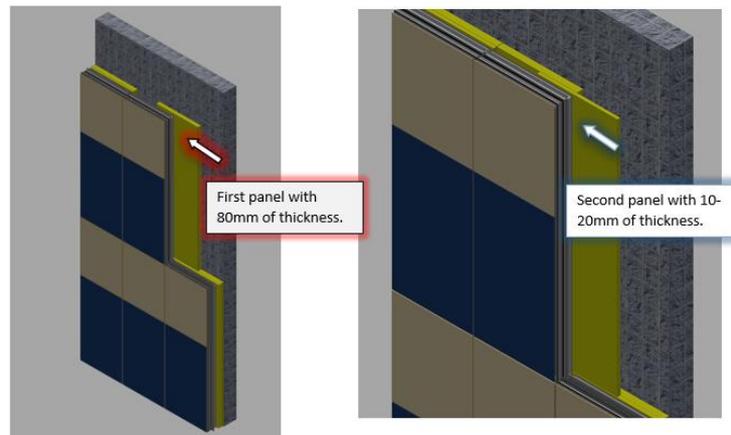


Figure 7 Detail of mineral wool panels insertion.

3.4. Install the horizontal gasket on the top of the unit.

The video will show all the steps with the support of the FOCCHI personnel, which will be involved into the filming, explaining, from the practical point of view, how to handle the unit's installation.

3. Definition of the eLearning platform.

After the study of different options, it was decided not to create our own eLearning platform, but to host the training materials in one of the most used eLearning platforms: www.udemy.com .

Udemy is an online eLearning platform. It is aimed at professional adults. Udemy uses content from online content creators. Using Udemy’s course development tools we can upload videos, PowerPoint presentations, pdf, audio, zip files and live classes. Udemy is part of the growing Massive Open Online Course (MOOC) movement available outside the traditional university system.

RenoZEB will create an instructor profile in Udemy and will upload all the courses from this profile.



The leading global marketplace for learning and instruction

By connecting students all over the world to the best instructors, Udemy is helping individuals reach their goals and pursue their dreams.

Our global reach

Udemy is the leading global marketplace for teaching and learning, connecting students everywhere to the world's best instruction anywhere.

30M
Students

100K
Courses

42K
Instructors

190M
Course enrollments

22M
Minutes of video

50+
Languages



4. On-site training.

The RenoZEB project has planned three on-site trainings: one training the trainers, and two national demo trainings hosted in the pilot cities.

These training days aim to generate an overview of the RenoZEB project processes: from planning to construction, and encourage persons of interest (promoters, construction companies, engineers and architects) to use and put in practice the concept and the different tools provided by RenoZEB.

4.1. Training the trainers in Brussels.

The training the trainers will be organized by ACE and coordinated by CYPE in month 30 in Brussels. It will reach a minimum of five trainers and a maximum of twenty (that is the max space at the ACE headquarters) from selected European countries. In order to guarantee gender equality half of the trainers to be trained will be women. Just in case more people are interested in the project training, this training will be recorded and uploaded to YouTube to be accessible for more users.

Training the trainers must provide participants with a deep knowledge about the RenoZEB methodology. When the training is end, the participants must be able to explain the methodology to third parties. The training session will be divided in 4 blocks of 2 hours each: RenoZEB concept and methodology;

| Name | Last Name | Profession | Phone 1 | Phone 2 | Skype | Mail | Country |
|------------|-----------|------------|-----------------|-----------------|--|--|---------|
| Margherita | Finamore | architect | +39 0721 387389 | +39 333 3625815 | Margherita.finamore@live.com | m.finamore@comune.pesaro.pu.it | Italy |
| Judit | Kimpian | architect | | | | Judit.Kimpian@ahr.co.uk | UK |

RenoZEB platform and workflow; RenoZEB software tools; Focchi Facade system.

Place: 29 Rue Paul Emile Janson, 1050 Brussels, Belgium

Date: March 2020

Duration: 8 hours

Time slot: 09:00 – 17:00

Number of participants: 5-20

4.2. National demo training.

Two national training and dissemination workshops will be organized in Spain and Estonia by TECNALIA and TREA with the support of CYPE, as task leader. The idea of this training sessions is two divide them into two parts: the first



part will explain the RenoZEB methodology and more specifically the use of the platform and software tools. The second part will consist of a visit to the demo building to see and explain the renovation process and how the Focchi Facade System works.

The idea is to provide participants with general knowledge of how they could apply the RenoZEB methodology to the renovation process and to demonstrate to them that the plug and play system performs in an appropriate way.

4.2.1. Durango, Spain.

Place: Elkartegy Building, St. Landako, 4, Durango, Spain

Date: March 2021

Duration: 6 hours

Number of assistants: 20

Time slot: 9:00-17:00

4.2.2. Vorü, Estonia.

Place: Tartu and Võru

Date: March 2021

Duration: 4+ 2 hours, training will be organized two parts, first part in Tartu and then visit the demo area Võru

Number of assistants: 10

Time slot: 9.00-17.00

5. Conclusions.

RenoZEB training has two parts: online training and onsite training. Online training will take place in the online e-learning platform Udemy where a RenoZEB profile will be created. Onsite training will be divided in two types of training: train the trainers (Brussels) and demo site training (Durango and Vorü).

Online and onsite training will offer the user a holistic view of RenoZEB project and methodology, teach how to use the online platform and software tools and finally how to install Focchi plug and play facade system.



A. Annex 1: IFC Builder Script.

Section 1: Introduction

Class 1: Information about IFC Builder

IFC Builder

IFC Builder is a free application from CYPE designed for the creation and maintenance of IFC building models. It is easy to use, accessible, and integrated into the Open BIM workflow through the import and export of IFC models.

Geometric pattern of the building

With IFC Builder it is possible to import the geometric model of the building in IFC format or generate it directly in the program.

Import the model from IFC files

When a project is created, it is possible to import a CAD / BIM model in IFC format generated by CAD / BIM programs, such as Allplan®, Archicad®, and Revit®. This allows IFC Builder to access the data of the programs that have the BIM (Building Information Modelling) technology and to automatically incorporate the constructive elements of the building.

Modelling in IFC Builder

Building modelling in IFC Builder can be done from scratch with or without the help of templates or drawings in DXF, DWG, JPEG or BMP format. The use of these templates speeds up the manual entry of data.

The user enters the constructive and structural elements of the building (according to his interest for his later calculations). The modelling is done floor by floor in a 2D workspace, using 3D elements.

The 3D view of the building can be displayed at any time, allowing the user to control the modelling process.

Reading point clouds

IFC Builder can also read a representation both in 3D and at the **plant** of point cloud files (* .pts; * .ptx; * .txt; * .xyz), which can be used as support to assist us in modelling reality in a precise and fast way from a BIM environment.



Definition of precincts

Once the building model has been defined (by importing CAD / BIM models, manually, or by combining both procedures), it is necessary to define the different enclosures that make up the building.

Project zoning

After defining the building's enclosures, these can be grouped according to their characteristics. For example, for the thermal study of a multi-family dwelling, the groups of enclosures can be: Non-habitable, Common areas, House 1, House 1B House 2, House 2B ...

Export in IFC format

The export of the generated model can be made to different variants of the generic or specific IFC format of the main CAD / BIM programs (Allplan®, Archicad® and Revit®), thus integrating it into the Open BIM workflow.

Video 1 (02:07): Downloading and Installing

In the next video we will learn how to download and install the program. The program is within the BIMServer.center platform and is found within the store. It is the first program that appears in the store and if we can go to download it will request a user login. If you are already registered simply enter your details, but above to the right there is also the option to access the free registration. Once we enter we can see the conditions, description and information and access the download button. Once it has finished downloading it will appear as a compressed zip file that must be decompressed. We can decompress on the desktop and we can see the different languages that the program is translated into. We can select the appropriate folder and run the installer.

Section 2: First steps

Video 2 (05:41): Creating a new job

In this class we will learn how to start the generation of some early work from scratch. To run the program we go to the icon that is on the desktop or go to the start menu and access ifc builder. The next window will always appear when we open the program. From here we will be able to see the section files: where we can generate a new file, go to



file management and find a file that we've already started or go to the option of examples where you have different projects made by the developers of the program.

In the next section we have the recent files which contains the previously accessed projects. In this case we do not have any previously made files and therefore the section is empty.

The next section is Help. It contains useful information regarding licensing and program documentation. Lastly is the BIMServer.center section which displays the connection status to the Server.center. Here I will enter the login and we can start a new project. Starting by pressing new file a window will appear. The new file window allows us to enter the name of the file and designate where the file will be saved, we will change the destination to a new folder. We can also give the file a description below and click accept to begin.

The next window is an assistant that gives us the option of importing a file or beginning from scratch. We will begin from scratch in this video and will teach you how to introduce the importation in the following video. The following window will appear where we can introduce the floors of our work. We have two buttons; the first allows us to introduce new floors, where we can designate the height and number of new floors in a group along with a name. You can now see that the floors have grown accordingly.

The other button allows us to introduce a basement floor with the same procedure as with the other floors. By accessing the ground floor configuration through the edit tool we can create a different type of basement. From here we can activate the option 'Elevation above ground floor level' in order to create a basement floor visible from the outside. We are able to enter a value, for example 1.5m, which indicates that the top of basement floor will be 1.5m above the ground level.

Lastly we have a few button found within the table allowing us to edit, insert new floors, and to delete them. We will now remove all the floors that we don't need and create our desired design. Once finished we can accept. We receive a prompt asking us if we want to introduce drawing templates for each floor; in this case we will answer no and the program will continue to the work environment and we can begin the construction of our design.



Video 3 (01:55): Creating a new job from an existing IFC file

In the previous class we learned how to begin a job from scratch. In this case we will select the automatic introduction CAD/BIM model import and accept and an assistant will appear where we will select the file (the .ifc) and we will see the geometry loaded in the window. Here is the geometry of our work that we've already modelled in 3d. The next step is to link each element generated so that it can be properly read by the program. Starting with floor slabs we must select the appropriate classifications and dimensions. We do the same for the walls and partitions, and the openings. We accept the configuration and the next window will display the imported model as read by the software in terms of floors as described in the previous video. Lastly, the same prompt will appear asking to introduce drawings templates for each floor.

Video 4 (02:38): Importing templates from a CAD file

At the end of the wizard the program asks us the question if we want to introduce the drawing templates for the floor. If we accept the template view management window will appear. In this window we will be able to load the templates of our works in the format dxf/dwg by clicking the new button. It will load the selected drawings and they will be visible in the window which will assist us when creating the floors. The next step is to assign the templates we have loaded to the floors that we have configured for our model. To do so we use the group views button and select each group on the left and assign it to one of the available templates. Once finished we can click accept and the program will load the work. We can switch through the floors using the black arrows at the top of the window and view each of the different floors with their attached templates. Next to the arrows we have the edit templates button which can be used to reconfigure the templates we selected. From here we can use the transformation tool on the toolbar of the template views manager to make changes to the selected drawing template, whether that be the visible area, make a displacement, rotation or change of the scale.

Video 5 (04:05): Graphical Interface

After having generated a new work you see the linked to the templates we will learn a little about the interface of the program

The interface of program is divided into three large groups



The first is the auxiliary toolbar at the top of the window. We have a selection of shortcuts for useful tools next to the file button that will be explained but firstly there is the file button. The file button allows us to create new files, open files that we have already made, change the name and description, save the project, and access the most recently used files.

There are shortcuts for saving undoing and redoing work located directly next to the file button.

Next to the shortcuts there are 3 tools used for configuring the templates of the project. Firstly the Edit templates button brings you to the Template views manager, the Edit views tool allows you to change which templates are visible in the window, and finally the template object snaps is used to activate object snaps for the template and is very useful when creating the building model according to a template.

The next 2 buttons are used to access the editing resources panel. The edit resources button will allow us to generate dimensions, lines, texts, annotations linked to an element, text boxes, introduce details, draw shapes, etc. Th

also let's say it is not a drawing program but we can help or define elements to generate a resource of address and mark certain points that we can then are the buttons and we have seen the low rise the group or the elevator that we call that allow us to a certain floor

simply by pressing the buttons on measure a rubber there we have it since we have defined almost all the buttons the following are the menu buttons the view buttons or the menu that we can have here to the right they work exactly the same as in any cat program

Next we have some mouse controls. If you are familiar with any other CYPE software you will know that the mouse wheel allows you to zoom in and out and if we press it we can pan the work around the screen, if we double-click it will automatically adjust the zoom to fit the entire work.

In the top right corner of the interface we have some basic navigational tools and access to the configuration button. Using the configuration tool we can change the units, send the work, and change the background colour.



Section 3: Using the program

Video 6 (02:03): Project Menu

Project menu

Beginning with the project tab there are 4 tools: Orientation, Floors/groups, Copy group, and move the building.

Starting with orientation, the tool is used to orient the building model. Selecting the tool allows the user to click in the window and drag the direction of north to set the desired orientation.

The Floors/groups button allows the user to reconfigure the floors of the building. It operates the exact same as the original configuration.

The copy group tool allows you to copy the desired elements from one floor/group to another. Simply select the tool and choose from the list of floors to copy them onto the currently selected floor.

Move the building allows you to select a node of the building to shift its location around the window.

Video 7 (07:14): Architecture tab – Walls and partitions

After having analyzed the project menu, we will go to the architecture menu and we will focus on the walls and partitions. When selecting it, it will appear in the menu where we can define the vertical constructive elements. In this case we have the following commands: external wall (that is in contact with the outside on one side), partitioning (element that is in contact with an enclosure on one side and another enclosure on the other side), basement wall (element that is in contact with a plot of land on one side), defences (banisters, parapets and so on that after all do not reach the top of the floor), and partitioning a fictitious wall. To begin we will draw an external wall. We create new and give it a reference and a thickness. We can now select it from the drop down menu. The button on the far right of the window provides a list of the available options we have configured and also allows us to edit, duplicate, and delete them. There are tools in this prompt for exporting and importing external walls as well.

So now that we have configured our external wall we can accept and move back to the main window. A toolbar appears on the left side of the workspace window which allows you to configure how the wall will be drawn around your mouse placement.



To draw the wall you must left click on a location in the workspace window and then drag the mouse to draw. Left click again to finish this section of the wall and continue dragging the mouse to create four corners. After placing the last wall right click to exit the command.

The tools in the walls and partitions section include a section for editing. The edit tool allows you to select a wall and alter its configuration. Move changes the position of a wall. It can be moved parallel to its position or moved by one of its ends. Adjust changes the position of walls with respect to the reference line. There are also tools for dividing and joining wall segments, and for copying and deleting them.

Placing partitions is the same procedure and external walls using a simple left click and drag of the mouse, right click to exit. The procedure is the same for basement walls as well... And for defences. And again for virtual partitions.

Video 8 (06:50): Architecture tab – Floor slabs

The next section of the architecture tab is the floor slabs. There are four elements inside this section: Screed, internal floor slab, flat roof, and sloped roof.

Starting with the Screed, we create a new Screed and can assign a reference and a thickness. We draw the screed in the same manner as the walls. Left clicking to begin drawing and right click to finish the command.

We can repeat the same process with the internal floor slab. In this case if you wanted to attach this to act as the floor above our screed we would need to move to the floor above and install it there. In this case we can just draw it adjacent.

Again with the flat roof.

Lastly we have the sloped roof. Again we create a new sloped roof from the prompt with a reference and thickness. We draw the shape the same as the other slabs. Now we have two extra tools for controlling the elevation of slabs. To alter the elevation of a regular slab we use the tool 'Introduce elevation changes in horizontal partitions'. We can now select a slab and adjust its elevation with the prompt. The other tool, Introduce elevation changes in roofs, allows us to set heights for the nodes of a sloped roof and in this way create a sloped roof.



The next tool is Openings in floor slabs. This tool allows you to draw a shape into a floor slab in order to remove a section. It is possible to access the openings section of the Architecture tab and use the delete tool to remove any openings you create in the slabs.

This section also contains a series of editing tools that allow the slabs to be reconfigured. Such as the Edit tool which allows users to change the type of slab selected. It is also possible to move, insert nodes, divide, copy, and delete slabs.

Video 9 (04:53): Architecture tab – Openings

The next section is the openings.

This section contains 6 elements: Doors, external carpentry and glazed openings, openings, and rectangular, circular and polygonal sky lights.

To place a door we create new and assign a reference, width and a height. There is an option for choosing to elect a width or not. Un-checking this box will let you draw the width as you place the door into the design. If you leave the box checked then the door will default to the given width. The door must be placed in a wall, hover the mouse over the selected wall and place with the left click. Drag the mouse in the chosen direction and left click again to place the door.

The external carpentry and glazed opening is very similar except for the inclusion of the Height above ground variable. To begin create new and designate the width(optional) and height. Now input the height above ground and accept. The placement is identical to with doors. This process is identical with the openings tool as well.

The skylight tools require a reference and then simply need the required measurements, whether that be length, width, or diameter. For the case of the polygonal skylight, you simply have to draw the shape as you see fit.

The openings sections has a selection of editing tools similar to the floor slabs section including: edit, move, adjust, rotate, copy, and delete.

Video 10 (02:24): Architecture tab – Columns

Now let's analyse the last of the construction elements in the architecture tab.



Opening the columns tool and selecting new we are presented with a prompt to design the column. We can select the shape and the dimensions along with a reference. Using the representation on the right side of the prompt we can designate how we would like to position the column. We will use the bottom left node. Now we can place the column into the design and we will place it in the bottom left corner. Now if we press the right mouse button we can make some changes to the column introduction such as to change the node used for positioning. So we can place this column on the right corner and it is worth saying again that all the elements introduced in IFC builder are introduced by the floor, just as these columns are introduced on the ground floor. We will now complete the other pillars of the building.

Now we will input a circular pillar by first right clicking to return to the configuration and selecting the circular option. We will then place this column in the interior of the building.

Well there you have the procedure for installing columns.

Video 11 (03:37): Architecture tab – Spaces and groups of spaces

After having learned all the building element commands let's have a look at the section for spaces. The spaces are used to designate the conditions inside the building inside certain given areas or spaces. Clicking new brings a prompt allowing you to create a new space with a reference and in this program you are able to choose between a space interior or exterior. In this case we wont choose exterior and we will call the space Offices. We then click accept and accept. To define a space it has to be an area that is enclosed by vertical elements such as walls. We then click in the space and enter the name of the space, in this case office 1. And now you can see if we click on the outside and input a space called office 2 that we receive an error saying that a space must be enclosed by partitions/walls.

If I create a partition in my office1 space you can see that the newly created room is no longer recognised as part of office1. Now what we can do is use the Move command in the spaces section to move the office2 into the newly created room. You can tell by the change in colour that the space is valid and now we have two spaces.

We can also use the edit tool to change the name or type of space. We can use the move command. We can use the copy command to copy a space into another room or we can use the delete command to remove a space from a room.



We also have the section called groups of spaces. The groups of spaces is quite simply the grouping of many spaces which is useful for calculation purposes and analysis.

We will create a group called group 1 and we will use this colour. Now we can use the assign tool to assign group 1 to our rooms that we have. If we push the right mouse button we can see that the colour has changed and now the two spaces have been grouped. We can also use the delete assignment tool to remove the assigned group from one of the two rooms and we can create a new group of spaces called group 2 and assign it to the second room.

Video 12 (00:56): Architecture tab – Nearby buildings

The final command in the architecture tab is the nearby buildings and other obstacles. This command allows us to introduce surrounding obstacles of a desired height and draw them to our specifications.

When we view the building in 3D we can see the result with our surrounding buildings being generated to the specified heights.

The other commands attached include edit, which allows us to alter the height of an already drawn nearby building.

We can also move and delete the nearby buildings with the final two buttons.

Section 4: Introduction of office buildings

Video 14 (07:39): Bottom floor

Now that we know all of the commands we are going to construct a building. In this first video we will start with the first floor. We begin with the construction elements of the architecture tab and the first element to input is the walls and partitions.

Let's click the walls and partitions to open the toolbar and press the maximise icon to make the use of the tools a bit more comfortable.

Next we are going to use the tool template object snaps located at the top of the window. Using the tool we can select which object snaps we would like to activate to assist our construction.

Now we can start to draw starting in the bottom corner and tracing around the edge of the building with the external wall tool. Using the toolbar on the



left side of the workspace window we will set the justification of the wall to be to the left of the mouse.

In this section we should zoom in to ensure that we are tracing the template correctly. Once we have finished, we complete the construction with the right click to exit the command.

We can view the result using the 3D view to see that our design now consists of the external walls of the ground floor.

Now we are going to draw the partitions, so we move back to the toolbar and select partitions. We are going to edit the current configuration and change the thickness to .15m and accept. As we draw you can see that the thickness doesn't exactly match the thickness of the template, but we won't worry about that right now. You must make sure to remember the justification you are using when drawing these walls as it is easy to incorrectly place these walls as you change directions.

With the staircase be sure to add a virtual wall, this way we can separate the spaces between the stairs and the adjacent room.

Now for the final walls we need to make another partition called T2 with a thickness of 0.3m. I am going to remove the midpoint and extension object snap and then trace around the template.

Now we can install the flooring. We will use the internal floor slab and we will select the nodes around the edge of the floor that require a floor slab. This means excluding the staircase and the vertical column near the bottom of the window.

Next we install the openings starting with the doors. Using the template we can see the desired width of each of the doors and draw them as we install. Then we input the glazed openings again according to the template we can determine the width for each opening. We can view the finished floor in the 3D viewer to verify its validity.

The last step is to designate the individual space types. Simply select each room and designate the correct description and reference.

Video 15 (05:41): Floor 1

After finishing the ground floor we can move up to the next floor. If we turn off the template we can see the design of the floor below because of the visibility settings in our layers. We can remove this by un-checking the box



in layers for the floor below but for this exercise it is very useful so we will leave it on.

We can now trace the walls of the floor below using the external walls tool. Once we have finished we can do the same for the internal partitions. We also have section that require a virtual partition such as the staircase.

Now we can install the flooring. As this is the ground floor we will use the screed. We will create a new screed called S1 and the thickness will be 0.3m and we will select the nodes around the edge of the floor.

Next we install the openings starting with the doors. We create a new door with reference Ext, uncheck the width so we can draw it to our own specifications and set the height at 2.03m. This will act as the front door. We can then move through the design and draw the doors as specified by the template. As the interior doors are different we use edit tool to edit the interior doors, adding a new door type called Int. After the doors comes the windows, we click the glazed openings button and create a new type called V1. Uncheck the width and set the height to 1.2m. We can leave the height above the ground at 1.2m and begin installing the windows according to the template.

We can take a look at the current progress using the 3D view to see the walls, partitions, floor slab, doors, and windows.

The last step is to designate the individual space types. Starting by creating a Dining room space and selecting the dining room, we can call it by the same name. We then create spaces for the remaining rooms: Corridor, Office, Stairs, WC, Risers, and Lift. Simply select each room and designate space and reference.

Video 16 (01:00): Floor 2

After having introduced the first floor let's go up in the group to the second floor and see that it is identical to the first floor. Therefore let's go to the project tools and use copy group. We then select the floor and elements we wish to copy and hit accept. Open the 3D view and you can see that the entire floor is completed. One change that you may have to make is to the names of the spaces in the new floor so that they can be distinguished from the floor below.



Video 17 (07:13): Floor 3

Now after having drawn the second floor we will use the arrows to move up and draw the third floor. You can see that the floor is different if you deactivate a lower floor.

Following the template we will first install the external walls. Then the defences.

If we open the 3D view we can visualise the change in form between the second and third floor, we can also see the difference between the external wall height and that of the defences.

Next let's input the partitions.

And now let's put in the internal floor slab and remember to only draw it around the edge of the sections that are inside the interior. For the exterior slabs we will use the flat roof option. Now let's remove the floor from the two small interior sections using the Openings in floor slabs tool.

We can now add in the openings starting with the doors. We have both interior and exterior doors. We can also add in the glazed windows according to the template.

Let us now assign the space

Video 18 (00:47): Floor 3, Cantilever

If we move to the 3D viewer you can see the building now has a cantilever on the third floor. So we must divide this element with the divide tool of the floor slabs section. So we activate the layer Floor below to see where the cantilever begins, then access the floor slabs section of the architecture tab. Using the divide tool we click on the wall where the cantilever begins and draw across to the end on the other side, following the outline of the floor below. Now select the edit tool and choose the newly divided internal floor slab of the cantilever. Choose the edit list of elements button and make a duplicate of the internal floor slab, renaming it to external floor slab and checking the External box. Observe that it changes colour. We have now correctly defined the element.

Video 19 (03:45): Terrace level

Now we will move up to the terrace level using the black arrows at the top of the window. You can see that the floor is different if you deactivate a lower floor.



Following the template we will first install the external walls. Then the defences.

If we open the 3D view we can visualise the change in form between the second and third floor, we can also see the difference between the external wall height and that of the defences.

Next let's input the partitions.

And now let's put in the internal floor slab and remember to only draw it around the edge of the sections that are inside the interior. For the exterior slabs we will use the flat roof option. Now let's remove the floor from the two small interior sections using the Openings in floor slabs tool.

We can now add in the openings starting with the doors. We have both interior and exterior doors. We can also add in the glazed windows according to the template.

Let us now assign the space FINISH

Video 20 (00:56): Rooftop level

And to finalise this work we will design the rooftop level. If we click the go to group button we can quickly move to the roof. In this case the work is very simple as we only need to install the floor slab.

So we open the floors labs tool and select flat roof. We can then trace around the edge of the template right clicking to finalise the command.

Now we can check the work in the 3D view to verify its validity and as you can see there are no issues. We now have a complete 3D building model.

Section 5: Exporting to the BIMServer.center

Video 21 (03:35): Exporting to the BIMServer.center and visualisation inside the platform:

Once we have finished the work, we can export the file as an ifc to the BIMServer.center. This can be done from the top right, BIMServer.center section of the toolbar. From here you can see I am connected to the server platform and we have an export button. When you press the button an export window pops up where we can link to a project, input a name for the ifc, and decide if we would like to export templates and generate DWG templates.



Firstly we press Project selection which will bring us a new prompt. In this prompt we can select a previously created project or we can create a new project with all the associated details such as the title and visibility settings.

Now we will move to the BIMServer.Center on the browser. To begin you must login, you can register an account simply if you haven't already.

So this is the BIMServer.center homepage where all the projects I am collaborating with are visible. We are going to press the create a new project button. In this case we will call the project Offices UDEMY and we can assign it as a seminar. We then have two options for the privacy settings for our project. I will set it as open so that the project will be visible to anyone on the BIMServer. For the collaboration settings I will choose open. This means that if someone would like to join the project and potentially collaborate, then they are open to request a collaboration whereby I will receive a request and can decide if I would like them to join. Lastly I can provide a description for my project which will be helpful in convincing people to collaborate with the project.

So here we have the project page we we can see an overview of everything happening with this project. At the moment it is empty but we will export our IFC building work to this project.

If we look at our windows notification icons and find the BIMServer synchroniser and open it with a double click we can continue. This window will tell us which project are synchronised on our local computer. We can press the cube button adjust which projects to maintain and the arrow to upload a local file to a project.

We now move back to IFC builder and we can execute the exportation. We select our new project and press accept. The software will tell us that the export has been successful and if we move to the synchroniser we can see the process in action. Once the synchroniser is finished we can move to the BIMServer.center in the browser and refresh our project. You can now see we have an IFC file called Offices and if we open the files tab we can see the templates that are associated with the different floors of the building. Moving back to the dashboard tab we can see the 3D model which is completely navigable using the mouse.

Section 6: Complex constructive solutions

Video 22 (03:48): Pitched/Gable roof

In this next video we will cover how to construct a pitched/gable roof in a very simple way. For this example we have already made a small rectangle



as seen in the 3d view and if we exit the 3D view we can see the walls of the floor below and we can use those to draw our roof slab. To do so we will use the sloped roof button. We will draw starting from the outside of the corner of the walls and trace around the edge of the building. Now we will divide the slab in half. To make this easier we have the object snap called midpoint which will help us to locate the halfway point of the roof. So we divide along the middle like so. Now we have two roof slabs that will make up our two sloping sides of the roof. We can now use the button Introduce elevation changes in roofs. When we activate the button we must select a roof slab by a node, so we move to the corners and select the top right corner of the left side of the roof. The entire roof slab will be highlighted so you will know if you are selecting the correct node. We then select Introduced elevation change and input our desired value, such as 2m. We will now receive a message in the opposite corner telling us that the points have not been introduced on the same plane. So we need to add in another elevation change to correct this. We select the bottom right corner of the left side of the roof and introduce the same height, 2m. Both the roof slab in the workspace window and in the 3D view should adjust accordingly. In the workspace window you can see now that the picture of the left side of the roof has changed and now includes an arrow indicating the direction of the slope. We can see in the 3D view that one half of the roof is now sloped. Now we repeat this process with the other half. And just like that we have completed the sloped roof. As you can see in the 3D view, the wall from the floor below will rise to meet the bottom of the sloped roof.

Video 23 (07:06): Pitched/Gable roof and Attic

In the next video we will do the same but in this case the pitched roof is going to be a hipped.

Start by drawing our sections of sloped roof, this time we will draw four triangles meeting in the center of the roof.

Once completed we input the elevation for the four nodes located on the centre point.

If we view the 3D model we can see that the roof is now a pyramid hip roof.

Now we will construct an attic. To do so we will first add in a new floor using the floors/groups button found in the Project tab. We are going to insert a floor above the ground floor and set the height at 2m. Now if we look at the 3D model we can see that our roof is detached from the building.

The next step is to adjust the construction of the sloped roof. We will start by accessing the floor slabs tools in the architecture tab. From here we will us



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the introduce elevation changes in roofs tool to change the 4 centre nodes of our roof from introduced elevated change to calculated elevation change. Once completed we will see that our roof looks flat again. Now we use the same tool on the nodes of the roof that are on the outside, on the corners of the building. We will set the introduced elevation change to -2m. Once completed we can see that the building looks as it did earlier, with the sloped roof connected to the top of the ground floor. However now we have an extra floor inbetween to use as our attic.

So the next step is to use the floor slabs tool internal floor slabs and draw a slab around the edge of the first floor. We will use the Groups of spaces section to designate this new room as the attic. Now when we return to the 3D model we can see the additional room. If we make the sloped roof transparent we can see the attic properly.