



BIM4ENERGY
E R A S M U S +

Erasmus+ Project ID: 2023-1-ES01-KA220-HED-000156652

BIM digital competencies to evaluate and improve the energy efficiency of European buildings.

A digital way towards positive energy districts

10:15 – 11:00 Experience in teaching BIM at UPCT & BIM4Energy Case Studies

Speaker: UPCT

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Ayuntamiento
de Ceutí



Universidad
Politécnica
de Cartagena





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Summary :

- Experience in teaching BIM at UPCT: Master in BIM Methodology for the development of Infrastructure projects.
- UPCT in BIM4Energy project: Approach for the Spanish and Lithuanian Case Studies

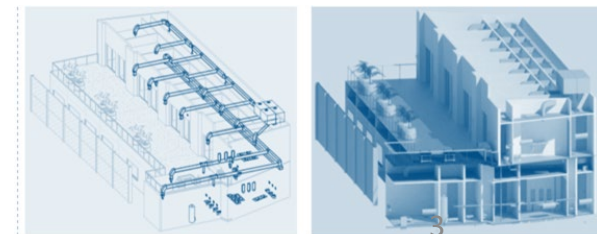
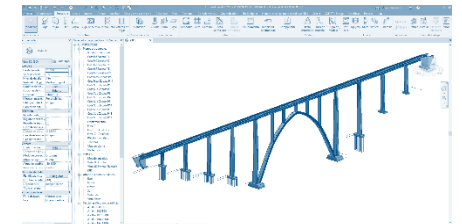


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MUMBIM MASTER'S DEGREE IN BIM METHODOLOGY FOR THE DEVELOPMENT OF INFRASTRUCTURE PROJECTS

Curriculum

		Módulo	ECTS	1 ^{er} cuat.	2 ^o cuat.
One Academic Year	Introduction to BIM methodology in Construction and 3D Modeling	I	6	6	
	Fundamentals of Infrastructure Management	I	6	6	
	Risk Management in Infrastructures	I	4		4
	Design and Analysis of Building Structures in a BIM framework	II	6	6	
	Road Design in a BIM Environment	II	6	6	
	Design, Analysis and BIM Model of Road and Rail Bridges	II	6	6	
	4D & 5D BIM Project	III	6		6
	Electives	V	6		6
	Master's Thesis	IV	14		14
			60	30	30
Elective		Módulo	ECTS	1 ^{er} cuat.	2 ^o cuat.
	Advanced BIM Modeling of Structures in Civil Works and Building (*)	V	6		6
	Design and BIM model of Building Facilities (MEP) (*)	V	6		6
	Practices in a Company (*) (*) Choosing an elective	V	6		6
Supplement		Módulo	ECTS	Anual	
	Building (to be studied by graduates in Industrial Engineering)	C	7,5	7,5	
	Roads and Airports (to be studied by Architects, graduates in Building Engineering and graduates in Industrial Engineering)	C	7,5	7,5	





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MUMBIM Course 1: Introduction to BIM methodology in Construction and 3D Modeling:

Unidades didácticas	Temas
UNIT I: INTRODUCTION TO BIM (BUILDING INFORMATION MODELING).	L0: ART AND AESTHETICS OF CONSTRUCTIONS L1: BIM CONCEPT VS CAD CONCEPT. L2: DIFFERENT BIM APPROACHES. L3: BIM METHODOLOGY IN CIVIL ENGINEERING. L4: STANDARDS AND REGULATIONS. L5: MATURITY OF THE BIM METHODOLOGY. IMPLANTATION LEVELS L6: APPLICATION OF THE BIM METHODOLOGY
UNIT II: SOFTWARE AND VISUALIZATION TECHNOLOGY	L7: SOFTWARE. L8: NEW VISUALIZATION TECHNOLOGIES.
UNIT III: IMPLEMENTATION OF BIM IN PROJECT TENDERS AND PUBLIC WORKS.	L9: BIM REQUIREMENTS. L10: BIM EXECUTION PLAN.



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MUMBIM Course 2: Fundamentals of Infrastructure Management

Unidades didácticas	Temas
TEACHING UNIT 1: CIVIL INFRASTRUCTURES	T1. INTRODUCTION TO CIVIL INFRASTRUCTURES.- Introduction to civil infrastructures. Sectors. Social, environmental, economic and financial aspects.
TEACHING UNIT 2: FUNDAMENTALS OF INFRASTRUCTURE MANAGEMENT	T2. FUNDAMENTALS OF MANAGEMENT.- Basic concepts of physical asset management. The balance between cost, risk and performance. The concept of value in infrastructure management. The lifecycle concept. ISO 55000, 55001 and 55002 standards.
TEACHING UNIT 3: INFRASTRUCTURE MANAGEMENT	<p>T3. STRATEGY & PLANNING.- Management Policy. Sustainable Development. Strategy & Objectives. Demand Analysis. Asset Management Strategic Planning. Asset Management Planning. Stakeholder Engagement.</p> <p>T4. DECISION MAKING.- Capital Investment Decision-Making. Operations & Maintenance Decision-Making. Lifecycle Value Realisation. Resourcing Strategy. Shutdowns & Outage Strategy.</p> <p>T5. LIFECYCLE DELIVERY.- Technical Standards & Legislation. Asset Creation & Acquisition. Procurement & Supply Chain Management. Systems Engineering. Configuration Management. Maintenance Delivery. Reliability Engineering. Asset Operations. Resource Management. Shutdown & Outage Management. Fault & Incident Response. Management of Change. Asset Decommissioning and Disposal.</p> <p>T6. ASSET INFORMATION.- Asset Information Strategy. Asset Information Standards. Asset Information Systems. Data & Information Management.</p> <p>T7. ORGANIZATION & PEOPLE.- Asset Management Leadership. Organizational Structure. Organizational Culture. Competence Management.</p> <p>T8. RISK.- Risk Assessment and Management. Contingency Planning & Resilience Analysis.</p> <p>T9. PERFORMANCE ANALYSIS.- Asset Performance & Health Monitoring. Asset Costing & Valuation. Asset Management System Monitoring. Management Review, Audit & Assurance.</p>
TEACHING UNIT 4: CURRENT SITUATION AND FUTURE OF INFRASTRUCTURE MANAGEMENT	T10. CURRENT SITUATION AND FUTURE OF INFRASTRUCTURE MANAGEMENT.- Global Trends. Infrastructure Ageing. Climate Change. Artificial Intelligence. Internet of Things. Green New Deal.



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MUMBIM Course 3: Risk Management in Infrastructures

Unidades didácticas	Temas
<p>TEACHING UNIT 1: PRINCIPLES OF RISK MANAGEMENT IN CIVIL INFRASTRUCTURES.</p>	<p>T1. INTRODUCTION. RISK IN CIVIL INFRASTRUCTURES.- Introduction to risk. Risk in civil infrastructures. Natural risks. Man-made risks. Geotechnical risks. Risk in transport infrastructures. Risks in hydraulic infrastructures. Risks in port infrastructures. Risks in urban infrastructures. Environmental risks. T2. PRINCIPLES AND GUIDELINES FOR RISK MANAGEMENT.- Benefits of risk management. Risk in ISO standards. ISO 31000. Principles. Framework. Processes. T3. CIVIL INFRASTRUCTURE MANAGEMENT AND RISK. Risk in standards ISO 55000, ISO 55001 and ISO 55002. Risk in the infrastructure lifecycle. Actions to manage risk.</p>
<p>TEACHING UNIT 2: RISK ASSESSMENT AND ASSOCIATED PROCESSES.</p>	<p>T4. RISK ASSESSMENT.- Uncertainty and risk. The ISO 31010 standard. Use of risk assessment techniques. Implementing risk assessment. Planning risk assessment. Information management. Applying risk assessment techniques. Review the analysis. Apply results to support decisions. Record and report risk assesment. Selecting techniques for risk assessment. T5. RISK IDENTIFICATION.- Objectives. Selecting techniques for risk identification. Techniques for risk identification. BIM and risk identification. T6. RISK ANALYSIS.- Objectives. Available information and BIM. Analyses for different types of consequences. Controls. Probability estimation. Consequence estimation. Risk analysis techniques. T7. RISK EVALUATION.- Objectives. Prioritization. Selecting techniques for risk evaluation. Techniques for risk evaluation.</p>
<p>TEACHING UNIT 3: RISK TREATMENT, RISK MONITORING AND RISK COMMUNICATION.</p>	<p>T8. RISK TREATMENT.- Objective. Processes oriented analysis of risk treatment. Risk treatment options. Selecting risk treatment options. Planning risk treatment options. Techniques for decision-maing on risk treatment options. T9. RISK MONITORING AND RISK COMMUNICATION.- Objectives of risk monitoring. Components for risk monitoring. Risk communication. Relevant aspects of risk communication. Channels and procedures for risk communication.</p>
<p>TEACHING UNIT 4: CURRENT AND FUTURE SITUATION OF RISK MANAGEMENT IN CIVIL INFRASTRUCTURES.</p>	<p>T10. CURRENT AND FUTURE SITUATION OF RISK MANAGEMENT IN CIVIL INFRASTRUCTURES.- Role of risk in future civil infrastructure management. Natural risks. Climate change. Emerging risks. Risk related to digitalization of civil infrastructures. BIM and risk management.</p>



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MUMBIM Course 4: Design and Analysis of Building Structures in a BIM framework

Unidades didácticas

UNIT I: BUILDING STRUCTURAL SYSTEM AND ITS ANALYSIS.

UNIT II: COLLABORATIVE TASKS ON BIM DESIGN OF BUILDINGS

UNIT III: PARAMETRIC DESIGN OF STRUCTURES.

Temas

L1: CONCEPTION OF A BUILDING STRUCTURE

L2: PREDIMENSION OF STRUCTURAL ELEMENTS.

L3. CONSIDERATIONS ABOUT THE STRUCTURAL ANALYSIS MODEL BUILT BY CYPECAD.

L4. BIM SERVER CENTER.

T5. INTRODUCTION TO PARAMETRIC DESIGN OF STRUCTURES.

T6. STRATEGIES IN PARAMETRIC DESIGN OF STRUCTURES.

[See the book of this course](#)



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MUMBIM Course 5: Road Design in a BIM framework

Unidades didácticas	Temas
Unit I. Basic concepts of road design	Lesson 1. Traffic and level of service. Basic concepts Lesson 2. Geometric design. Basic concepts. Norms Lesson 3. Earthworks, subgrades and pavements. Basic concepts. Norms Lesson 4. Drainage. Norms Lesson 5. Other standards used in road design
Unit II. Road design in a BIM environment	Lesson 6. Introduction to BIM in civil works and road design Lesson 7. Geometric Road design using CIVIL 3D. Relationship with the BIM methodology Lesson 8. Geometric Road design using CLIP. Relationship with the BIM methodology



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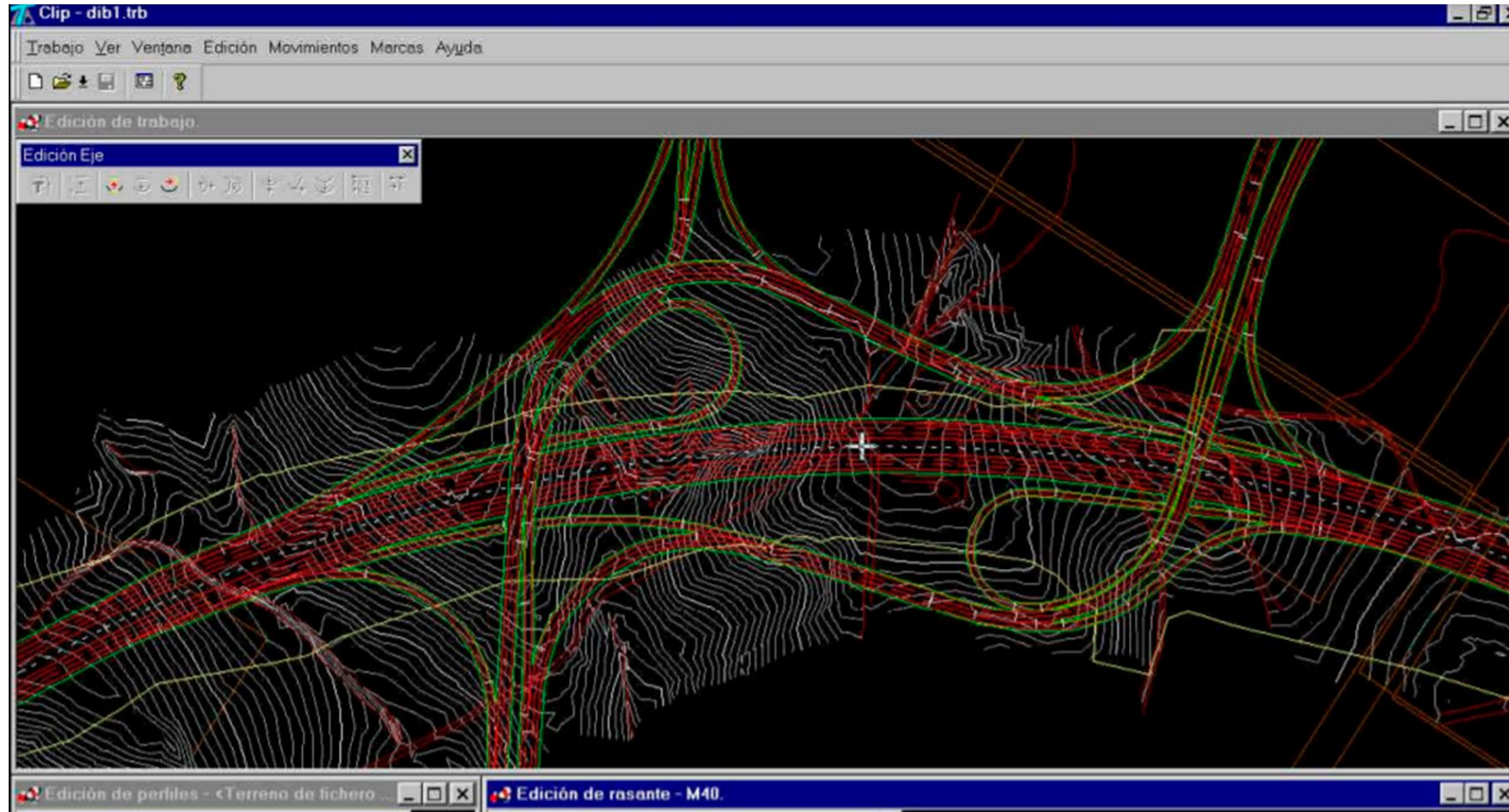
MUMBIM Course 5: Road Design in a BIM framework





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MUMBIM Course 5: Road Design in a BIM framework . Master Thesis Luis Bañon



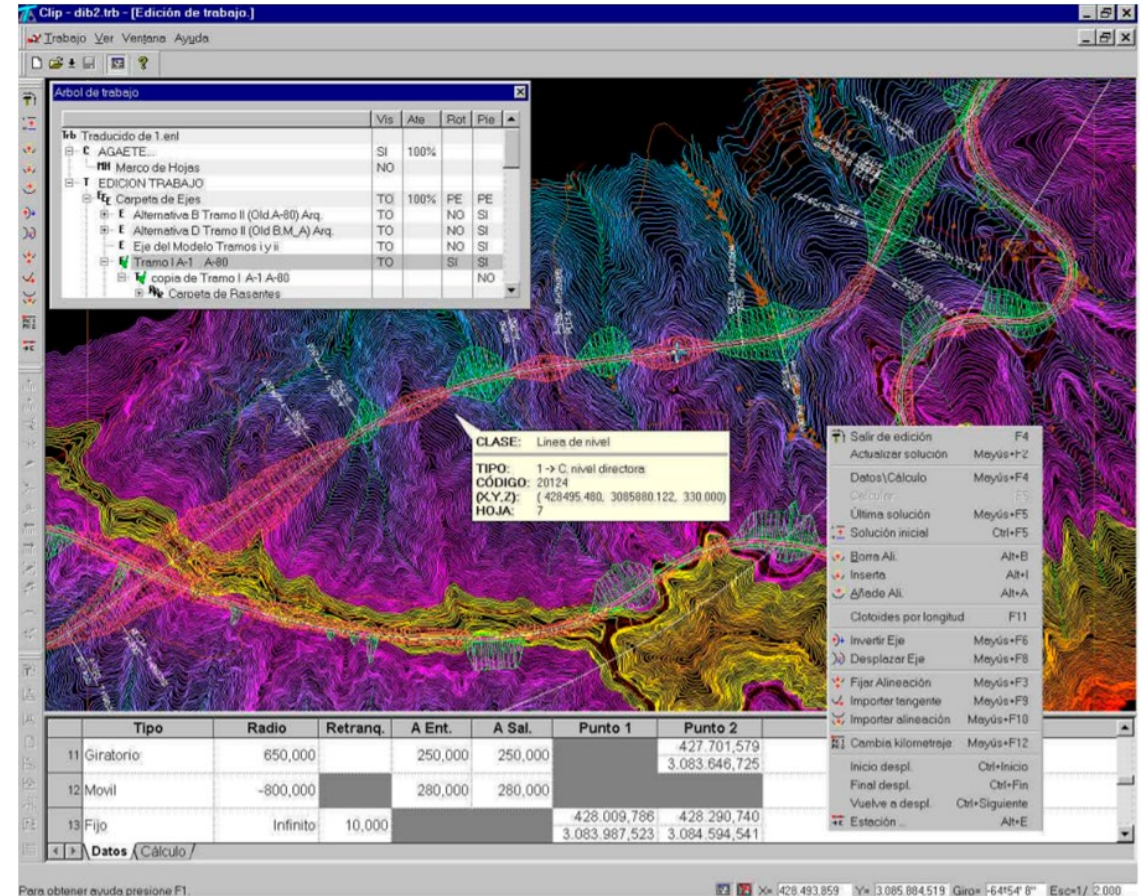
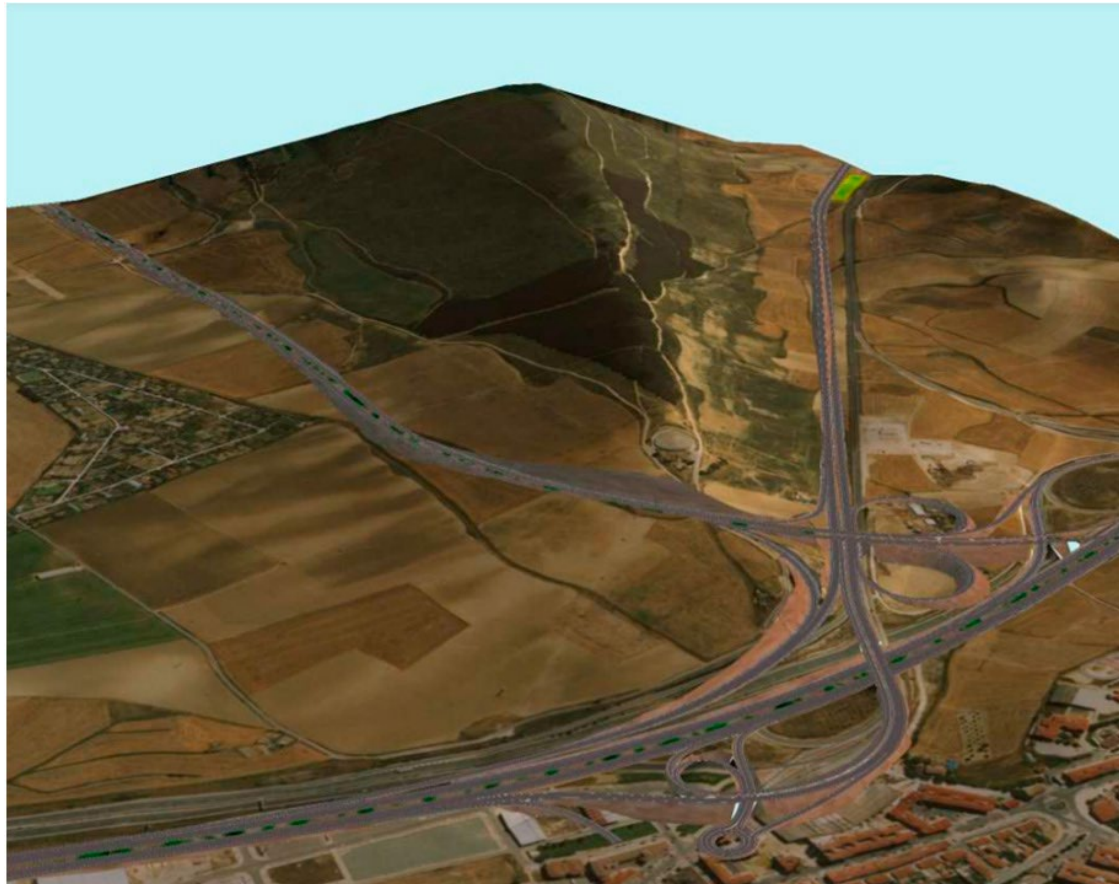
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MUMBIM Course 5: Road Design in a BIM framework . Master Thesis Luis Bañon



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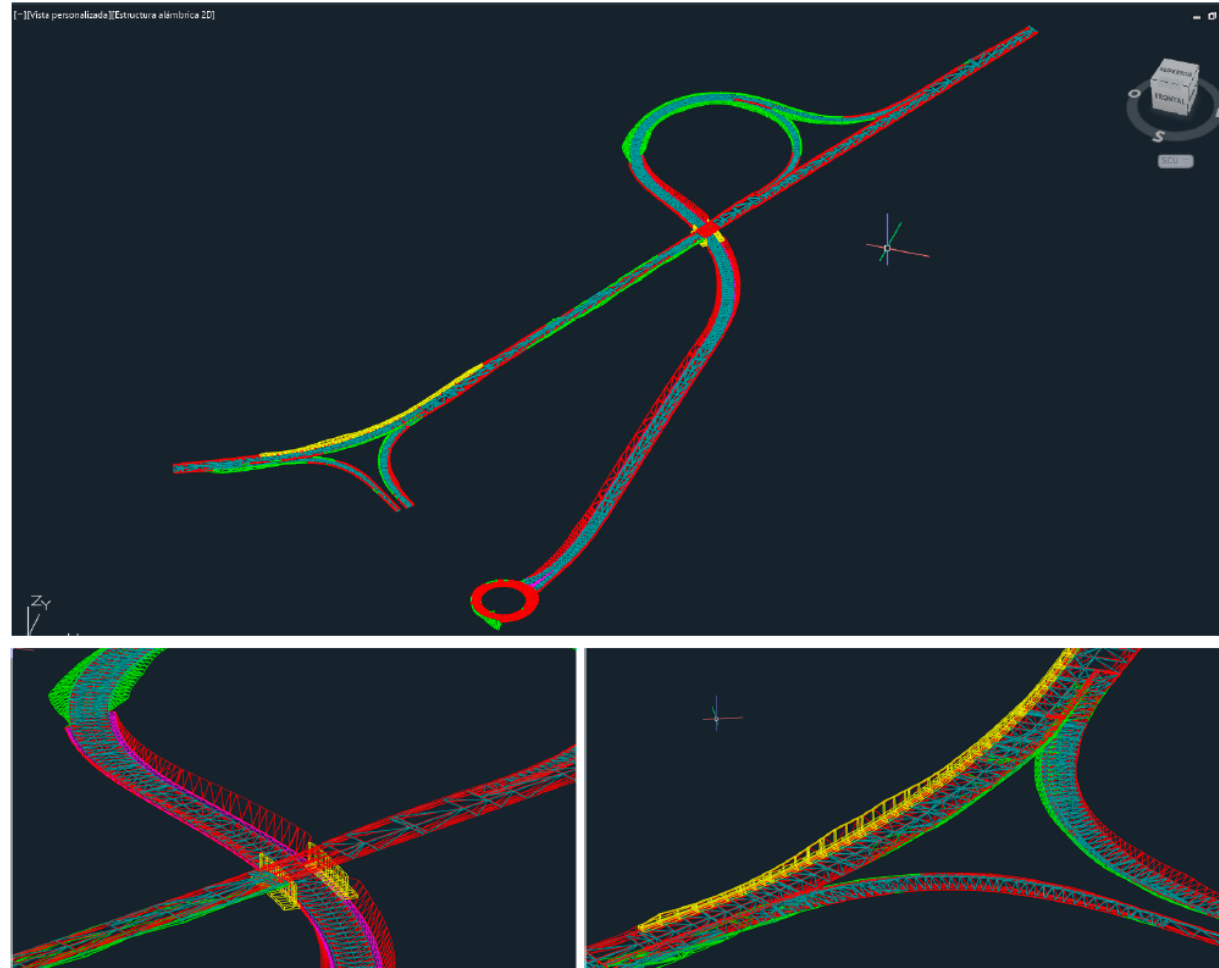
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Carpetas de Ejes				
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Tramo I A-1 A-80	TO		SI	SI
copia de Tramo I A-1 A-80				NO
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12 Movil	-800,000		280,000	280,000		
13 Fijo	Infinito	10,000			428.009,786 3.083.987,523	428.290,740 3.084.594,541

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MUMBIM Course 5: Road Design in a BIM framework . Master Thesis Luis Bañon

CAD file





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MUMBIM Course 6: Design, Analysis and BIM Model of Road and Rail Bridges

Unidades didácticas	Temas
UNIT I: BRIDGE ENGINEERING INTRODUCTION	L1: BRIDGE STANDARDS AND REGULATIONS. L2: BRIDGE TYPOLOGY. L3: ACTIONS ON ROAD BRIDGES.
UNIT II: COMMON BRIDGE TYPOLOGIES	L4: BEAM DECK BRIDGES. L5: SLAB BRIDGES. L6: BOX BEAM BRIDGES AND TWIN GIRDER COMPOSITE BRIDGES.
UNIT III: RAILWAY BRIDGES	L7: RAILWAY BRIDGES. L8: RESEARCH ON RAILWAY BRIDGES
UNIT IV: THE BIM METHODOLOGY IN BRIDGE DESIGN.	L9: SOFTWARE FOR DESIGN, ANALYSIS AND BIM MODELING OF BRIDGES. L10: BIM USES IN BRIDGE DESIGN.

[See the book of this course](#)

[Software BIM for Bridges](#)

[BIM workflow with Rhino](#)

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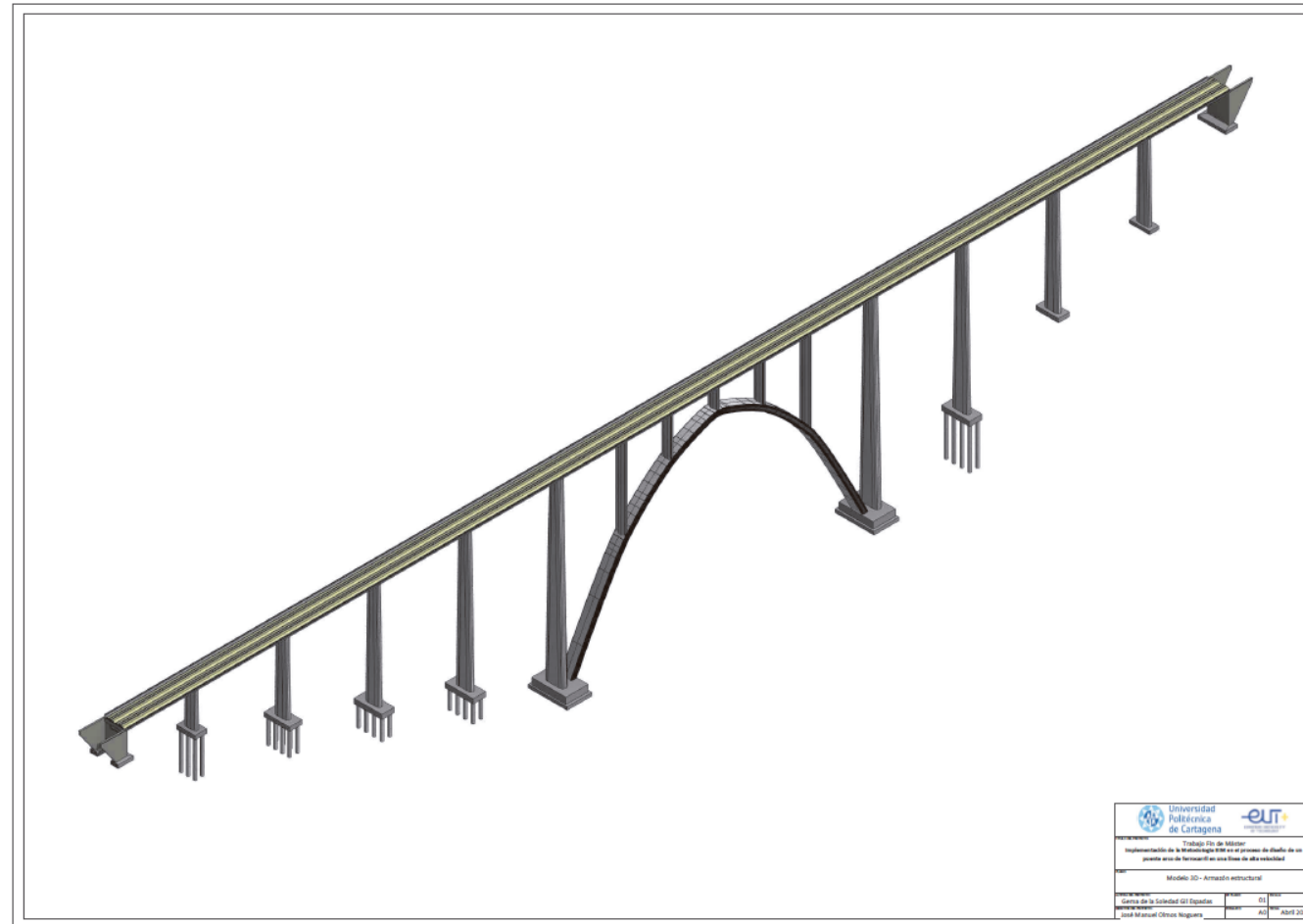
MUMBIM Course 6: Design, Analysis and BIM Model of Road and Rail Bridges

[Master Thesis of Abel García](#)



MUMBIM Course 6: Design, Analysis and BIM Model of Road and Rail Bridges

[Master Thesis of Gema Gil Espadas](#) Pg 84



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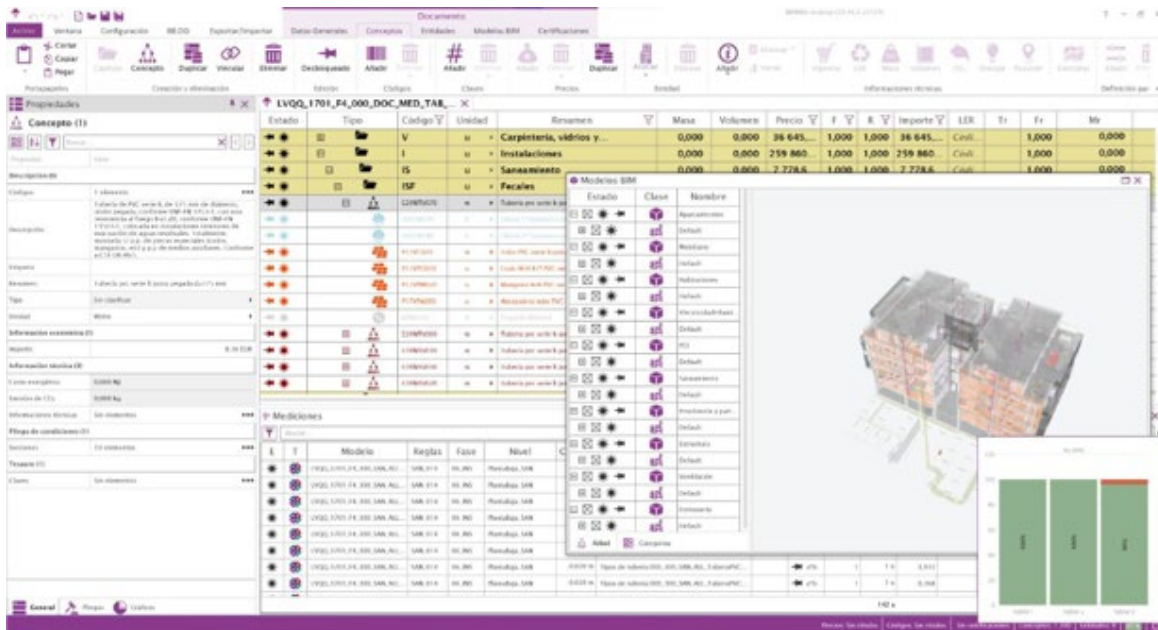
MUMBIM Course 7: 4D & 5D BIM Project

Unit 1: Drafting of Projects in BIM environment

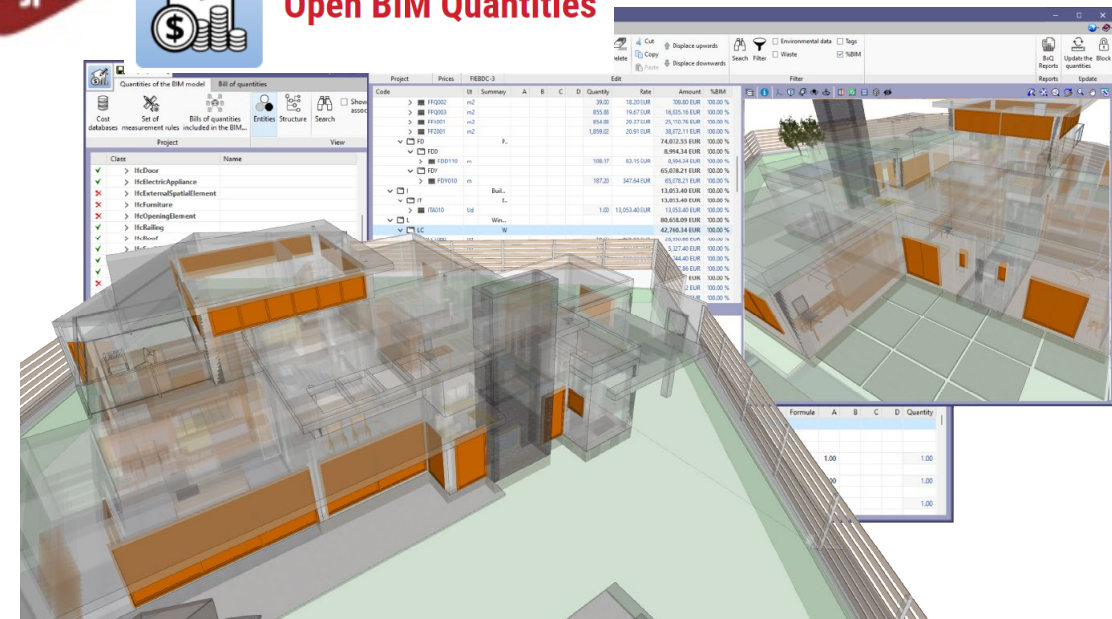
Unit 2: Introduction to 4D Bim, planning, control and detection of interference.

Unit 3: Introduction to 5D BIM. Measurements and Budgets in BIM environment. BIM environment and Virtual Reality.

Mamba (Bimmate)



Open BIM Quantities





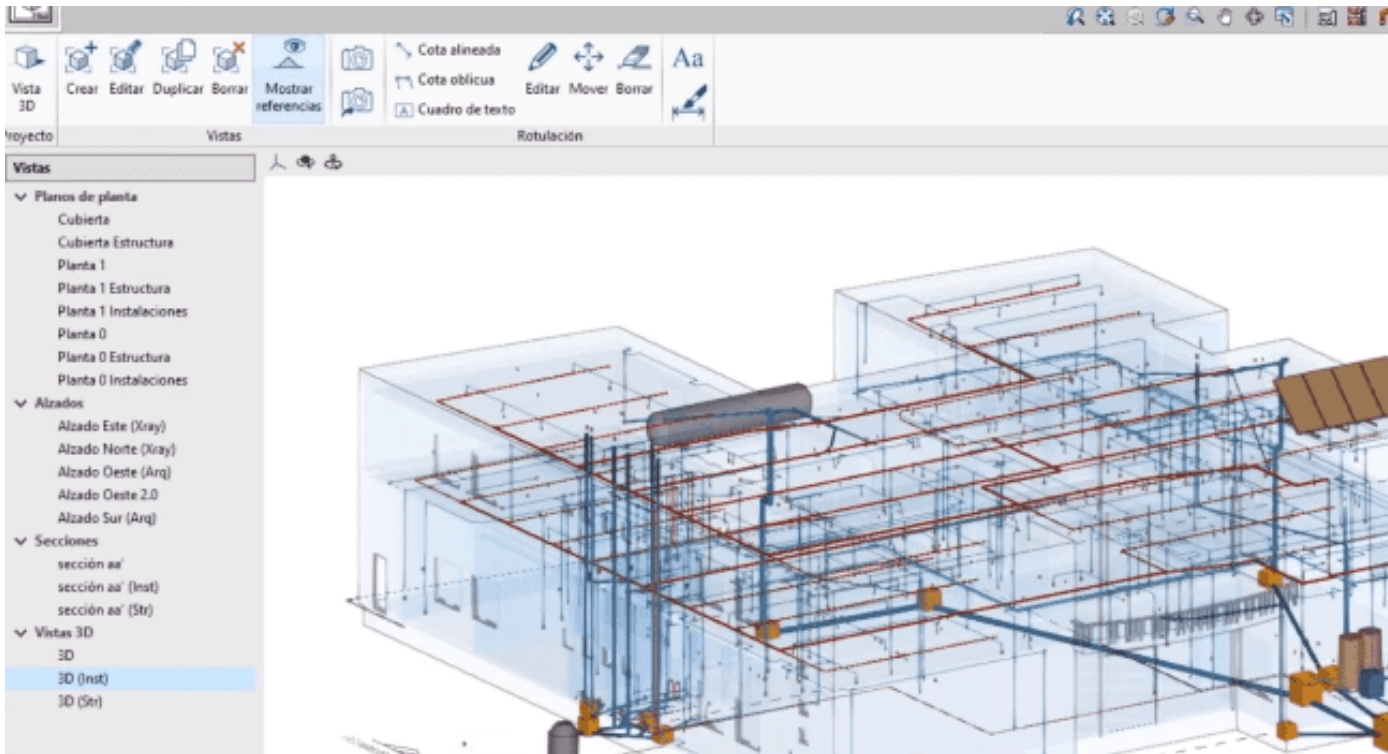
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MUMBIM Course 8: Advanced BIM Modeling of Structures in Civil Works and Building

Unidades didácticas	Temas
UNIT I: BIM MODELING OF STRUCTURES	L1: WORKFLOW OF THE STRUCTURE DESIGN WITH BIM. L2: PHILOSOPHY OF STRUCTURAL MODELLING. L3: RELATIONSHIP BETWEEN ANALYTICAL MODEL AND BIM MODEL. L4: ADVANCED BIM MODELS OF BUILDING STRUCTURES AND CIVIL WORKS.
UNIT II: NEW TECHNIQUES IN BIM INFRASTRUCTURE MODELING	T5: 3D SCANNING OF BUILDINGS BY MEANS OF PHOTOGRAMMETRY.

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MUMBIM Course 9: Design and BIM model of Building Facilities (MEP Design)



Unidades didácticas

Fire protection systems

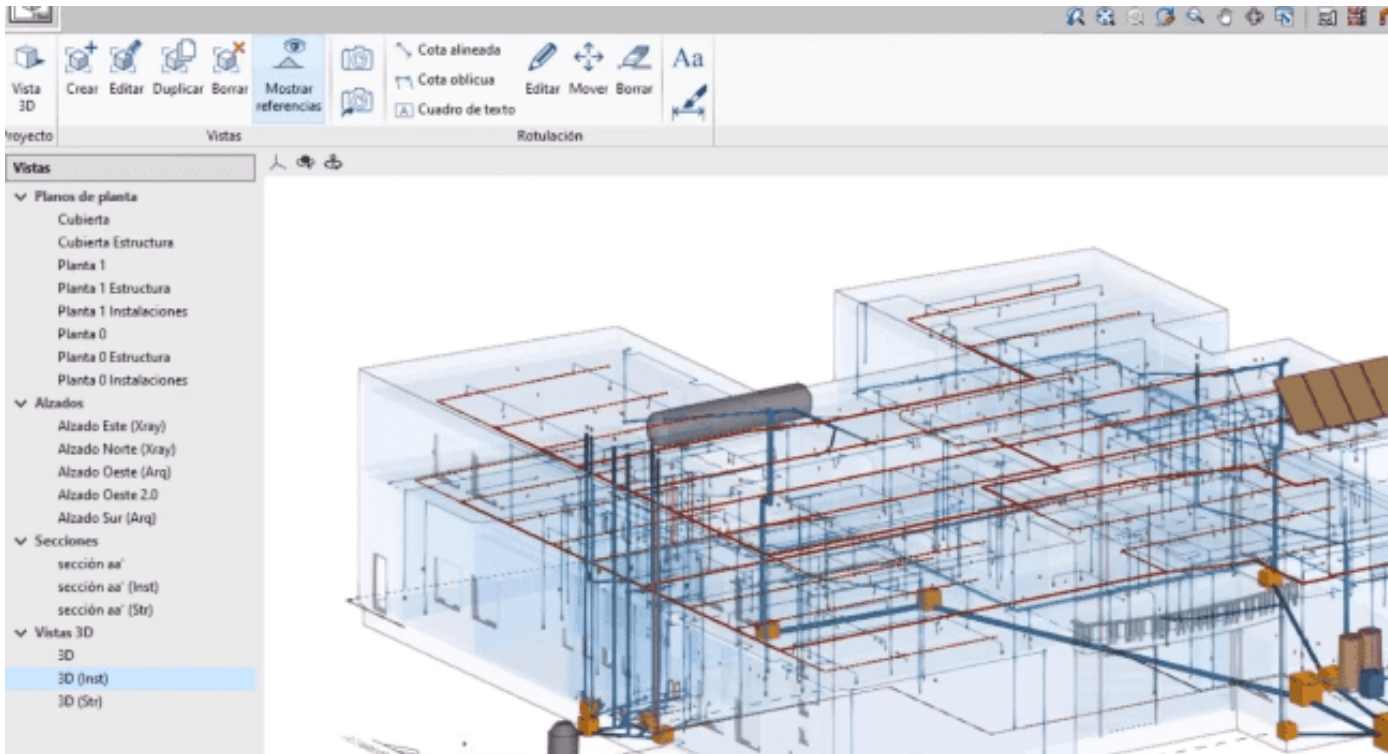
Building sanitary, water and gas supply systems

Building electrical systems

Building energy efficiency



MUMBIM Course 9: Design and BIM model of Building Facilities (MEP Design)



Unidades didácticas

Fire protection systems

Building sanitary, water and gas supply systems

Building electrical systems

Building energy efficiency





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- Teaching material and its use: BIMVET3 Project
- <https://bimvet3.eu/allcourses/>



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- Online class experience
 - Video-classes in Virtual Classroom for the theoretical part of the courses.
 - Online Live classes by Teams for practices with software.
 - Each student has the educational version of the software installed in his/her PC, and follows the step by step pdf tutorial.
- Tips for teaching BIM:
 - Students can use 2 screen, one for the software to learn and the other for see the pdf tutorial file,
 - Teacher solves doubts. Student can shares his/her screen in the Teams session. Others student can watch the screen of student that is asking



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- A proposal to introduce BIM in secondary education.

[A proposal to introduce BIM in secondary education.](#)



Article

**Design of 3D Metric Geometry Study and Research Activities
within a BIM Framework**



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UPCT in BIM4Energy project: Approach for the Spanish and Lithuanian Case Studies

WP2: Building Energy Efficiency Study with BIM

- **SO1:** Develop a **study to evaluate the energy performance of 3 cases of existing and representative buildings** in the municipalities of the Project partners **using the BIM methodology** and **propose several alternatives for the energy rehabilitation of these building** to improve their energy efficiency. (WP2). This specific objective will contribute to satisfy different identified needs, as the first step is to evaluate the energy performance of three common place buildings in Spain, Romania and Lithuania, so that results may be extrapolated to other constructions.



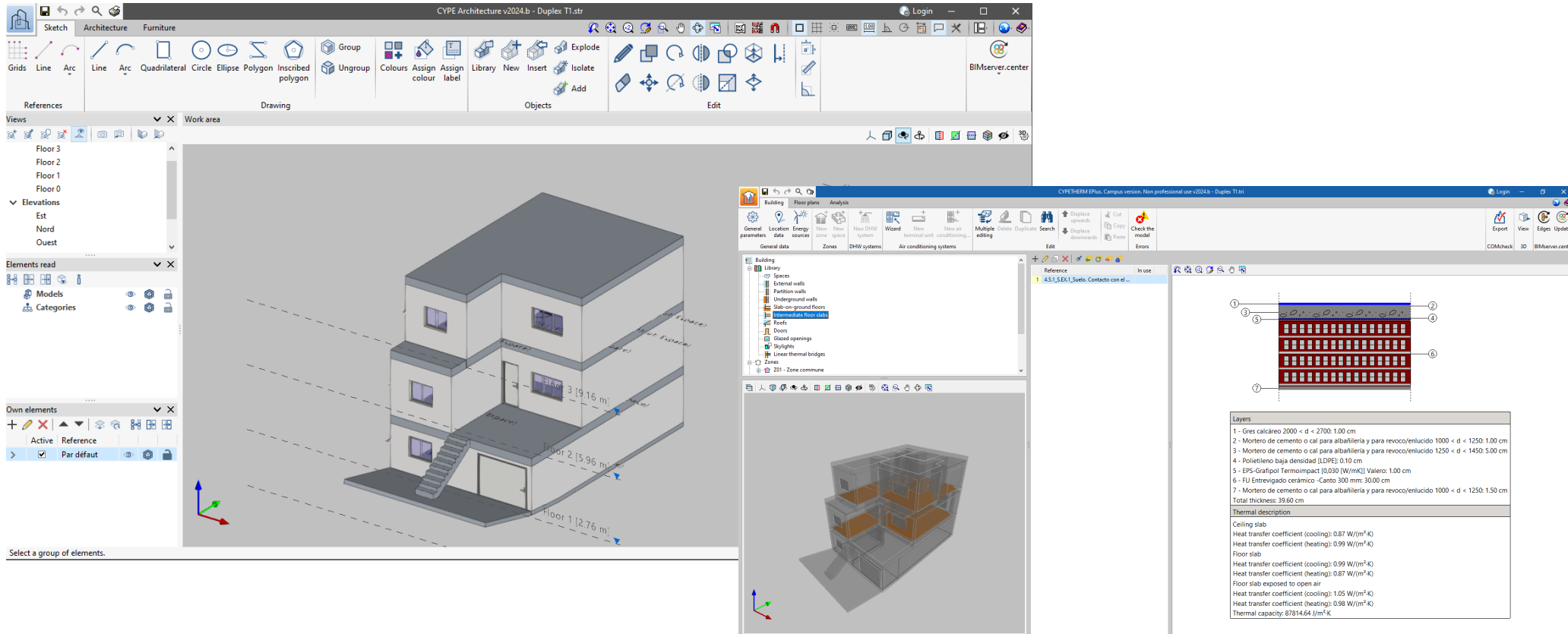
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UPCT in BIM4Energy project: Approach for the Spanish and Lithuanian Case Studies

- **Creating the BIM model** of the three different typical models which has been chosen: **Single-family detached house in Spain, Residential 5-story building in Lithuania** and **educational building in Romania**.
- Energy efficiency of the case study buildings will be made for the **different types of materials used for the thermal envelope and the different HV/ AC systems of those constructions periods selected**. The aim of doing this analysis is that this data feeds the webapp (WP4), so that municipal staff, construction workers and citizens when wanting to improve the energy performance of an specific building, they may select the materials of the thermal envelop and the HV/ AC systems of the building they want to renovate, and get information about the improvements that may be made.

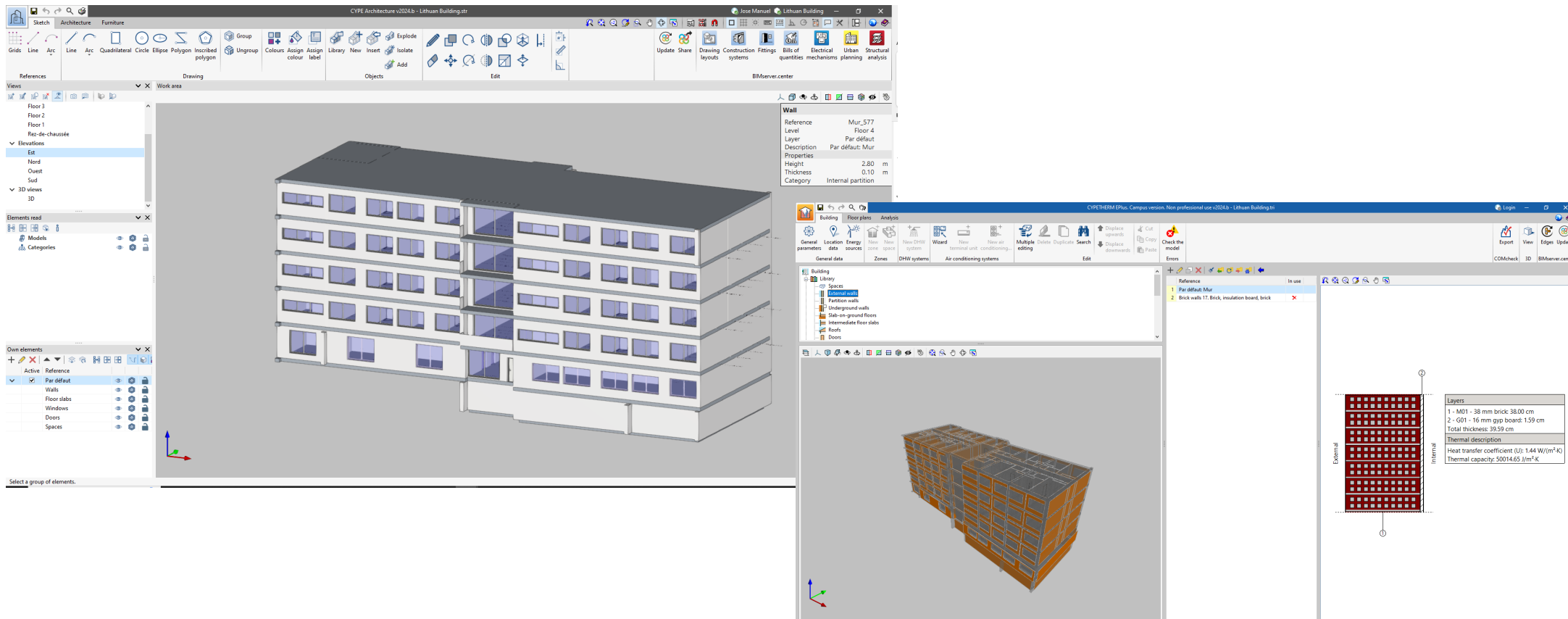
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UPCT in BIM4Energy project. Spanish Case Study: Single-family detached house.



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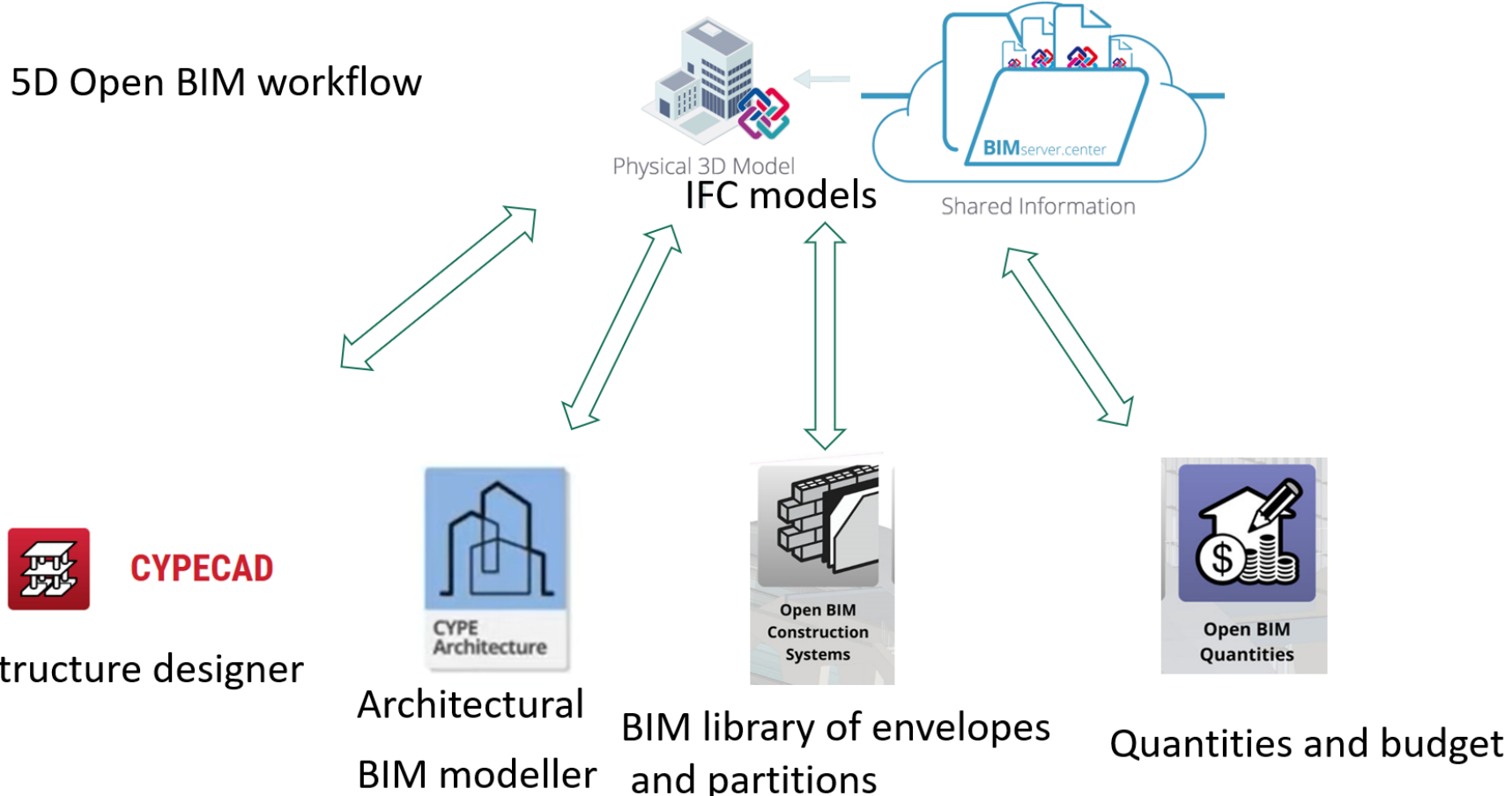
UPCT in BIM4Energy project. Lithuanian Case Study: Residential 5-story building.



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UPCT in BIM4Energy project: Approach for the Spanish and Lithuanian Case Studies

Open BIM workflow with Cype

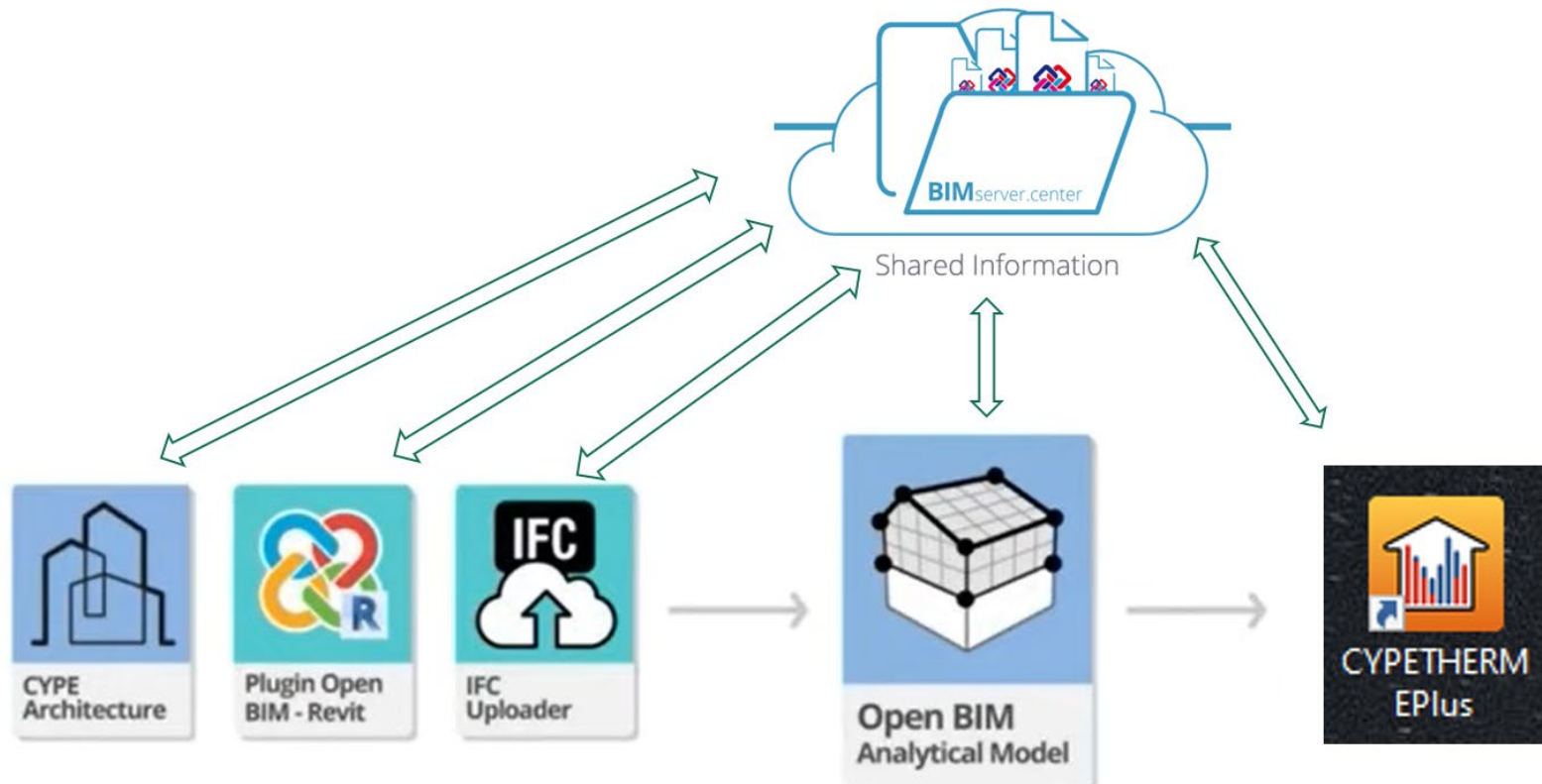


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UPCT in BIM4Energy project: Approach for the Spanish and Lithuanian and Spanish Case Studies

Open BIM workflow with Cype

Energy analysis workflow





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That's all

Thanks for your attention