BIMEPD

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ADAPTED SENIOR TRAINING PROGRAM ON BIM METHODOLOGIES FOR THE INTEGRATION OF EPD IN SUSTAINABLE CONSTRUCTION STRATEGIES

2020-1-ES01-KA204-083128

Module 08

Methodologies for calculating environmental impact from BIM objects with LOD600 development level.

COAMU Colegio Oficial de Arquitectos Región de Murcia

iED institute of Entrepreneurship Development

Centro Tecnológico del mármol, piedra y materiales

Warsaw University of Technology

Bulgarian Green Building Council

cype

Erasmus+

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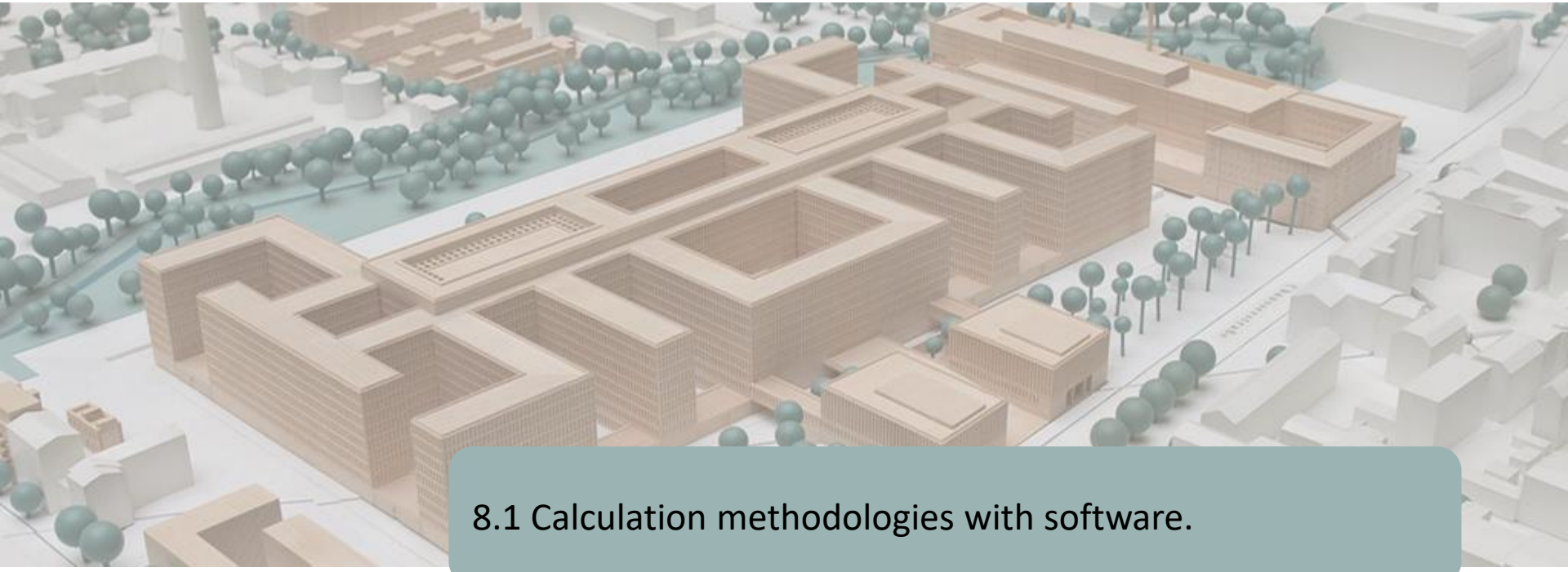

8.1 Calculation methodologies with software.

8.2 BIMclay

8.3 BIMstone

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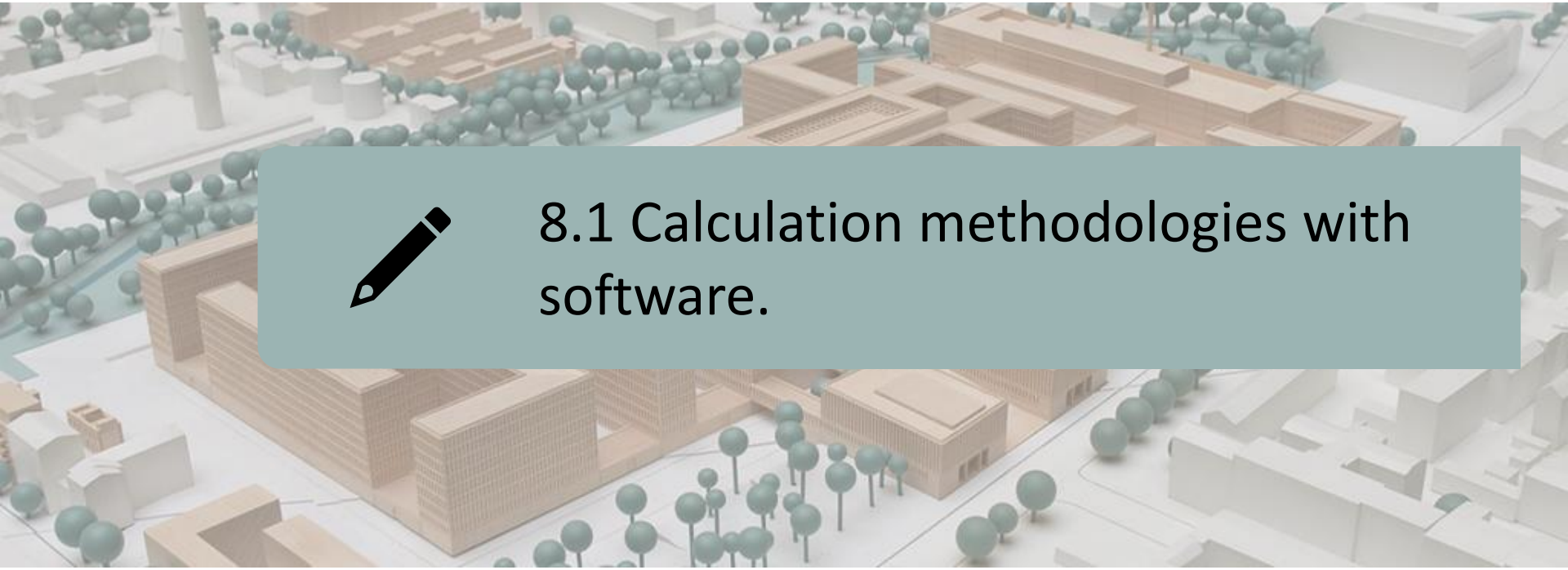

8.1 Calculation methodologies with software.

BASED ON SOFTWARE-INTEGRATED DATABASES

BASED ON DATA INTEGRATION IN BIM LOD600 OBJECTS

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BASED ON SOFTWARE-INTEGRATED DATABASES

As we have already seen, there are currently several BIM software for sustainable building modelling, as we saw in section 5.4, where some of them were highlighted:

- COCON-BIM
- ONE CLICK LCA with BIM
- TALLY
- CYPE module IA-ACV
- CYPE and CSTB: ElodieBIM

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BASED ON SOFTWARE-INTEGRATED DATABASES

In module 9 we will also see examples of 3 other projects that are also based on this database methodology (either integrated in the software or a plug-in/complement or a database that can be imported into the software):

- BIMhealthy
- UrbanBIM
- CircularBIM

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EXPLANATORY NOTE

In computing, an add-on or plug-in is an application (or software) that relates to another application to add a new and usually very specific function to it. This additional application is executed by the main application and they interact through the application programming interface.
It is also known as a plug-in or add-on, and as a connector or extension.

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BASED ON SOFTWARE-INTEGRATED DATABASES

These software products are based on databases that may be integrated in the software or where import is possible. They are therefore not based on BIM objects with environmental information contained in them, but on the linking of the elements of a BIM model with the environmental data of a unit of work contained in these databases.

In this respect, we will show two examples of how this linking of BIM models in IFC formats to software with these environmental databases works:

- CYPE module IA-ACV
- CYPE and CSTB: ElodieBIM

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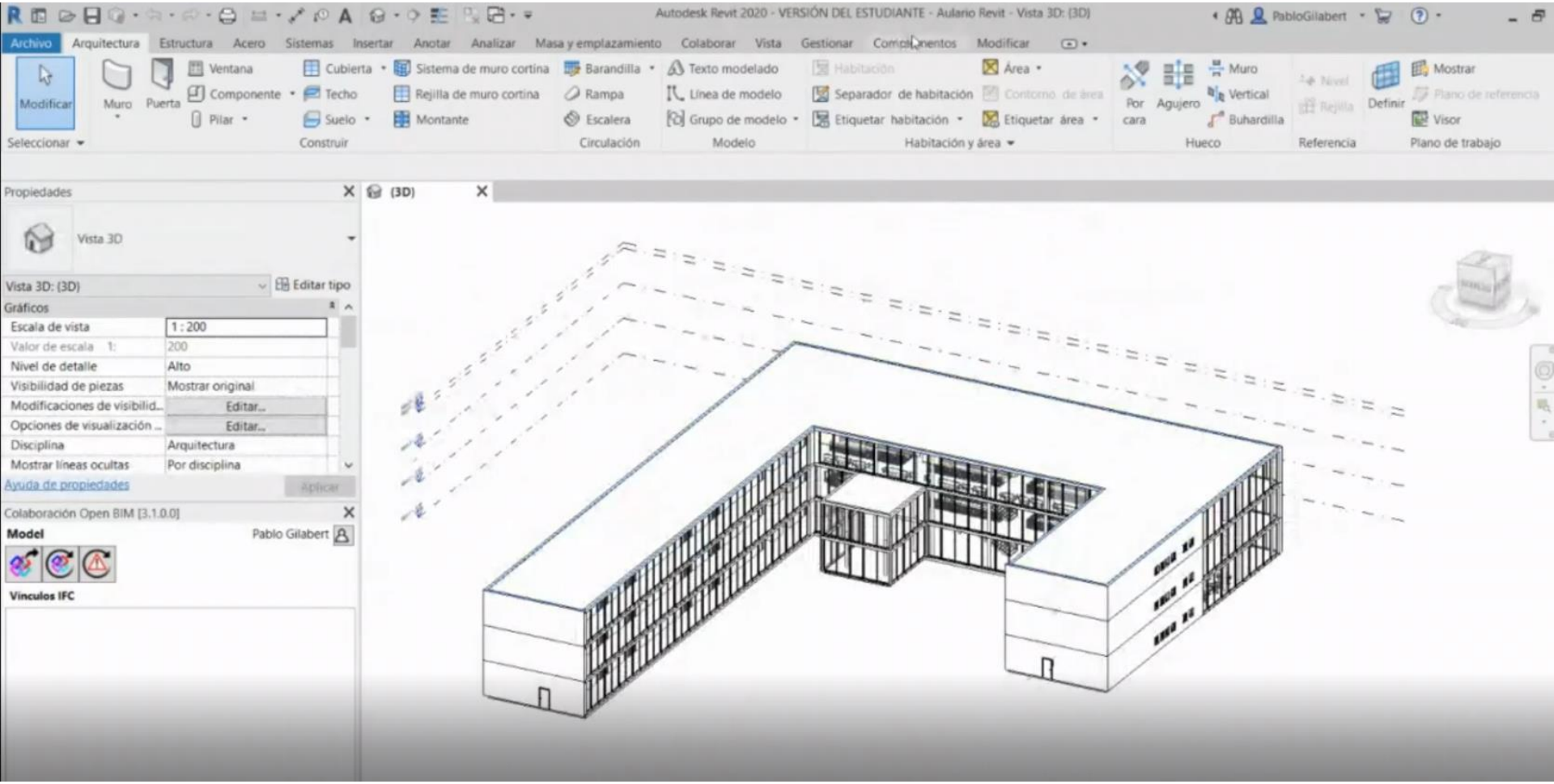
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE module IA-ACV: From Revit to CYPE Arquímedes



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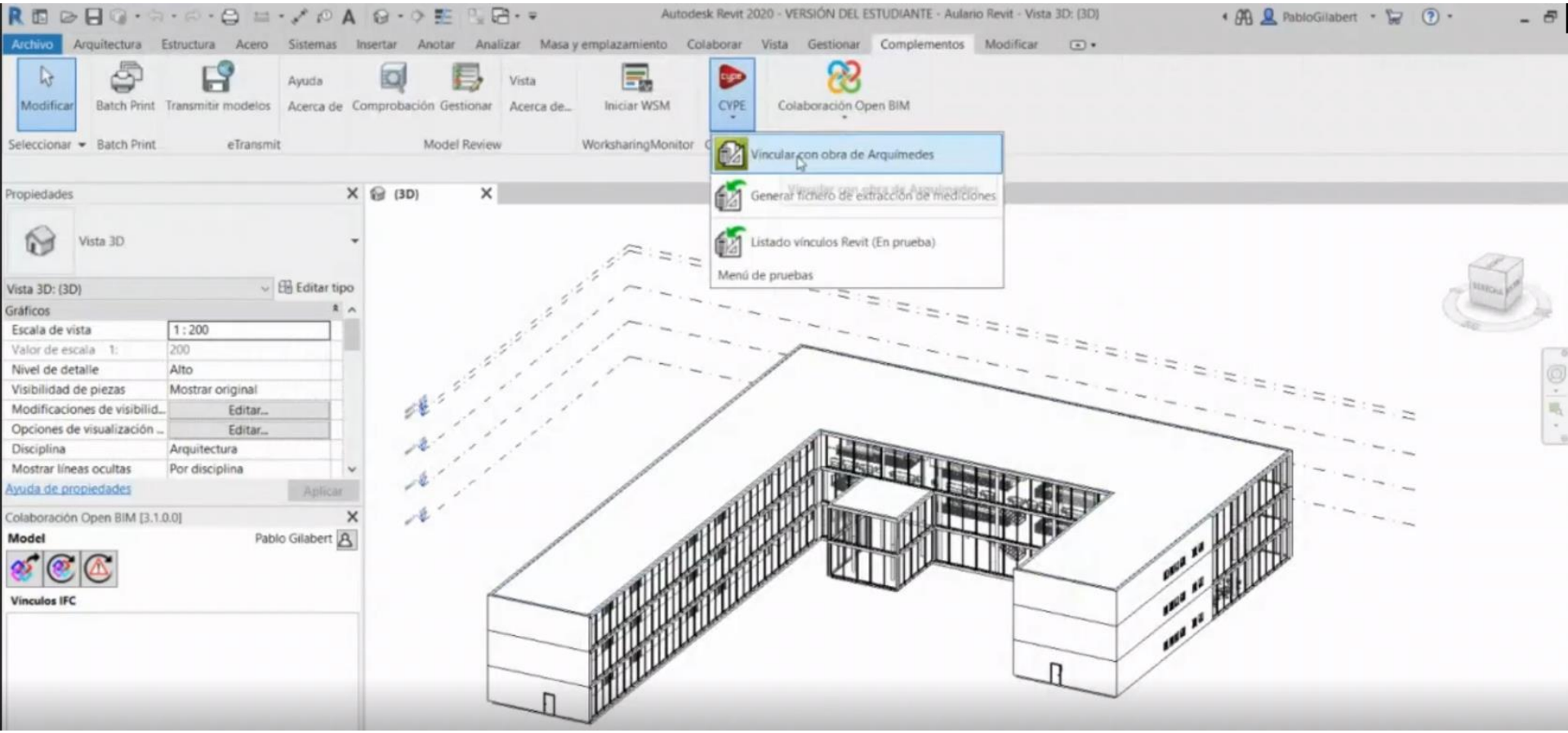
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE module IA-ACV: From Revit to CYPE Arquímedes



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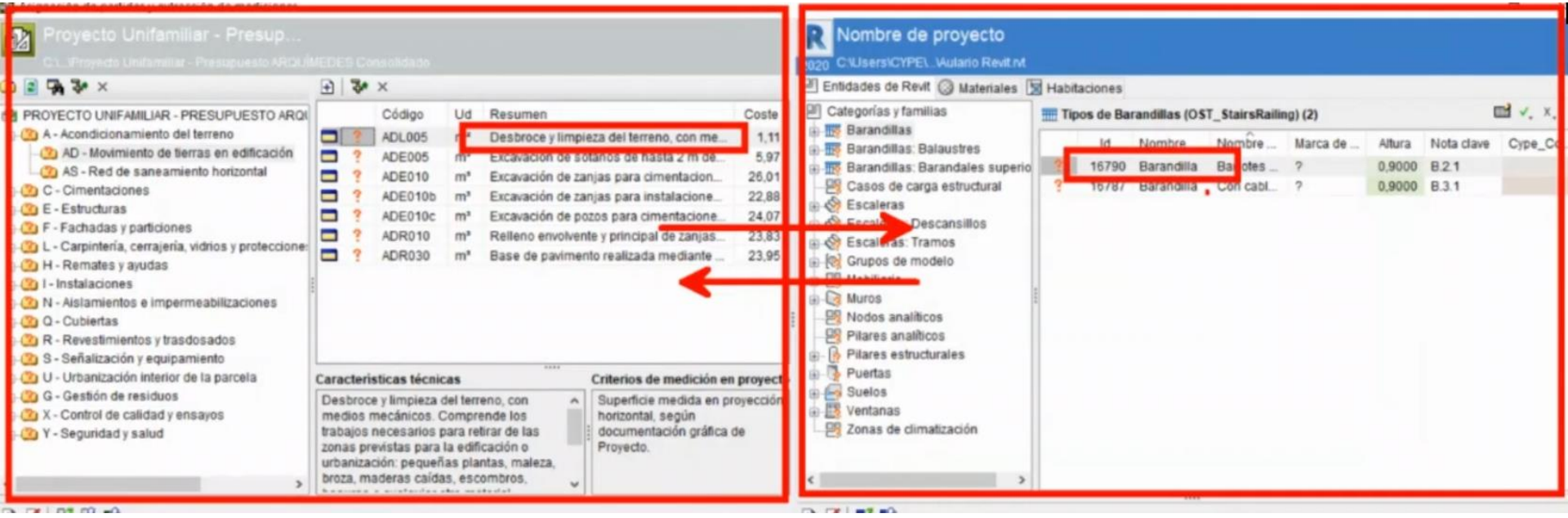
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE module IA-ACV: From Revit to CYPE Arquímedes

From Revit or from a BIM model in IFC format it is possible to link with the work units present in Archimedes. It is also possible to automate this process if the "Key Note" of a model from Revit is properly linked to the Arquímedes database.



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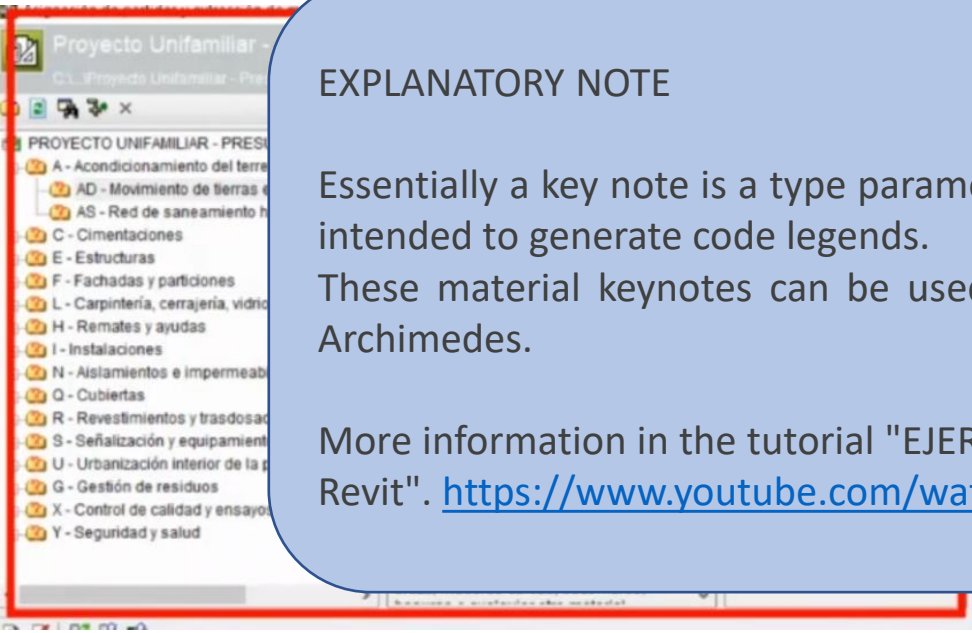

EXPLANATORY NOTE

Essentially a key note is a type parameter that is included in all families, and is originally intended to generate code legends.
These material keynotes can be used to link to the material and work unit codes in Archimedes.

More information in the tutorial "EJERCICIO 1 CYPE Y REVIT Arquímedes y notas clave de Revit". https://www.youtube.com/watch?v=HgjwkHFlv5Q

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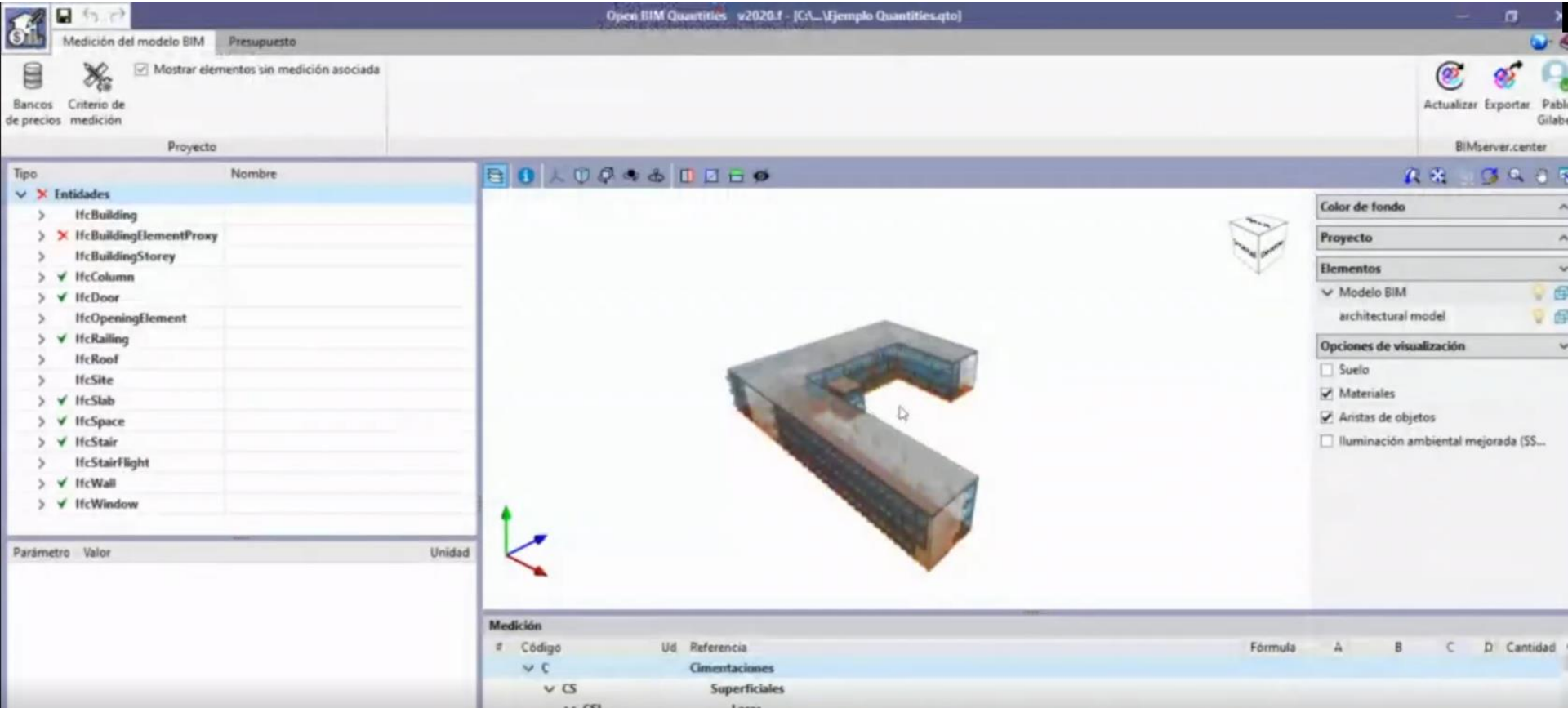
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE IA-ACV module: From Open BIM Quantities to CYPE Arquímedes

It is also possible, for example, to carry out this process from Open BIM Quantities.



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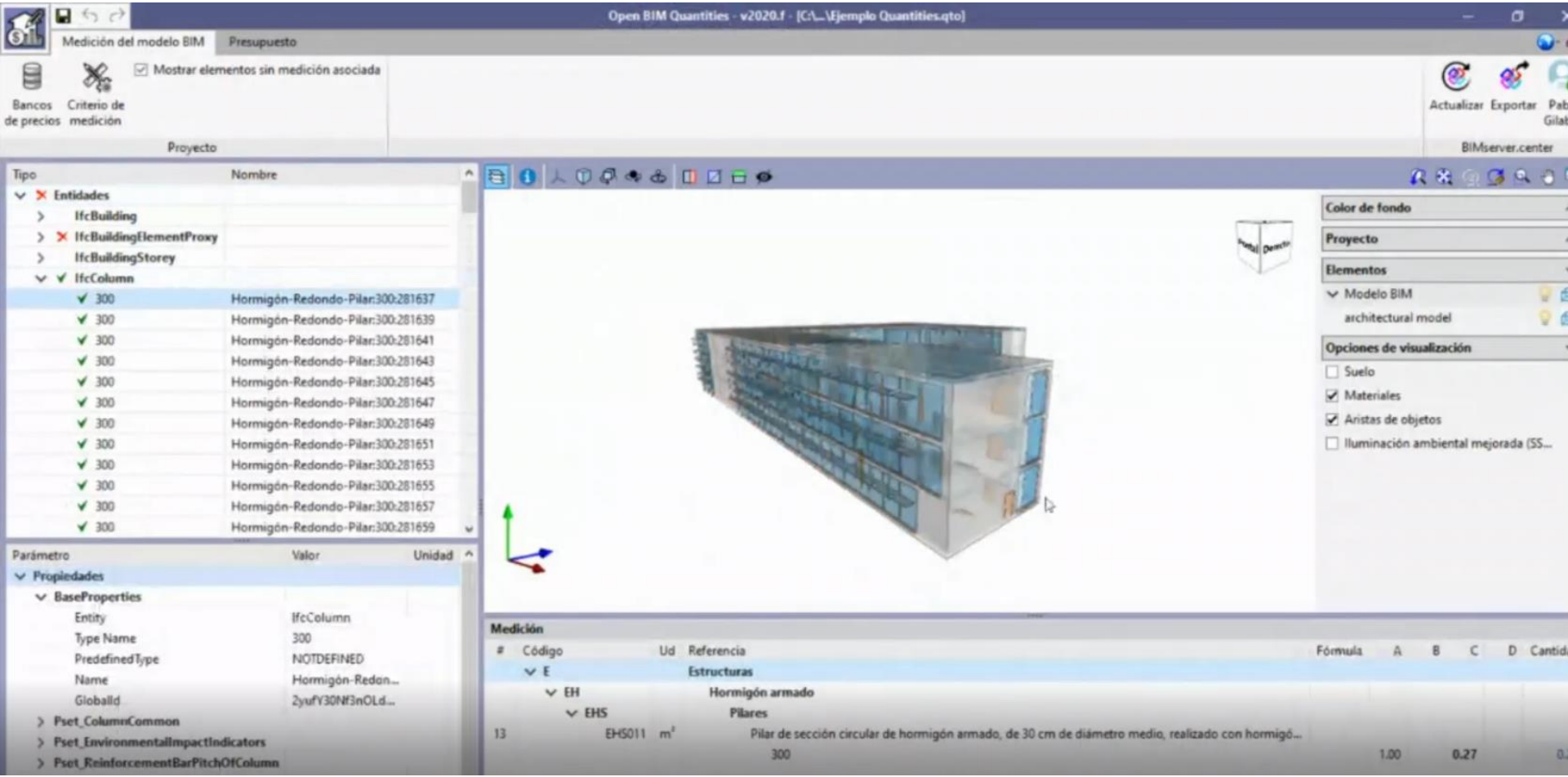
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE IA-ACV module: From Open BIM Quantities to CYPE Arquímedes



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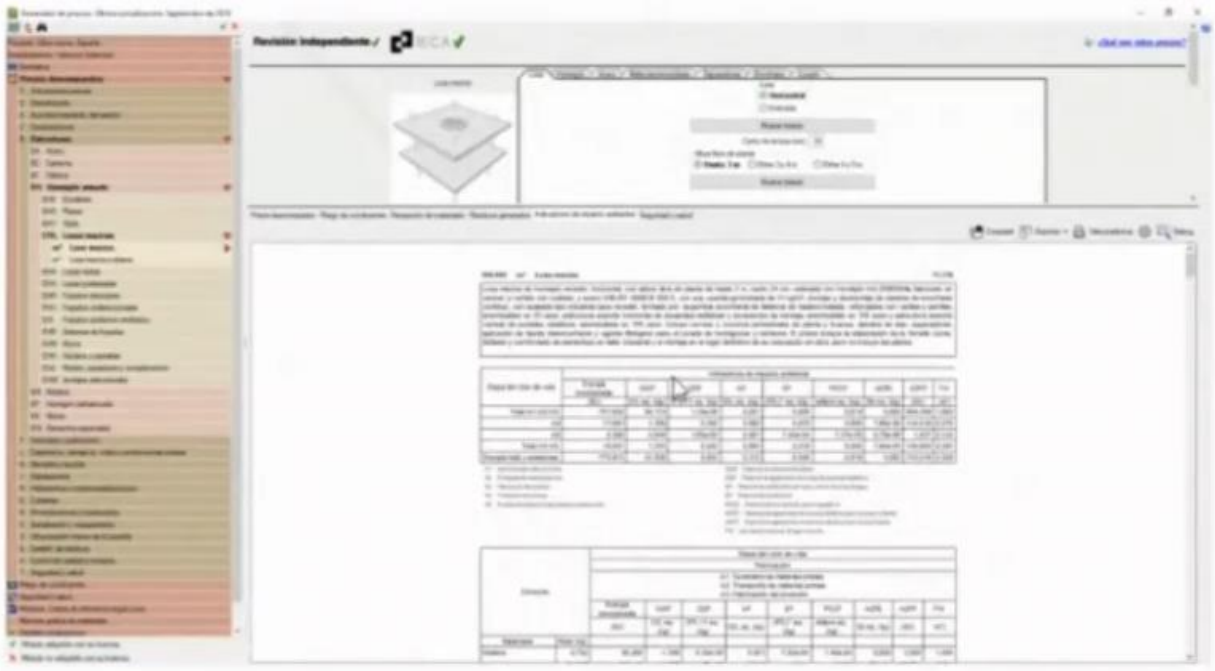
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE module IA-ACV: Arquímedes Price Generator

- Embodied energy. Expressed in MJ
- Global Warming Potential (GWP). Expressed in kg CO2 equivalent
- Stratospheric Ozone Depletion Potential (ODP). Expressed in CFC 11 equivalent
- Soil and Water Acidification Potential (AP). Expressed in kg SO2 equivalent
- Eutrophication Potential (EP). Expressed in kg of (PO4)3-equivalent
- Tropospheric Ozone Formation Potential (TOPP). Expressed in kg ethylene equivalent
- Abiotic Resource Depletion Potential for non-fossil resources (ADPE). Expressed in kg Sb equivalent
- Abiotic Resource Depletion Potential for Fossil Resources (ADFP). Exposed in MJ
- Net water use (FW). Expressed in m3



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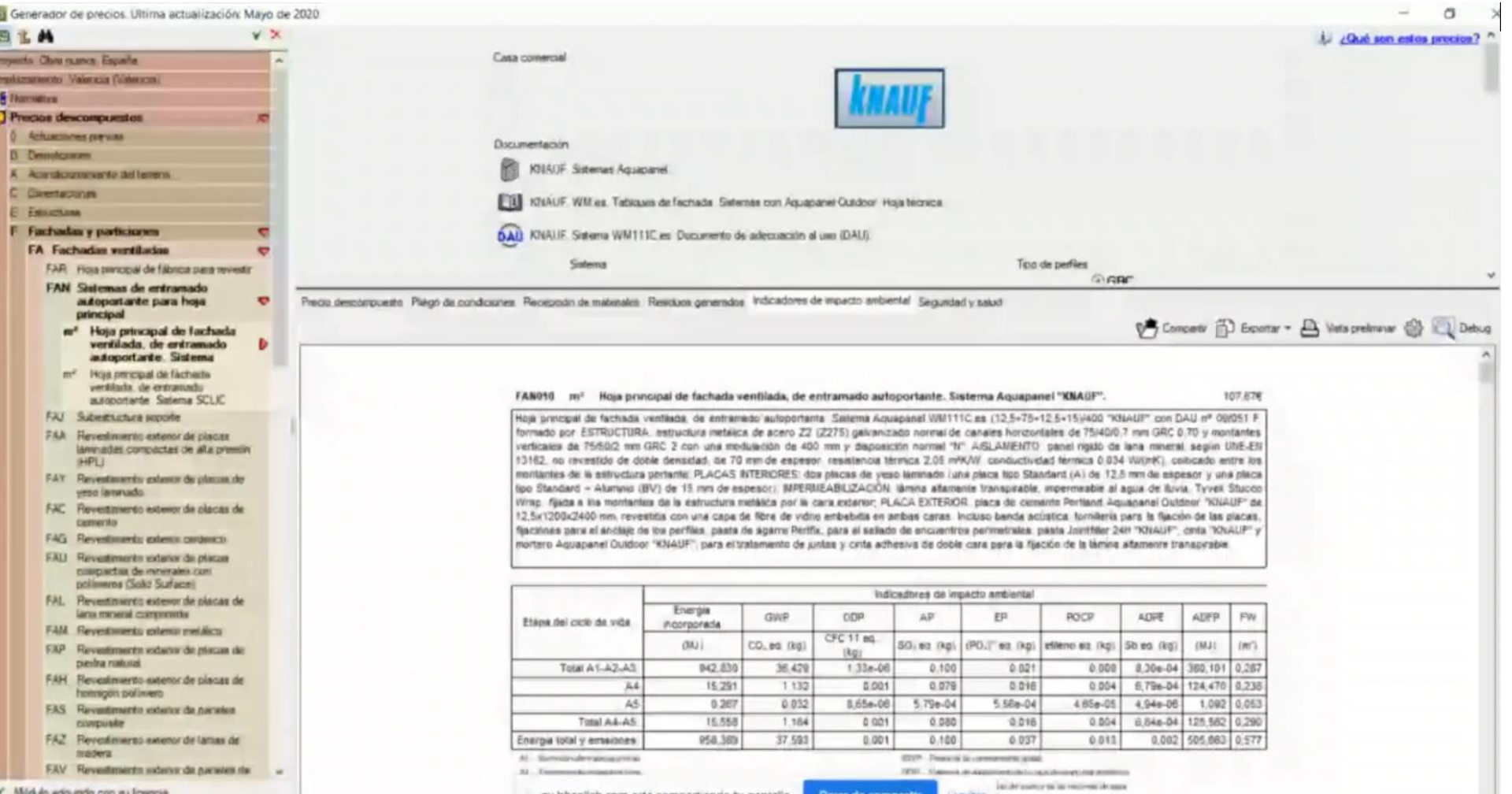
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE module IA-ACV: Arquímedes Price Generator



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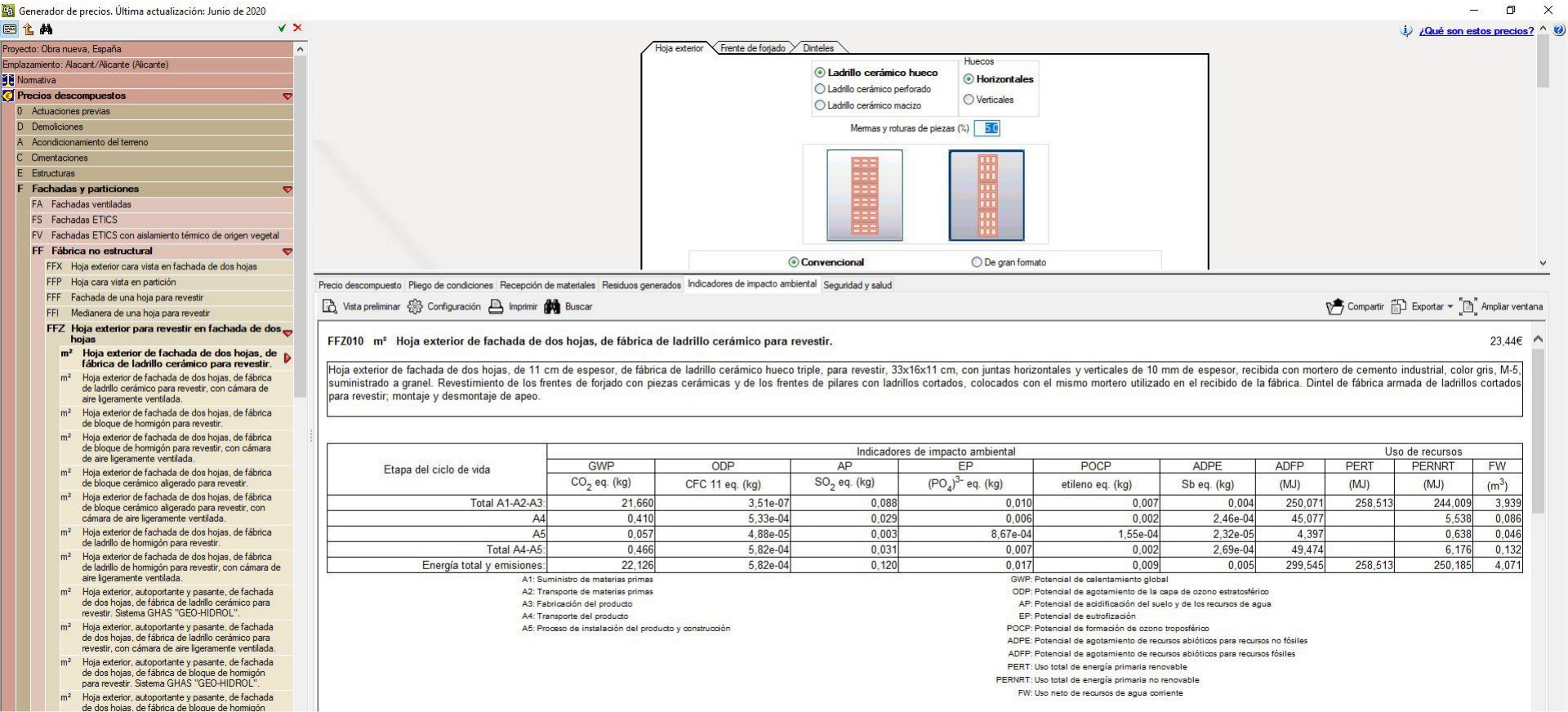

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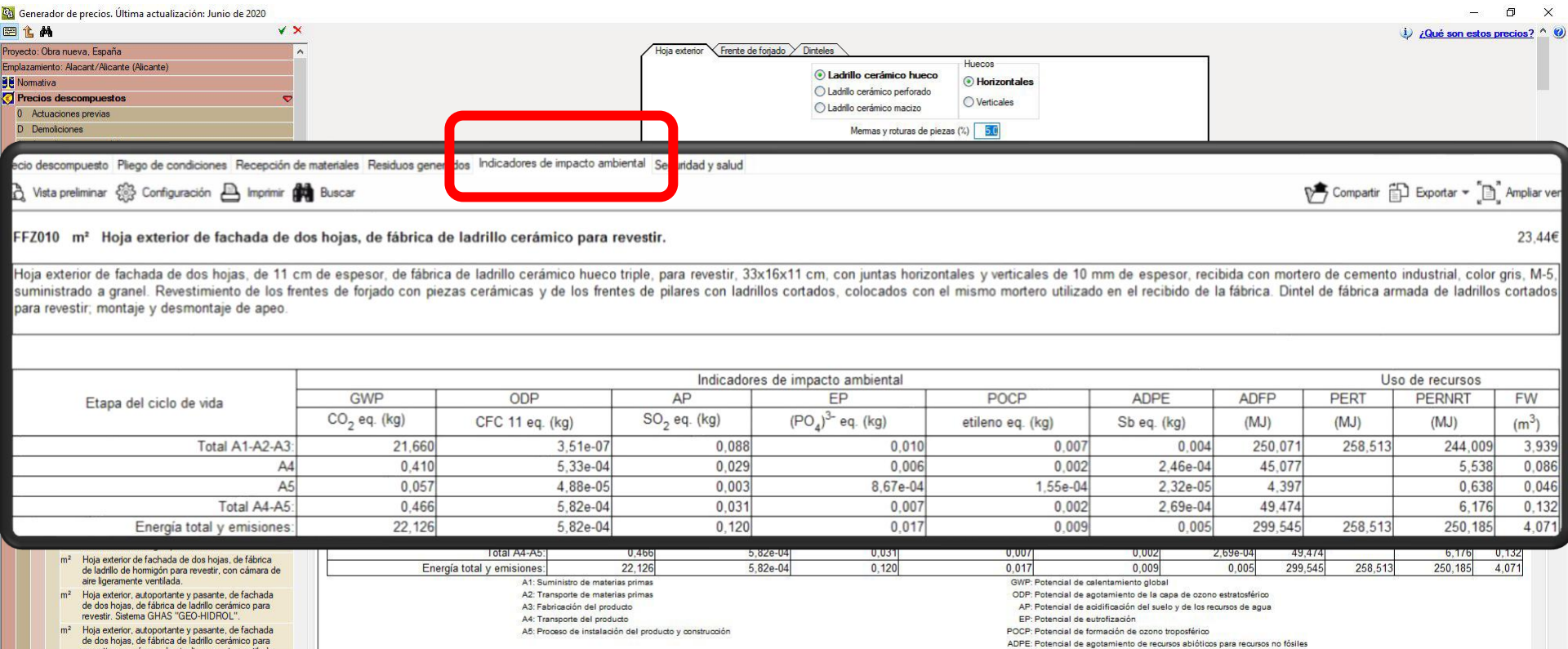
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE module IA-ACV: Arquímedes Price Generator

Once the BIM model has been integrated into Arquímedes, the environmental impact data can be accessed and a complete report from phases A1 to A5 can be obtained.



Etapa del ciclo de vida	Indicadores de impacto ambiental						Uso de recursos			
	GWP	ODP	AP	EP	POCP	ADPE	ADFP	PERT	PERNRT	FW
	CO_2 eq. (kg)	CFC 11 eq. (kg)	SO_2 eq. (kg)	$(PO_4)^{3-}$ eq. (kg)	etileno eq. (kg)	Sb eq. (kg)	(MJ)	(MJ)	(MJ)	(m^3)
Total A1-A2-A3:	21,660	3,51e-07	0,088	0,010	0,007	0,004	250,071	258,513	244,009	3,939
A4	0,410	5,33e-04	0,029	0,006	0,002	2,46e-04	45,077		5,538	0,086
A5	0,057	4,88e-05	0,003	8,67e-04	1,55e-04	2,32e-05	4,397		0,638	0,046
Total A4-A5:	0,466	5,82e-04	0,031	0,007	0,002	2,69e-04	49,474		6,176	0,132
Energía total y emisiones:	22,126	5,82e-04	0,120	0,017	0,009	0,005	299,545	258,513	250,185	4,071

A1: Suministro de materias primas
A2: Transporte de materias primas
A3: Fabricación del producto
A4: Transporte del producto
A5: Proceso de instalación del producto y construcción

GWP: Potencial de calentamiento global
ODP: Potencial de agotamiento de la capa de ozono estratosférico
AP: Potencial de acidificación del suelo y de los recursos de agua
EP: Potencial de eutrofización
POCP: Potencial de formación de ozono troposférico
ADPE: Potencial de agotamiento de recursos abióticos para recursos no fósiles

Module 8

BASED

CYPE modu

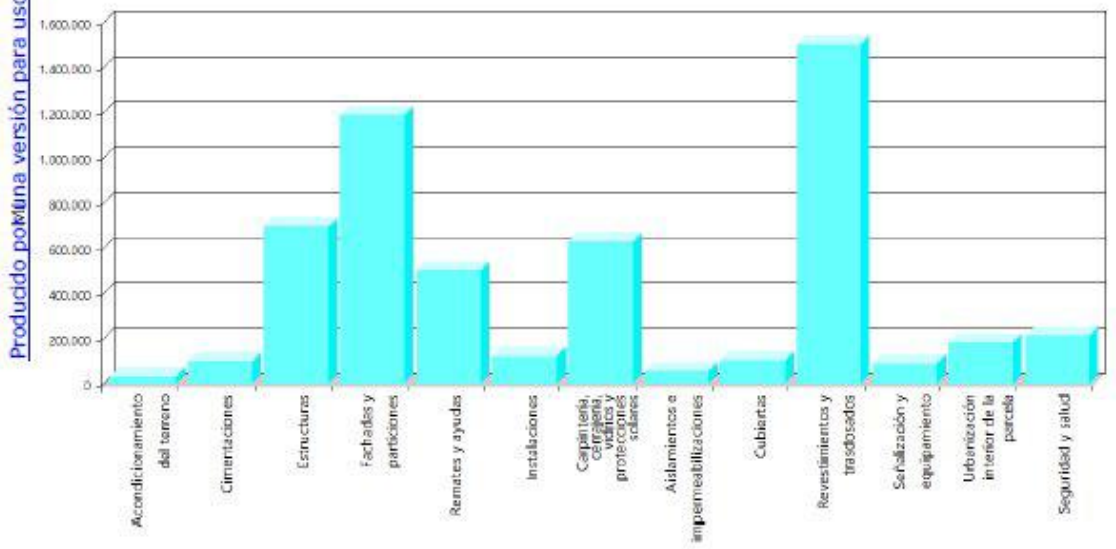
Once the BI
impact data
be obtained

Proyecto:
Situación:
Promotor:

8.8. Uso total de energía primaria renovable. - PERT (MJ)

USO TOTAL DE ENERGÍA PRIMARIA RENOVABLE. (MJ)				
Capítulos	A1-A2-A3 PRODUCTO	A4 TRANSPORTE	A5 CONSTRUCCIÓN	TOTAL
Acondicionamiento del terreno	33.552,93	0,00	0,00	33.552,93
Cimentaciones	99.650,49	0,00	0,00	99.650,49
Estructuras	695.653,37	0,00	0,00	695.653,37
Fachadas y particiones	1.189.485,33	0,00	0,00	1.189.485,33
Remates y ayudas	503.887,22	0,00	0,00	503.887,22
Instalaciones	122.844,74	0,00	0,00	122.844,74
Carpintería, cerrajería, vidrios y protecciones solares	630.304,83	0,00	0,00	630.304,83
Aislamientos e impermeabilizaciones	56.161,00	0,00	0,00	56.161,00
Cubiertas	102.189,60	0,00	0,00	102.189,60
Revestimientos y trasdosados	1.503.016,21	0,00	0,00	1.503.016,21
Señalización y equipamiento	89.989,66	0,00	0,00	89.989,66
Urbanización interior de la parcela	185.750,44	0,00	0,00	185.750,44
Seguridad y salud	213.197,63	0,00	0,00	213.197,63
Total	5.425.683,45	0,00	0,00	5.425.683,45

USO TOTAL DE ENERGÍA PRIMARIA RENOVABLE.



Producido por una versión para uso interno de CYPE

Generador de precios. Última actualización: Junio de 2020
Proyecto: Obra nueva, España
Emplazamiento: Alacant/Alicante (Alicante)
Normativa
Precios descompuestos
0 Actuaciones previas
D Demoliciones
Vista preliminar | Configuración | Imprim
FFZ010 m² Hoja exterior de fachada
Hoja exterior de fachada de dos hojas, de
suministrado a granel. Revestimiento de lo
para revestir; montaje y desmontaje de ape
Etapa del ciclo de vida
Total A1-A2-
Total A4-
Energía total y emision
m² Hoja exterior de fachada de dos hojas, de fábrica de ladrillo de hormigón para revestir, con cámara d aire ligeramente ventilada.
m² Hoja exterior, autoportante y pasante, de fachada de dos hojas, de fábrica de ladrillo cerámico para revestir. Sistema GHAS "GEO-HIDROL".
m² Hoja exterior, autoportante y pasante, de fachada de dos hojas, de fábrica de ladrillo cerámico para

¿Qué son estos precios?
Exportar | Ampliar ver
23,44€
ento industrial, color gris, M-5,
a armada de ladrillos cortados

Uso de recursos	PERNRT (MJ)	FW (m^3)
	244,009	3,939
	5,538	0,086
	0,638	0,046
	6,176	0,132
	250,185	4,071

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BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE module IA-ACV: Arquímedes Price Generator

Recommended video:

Environmental assessment of buildings with the CYPE Price Generator. Torroja Institute TV.

https://www.youtube.com/watch?v=TYoeJjFYhp8

Management I. Arquimedes and Price Generator. CYPE Software.

https://www.youtube.com/watch?v=8xcSaJGv98E

Open BIM add-on for Revit. CYPE Software.

https://www.youtube.com/watch?v=p3_ti0sO_C4

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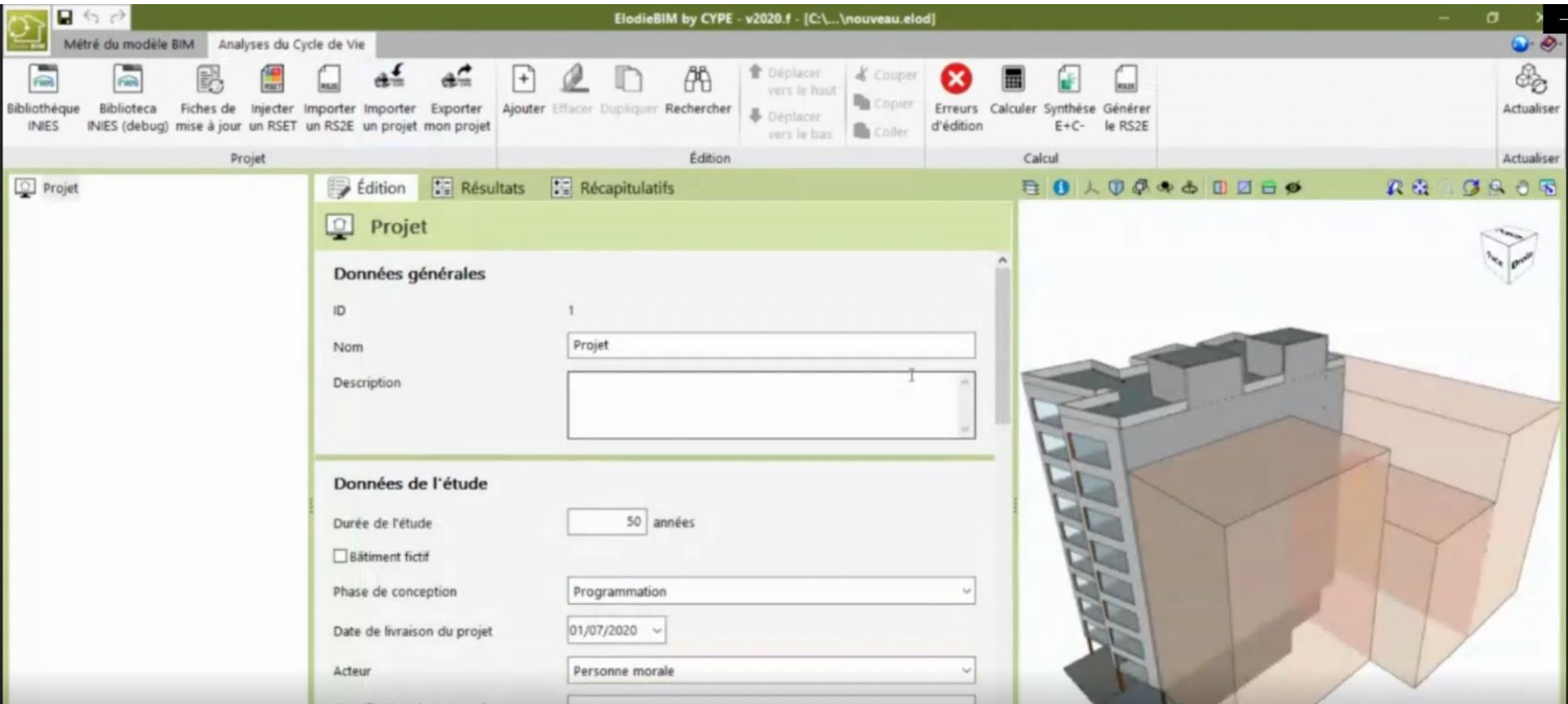
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE and CSTB: ElodieBIM

This software can also import a model into IFC to link its BIM objects to the environmental database contained in the programme.



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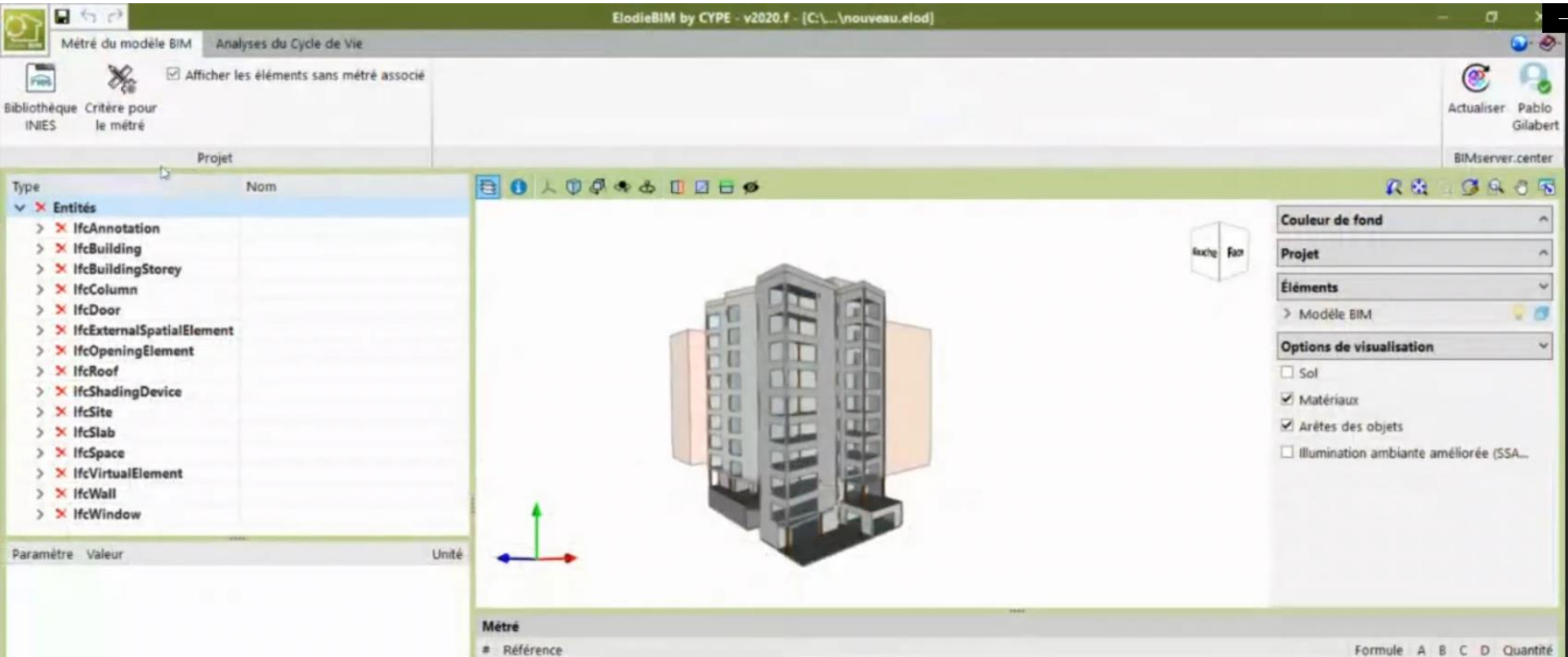
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE and CSTB: ElodieBIM

It allows the Life Cycle Assessment of a building to be calculated in France in response to the needs of professionals who will be obliged to submit a technical report on the life cycle of buildings from 1 January 2021.



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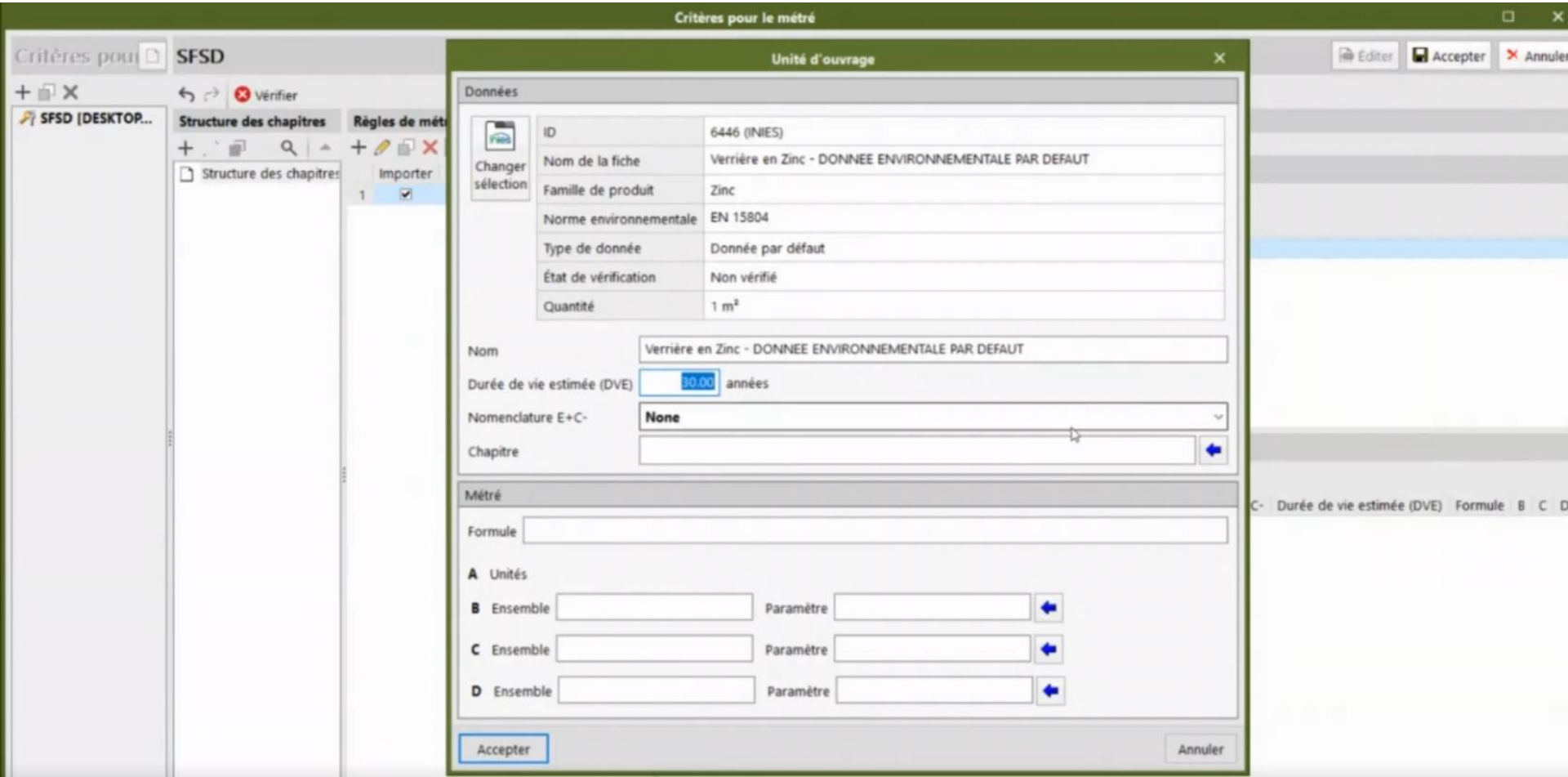

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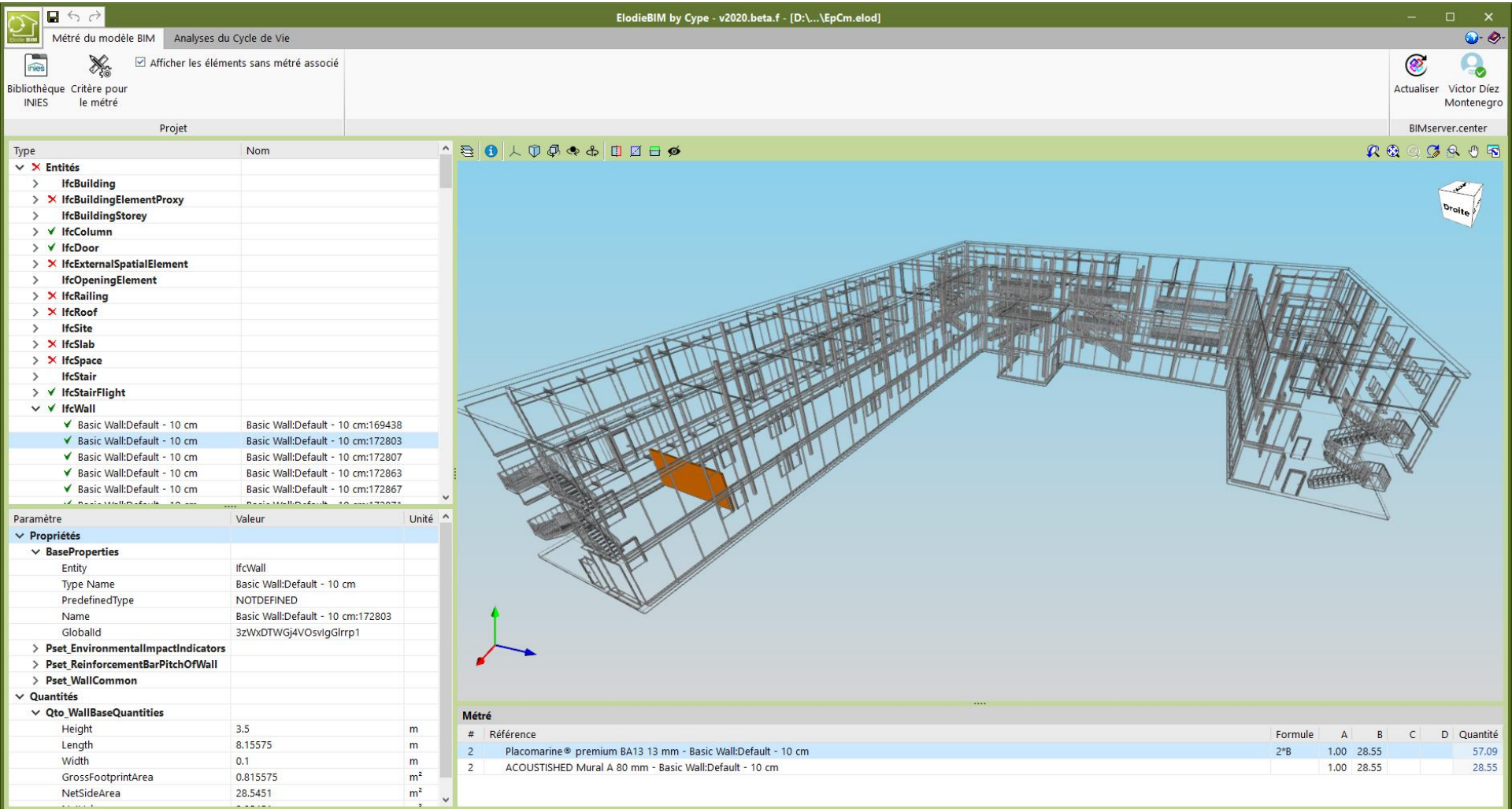

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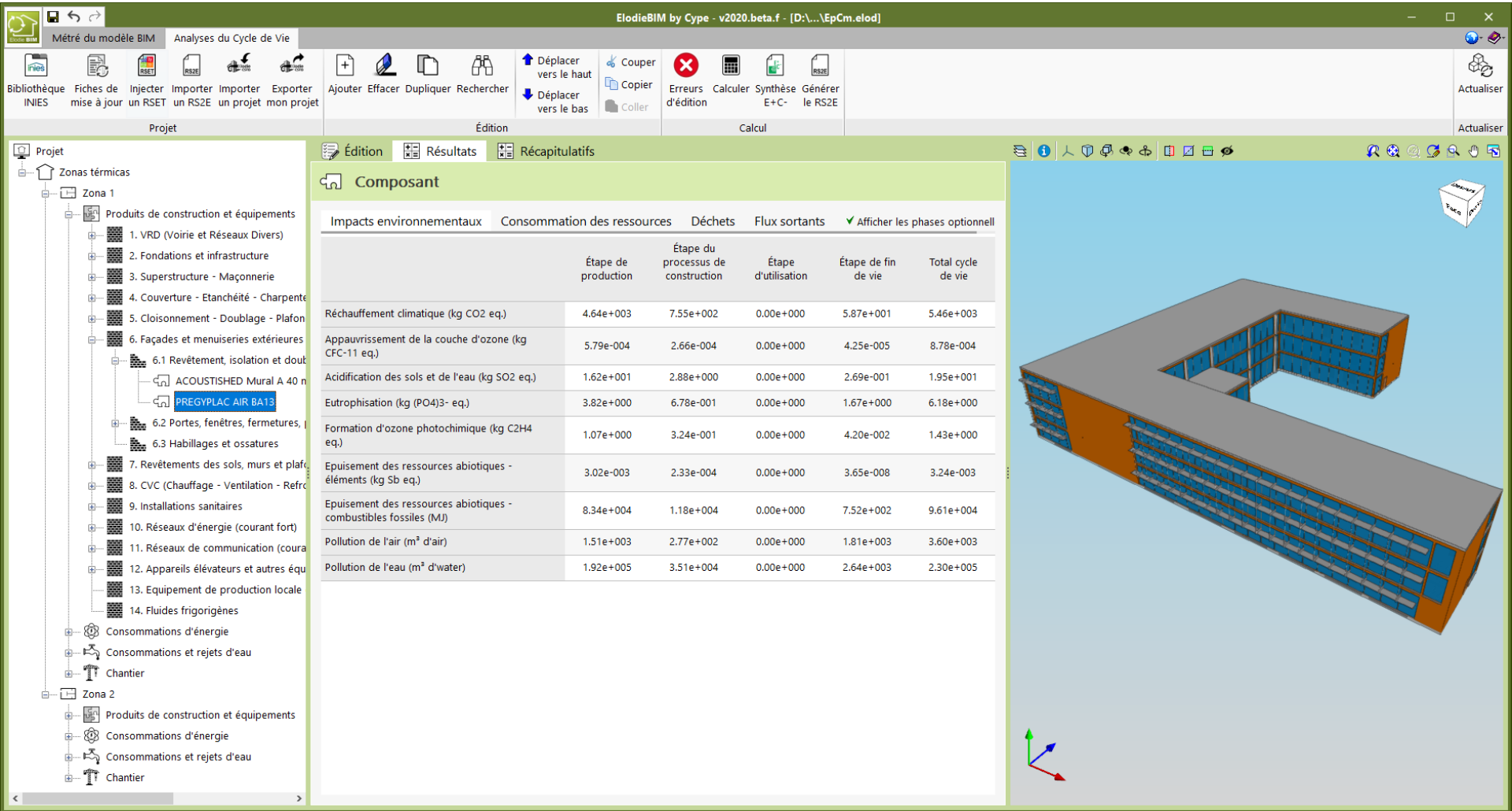

	Étape de production	Étape du processus de construction	Étape d'utilisation	Étape de fin de vie	Total cycle de vie
Réchauffement climatique (kg CO2 eq.)	4.64e+003	7.55e+002	0.00e+000	5.87e+001	5.46e+003
Appauvrissement de la couche d'ozone (kg CFC-11 eq.)	5.79e-004	2.66e-004	0.00e+000	4.25e-005	8.78e-004
Acidification des sols et de l'eau (kg SO2 eq.)	1.62e+001	2.88e+000	0.00e+000	2.69e-001	1.95e+001
Eutrophisation (kg (PO4)3- eq.)	3.82e+000	6.78e-001	0.00e+000	1.67e+000	6.18e+000
Formation d'ozone photochimique (kg C2H4 eq.)	1.07e+000	3.24e-001	0.00e+000	4.20e-002	1.43e+000
Epuisement des ressources abiotiques - éléments (kg Sb eq.)	3.02e-003	2.33e-004	0.00e+000	3.65e-008	3.24e-003
Epuisement des ressources abiotiques - combustibles fossiles (MJ)	8.34e+004	1.18e+004	0.00e+000	7.52e+002	9.61e+004
Pollution de l'air (m^3 d'air)	1.51e+003	2.77e+002	0.00e+000	1.81e+003	3.60e+003
Pollution de l'eau (m^3 d'water)	1.92e+005	3.51e+004	0.00e+000	2.64e+003	2.30e+005

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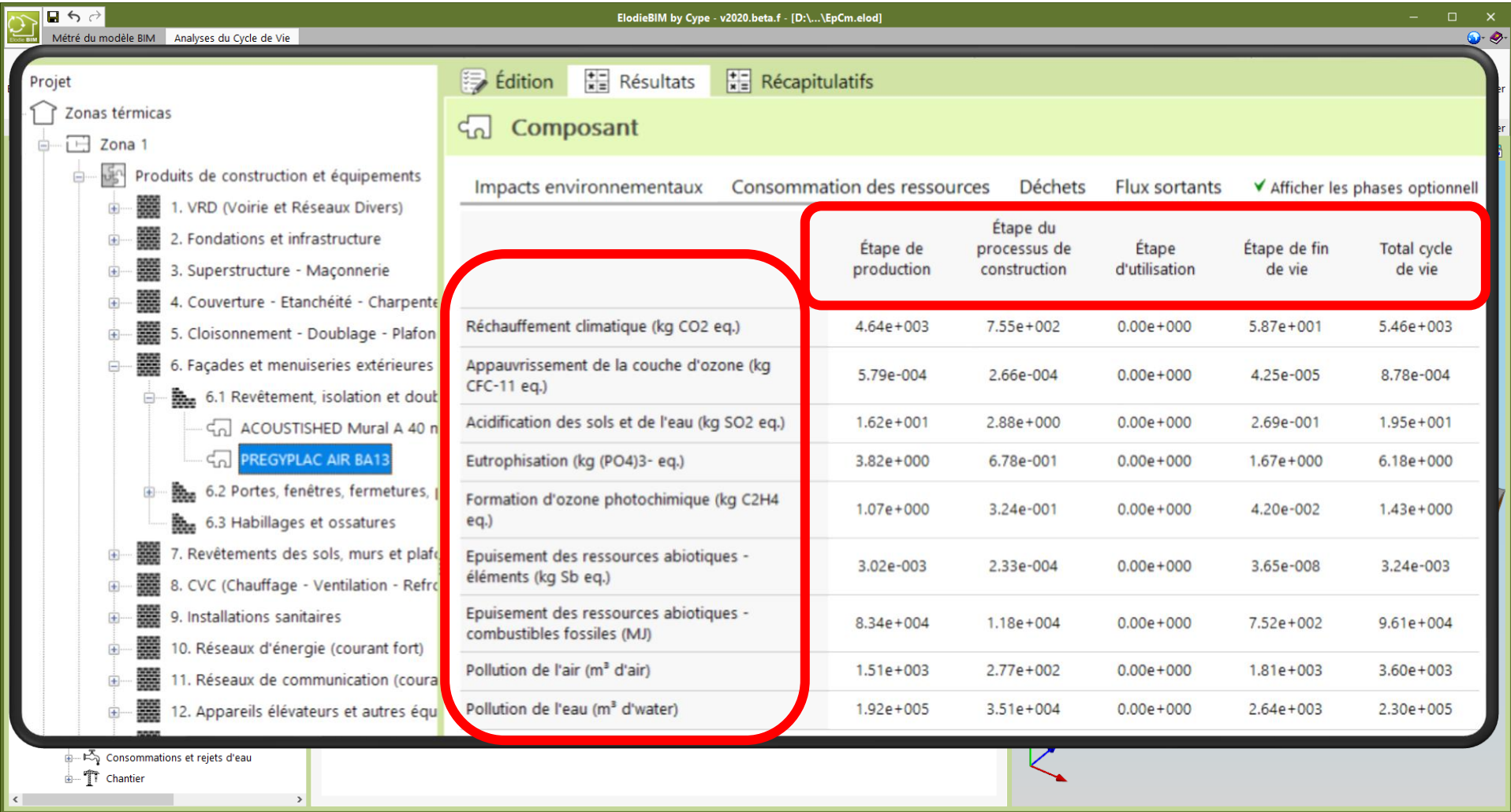
BASED ON SOFTWARE-INTEGRATED DATABASES

CYPE and CSTB: ElodieBIM



	Étape de production	Étape du processus de construction	Étape d'utilisation	Étape de fin de vie	Total cycle de vie
Réchauffement climatique (kg CO2 eq.)	4.64e+003	7.55e+002	0.00e+000	5.87e+001	5.46e+003
Appauvrissement de la couche d'ozone (kg CFC-11 eq.)	5.79e-004	2.66e-004	0.00e+000	4.25e-005	8.78e-004
Acidification des sols et de l'eau (kg SO2 eq.)	1.62e+001	2.88e+000	0.00e+000	2.69e-001	1.95e+001
Eutrophisation (kg (PO4)3- eq.)	3.82e+000	6.78e-001	0.00e+000	1.67e+000	6.18e+000
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Epuisement des ressources abiotiques - éléments (kg Sb eq.)	3.02e-003	2.33e-004	0.00e+000	3.65e-008	3.24e-003
Epuisement des ressources abiotiques - combustibles fossiles (MJ)	8.34e+004	1.18e+004	0.00e+000	7.52e+002	9.61e+004
Pollution de l'air (m^3 d'air)	1.51e+003	2.77e+002	0.00e+000	1.81e+003	3.60e+003
Pollution de l'eau (m^3 d'water)	1.92e+005	3.51e+004	0.00e+000	2.64e+003	2.30e+005

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BASED ON DATA INTEGRATION IN BIM LOD600 OBJECTS

On the other hand, in models of calculation methodologies with software that start with the environmental information contained in BIM objects, would require the development of LOD600, as well as the parameterisation of these BIM objects and their development at LOD400 and LOD500 levels.

Current calculation software based on databases and not on information contained in BIM objects, usually do not allow as much specificity as could be achieved from the customisation of a BIM object, which belongs to a specific manufacturer. These options can be implemented in BIM objects, but it is not something that is currently standardised.

An example of data integration in a BIM object is shown below.

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BASED ON DATA INTEGRATION IN BIM LOD600

Propiedades de tipo

Familia: Familia de sistema: Muro básico — Cargar...

Tipo: Fachada monocapa con cámara de aire — Duplicar...

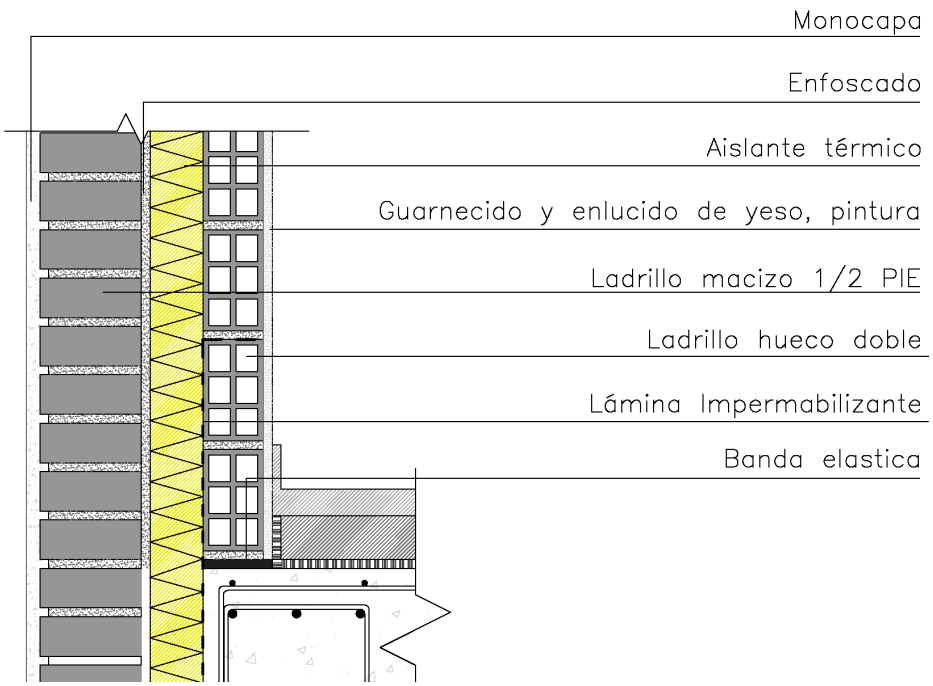
Cambiar nombre...

Parámetros de tipo

Parámetro	Valor
Construcción	
Estructura	Editar...
Envolvente en inserciones	Sin envolvente
Envolvente en extremos	Ninguno
Anchura	0.2850
Función	Exterior
Gráficos	
Patrón de relleno de detalle bajo	
Color de relleno de detalle bajo	Negro
Materiales y acabados	
Material estructural	Ladrillo cerámico perforado
Propiedades analíticas	
Coeficiente de transferencia de calor (U)	0.8333 W/(m²·K)
Resistencia térmica (R)	1.2000 (m²·K)/W
Masa térmica	0.00 kJ/K
Absortancia	0.700000
Aspereza	3
Emisiones de CO2eq (Fases A1-A5)	
Emisiones de CO2eq (Fases B1-B5)	
Emisiones de CO2eq (Fases C1-C4)	
Reciclabilidad	
Reusabilidad	
Datos de identidad	
Imagen de tipo	
Nota clave	
Modelo	
Fabricante	
Comentarios de tipo	
URL	

<< Vista previa — Aceptar — Cancelar — Aplicar

a



Construction diagram of the façade.

Example of integration of environmental impact data into a BIM material from Autodesk Revit.

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BASED ON DATA INTEGRATION IN BIM LOD600 OBJECTS

Based on these BIM object development methodologies we will see in this module those implemented in the projects co-financed by the Erasmus+ programme of the European Union:

- BIMclay.
- BIMstone.

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8.2 BIMclay

DEFINITION OF THE PROJECT

OBJECTIVES

CONSORTIUM AND IMPACT

INTELLECTUAL OUTPUTS

BIMclay RESULTS

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DEFINITION OF THE PROJECT

IMPROVEMENT OF THE ACV SKILLS AND QUALIFICATIONS OF PROFESSIONALS IN THE CERAMICS SECTOR WITH THE SUPPORT OF BIM APPLICATIONS.

- The European associations of the ceramic sector, aimed at solving the demands of their associated companies, put on the table the need to establish common criteria in the placement of their products, as well as to control the environmental impacts derived, due to the great influence of the sector in the construction, providing the product with an added value with the inclusion of information on the impact on the environment.
- The nature of the BIMclay project is the production and development of multimedia materials based on BIM, considering the challenges to be addressed in terms of LCA of clay products, to be used as training material for both vocational training students and professionals in the ceramics sector.

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OBJECTIVES

- To investigate the most suitable and sustainable tile installation methods for the main ceramic products used throughout Europe, analysing the results and selecting the best practices.
- To make available the information gathered on the most appropriate tile installation methodologies for ceramic products on site, differentiated according to product type, use and installation method.
- To develop an interactive BIM tool with an integrated database of the tile installation methods compiled in the research, as well as the different product typologies, uses and main environmental characteristics to be highlighted.
- To promote those tile installation methods that extend the life cycle of ceramic products, especially those that allow a second use according to environmental sustainability criteria.
- To provide a tool to the user for the LCA analysis of ceramic products with the intention of promoting their sustainability.

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CONSORTIUM AND IMPACT

- Associacao Portuguesa da Industria Ceramica – Portugal.
- Centro Tecnologico da Ceramica e do Vidrio – Portugal.
- Hispalyt, Asociación Española de Fabricantes de Ladrillos y Tejas de Arcilla Cocida Spain.
- Asociación Empresarial y de Investigación Centro Tecnológico del Mármol. Piedra y Materiales – Spain.
- Institute of Entrepreneurship and Development – Greece.

APICER associação portuguesa da indústria de cerâmica

CTCV

HISPALYT CERÁMICA PARA CONSTRUIR

Centro Tecnológico del mármol, piedra y materiales

iED institute of Entrepreneurship Development

- Development of a BIM educational tool that promotes a change of mentality and behaviour in the ceramics sector, replicable to other professional sectors, which encourages addressing the environmental challenges demanded by society in the construction sector.

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ITELLECTUAL OUTPUTS

- Establishment of a common Study Plan on methodologies for laying ceramic products, Life Cycle Analysis and current legislation.
- Development of BIMclay Multimedia Materials. New interactive BIM learning methods.
- BIMclay 3D animations.
- Interactive BIM tool.
- BIMclay Online Resource Centre.

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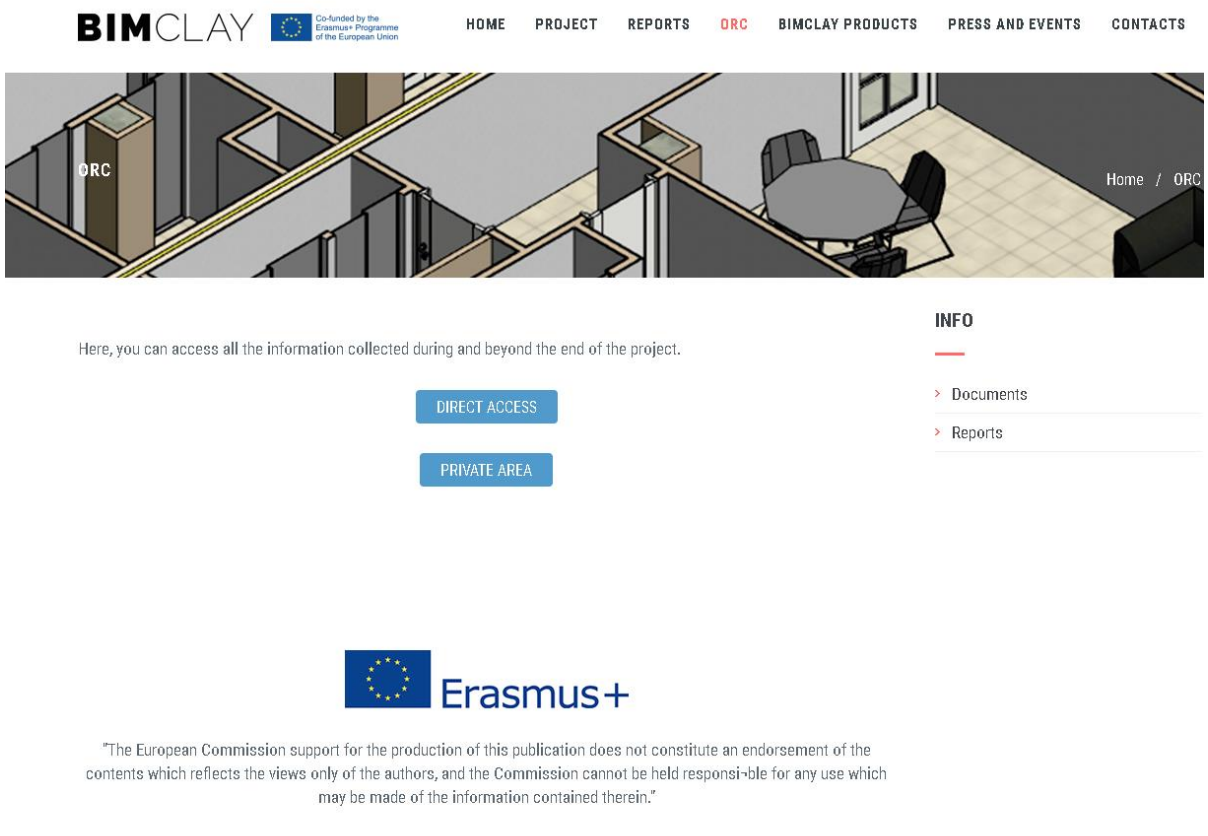
ITELLECTUAL OUTPUTS

O3. OPEN EDUCATIONAL RESOURCE (OER).

The project has a platform for accessing project information.

www.bimclay.eu



ITELLECTUAL OUTPUTS

O1. Establishment of common learning outcomes on fired clay installation methods, life cycle assessment (LCA) and related regulations.

O1/A1. Study on the regulations for the installation of fired clay products.

PORTUGUESE REGULATION REGARDING CLAY PLACING METHODS

NP EN 15037-3:2009+A1:2013. Produtos pre-fabricados em betão. Sistemas de pisos com vigas e blocos. Parte 3: Abobadilhas cerâmicas	EN 15037-3:2010+A1:2011. Precast concrete products - Beam-and-block floor systems - Part 3: Clay blocks
NP EN 1304:2007. Telhas cerâmicas e acessórios – Definições e especificações dos produtos	EN 1304:2013. Clay roofing tiles and fittings - Product definitions and specifications.
NP EN 771-1:2011+A1:2015. Especificações para unidades de alvenaria. Parte 1: Unidades cerâmicas (tijolos cerâmicos)	EN 771-1:2011+A1:2015. Specification for masonry units - Part 1: Clay masonry units.
-	EN 845-1:2013+A1:2016. Specification for ancillary components for masonry - Part 1: Wall ties, tension straps, hangers and brackets
NP EN 1344:2016. Blocos cerâmicos para pavimento. Especificações e métodos de ensaio	EN 1344:2013+AC:2015. Clay pavers - Requirements and test methods.
NP EN 14411:2015. Pavimentos e revestimentos cerâmicos. Definições, classificação, características, avaliação da conformidade e marcação	EN 14411:2012. Ceramic tiles - Definitions, classification, characteristics, evaluation of conformity and marking.
-	EN 14411:2016. Ceramic tiles - Definition, classification, characteristics, assessment and verification of constancy of performance and marking.
-	EN 16578:2016. Ceramics sanitary appliances - Sustainability assessment.
NP EN 12004-1:2017. Colas para ladrilhos. Parte 1: Requisitos, avaliação e verificação da regularidade do desempenho, classificação e marcação	EN 12004-1:2017. Adhesives for ceramic tiles - Part 1: Requirements, assessment and verification of constancy of performance, classification and marking.
-	EN 12004-2:2017. Adhesives for ceramic tiles - Part 2: Test methods.
-	EN 13888:2009. Grout for tiles - Requirements, evaluation of conformity, classification and designation
NP EN 998-1:2013. Especificação de argamassas para alvenarias. Parte 1: Argamassas para reboco interiores e exteriores	EN 998-1:2016. Specification for mortar for masonry – Parte 1: Rendering and plastering mortar
NP EN 998-2:2017. Especificação de argamassas para alvenarias. Parte 2: Argamassas de assentamento	EN 998-2:2016. Specification for mortar for masonry – Parte 1: Masonry mortar

SPANISH REGULATION REGARDING CLAY PLACING METHODS

REAL DECRETO 314/2006, de 17 de marzo, por el que se aprueba el Código Técnico de la Edificación.	ROYAL DECREE 314/2006, of March 17, which approves the Technical Building Code
UNE-EN 15037-3:2010+A1:2011. Productos prefabricados de hormigón. Sistemas de forjado de vigueta y bovedilla. Parte 3: Bovedillas de arcilla cocida.	UNE-EN 15037-3:2010+A1:2011. Precast concrete products - Beam-and-block floor systems - Part 3: Clay blocks
UNE 67041:1988. Tableros cerámicos de arcilla cocida para cubiertas. Declaración y especificaciones.	UNE 67041:1988. Ceramic slabs of burned clay for covering. Designation and technical characteristics.
UNE-EN 1304:2014. Tejas y piezas auxiliares de arcilla cocida. Definiciones y especificaciones de productos.	UNE-EN 1304:2014. Clay roofing tiles and fittings - Product definitions and specifications.
UNE-EN 771-1:2011+A1:2016. Especificaciones de piezas para fábrica de albañilería. Parte 1: Piezas de arcilla cocida.	UNE-EN 771-1:2011+A1:2016. Specification for masonry units - Part 1: Clay masonry units.
UNE-EN 845-1:2014. Especificación de componentes auxiliares para fábricas de albañilería. Parte 1: Llaves, flejes, estribos y ménsulas.	UNE-EN 845-1:2014. Specification for ancillary components for masonry - Part 1: Wall ties, tension straps, hangers and brackets
UNE-EN 1344:2015. Adoquines de arcilla cocida. Especificaciones y métodos de ensayo.	UNE-EN 1344:2015. Clay pavers - Requirements and test methods.
UNE-EN 14411:2013. Baldosas cerámicas. Definiciones, clasificación, características, evaluación de la conformidad y marcado.	UNE-EN 14411:2013. Ceramic tiles - Definitions, classification, characteristics, evaluation of conformity and marking.
UNE-EN 14411:2016. Baldosas cerámicas. Definiciones, clasificación, características, evaluación y verificación de la constancia de las prestaciones, y marcado.	UNE-EN 14411:2016. Ceramic tiles - Definition, classification, characteristics, assessment and verification of constancy of performance and marking.
UNE 136020:2004. Tejas cerámicas. Código de práctica para el diseño y el montaje de cubiertas con tejas cerámicas.	UNE 136020:2004. Clay roofing tiles. Code of practice for the design and fixing of roofs with clay roofing tiles.

GREEK REGULATION REGARDING CLAY PLACING METHODS

ΕΤΕΠ ΕΛΟΤ ΤΠ 1501-03-02-02-00:2009. Τούβλα από αποπλυθούς	ETEP ELOT TP 1501-03-02-02-00:2009. Clay bricks masonry
ΕΤΕΠ ΕΛΟΤ ΤΠ 1501-03-05-01-00. Επικεραμώσεις στεγών.	ETEP ELOT TP 1501-03-05-01-00. Roof coverings with clay roofing tiles.
ΕΤΕΠ ΕΛΟΤ ΤΠ 1501- 03-06-02-03. Θερμομονώσεις κεραμοσκεπών στεγών.	ETEP ELOT TP 1501- 03-06-02-03. Thermal insulation of clay roofing tiles
ΕΤΕΠ ΕΛΟΤ ΤΠ 1501- 08-05-03-01. Υπόστρωμα στεγανοποίησης λιμνοδεξαμενών και ΧΥΤΑ από αργιλικά υλικά	ETEP ELOT TP 1501- 08-05-03-01. Clay barrier liners for ponds and landfills
ΕΤΕΠ ΕΛΟΤ ΤΠ 1501- 03-07-02-00. Επενδύσεις με κεραμικά πλακίδια, εσωτερικές και εξωτερικές.	ETEP ELOT TP 1501- 03-07-02-00Ceramic tiles covering of indoor and outdoor surfaces.
ΕΤΕΠ ΕΛΟΤ ΤΠ 1501- 08-05-02-04. Ξέρόβιστη αρμών κατασκευών από σκυρόδεμα με ασφαλτικές μαστίχες	ETEP ELOT TP 1501- 08-05-02-04. Concrete structures joint sealing using asphaltic mastics
ΕΛΟΤ ΕΝ 772-1. Μέθοδοι δοκιμής στοιχείων τοιχοποίας - Μέρος 1. Προσδιορισμός της αντοχής σε θλίψη.	ELOT EN 772-1. Methods of test for masonry units.- Part 1: Determination of compressive strength
ΕΛΟΤ ΕΝ 998-1. Προδιαγραφή κονιαμάτων τοιχοποίας – Μέρος 1: Κονιάματα επιπλάστωσης	ELOT EN 998-1. Specification for mortar for masonry – Part 1: Rendering and plastering mortar.
ΕΛΟΤ ΕΝ 998-2 Ε2. Προδιαγραφή κονιαμάτων τοιχοποίας – Μέρος 2: Κονιάματα τοιχοποίας	ELOT EN 998-2 E2. Specification for mortar for masonry - Part 2: Masonry mortar.
ΕΛΟΤ ΕΝ 1052-3. Προδιαγραφή κονιαμάτων τοιχοποίας – Μέρος 3: Προσδιορισμός της αρχικής αντοχής σε διάτμηση	ELOT EN 1052-3. Methods of test for masonry – Part 3: Determination of initial shear strength.
ΕΛΟΤ ΕΝ 1015-11. Μέθοδοι δοκιμής κονιαμάτων τοιχοποίας – Μέρος 11: Προσδιορισμός της αντοχής σε κάμψη και θλίψη σκληρυμένου κονιάματος.	ELOT EN 1015-11. Methods of test for mortar for masonry - Part 11: Determination of flexural and compressive strength of hardened mortar.

DIRECTIVE 2011/92/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment	DIRECTIVA 2011/92/UE DO PARLAMENTO EUROPEU E DO CONSELHO de 13 de dezembro de 2011 relativa à avaliação dos efeitos de determinados projectos públicos e privados no ambiente	ΟΔΗΓΙΑ 2011/92/ΕΕ ΤΟΥ ΕΥΡΩΠΑΪΚΟΥ ΚΟΙΝΟΒΟΥΛΙΟΥ ΚΑΙ ΤΟΥ ΣΥΜΒΟΥΛΙΟΥ της 13ης Δεκεμβρίου 2011 για την εκτίμηση των επιπτώσεων ορισμένων σχεδίων δημοσίων και ιδιωτικών έργων στο περιβάλλον	DIRECTIVA 2011/92/UE DO PARLAMENTO EUROPEU E DO CONSELHO de 13 de dezembro de 2011 relativa à avaliação dos efeitos de determinados projectos públicos e privados no ambiente
REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC	REGULAMENTO (UE) N.o 305/2011 DO PARLAMENTO EUROPEU E DO CONSELHO de 9 de Março de 2011 que estabelece condições harmonizadas para a comercialização dos produtos de construção e que revoga a Directiva 89/106/CEE do Conselho	ΚΑΝΟΝΙΣΜΟΣ (ΕΕ) αριθ. 305/2011 ΤΟΥ ΕΥΡΩΠΑΪΚΟΥ ΚΟΙΝΟΒΟΥΛΙΟΥ ΚΑΙ ΤΟΥ ΣΥΜΒΟΥΛΙΟΥ της 9ης Μαρτίου 2011 για τη θέσπιση εναρμονισμένων όρων εμπορίας προϊόντων του τομέα των δομικών κατασκευών και για την κατάργηση της οδηγίας 89/106/ΕΟΚ του Συμβουλίου	REGULAMENTO (UE) N.o 305/2011 DO PARLAMENTO EUROPEU E DO CONSELHO de 9 de Março de 2011 que estabelece condições harmonizadas para a comercialização dos produtos de construção e que revoga a Directiva 89/106/CEE do Conselho
DIRECTIVE (EU) 2016/2284 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC	DIRETIVA (UE) 2016/2284 DO PARLAMENTO EUROPEU E DO CONSELHO de 14 de dezembro de 2016 relativa à redução das emissões nacionais de certos poluentes atmosféricos, que altera a Diretiva 2003/35/CE e revoga a Diretiva 2001/81/CE	ΟΔΗΓΙΑ (ΕΕ) 2016/2284 ΤΟΥ ΕΥΡΩΠΑΪΚΟΥ ΚΟΙΝΟΒΟΥΛΙΟΥ ΚΑΙ ΤΟΥ ΣΥΜΒΟΥΛΙΟΥ της 14ης Δεκεμβρίου 2016 σχετικά με τη μείωση των εθνικών εκπομπών ορισμένων ατμοσφαιρικών ρύπων, την τροποποίηση της οδηγίας 2003/35/ΕΚ και την κατάργηση της οδηγίας 2001/81/ΕΚ	DIRETIVA (UE) 2016/2284 DO PARLAMENTO EUROPEU E DO CONSELHO de 14 de dezembro de 2016 relativa à redução das emissões nacionais de certos poluentes atmosféricos, que altera a Diretiva 2003/35/CE e revoga a Diretiva 2001/81/CE
REGULATION (EU) No 525/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 May 2013 on a	REGULAMENTO (UE) N.o 525/2013 DO PARLAMENTO EUROPEU E DO CONSELHO de 21 de maio de 2013 relativo à criação de um	ΚΑΝΟΝΙΣΜΟΣ (ΕΕ) αριθ. 525/2013 ΤΟΥ ΕΥΡΩΠΑΪΚΟΥ ΚΟΙΝΟΒΟΥΛΙΟΥ ΚΑΙ ΤΟΥ ΣΥΜΒΟΥΛΙΟΥ της 21ης	REGULAMENTO (UE) N.o 525/2013 DO PARLAMENTO EUROPEU E DO CONSELHO de 21 de maio de 2013 relativo à criação de um

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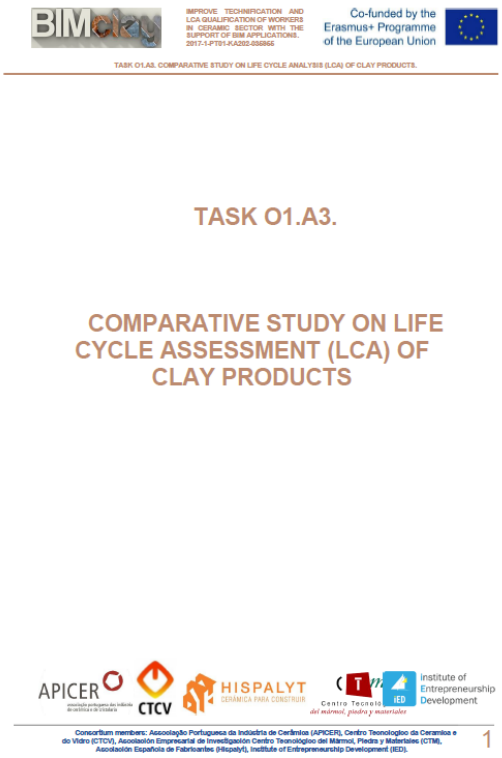
ITELLECTUAL OUTPUTS

O1. Establishment of common learning outcomes on fired clay installation methods, life cycle assessment (LCA) and related regulations.

O1/A3. Comparative study on Life Cycle Assessment (LCA) of fired clay products in the participating countries.



BIMclay

IMPROVE TECHNIFICATION AND LCA QUALIFICATION OF WORKERS IN CERAMIC SECTOR WITH THE SUPPORT OF BIM APPLICATIONS. 2017-1-PT01-KA202-036866

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TASK O1.A3. COMPARATIVE STUDY ON LIFE CYCLE ANALYSIS (LCA) OF CLAY PRODUCTS.

TASK O1.A3.

COMPARATIVE STUDY ON LIFE CYCLE ASSESSMENT (LCA) OF CLAY PRODUCTS

APICER CTCV HISPALYT CERÁMICA PARA CONSTRUIR CTM Centro Tecnológico del mármol, piedra y materiales IED Institute of Entrepreneurship Development

Consortium members: Associação Portuguesa da Indústria de Cerâmica (APICER), Centro Tecnológico da Cerâmica e do Vidro (CTCV), Asociación Empresarial de Investigación Centro Tecnológico del Mármol, Piedra y Materiales (CTM), Asociación Española de Fabricantes (Hispalyt), Institute of Entrepreneurship Development (IED).

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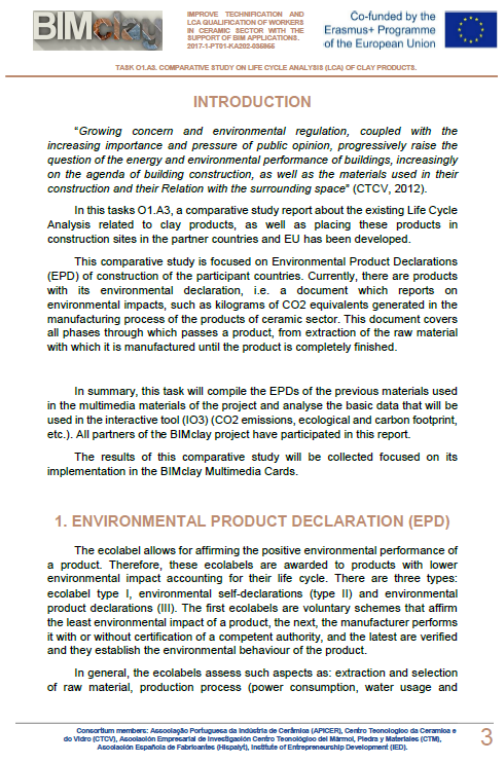

BIMclay

IMPROVE TECHNIFICATION AND LCA QUALIFICATION OF WORKERS IN CERAMIC SECTOR WITH THE SUPPORT OF BIM APPLICATIONS. 2017-1-PT01-KA202-036866

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TASK O1.A3. COMPARATIVE STUDY ON LIFE CYCLE ANALYSIS (LCA) OF CLAY PRODUCTS.

INTRODUCTION

"Growing concern and environmental regulation, coupled with the increasing importance and pressure of public opinion, progressively raise the question of the energy and environmental performance of buildings, increasingly on the agenda of building construction, as well as the materials used in their construction and their Relation with the surrounding space" (CTCV, 2012).

In this tasks O1.A3, a comparative study report about the existing Life Cycle Analysis related to clay products, as well as placing these products in construction sites in the partner countries and EU has been developed.

This comparative study is focused on Environmental Product Declarations (EPD) of construction of the participant countries. Currently, there are products with its environmental declaration, i.e. a document which reports on environmental impacts, such as kilograms of CO2 equivalents generated in the manufacturing process of the products of ceramic sector. This document covers all phases through which passes a product, from extraction of the raw material with which it is manufactured until the product is completely finished.

In summary, this task will compile the EPDs of the previous materials used in the multimedia materials of the project and analyse the basic data that will be used in the interactive tool (IO3) (CO2 emissions, ecological and carbon footprint, etc.). All partners of the BIMclay project have participated in this report.

The results of this comparative study will be collected focused on its implementation in the BIMclay Multimedia Cards.

1. ENVIRONMENTAL PRODUCT DECLARATION (EPD)

The ecolabel allows for affirming the positive environmental performance of a product. Therefore, these ecolabels are awarded to products with lower environmental impact accounting for their life cycle. There are three types: ecolabel type I, environmental self-declarations (type II) and environmental product declarations (III). The first ecolabels are voluntary schemes that affirm the least environmental impact of a product, the next, the manufacturer performs it with or without certification of a competent authority, and the latest are verified and they establish the environmental behaviour of the product.

In general, the ecolabels assess such aspects as: extraction and selection of raw material, production process (power consumption, water usage and

Consortium members: Associação Portuguesa da Indústria de Cerâmica (APICER), Centro Tecnológico da Cerâmica e do Vidro (CTCV), Asociación Empresarial de Investigación Centro Tecnológico del Mármol, Piedra y Materiales (CTM), Asociación Española de Fabricantes (Hispalyt), Institute of Entrepreneurship Development (IED).

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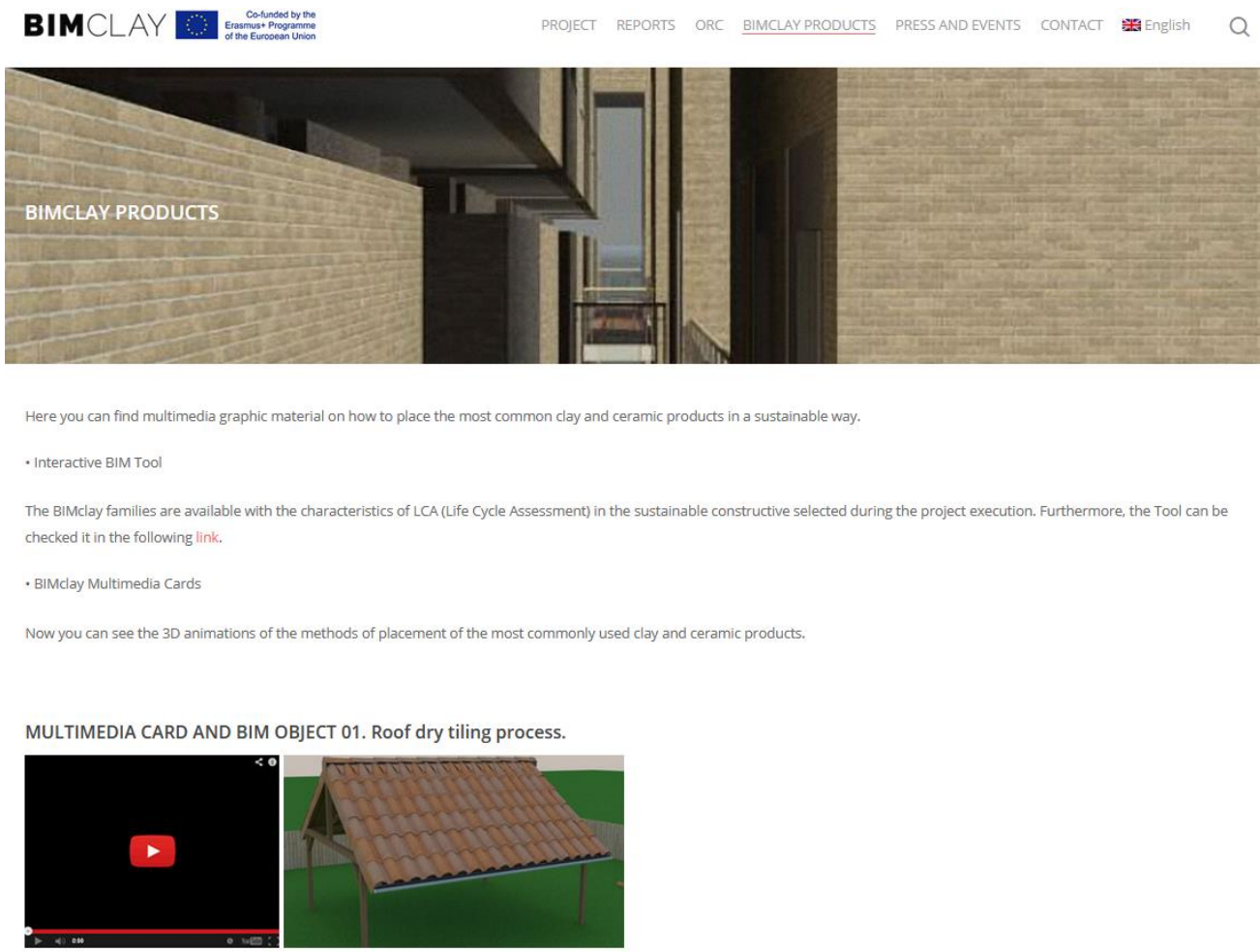
BIMclay RESULTS

BIM OBJECTS, 3D ANIMATIONS AND CALCULATION TOOLS

www.bimclay.eu



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BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

1. First of all, we proceeded to select the work units to be represented

PRODUCT	APPLICATION SYSTEM
Ceramic roofing tiles	1. Roof tiles flat or curved (dry application) 2. Roof tiles mixed: Placing with mortar
Brick	3. Construction of walls of small format bricks and prefabricated ceramic and plaster panel 4. Construction of large format hollow brick walls and prefabricated ceramic and plaster panel
Facing brick	5. Ventilated facades 6. Non-ventilated facades
Ceramic tiles	7. Floor tiling 8. Renovation floor tiling 9. Floating floor 10. Mosaic 11. External walls tiling (ventilated)
Paver	12. Pavers on sand bed.

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BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

2. Their classification within the BIM categories was identified.

BIM CLASSIFICATION (FAMILIES)	PRODUCT	APPLICATION SYSTEM
ROOF	Ceramic roofing tiles	1. Roof tiles flat or curved (dry application). 2. Roof tiles mixed: Placing with mortar.
ARCHITECTURAL WALLS	Brick	3. Construction of walls of small format bricks and prefabricated ceramic and plaster panel. 4. Construction of large format hollow brick walls and prefabricated ceramic and plaster panel.
	Facing brick	5. Ventilated facades (Facing bricks) 6. Non-ventilated facades (Facing bricks)
	Ceramic tiles	10. Mosaic. 11. External walls tiling (ventilated. Ceramic).
ARCHITECTURAL FLOORS	Ceramic tiles	7. Floor tiling. 8. Renovation floor tiling. 9. Floating floor.
	Paver	12. Pavers on sand bed.

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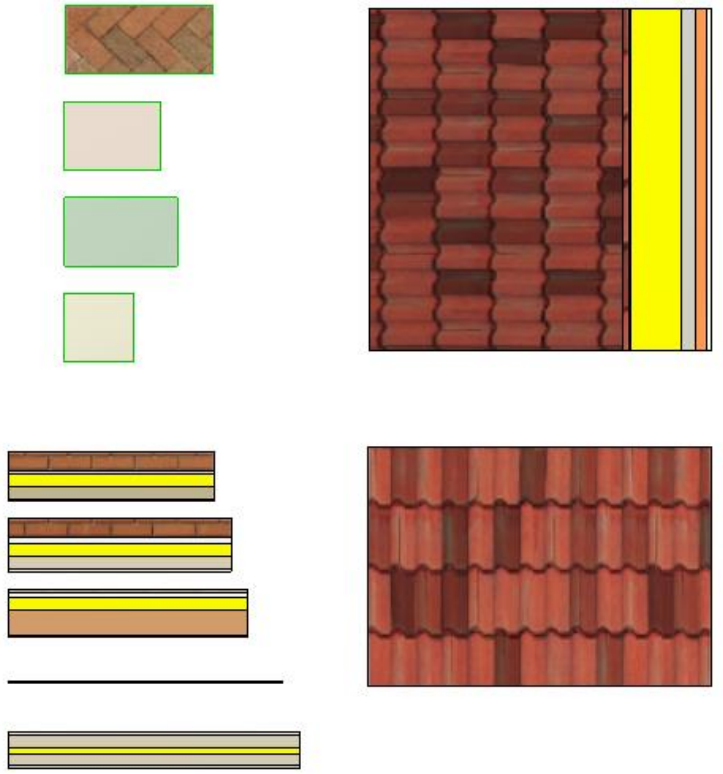
BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

3. The graphic representation shown in this sheet corresponds to the objects finally developed.

Specifically, Revit was used.



BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

4. A comprehensive search was carried out among partners for different DAPs and scientific articles on the subject.

Almeida, M. I., Dias, A. C., Demertzi, M., Arroja, L. Contribution to the development of product category rules for ceramic bricks. Journal of Cleaner Production 92: 206-215, (2015).

Almeida, M. I., Dias, A. C., Arroja, L. Environmental Product Declaration – New challenges, new impact categories. Case study applied to ceramic floor tiles. Congress of Innovation on Sustainable Construction CINCOS'16 (2016).

Almeida, M. I., Dias, A. C., Arroja, L. Environmental Product Declaration – New challenges, new impact categories. Case study applied to ceramic floor tiles. Congress of Innovation on Sustainable Construction CINCOS'16 (2016).

Almeida, M.I., Dias, A.C., Demertzi, M., Arroja, L. Environmental profile of ceramic tiles and their potential for improvement. Journal of Cleaner Production 131: 583-593, (2016).

Revigrés. Environmental Product Declaration - Tech Porcelain Tiles, (2017).

Almeida, M.I., Dias, A.C., Arroja, L. Declaração ambiental de produto - Caso de estudo de fundamentação de impactes na telha cerâmica. Congress of Innovation on Sustainable Construction CINCOS'14 (2014).

Almeida, M.I., Dias, A.C., Arroja, L. Influência de variáveis da tecnologia de fabrico na determinação de impactes ambientais da telha cerâmica. Conferência Internacional de Ambiente em Língua Portuguesa (CIALP).

Pavigrés Cerâmicas, S.A.. Declaração Ambiental de Produto - Grés porcelânico, (2019). Sistema DAPHabitat. https://daphabitat.pt/pt_PT/dap/dap-registadas/

Revigrés. Environmental Product Declaration - Glazed and Unglazed Porcelain Tiles, (2017). Sistema DAPHabitat. https://daphabitat.pt/pt_PT/dap/dap-registadas/

Pavigrés Cerâmicas, S.A.. Declaração Ambiental de Produto - Monoporosa, (2019). Sistema DAPHabitat. https://daphabitat.pt/pt_PT/dap/dap-registadas/

GlobalEPD_002_041_ESP. Datos promediados de los parámetros del ACV. El principal uso recomendado para este producto es como revestimiento de paredes en el sector de la construcción. https://www.aenor.com/Producto_DAP_pdf/GlobalEPD_002_041_ESP.PDF

https://www.aenor.com/Producto_DAP_pdf/GlobalEPD_002_042_ESP.PDF

https://www.aenor.com/Producto_DAP_pdf/GlobalEPD_002_013_ren1_ESP.pdf

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BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

5. A comparative study was carried out in order to homogenise all the data and to find out the common phases calculated between the EPDs and scientific articles finally selected.

Roof

Almeida, M.I., Dias, A.C., Arroja, L. Declaração ambiental de produto - Caso de estudo de fundamentação de impactes na telha cerâmica. Congress of Innovation on Sustainable Construction CINCOS'14 (2014).

Ceramic tile (2007)		**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP [kg CO2 eq]	GWP [µg CO2 eq]		1,07E+01													
ODP [kg CFC-11 eq]	ODP [µg CFC-11 eq]		1,33E-06													
AP [kg SO2 eq]	AP [µg SO2 eq]		7,66E-02													
EP [kg (PO4)3- eq]	EP [µg (PO4)3- eq]		1,37E-02													
POCP [kg etileno eq]	POCP [µg etileno eq]		2,23E-03													
ADPE [kg Sb eq]	ADPE [µg Sb eq]		4,50E-06													
ADPF [MJ]	ADPF [MJ]		1,69E+02													
Ceramic tile (2013)		**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP [kg CO2 eq]	GWP [µg CO2 eq]		8,97E+00													
ODP [kg CFC-11 eq]	ODP [µg CFC-11 eq]		1,10E-06													
AP [kg SO2 eq]	AP [µg SO2 eq]		5,73E-02													
EP [kg (PO4)3- eq]	EP [µg (PO4)3- eq]		8,83E-03													
POCP [kg etileno eq]	POCP [µg etileno eq]		1,85E-03													
ADPE [kg Sb eq]	ADPE [µg Sb eq]		4,71E-06													
ADPF [MJ]	ADPF [MJ]		1,42E+02													

Ceramic tile. Stages:

Almeida, M.I., Dias, A.C., Arroja, L. Influência de variáveis da tecnologia de fabrico na determinação de impactes ambientais da telha cerâmica. Conferência Internacional de Ambiente em Língua Portuguesa (CIALP)

T1. Without refractory furniture (2014):		**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP [kg CO2 eq]	GWP [µg CO2 eq]															1,12E+01
ODP [kg CFC-11 eq]	ODP [µg CFC-11 eq]															1,85E-06
AP [kg SO2 eq]	AP [µg SO2 eq]															5,40E-02
EP [kg (PO4)3- eq]	EP [µg (PO4)3- eq]															4,40E-03
POCP [kg etileno eq]	POCP [µg etileno eq]															2,20E-03
ADPE [kg Sb eq]	ADPE [µg Sb eq]															3,31E-07
ADPF [MJ]	ADPF [MJ]															1,75E+02
T2. With refractory furniture (2014):		**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP [kg CO2 eq]	GWP [µg CO2 eq]															1,50E+01
ODP [kg CFC-11 eq]	ODP [µg CFC-11 eq]															2,49E-06
AP [kg SO2 eq]	AP [µg SO2 eq]															5,00E-02
EP [kg (PO4)3- eq]	EP [µg (PO4)3- eq]															5,50E-03
POCP [kg etileno eq]	POCP [µg etileno eq]															2,10E-03

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BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

5. The data to be integrated were selected and the units were changed (so that they could be included in the BIM model software) and the conversion factor from T to m2 was applied in the case of the EPD products from the PCR 002 sectoral panel of Global EPD.

1. GWP (kg CO2 eq)/m2		1. GWP (kg CO2 eq)	(Área * 1 / (1 m²)) * [1. GWP (kg CO2 eq)/m2]	1. GWP (kg CO2 eq)
2. ODP (µg CFC-11 eq)/m2		2. ODP (µg CFC-11 eq)	(Área * 1 / (1 m²)) * [2. ODP (µg CFC-11 eq)/m2]	2. ODP (kg CFC-11 eq)
3. AP (kg SO2 eq)/m2		3. AP (kg SO2 eq)	(Área * 1 / (1 m²)) * [3. AP (kg SO2 eq)/m2]	3. AP (kg SO2 eq)
4. EP (kg (PO4)3- eq)/m2		4. EP (kg (PO4)3- eq)	(Área * 1 / (1 m²)) * [4. EP (kg (PO4)3- eq)/m2]	4. EP (kg (PO4)3- eq)
5. POCP (kg etileno eq)/m2		5. POCP (kg etileno eq)	(Área * 1 / (1 m²)) * [5. POCP (kg etileno eq)/m2]	5. POCP (kg etileno eq)
6. ADPE (µg Sb eq)/m2		6. ADPE (µg Sb eq)	(Área * 1 / (1 m²)) * [6. ADPE (µg Sb eq)/m2]	6. ADPE (kg Sb eq)
7. ADPF (MJ)/m2		7. ADPF (MJ)	(Área * 1 / (1 m²)) * [7. ADPF (MJ)/m2]	7. ADPF (MJ)
ORC BIMclay				
Source (link of the EPD)				
Youtube BIMclay				
Phases of the EPD				

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BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

5. The data to be integrated were selected and the units were changed (so that they could be included in the BIM model software) and the conversion factor from T to m2 was applied in the case of the EPD products from the PCR 002 sectoral panel of Global EPD.

Ceramic roof tiles according to Standard UNE-EN 1304		A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		kg/m2	kg/m2 y µg/m2	
GWP [kg CO2 eq]	GWP [µg CO2 eq]	199	16,7	1,9	0	0	0	0	0	0	0	0	3,85	1,21	8,67	0	231,33	9,2372221	9,2372221	GWP [kg CO2 eq]/m2
ODP [kg CFC-11 eq]	ODP [µg CFC-11 eq]	8,78E-08	4,21E-11	1,09E-09	0	0	0	0	0	0	0	0	9,72E-12	1,26E-11	9,62E-11	0	8,9051E-08	3,5559E-09	0,00355587	ODP [µg CFC-11 eq]/m2
AP [kg SO2 eq]	AP [µg SO2 eq]	0,729	0,0412	0,00146	0	0	0	0	0	0	0	0	0,00916	0,00836	0,052	0	0,84118	0,0335891	0,0335891	AP [kg SO2 eq]/m2
EP [kg (PO4)3- eq]	EP [µg (PO4)3- eq]	0,0795	0,0101	0,000347	0	0	0	0	0	0	0	0	0,00225	0,00202	0,00707	0	0,101287	0,00404448	0,00404448	EP [kg (PO4)3- eq]/m2
POCP [kg etileno eq]	POCP [µg etileno eq]	0,0785	-0,0127	0,000346	0	0	0	0	0	0	0	0	-0,00274	0,00122	0,005	0	0,069626	0,00278023	0,00278023	POCP [kg etileno eq]/m2
ADPE [kg Sb eq]	ADPE [µg Sb eq]	0,000027	0,0000013	-1,05E-07	0	0	0	0	0	0	0	0	2,99E-07	0,00000215	0,00000299	0	3,3634E-05	1,343E-06	1,34303691	ADPE [µg Sb eq]/m2
ADPF [MJ]	ADPF [MJ]	3340	227	3,57	0	0	0	0	0	0	0	0	52,5	22,9	113	0	3758,97	150,099169	150,099169	ADPF [MJ]/m2

LCA for BIM f	C:\ProgramData\Autodesk\Revit
1. GWP (kg CO2 eq)/m2	
2. ODP (µg CFC-11 eq)/m2	
3. AP (kg SO2 eq)/m2	
4. EP (kg (PO4)3- eq)/m2	
5. POCP (kg etileno eq)/m2	
6. ADPE (µg Sb eq)/m2	
7. ADPF (MJ)/m2	
ORC BIMclay	https://bimclay.eu/oer/oer-direct-a
Source (link c	https://www.aenor.com/Producto
Youtube BIM	https://www.youtube.com/watch?
Phases of the	A1-A5; C2-C4

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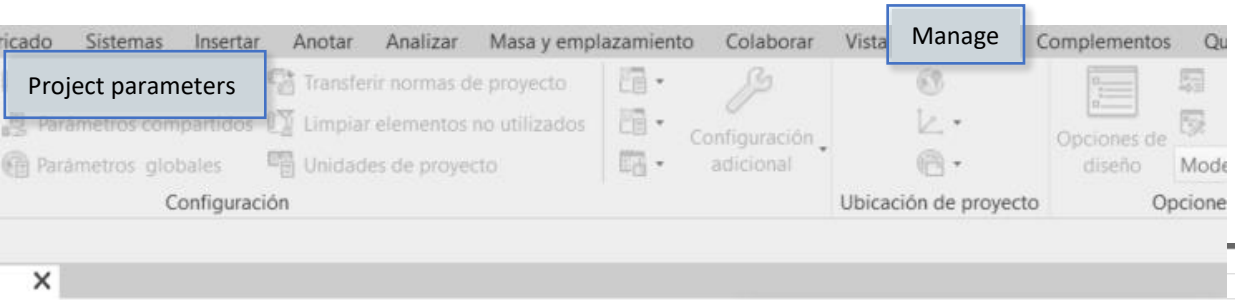
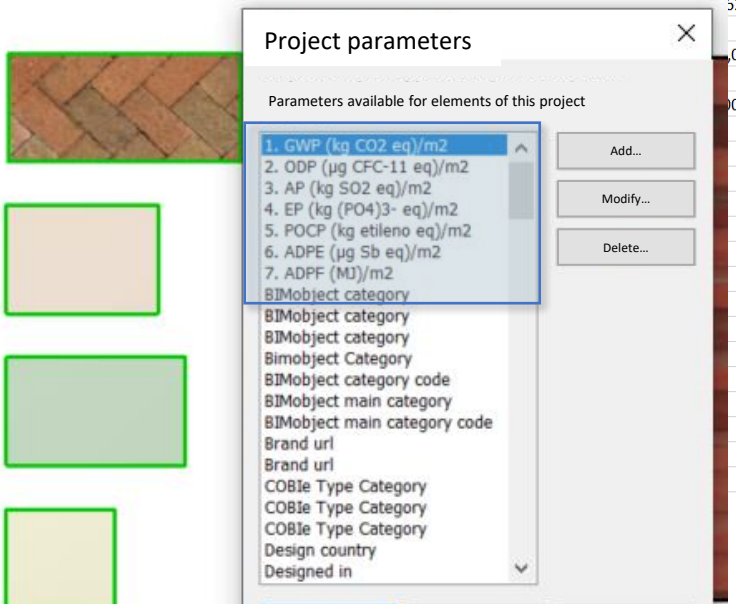
BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

6. Project parameters were created according to the defined impacts.





	D		kg/m2	kg/m2 y µg/m2	
8,67	0	231,33	9,2372221	9,2372221	GWP [kg CO2 eq]/m2
52E-11	0	8,9051E-08	3,5559E-09	0,00355587	ODP [µg CFC-11 eq]/m2
0,052	0	0,84118	0,0335891	0,0335891	AP [kg SO2 eq]/m2
00707	0	0,101287	0,00404448	0,00404448	EP [kg (PO4)3- eq]/m2
0,005	0	0,069626	0,00278023	0,00278023	POCP [kg etileno eq]/m2
00299	0	3,3634E-05	1,343E-06	1,34303691	ADPE [µg Sb eq]/m2
113	0	3758,97	150,099169	150,099169	ADPF [MJ]/m2
				LCA for BIM f	C:\ProgramData\Autodesk\Revit
				1. GWP (kg CO2 eq)/m2	
				2. ODP (µg CFC-11 eq)/m2	
				3. AP (kg SO2 eq)/m2	
				4. EP (kg (PO4)3- eq)/m2	
				5. POCP (kg etileno eq)/m2	
				6. ADPE (µg Sb eq)/m2	
				7. ADPF (MJ)/m2	
				ORC BIMclay	https://bimclay.eu/oer/oer-direct-a
				Source (link c	https://www.aenor.com/Producto
				Youtube BIM	https://www.youtube.com/watch?
				Phases of the	A1-A5; C2-C4

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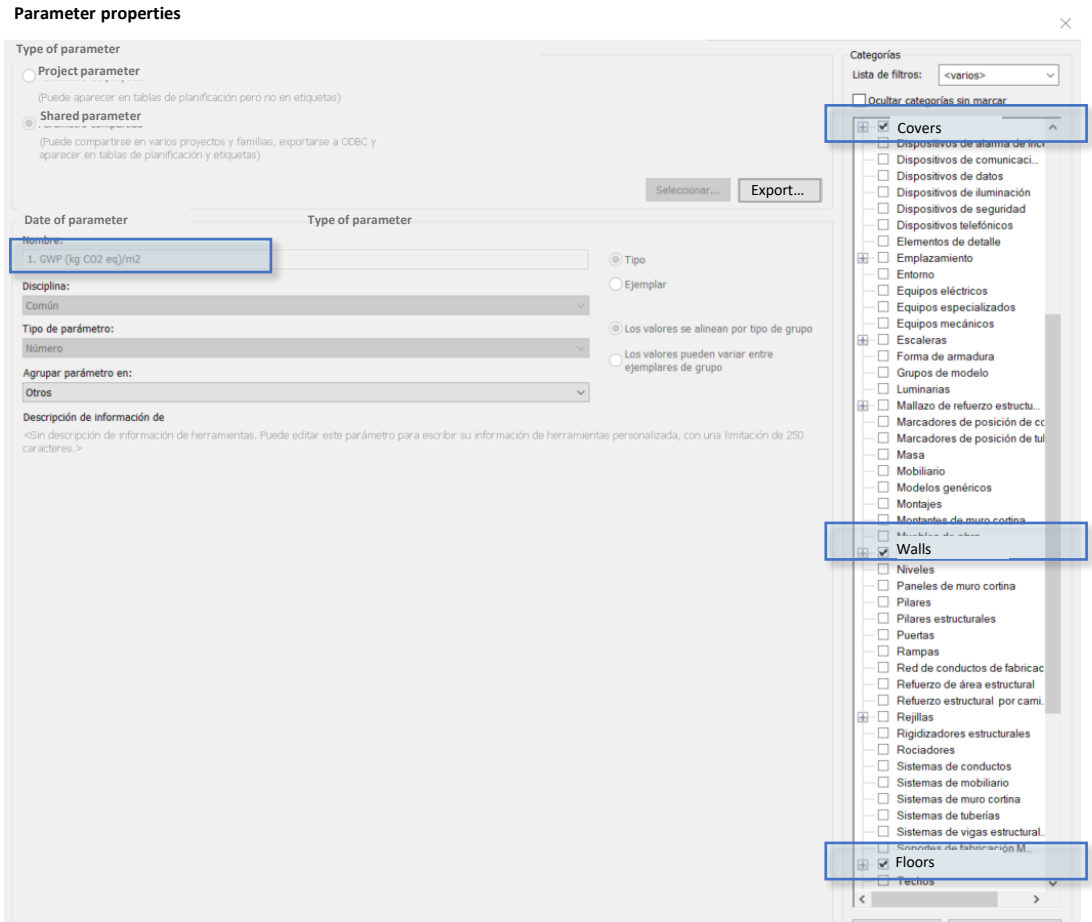
BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

7. These parameters were configured for inclusion in Walls, Floors and Roofs.



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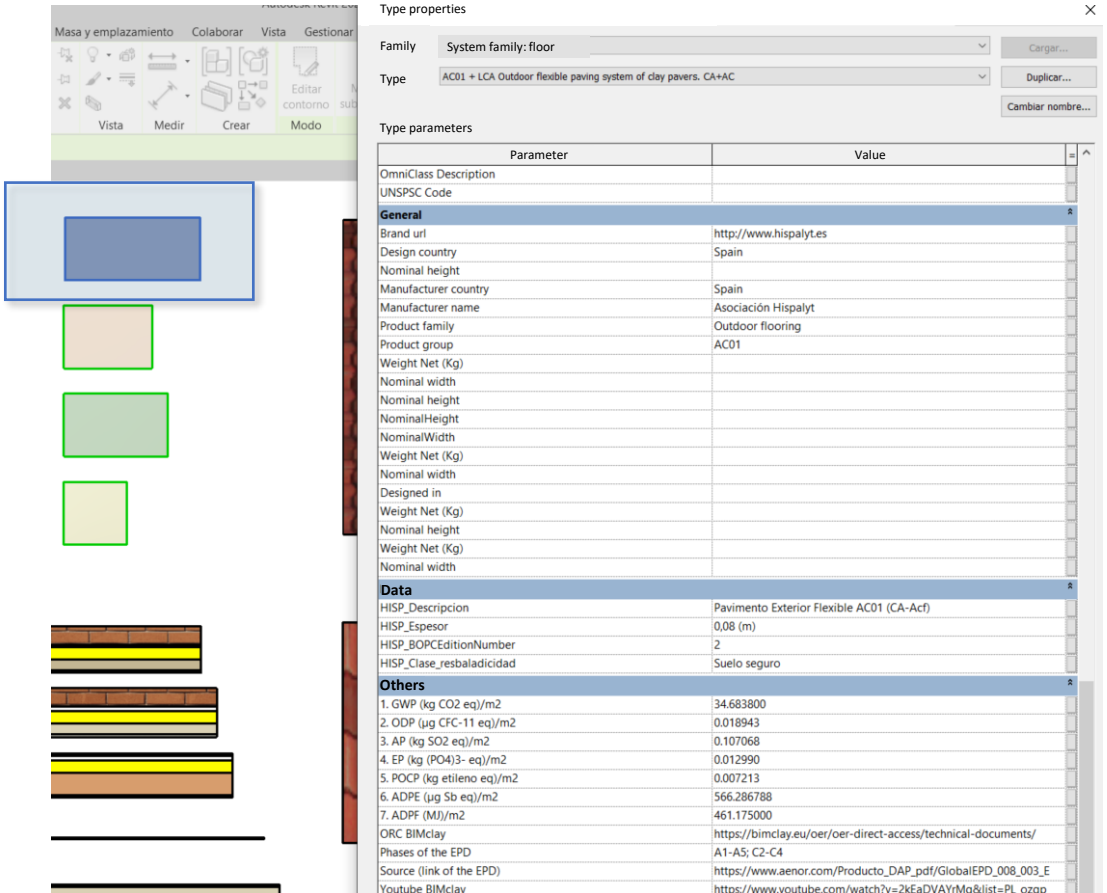
BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

8. Environmental information was completed for each BIM object.



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BIMclay RESULTS

BIM OBJECTS WITH REALISED ENVIRONMENTAL INFORMATION

9. Finally, in order to obtain the global environmental impact data of the project for the ceramic and fired clay products defined, a quantification table linked to these new project parameters was created:

Level 1 | Tabla de planificación de cubiertas | Wall planning table

<Wall planning table>

A	B	C	D	E	F	G	H	I
Familia y tipo	Área	1. GWP (kg CO2 eq)	2. ODP (µg	3. AP (kg	4. EP (kg	5. POCP (kg	6. ADPE (µg	7. ADPF (MJ)
Muro básico: FC23-P-bgf + LCA Double skin clay facing brick façade with v	5.20 m²	73.091429	0.037612	0.453128	0.045521	0.03419	534.532887	1573.800353
Muro básico: FC01-P-b + LCA Double skin clay facing brick façade. LPcv1	4.80 m²	67.469011	0.034718	0.418272	0.042019	0.03156	493.414973	1452.738787
Muro básico: FC25-B1 + LCA Single skin clay block façade with ventilated	5.60 m²	57.474116	10.886792	0.499509	0.041541	0.037733	25.261919	932.1704
Muro básico: Mosaic-30X30	6.40 m²	75.1936	0.3776	0.118765	0.019872	0.01056	165.05728	1009.216
Muro básico: PV03-bgf + LCA Silensis Type 2A internal party wall. ENL+L	6.80 m²	12.693859	0.011125	0.641934	0.052557	0.051646	10.626748	1938.123957

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8.3 BIMstone

DEFINITION OF THE PROJECT

OBJECTIVES

CONSORTIUM AND IMPACT

INTELLECTUAL OUTPUTS

BIMstone PLUG-IN

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DEFINITION OF THE PROJECT

BIM LEARNING APPLICATION FOCUSED ON LCA QUALIFICATION AND TECHNIFICATION OF WORKERS IN NATURAL STONE SECTOR

Coordinator: Deutscher Naturwerkstein-Verband E.V.

Call: Erasmus+ 2018. Strategic Partnerships for Vocational Education and Training (KA202)

Action: Cooperation for innovation and exchange of good practice

Referencia: 2018-1-DE02-KA202-005146

Start date: 01-09-2018

End date: 31-08-2020

Funded by: European Union

Co-funded by the
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of the European Union

OBJECTIVES

The overall objective of the BIMstone project is to increase the competences of workers in the field of stone product placement, through the production and development of multimedia materials based on BIM and taking into account the challenges related to the life cycle assessment of stone products, to be used as training material for both vocational students and professionals in the sector, in order to give more merit to academic promotion.

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CONSORTIUM AND IMPACT

Deutscher Naturwerkstein-Verband E.V (DNV). Germany www.natursteinverband.de

Colegio Oficial de Arquitectos de la Región de Murcia (COAMU). Spain www.coamu.es

Asociación Empresarial de Investigación Centro Tecnológico del Mármol, Piedra y Materiales (CTM) . Spain www.ctmarmol.es

Klesarska skola, Pučišća (KLESARSKA). Croatia www.ss-klesarska-pucisca.skole.hr

Asociatia Romania Green Building Council (RoGBC). Romania www.rogbc.org

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INTELLECTUAL OUTPUTS

O1. Establishment of common learning outcomes on stone-laying methods, Life Cycle Assessment and related regulations.

O2. BIMstone multimedia materials. New interactive BIM learning methods.

O3. BIMstone Open Educational Resource (OER).

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INTELLECTUAL OUTPUTS

O1. Establishment of common learning outcomes on stone-laying methods, Life Cycle Assessment and related regulations.

O1/A1. Comparative study of the regulations for the laying of stone products.

O1/A2. Sustainable construction methods and procedures for the installation of stone products.

O1/A3. Comparative study on life cycle assessment (LCA) of stone products in the participating countries.

O1/A4. Report on the results of the First International Seminar in Murcia (Spain).

O1/A5. BIMstone course curriculum based on ecological challenges and BIM technologies.

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INTELLECTUAL OUTPUTS

O2. BIMstone multimedia materials. New interactive BIM learning methods.

O2/A1. Computer production of BIMstone Multimedia Cards.

O2/A2. Interactive BIM tool.

O2/A3. Pedagogical test and implementation of software improvements of BIMstone Multimedia Cards.

O2/A4. Technical test and implementation of IT improvements of the BIMstone Multimedia Cards.

O2/A5. Report on the results of the Workshop in Bucharest (Romania) on new methods of interactive BIM-learning applied to the stone products sector.

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INTELLECTUAL OUTPUTS

O3. BIMstone Open Educational Resource (OER).

O3/A1. Computer production of Open Education Resource.

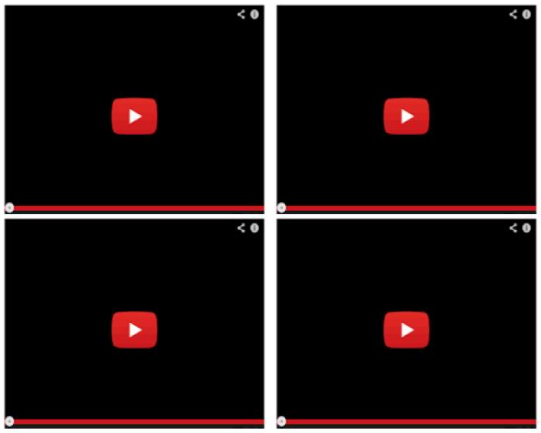
O3/A2. Implementation of the BIMstone Pilot Course: environment testing and technical improvement.

O3/A3. Report on the results of the International BIMstone Seminar in Würzburg (Germany).

INTELLECTUAL OUTPUTS

BIMstone MULTIMEDIA CARDS

They consist of 10 3D animations explaining the most sustainable construction processes used in natural stone works.



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BIMstone PLUG-IN

A BIM-based Interactive Tool was developed in this project for the integration of the technical documentation developed in the project (execution manuals, 3D animations, DAP of the natural stone, etc.). This task was divided into two sub-tasks:

A. Production of BIMstone families in common BIM format.

BIM objects were produced with the characteristics of the LCA of natural stone and sustainable construction methods, of the different construction materials selected in the project, i.e. of the most used construction elements, with direct links to the OER (Open Educational Resource) of the project for students, teachers and professionals of the sector.

B. Integration of the BIMstone training materials in a plug-in.

A plug-in for a professional BIM software was developed with the aim of linking the project's training materials with the most common tools in the educational and professional field. Therefore, both the "BIMstone families" and the "BIMstone Multimedia Cards" (3D animations of construction processes) were integrated into these plug-ins and interfaced with the project's OER.

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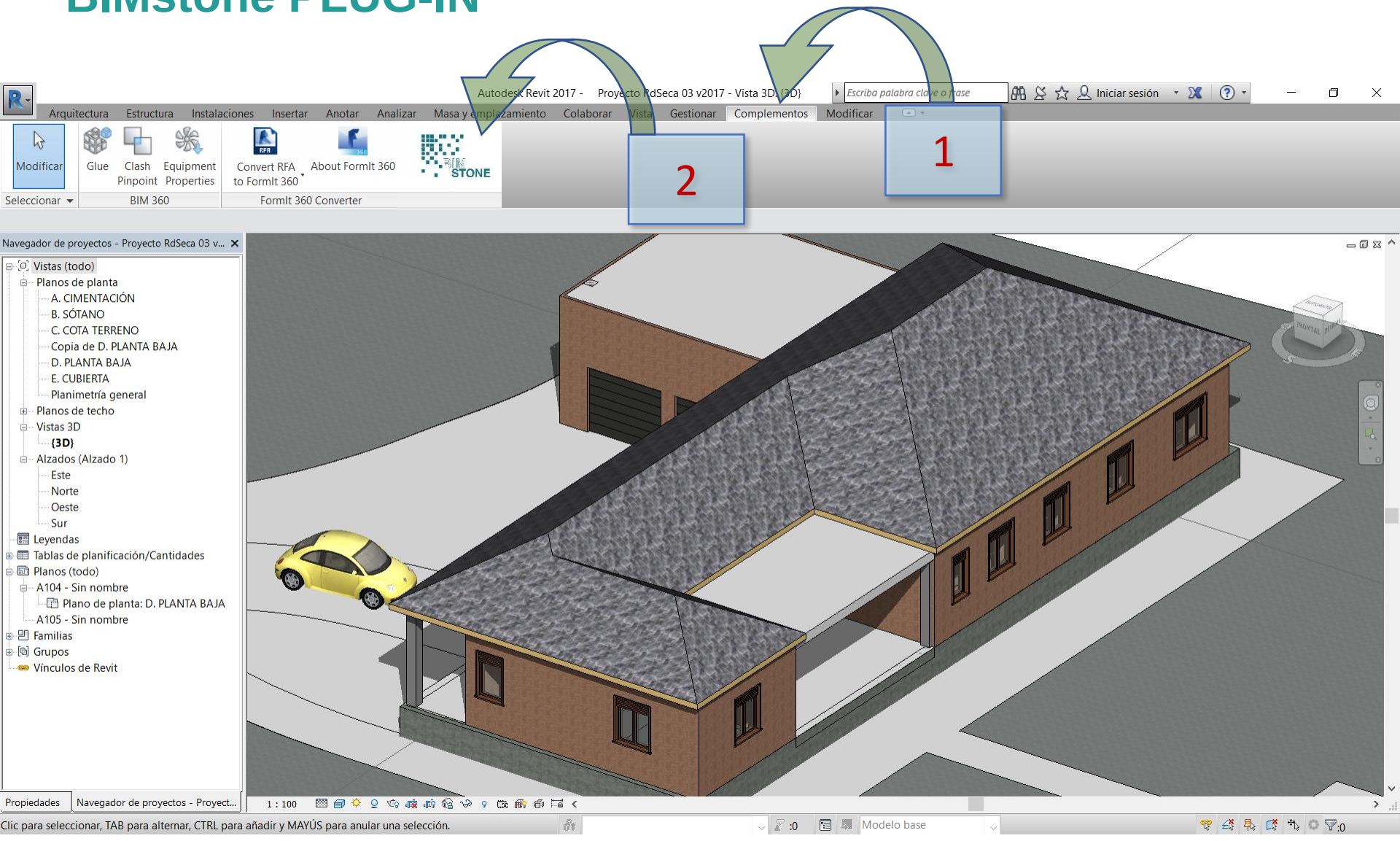
BIMstone PLUG-IN



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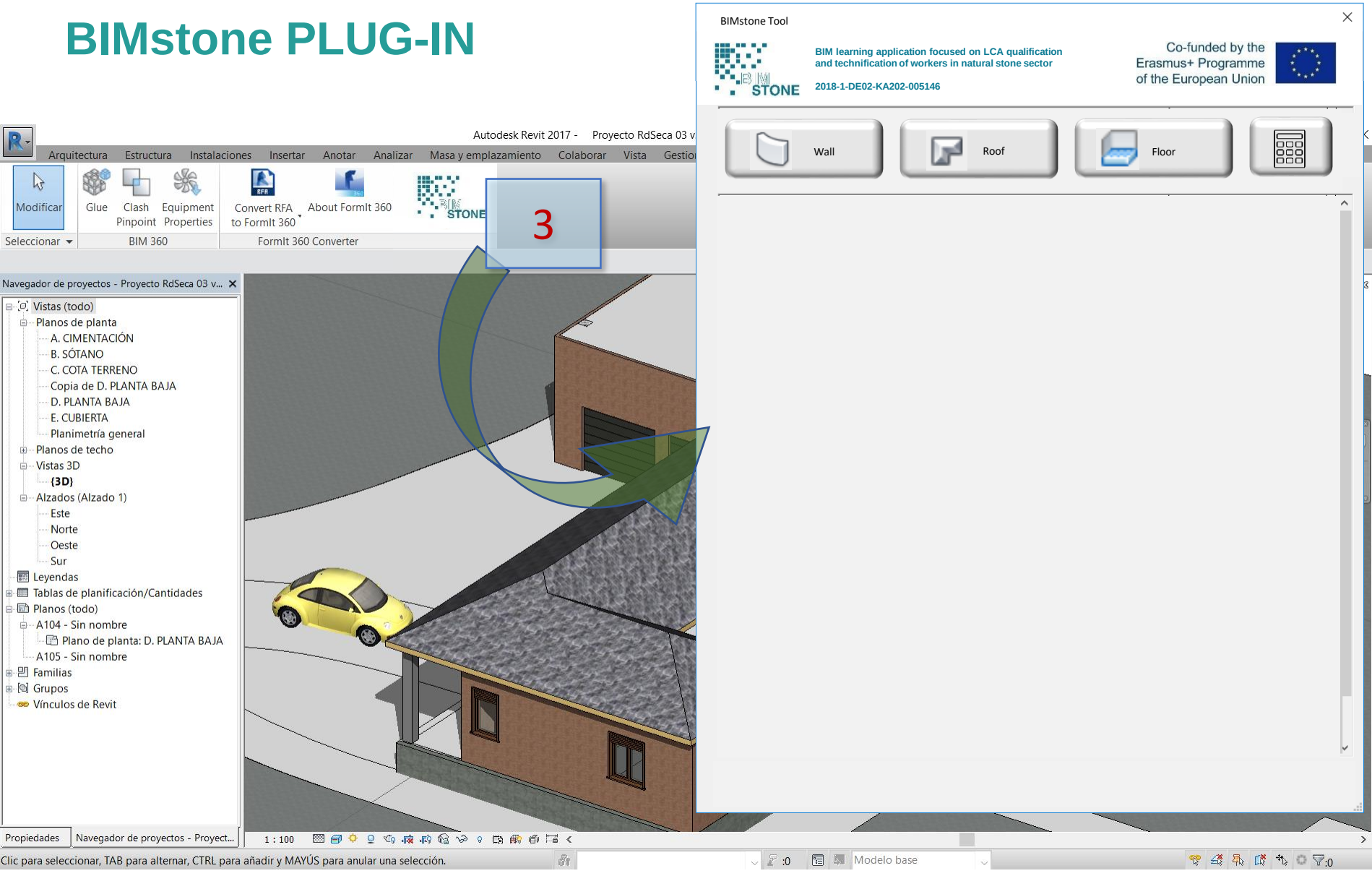
BIMstone PLUG-IN



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BIMstone PLUG-IN

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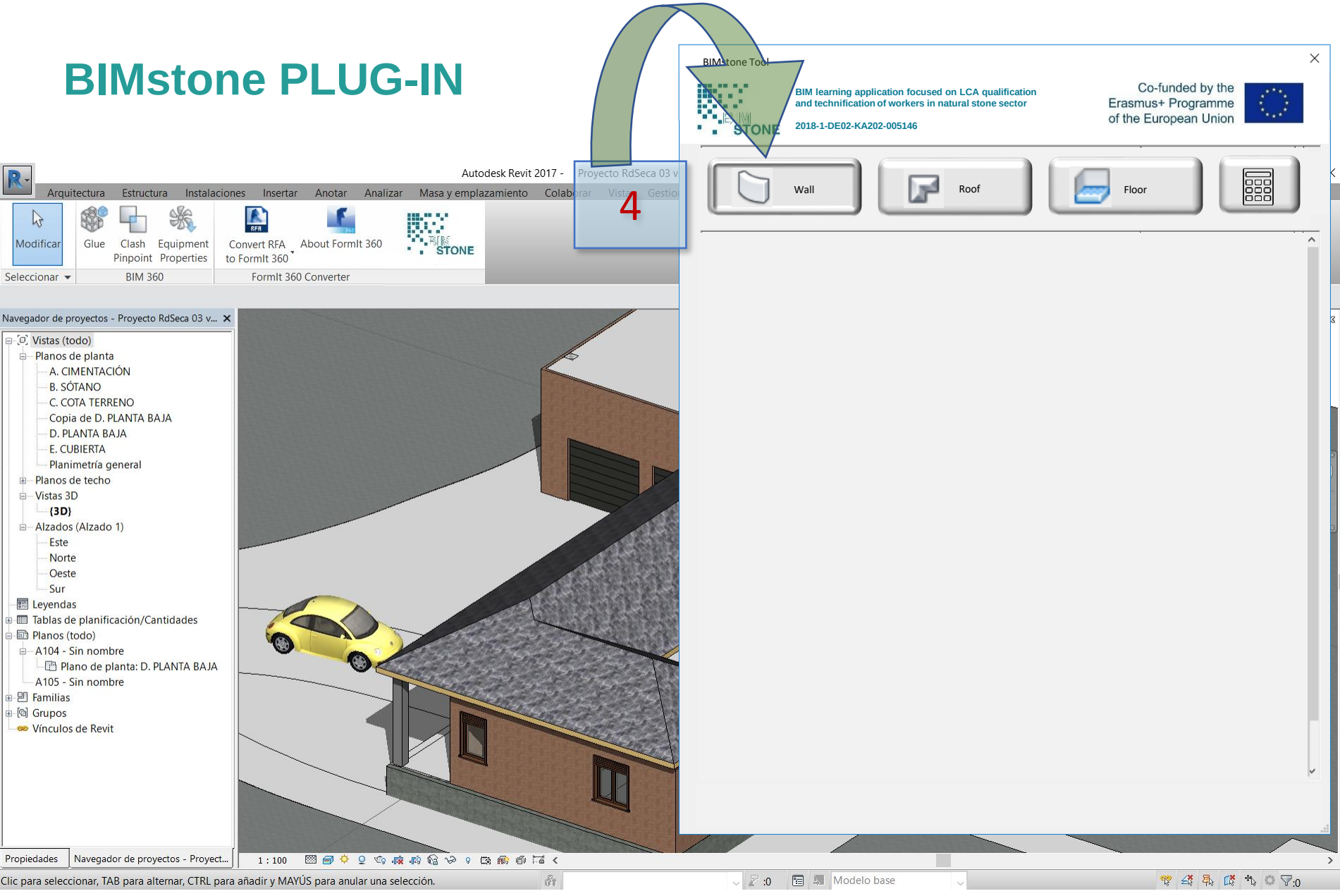
BIMstone PLUG-IN



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BIMstone PLUG-IN

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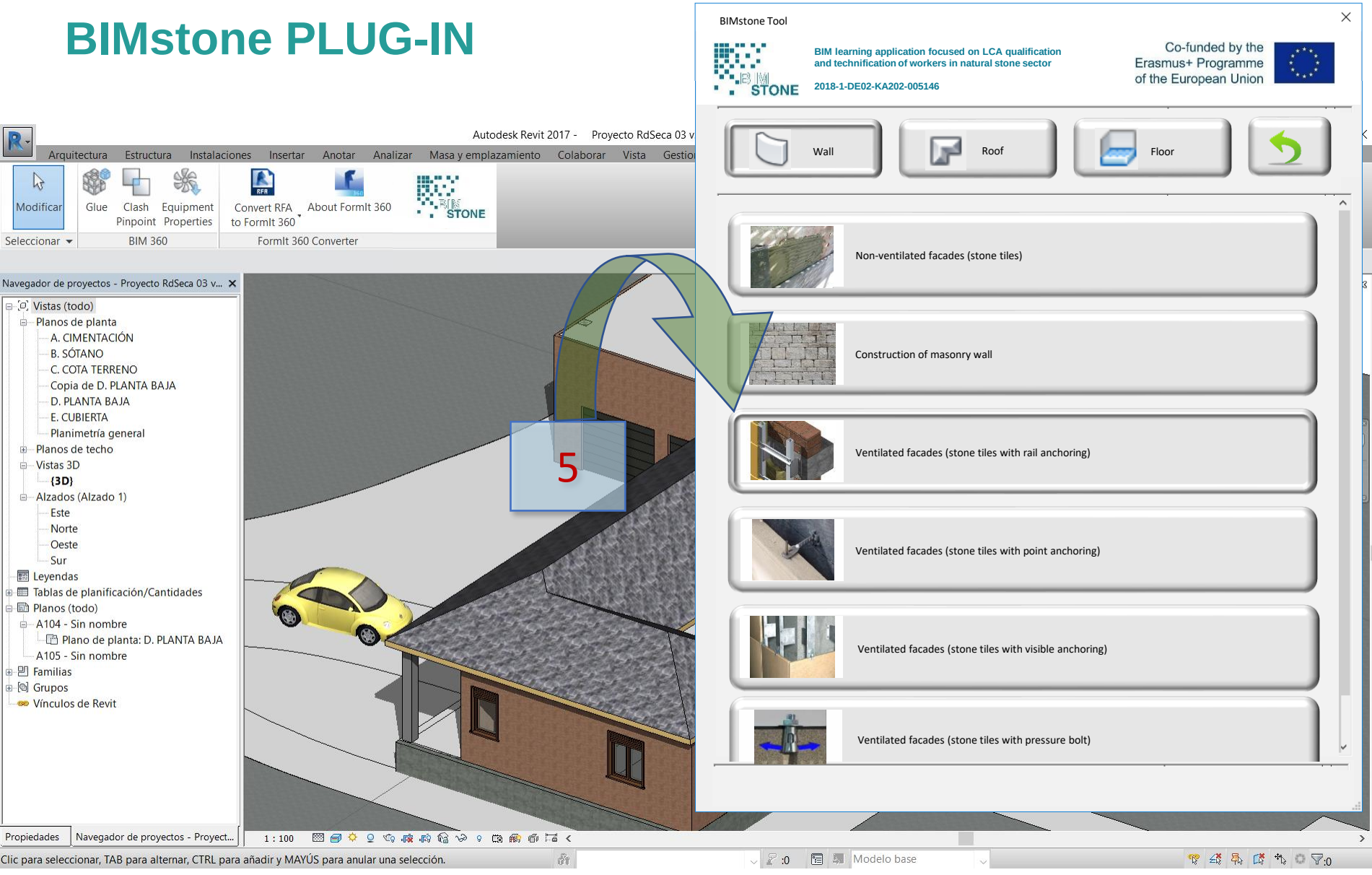
BIMstone PLUG-IN



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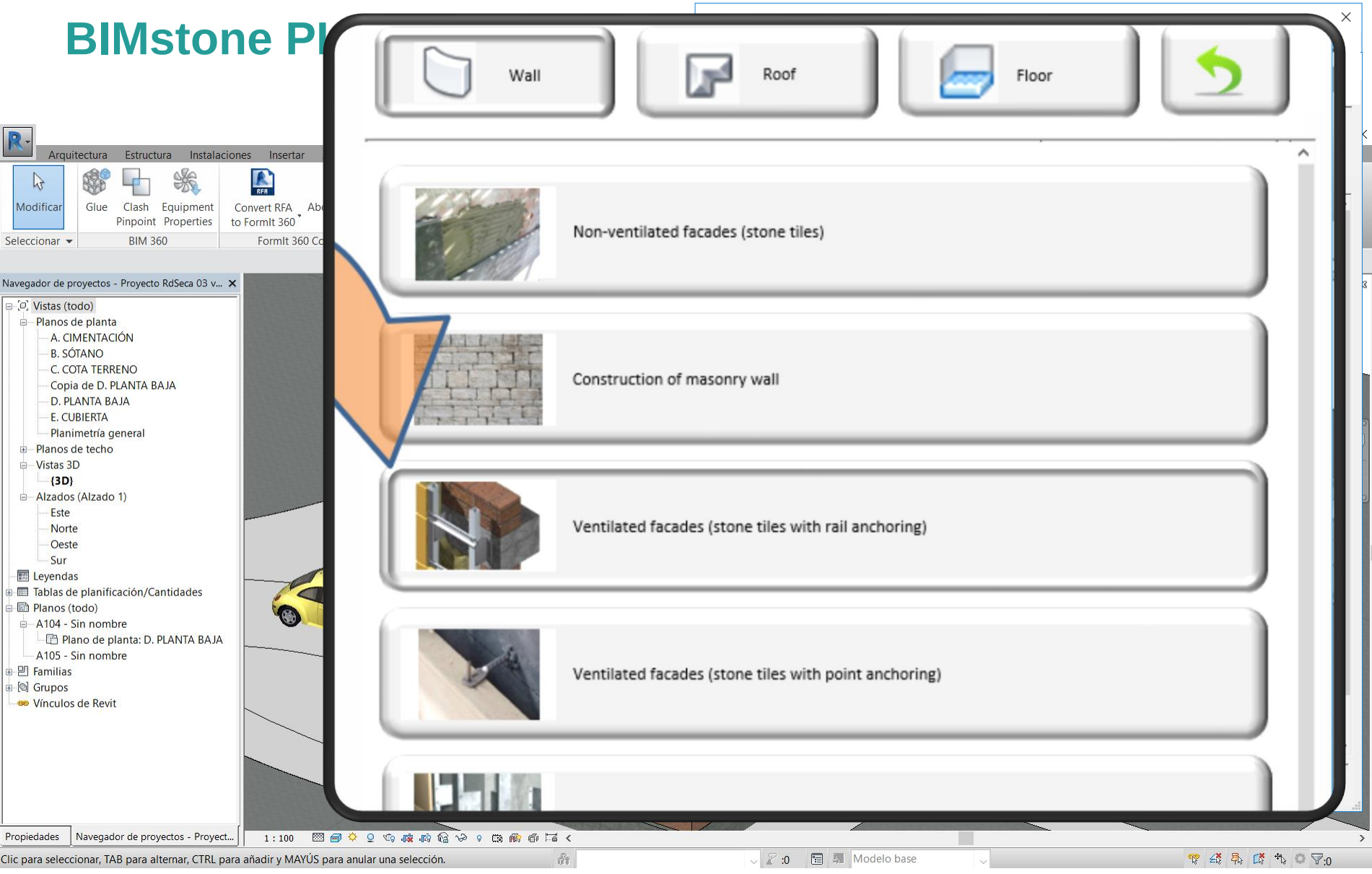
BIMstone Pl



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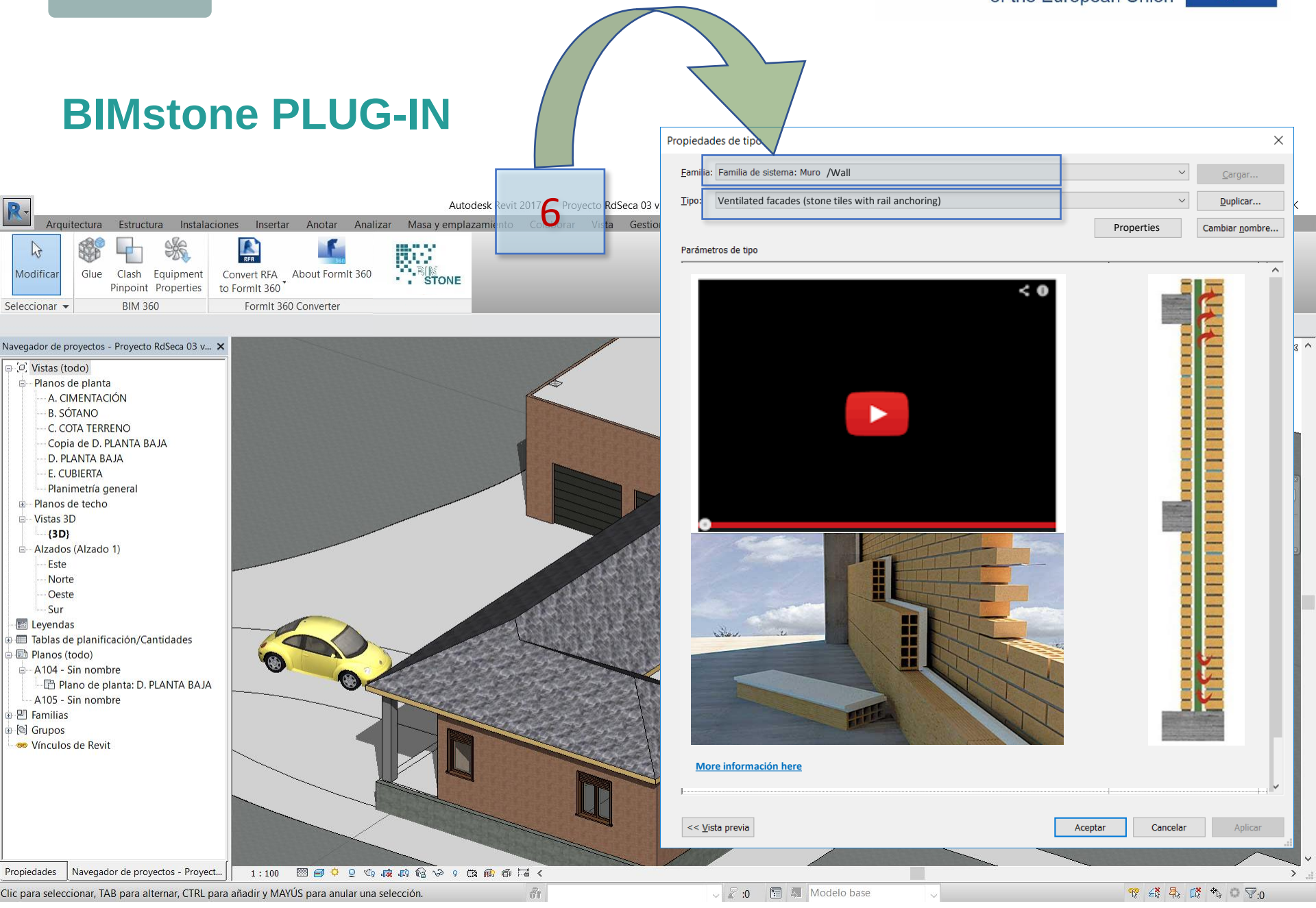
BIMstone PLUG-IN



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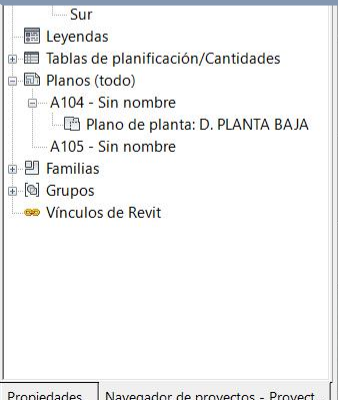
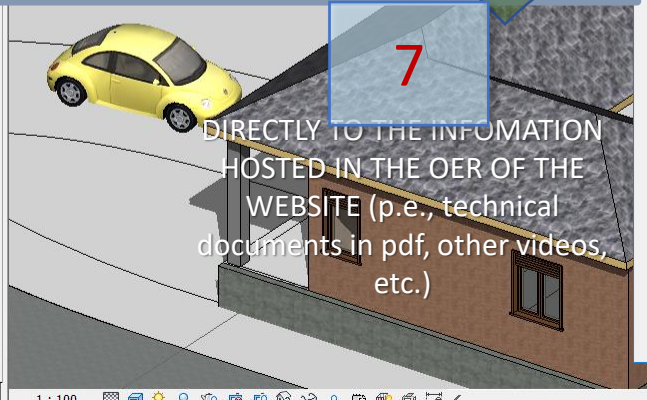
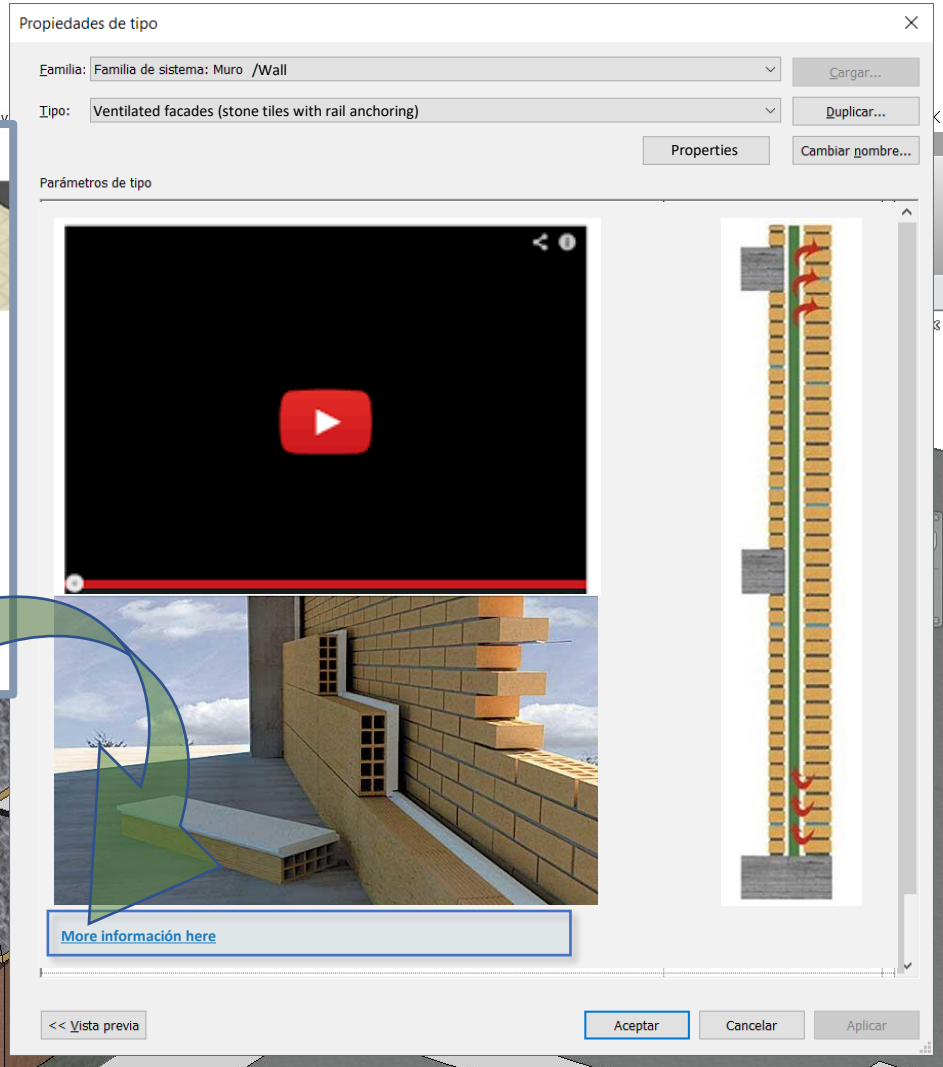
BIMstone PLUG-IN







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Modelo base

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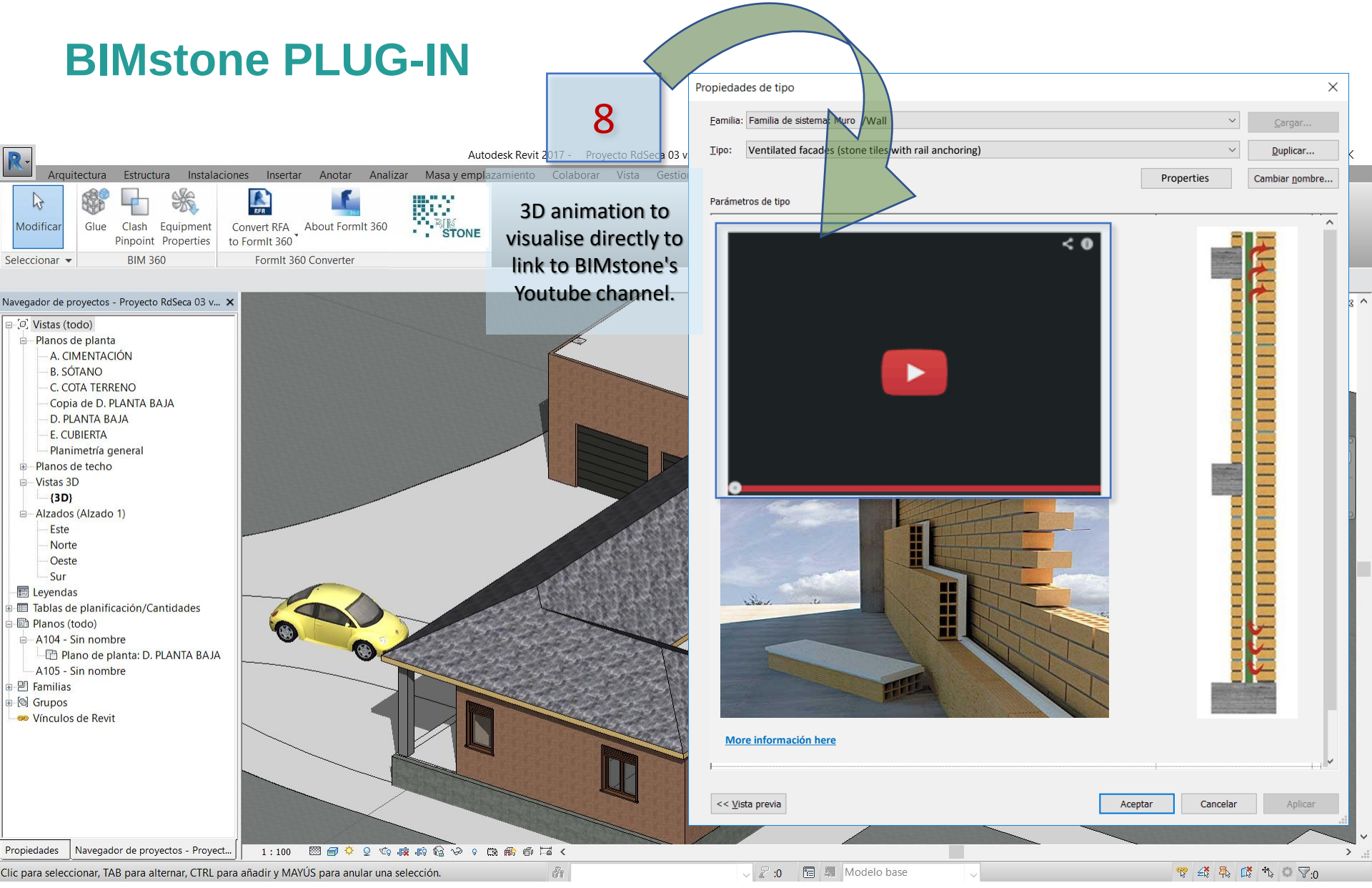
BIMstone PLUG-IN

8

3D animation to visualise directly to link to BIMstone's Youtube channel.



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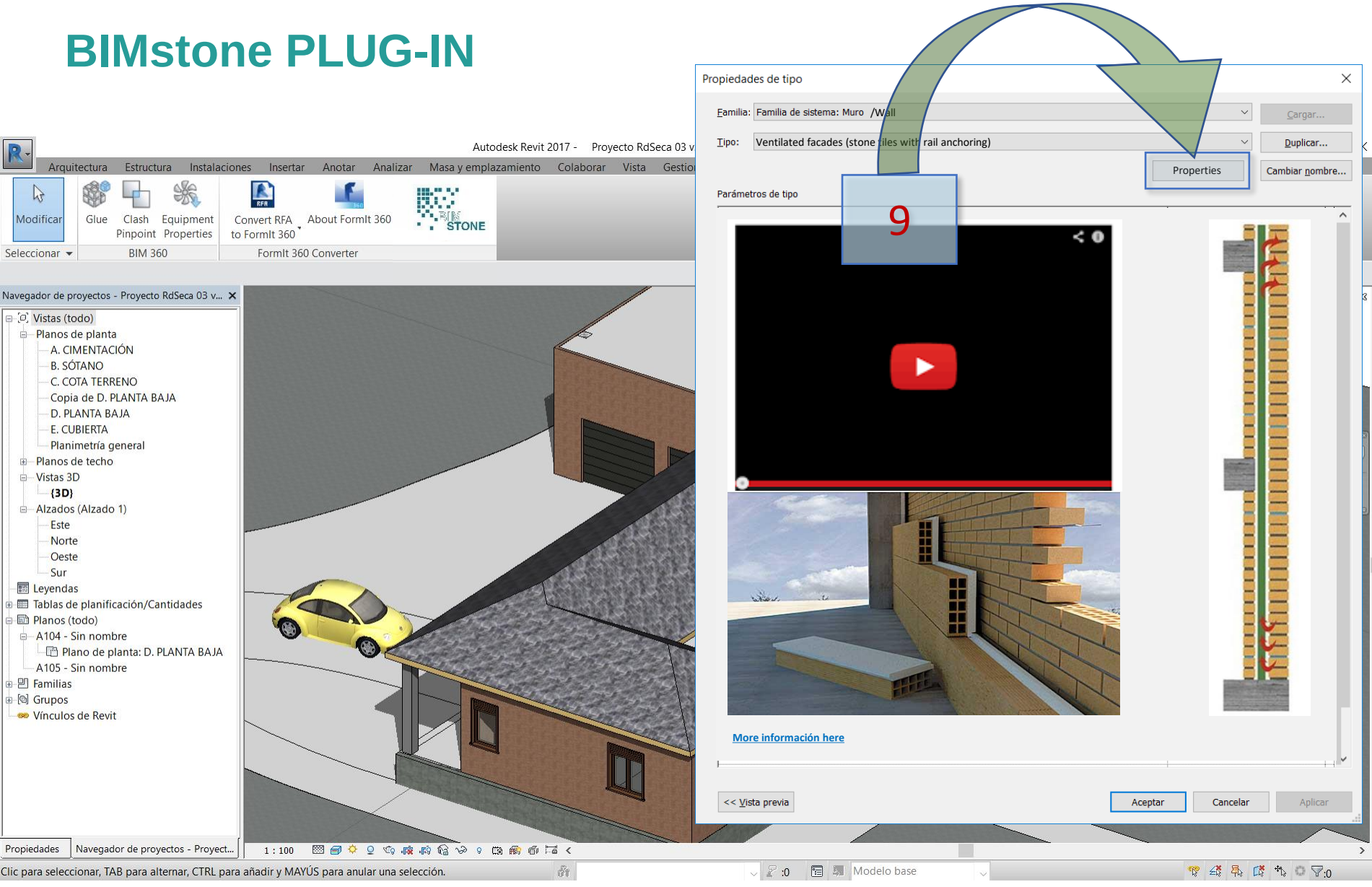

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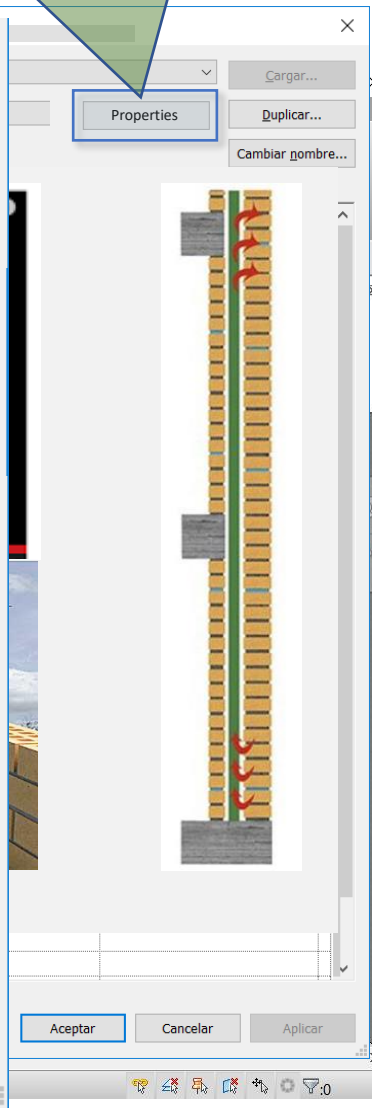
BIMstone PLUG-IN

Analytical properties	
Heat transfer coefficient (U)	0.8333 W/(m²·K)
Thermal resistance (R)	1.2000 (m²·K)/W
Termic mass	0.00 kJ/K
Absorbance	0.700000
Roughness	3
ENVIRONMENTAL IMPACT OF NATURAL STONE ELEMENTS	
GWP Global Warming Potential (Phase A to Phase D)	NUMBER kg CO2 eq
ODP Stratospheric Ozone Depletion Potential (Phase A to Phase D)	NUMBER kg CFC-11 eq
AP Acidification potential of soil and water resources (Phase A to Phase D)	NUMBER kg SO2 eq
EP Eutrophication Potential (Phase A to Phase D)	NUMBER kg (PO4)3- eq
POCP Tropospheric Ozone Formation Potential (Phase A to Phase D)	NUMBER kg etileno eq
ADPE Depletion potential (...) non-fossil resources (elements) (Phase A to F.D)	NUMBER kg Sb eq
ADPF Depletion potential (...) fossil resources (fossil fuels) (F.A to F.D)	NUMBER MJ

Identity data	
Type image	
Key note	CODE
Model	
Manufacturer	
Comments of type	
URL	www.bimstoneproject.eu/ EXAMPLE

<< Preview

Accept | Cancel | Apply



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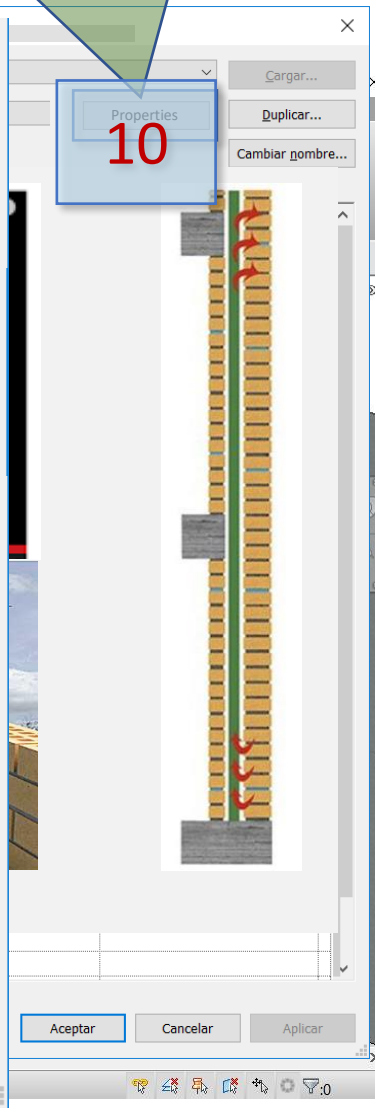

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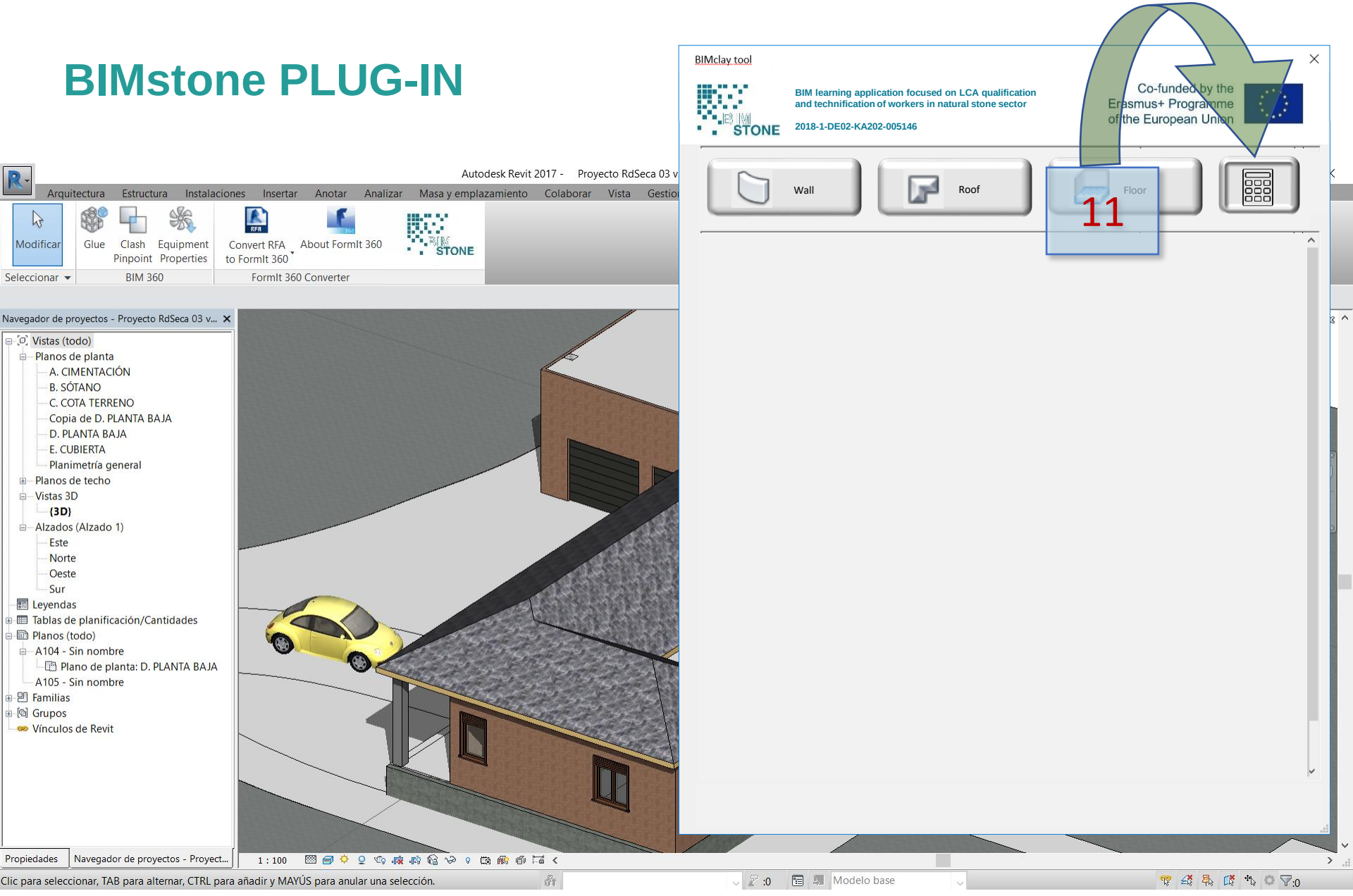

8.2 BIMstone

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BIMstone Tool

BIM learning application focused on LCA qualification and technification of workers in natural stone sector

2018-1-DE02-KA202-005146

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Wall | Roof | Floor

BIM OBJECTS USED IN THE PROJECT*

FAMILY	NAME	L* m	H* m	M* kg	**Conversion factor to m2	m2 IN THE PROJECT	GWP	ODP	AP	EP	POCP	ADPE	ADPF	MF
Wall	Ventilated facades (stone tiles with rail anchoring). A-D Phases													
	Stone tiles (wall)	m	m	kg	Result of the formula**	m2 drawn in the project	GWP/m2	ODP/m2	AP/m2	EP/m2	POCP/m2	ADPE/m2	ADPF/m2	
	Rail anchoring	m	m	kg	Result of the formula**	m2 drawn in the project	GWP/m2	ODP/m2	AP/m2	EP/m2	POCP/m2	ADPE/m2	ADPF/m2	MFR/m2
Floor	Flooring. Stone tiles. A-D Phases (Another EXAMPLE)													
	Stone tiles (floor)	***	***	***	***	m2 drawn in the project	GWP/m2	ODP/m2	AP/m2	EP/m2	POCP/m2	ADPE/m2	ADPF/m2	
	TOTAL. A-D Phases						**Σ GWP**	**Σ ODP**	**Σ AP**	**Σ EP**	**Σ POCP**	**Σ ADPE**	**Σ ADPF**	

*L: Dimension of the length of the piece in metres; H: dimension of the height of the piece in metres; M: mass of the piece in kg.
** Formula of the Conversion factor in the following EPD:
Información EPD Stone tiles on walls: link to AENOR or ECOplatform
Información EDP Stone tiles on floors: link to AENOR or ECOplatform

...others links of EPDs...

** It is not necessary for the calculation
***Estimation for 50 years

EXPORT DATA IN EXCEL OR PDF

Propiedades | Navegador de proyectos - Proyect...

1 : 100

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Modelo base

8.2 BIMstone

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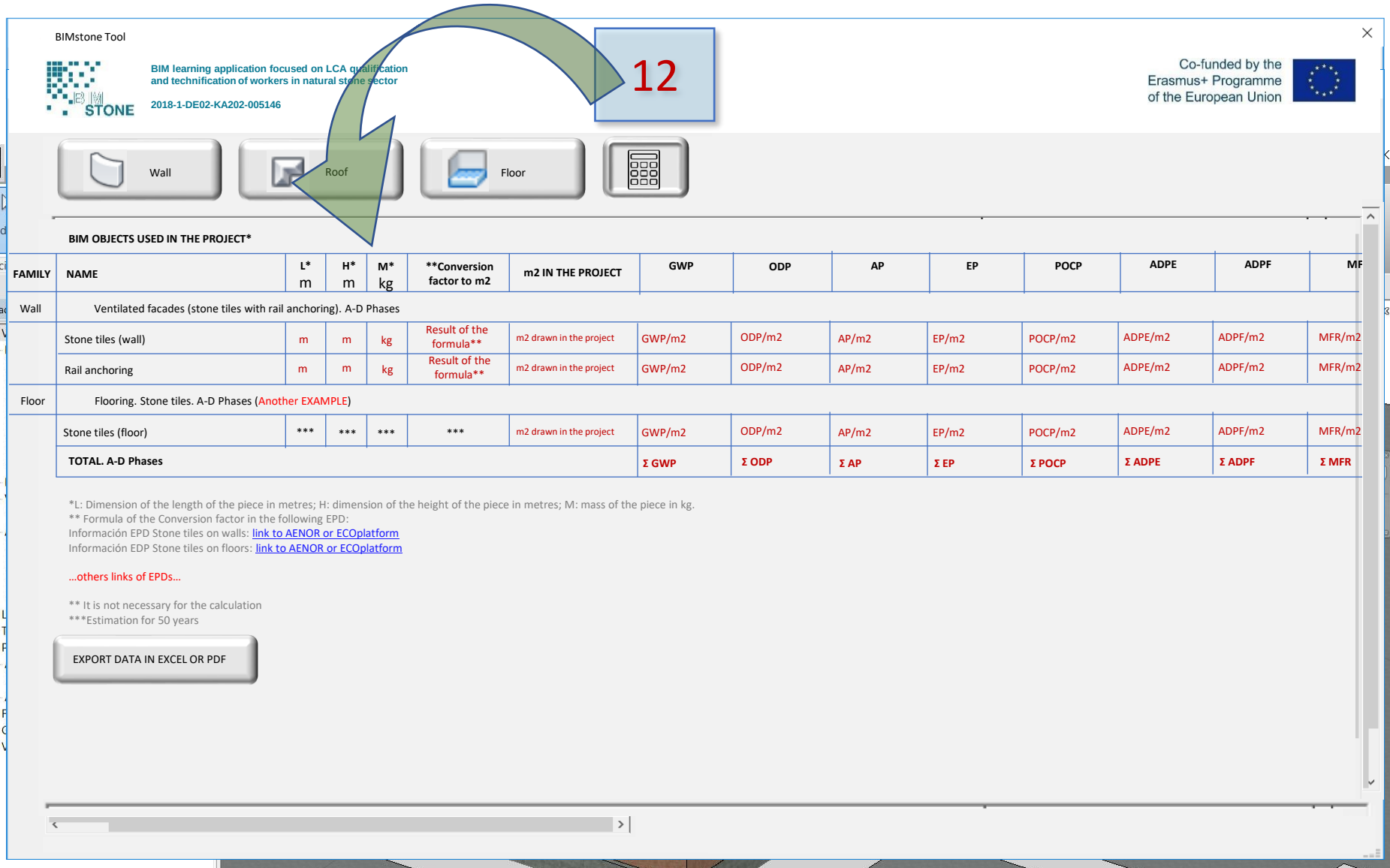

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BIM learning application focused on LCA qualification and technification of workers in natural stone sector

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Wall | Roof | Floor

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	Rail anchoring	m	m	kg	Result of the formula**	m2 drawn in the project	GWP/m2	ODP/m2	AP/m2	EP/m2	POCP/m2	ADPE/m2	ADPF/m2	MFR/m2
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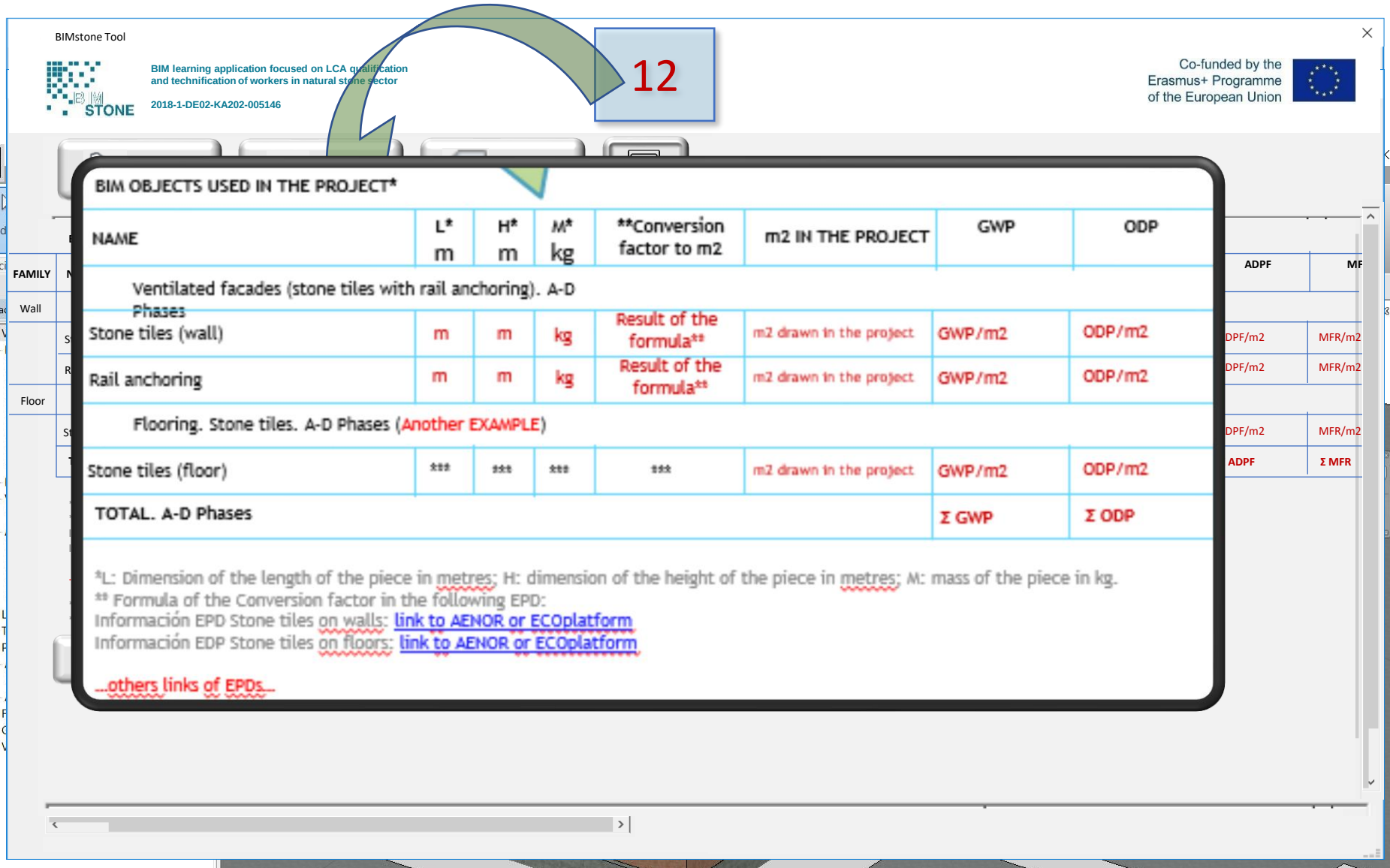
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BIM OBJECTS USED IN THE PROJECT*
NAME
L* m
H* m
M* kg
**Conversion factor to m2
m2 IN THE PROJECT
GWP
ODP
Ventilated facades (stone tiles with rail anchoring). A-D Phases
Stone tiles (wall)
m
m
kg
Result of the formula**
m2 drawn in the project
GWP/m2
ODP/m2
Rail anchoring
m
m
kg
Result of the formula**
m2 drawn in the project
GWP/m2
ODP/m2
Flooring. Stone tiles. A-D Phases (Another EXAMPLE)
Stone tiles (floor)
***
***
***
***
m2 drawn in the project
GWP/m2
ODP/m2
TOTAL. A-D Phases
Σ GWP
Σ ODP
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Wall | Roof | Floor

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	TOTAL. A-D Phases						**Σ GWP**	**Σ ODP**	**Σ AP**	**Σ EP**	**Σ POCP**	**Σ ADPE**	**Σ ADPF**	**Σ MFR**

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BIMstone OER

An Open Educational Resource (OER) was designed and produced to support the implementation of the BIMstone Pilot Courses and the BIMstone Multimedia Cards produced.

It was made freely available on the project website to be used as didactic support material in the numerous architecture, construction and heritage courses distributed in the stone products sector.

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BIMstone OER

OER

In this open-access platform, you can access all the information collected during and beyond the end of the project. The platform provides more information for self-learning educational.

DIRECT ACCESS

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SOURCES

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Website del proyecto BIMstone. http://www.bimstoneproject.eu/

BIMEPD

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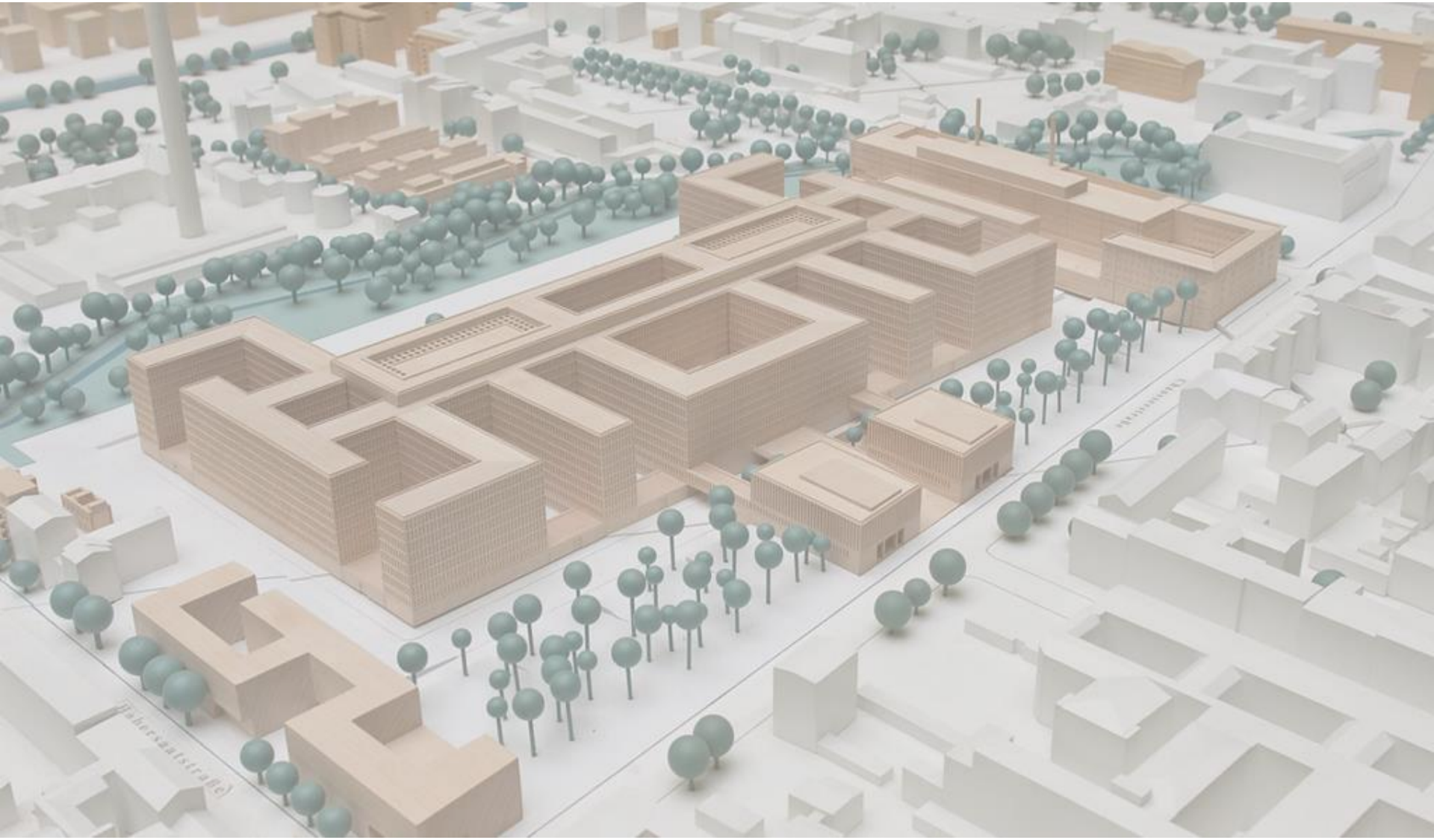

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