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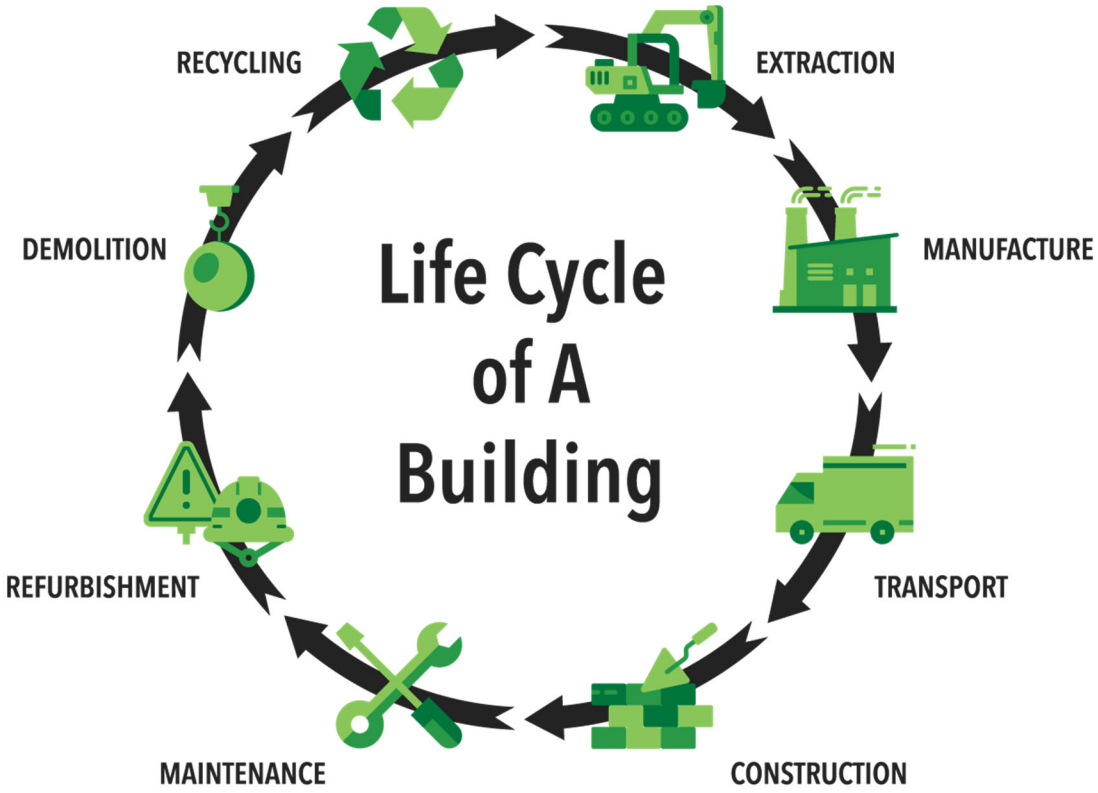
BIM-LCA Construction Project

Title: LCA of a building using Excel.



1 – Aims

The objectives of this tutorial about LCA with the Excel app of the BIM-LCA Constructio Project are as follows:

- Learning what means Sustainable Construction.
- Knowing about the definition of Life Cycle Analysis (LCA) of a building.
- Knowing about the stages of a LCA according to the ISO 14040.
- Learning about the stages of the Life cycle of a building.
- Learning about how the LCA Excel app, developed in the BIM-LCA Construction Project, works to calculate several environmental impact and energy consumption indicators of the life cycle of a building.
- Practice the knowledge acquired through exercises with the Project Excel app, to compare the sustainability of various alternatives in the use of materials in a building.

2 - Learning methodology

The teacher will give an explanation about Open BIM software workflow for LCA of about 15 minutes.

Students will read this tutorial and follow the steps shown in the tutorial, namely:

- Sustainable construction.
  - Principles of Sustainable Construction
  - Benefits of sustainable construction of buildings
- Life cycle Analysis
  - Definition and methodological stages of Life Cycle Assessment
  - Stages of the life cycle of a building
- LCA Excel tool
  - Tab: Building & Material inputs
  - Tab: Material quantities
  - Material Impact Data
  - Tab: Results - Tables
  - Tab: Graphical results
- Exercise 1
- Exercise 2

In order to evaluate the success of the application, the student will solve the two exercises proposed in this tutorial using the project's Excel application.

3 - Tutorial duration

The implementation described in this tutorial will be carried out through the BIM-LCA Project website by self-learning.

2 lesson hours are suitable for this training.

4 – Necessary teaching recourses

Computer room with PCs with internet access.

Required software: Microsoft Office.

5 – Contents & tutorial

5.1 – Introduction.

In the BIM-LCA in Construction E+ Project, an excel tool has been developed to carry out Life Cycle Analysis on buildings. This tutorial is intended as a guide to the use of this tool. At the end of the tutorial, two practical exercises are proposed to the students to compare the environmental impact results of several alternatives proposed in the construction of a single-family home.

5.2 – Sustainable construction.

Sustainable construction is a conception of the design of construction in a sustainable way, seeking the use of natural resources in order to minimize their impact on the environment and its inhabitants.

Sustainable construction is based on the correct use, management and reuse of natural resources and available energy, during the construction process and subsequent use of the building, applying Life Cycle Assessment (LCA) as an environmental tool.

The importance of committing to sustainable construction is supported by recent studies, which have found that the construction sector is responsible for the use of around 36% of the total energy consumed and, in particular, 65% of electricity consumption, without forgetting the impact it has on the environment, the consumption of raw materials, greenhouse gas emissions, waste generation and drinking water consumption.

5.2.1. Principles of Sustainable Construction

Sustainable construction is based on principles accepted by most of the agents involved in the construction process, summarised in the following points:

- The consideration from the initial phases of the project of the environmental conditions to obtain the maximum performance with the least environmental impact, highlighting the following:
    - Climate
    - Hydrographic
    - Topographic
    - Geological
    - Surrounding ecosystems

- Efficiency and moderation in the use of construction materials, prioritizing those with low energy content.
- Reducing energy consumption for heating, air conditioning, lighting, transport and other equipment, covering the rest of the demand with renewable energy sources.
- The minimization of the overall energy balance of the building, covering all phases of the construction process and the stages of the building's life:
    - -Design
    - -Construction
    - - Use, repair and maintenance
    - - End of Life: Deconstruction and Recycling
- Consideration of basic requirements and regulatory compliance in relation to:
    - Safety
    - Habitability
    - Hygrothermal comfort
    - Healthiness
    - Lighting

5.2.2. Benefits of sustainable construction of buildings

Sustainable construction brings economic, social and environmental benefits, including:

- Economic benefits
    - Reduced use and maintenance costs
    - Increased construction value
    - Increased energy efficiency of the building
- Social benefits
    - Improved acoustic, thermal and hygrothermal quality of buildings
    - Increased user well-being
- Environmental benefits
    - Improved air and water quality
    - Reduction of solid waste

- Preservation and conservation of natural resources

5.3 – Life cycle Analysis (LCA).

Life Cycle Assessment (LCA) or 'cradle-to-grave analysis' is a tool that studies and evaluates the environmental impact of a product or service during all stages of its existence, establishing an environmental balance in order to achieve sustainable development.

At the end of the 20th century, there was a growing need to establish universal indicators that objectively evaluate industrial processes and projects, in order to adequately preserve the environment.

As a result of the Conference on Environment and Development in June 1992 in Rio de Janeiro, Brazil, the International Standards Organization (ISO) undertook to develop international environmental standards. To this end, Technical Committee 207 (1993) was created, responsible for the development of the standards on Environmental Management Systems (EMS) called ISO 14000, whose objective is to standardize the modes of production and provision of services, in order to protect the environment and increase its quality and competitiveness.

The purpose of ISO standards is to encourage and promote more effective management of the environment by providing useful tools for collecting, interpreting and transmitting evidence-based and objective information, in order to improve environmental interventions. Providing three groups of environmental tools: the Life Cycle Assessment (LCA), the Environmental Performance Assessment (EDA) and the Ecolabelling System.

Subcommittee SC 5 of the Technical Committee 207 is responsible for developing standards to regulate Life Cycle Assessment, including:

- UNE-EN ISO 14040. Environmental management. Life cycle analysis. Principles and frame of reference.
- UNE-EN ISO 14044. Environmental management. Life cycle analysis. Requirements and guidelines.

5.3.1. Definition and methodological stages of Life Cycle Assessment

The SETAC (Society of Environmental Toxicology And Chemistry) defines Life Cycle Assessment as:

"An objective process for assessing the environmental burdens associated with a product, process or activity, identifying and quantifying the use of matter and energy, as well as emissions or discharges into the environment, to determine the impact of that use of resources and those emissions or discharges, in order to evaluate and implement

environmental improvement strategies. The study includes the complete cycle of the product, process or activity, taking into account the stages of: extraction and processing of raw materials, production, transport and distribution, use, reuse and maintenance, recycling and final disposal."

In accordance with the UNE-EN ISO 14040 standard, the development of a Life Cycle Assessment must include the following methodological stages:

- Stage 1: Definition of objectives and scope (Functional Unit)
- Stage 2: General Inventory Analysis
- Stage 3: Impact Assessment
- Stage 4: Interpretation of the results.

5.3.2. Stages of the life cycle of a building

Based on the classification and nomenclature included in the UNE-EN ISO 14040 and UNE-EN ISO 14044 standards, four stages are established in the life cycle of a building:

- Product: A1 - A3
    - Extraction of raw materials (A1)
    - Transport to factory (A2)
    - Manufacturing (A3)
- Construction process: A4 - A5
    - Transport of the product (A4)
    - Product Installation and Construction Process (A5)
- Product Usage: B1 - B7
    - Usage (B1)
    - Maintenance (B2)
    - Repair (B3)
    - Substitution (B4)
    - Rehabilitation (B5)
    - Operational Energy Use (B6)
    - Operational Water Use (B7)

- End of life: C1 - C4
    - Deconstruction and demolition (C1)
    - Transport (C2)
    - Waste management for reuse, recovery and recycling (C3)
    - Final Elimination (C4)

5.4 – LCA Excel tool

With the LCA Excel app developed in this Project it is possible to estimate the following environmental impacts produced by the construction of a building in stages A1-A5. That is, until the construction of the building is finished.

The environmental impacts considered are:

Enviromental Impacts	Units
Abiotic depletion potential for fossil resources (ADPF)	MJ
Abiotic depletion potential for non fossil resources (ADPE)	kg Sb-eq.
Acidification potential (AP)	kg SO2-eq.
Global warming potential (GWP)	kg CO2-eq.
Eutrophication potential (EP)	kg Phosphat-eq.
Photochemical Ozone Creation Potential (POCP)	kg Ethen-eq
Ozone Depletion Potential (ODP)	kq CFC 11-eq

The excel also studies the use of the following resources

Energy consumption	Units
Total use of renewable primary energy resources (PERT)	MJ
Total use of non renewable primary energy resource (PENRT)	MJ

The types of buildings that the Excel app can analyse are:

- Single-family houses
- Multi-storey buildings
- Industrial warehouses.

The LCA Excel Application developed in this project has four main tabs. These are:

- Building & Material inputs.
- Material quantities.
- Material impact data.
- Results – Tables.

- Graphical results.

5.4.1. Tab: Building & Material inputs

User describe in this tab general information about the building analysed.

User has to introduce in this tab data about areas and volumes of the elements of the structure and the construction systems of the building. These data can be obtained form the BIM model using BIM-software.

The choice of type of materials and type of construction products is also carried out in this section.

Among the decisions to be made in this building data entry tab are the following:

- Choice of the type of foundation: Piles, footings or foundation slab
- Choice of the material of the beams and columns of the structure: reinforced concrete, steel or wood.
- Choice of the type of structural slabs.
- Choice of the type of flooring.
- Choice of the type of interior partitions.
- Choice the type of façades: double brick wall, ventilated façade or wooden façade.
- Choice the roofs: flat, inclined.

The following pages of this tutorial show all inputs and all decisions to be made about the types of building construction systems to be studied.

The values of the inputs shown correspond to a case study of a single-family house with a reinforced concrete structure and brick facades and partitions.

Case Study: Single-Family Home with Concrete Structure and Brick Walls

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BIM-LCA Construction Project

Inputs

1- Data of the building

Project Name:	**Single-family house in concrete and bricks**	
Building type	Residential	
Address	Street 1	
IndoorFloor area	257.52	m2
Analysed service life	50	year
City	Cartagena	
Country	Spain	

Excel Legend

10.80	User input (or parameter readed from IFC file)
23.87	Parameter calculated by app and not editable

2- Areas and volumes in elements of the building - User inputs

Footing volume (m3):	53.89
Volume of Foundation beams (m3):	9.53
Footing plant area (m2):	73.81
Foundation beam plant area (m2):	23.87
Volume of piles (m3):	0.00
Volumen of pile caps (m3):	0.00
Pile cap plant area (m2):	0.00
Foundation slab volume (m3):	0.00
Foundation slab plant area (m2):	0.00
Column volume (m3):	10.89
beam volume (m3):	19.68
Retaining wall volume (m3):	0.00
Area of slabs (including beams) (m2):	351.13
Partition area (m2):	221.66
Facade area (m2):	374.42
Exterior party wall (m2):	0.00
Stairs (m2):	10.80
Ramps (m2):	0.00
Steel volume in stiffening elements (m3):	0.00
Concrete volume in stiffening walls (m3):	0.00
Interior door surface (m2):	7.64
Main door surface (m2):	4.00
Exterior glazed door surface (m2):	4.00
Windows surface (m2):	21.54
Flat roof area (m2):	134.33
Inclinated roof area (horizontal projection) (m2):	86.22
roof inclination angle (deg):	20.00
parapets (m2):	26.40
Railing (m):	5.50

Note: IMPORTANT - If any of the previus element is missing in the project enter 0

Floor Areas (m2)	Indoor	outdoor	total
Ground floor:	116.52	80.37	196.89
Intermediate floors:	141		
roof type 1:		128.48	
roof tape 2:		5.85	

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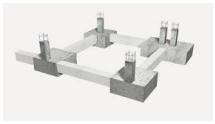
BIM-LCA Construction Project

Inputs

2- Choice the type of structural, construction systems & materials

a) Type of Foundation: 2 (enter 1, 2 or 3)


(1) Piles and pile caps


(2) Footings


(3) Foundation slab

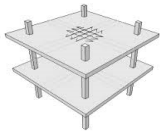
b) Material in Beams and Columns 1

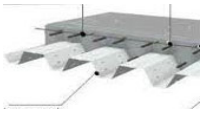

(1) Reinf. Concrete

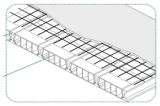

(2) Steel


(3) Timber

c) Type of structural slabs 1 (enter 1, 2, 3 or 4)


(1)-Mass concrete slabs


(2) Composite slab slabs


(3) Lightweight concrete slabs


(4) Timber slabs

c-1) If the perviuos answer was *(3) Lightweight concrete slabs* , pease chose:

Type of bocks: 1


(1) Concrete blocks


(2) Ceramic blocks

d) If it exists in the building, choose one of these stiffening systems:

Type of structure stiffening system: 0

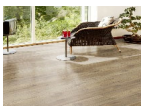
(0) Without stiffening system


(1) Concrete stiffening walls


(2) Steel stiffening elements

e) Type of flooring (non-structural) 1


(1) Ceramic flooring


(2) Wood floating floor


(3) Screed flooring

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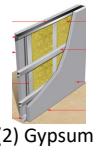
BIM-LCA Construction Project

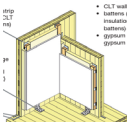
Inputs

f) Type of internal partitions 1

(1) Brick walls



(2) Gypsum cardboard walls



(3) Structural Timber wall

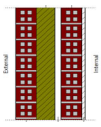
g) Type of stairs 1

(1) Concrete

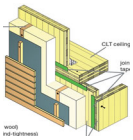
(2) Steel

(3) Timber

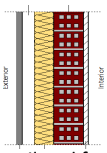
h) Type of facades 1



(1) Double bricks wall



(2) Timber



(3) Ventilated facade

h-1) If the perviuos answer was *(3) Ventilated facade* , pease chose:

Type of tiles for external cladding: 1

N-STON	PORCE	A-STON
(1) Natural semi-rijo limestone	(1) EXTRUDED PORCELAIN	(2) Artificial stone Aggregates+polyester resins

i) Type of windows 1

(1) PVC Double Glazed Window WIN_PVC

(2) Hardwood double glazed window WIN_WOOD

(3) Aluminium Window WIN_AL

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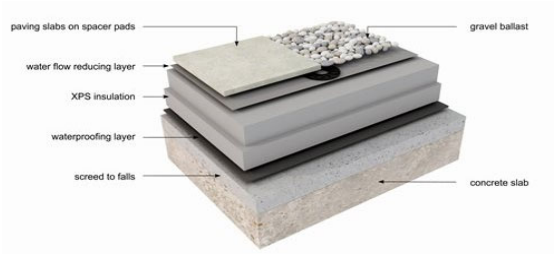
BIM-LCA Construction Project

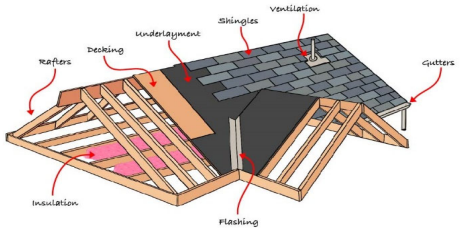
Inputs

j) Type of finishing coat in flat roof 1 (enter 1 or 2)



(1) Ceramic tiles (2) Gravel ballast

k) Type of inclinated roof 1



(1) with brick walls (2) With timber structure

l) Structure under inclinated roof

Eliminate the structure and insulation of inclinated roofs?: 2 (enter 1 or 2)

(1) Yes (2) No

m) Material in the insulation layers of the facades and roofs 1 (enter 1,2,...or 6)

1	MWOOL	Mineral wool insulation
2	POLYU1	Insulation board with a core of rigid polyurethane
3	POLYU2	Polyurethane thermal insulation spray foam
4	EPS	Expanded Polystyrene for insulation
5	CELL	Cellulose Fibre Insulation
6	CORK	Cork-based thermal insulation panels

5.4.2. Tab: Material quantities

In the *Material quantities* tab, the Excel app performs the calculations to estimate the quantity of each of the materials found in the building to be studied.

The user can modify parameters such as the thickness of the different materials in the layers of the Construction Systems or the reinforcement quantities in the concrete elements.

These calculations are shown on the following pages: parameters considered, formulas used, and estimated material quantities.

BIM-LCA

BIM-LCA Construction Project

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Building Material Quantities

Excel Legend

10.80	User input (or parameter readed from IFC file)
23.87	Parameter calculated by app and not editable
30	Parameter loaded by default by app and editable by user
846.26	**kg** Quantity calculated by the program based on the user inputs and parameters of each material. Not user-editable
MWOOL	A type of material or construction element from which one material can be chosen from several alternatives. See note 3, 4 and 5.

Project name: Single-family house in concrete and bricks

							Auxiliary quantiites								
						nr.	thickness	density	Parameter 1		Parameter 2		Material		
Building part	Building element types / building elements		Ref.	Type of Material	Mat Code	1/0	e (m)	d (kg/m3)	Par. Value	Par. name (unit)	Par. Value	Par. name (unit)	Quantities (Q)	Unit	Formula
1- Foundations	1.A - Piles		1.A.1	Concrete	CON1	0			0.00	vol (m3)			0.00	m3	Q=nr*Par1
			1.A.2	Rebar	REB	0			30	Kg Rebar/m3 Con			0.00	kg	Q=nr*Par1*Qcon
	1.B-Basement	1.B.1-Pile Caps	1.B.1.1	Concrete	CON1	0			0.00	vol (m3)			0.00	m3	Q=nr*Par1
			1.B.1.2	Rebar	REB	0			80	Kg Rebar/m3 Con			0.00	kg	Q=Par1*Qcon
			1.B.1.3	Blinding concrete	CON0	0	0.10		0.00	pile cap area (m2)			0.00	m3	Q=nr*e*Par1
		1.B.2-Footings	1.B.2.1	Concrete	CON1	1			53.89	footing vol (m3)			53.89	m3	Q=nr*Par1
			1.B.2.2	Rebar	REB	1			63.3	Kg Rebar/m3 Con			3411.24	kg	Q=Par1*Qcon
			1.B.2.3	Blinding concrete	CON0	1	0.10		73.81	Footing area (m2)			7.38	m3	Q=nr*e*Par1
		1.B.3-Foundation beams	1.B.3.1	Concrete	CON1	1			9.53	beam vol (m3)			9.53	m3	Q=nr*Par1
			1.B.3.2	Rebar	REB	1			88.8	Kg Rebar/m3 Con			846.26	kg	Q=nr*Par1*Qcon
			1.B.3.3	Blinding concrete	CON0	1	0.10		23.87	Beam area (m2)			2.39	m3	Q=nr*e*Par1
		1.B.4-Foundation slab	1.B.4.1	Concrete	CON1	0			0.00	slab vol (m3)			0.00	m3	Q=nr*Par1
			1.B.4.2	Rebar	REB	0			75	Kg Rebar/m3 Con			0.00	kg	
			1.B.4.3	Blinding concrete	CON0	0	0.10		0.00	Slab area (m2)			0.00	m3	Q=e*Par1
	1.C - Retaining walls		1.C.1	Concrete	CON3	1			0.00	wall vol (m3)			0.00	m3	Q=nr*Par1
			1.C.2	Rebar	REB	1			90	Kg Rebar/m3 Con			0.00	kg	Q=Par1*Qcon
2 - Load bearing structural frame	2.A-Frames	2.A.1-Beams (Timber, steel or concrete)	2.A.1.1	Gulam Timber	GLT	0			19.68	beam volume (m3)			0.00	m3	Q=nr*Par1
			2.A.1.2	Steel in timber connec. (galvanized)	ST-G	0			8	kg Steel/m3 timber			0.00	kg	Q=nr*Par1*Q CLT
			2.A.1.3	Structural steel	ST	0		7850	19.68	beam volume (m3)	1.1	due to connections	0.00	kg	Q=nr*Par1*d*Par2
			2.A.1.4	Concrete	CON3	1			19.68	beam volume (m3)			19.68	m3	Q=nr*Par1
			2.A.1.5	Rebar	REB	1			137.6	Kg Rebar/m3 Con			2707.97	kg	Q=Par1*Q Con
		2.A.2-Columns (Timber, steel or concrete	2.A.2.1	Gulam Timber	GLT	0			10.89	column vol (m3)			0.00	m3	Q=nr*Par1
			2.A.2.2	Steel in timber connect. (galvanized)	ST-G	0			8	kg Steel/m3 timber			0.00	kg	Q=nr*Par1*Q CLT
			2.A.2.3	Structural steel	ST	0		7850	10.89	column vol (m3)	1.1	due to connections	0.00	kg	Q=nr*Par1*d*Par2
			2.A.2.4	Concrete	CON3	1			10.89	column vol (m3)			10.89	m3	Q=nr*Par1
			2.A.2.5	Rebar	REB	1			202.3	Kg Rebar/m3 Con			2203.05	kg	
		2.A.3-Mass concrete slabs or	2.A.3.1	Concrete	CON2	1	0.25		272.41	Slab area (m2)			68.10	m3	Q=nr*e*Par1
			2.A.3.2	Rebar	REB	1			90	Kg Rebar/m3 Con			6129.23	kg	
		2.A.4-Composite slabs or	2.A.4.1	Concrete	CON2	0	0.16		351.13	Slab area (m2)			0.00	m3	Q=nr*e*Par1
			2.A.4.2	Rebar	REB	0			25	Kg Rebar/m3 Con			0.00	kg	Q=Par1*Q Con
			2.A.4.3	Galvanized steel plates	ST-G	0	0.001	7850	351.13	Slab area (m2)	1.200	m2 plates/m2 slab	0.00	kg	Q=nr*e*Par1*Par2*d
		2.A.5-Lightweight concrete slabs or	2.A.5.1	Concrete blocks or	CONB	0	0.25		272.41	Slab area (m2)	0.820	m3 block/m2 slab	0.00	m3	Q=nr*e*Par1*Par2
			2.A.5.2	Ceramic blocks	CERB	0	0.25	320	272.41	Slab area (m2)	0.820	m3 block/m2 slab	0.00	kg	Q=nr*e*Par1*Par2*d
			2.A.5.3	Precast concrete beams	CONBEAM	0		2500	272.41	Slab area (m2)	0.038	m2 beam cross sec	0.00	kg	Q=nr*(Par1/0.8)*Par2*d
			2.A.5.4	Concrete (cast in place)	CON2	0	0.05		272.41	Slab area (m2)			0.00	m3	Q=nr*Par1*e
			2.A.5.5	Rebar	REB	0			25	Kg Rebar/m3 Con			0.00	kg	Q=Par1*Q Con
		2.A.6-Mass timber structural floors	2.A.6.1	Cross Laminated Timber (CLT) panels	CLT	0	0.16		351.13	foor area (m2)			0.00	m3	Q=nr*Par1*e
			2.A.6.2	Steel in timber connect. (galvanized)	ST-G	0			4	kg Steel/m3 CLT			0.00	kg	Q=nr*Par1*Q CLT
	2.B-Concrete stiffening walls/steel in stiffening elements		2.B.1	Structural steel	ST	0		7850	0.00	steel volume (m3)	1.1	due to connections	0.00	kg	Q=nr*Par1*d*Par2
			2.B.2	Concrete	CON3	0			0.00	concrete vol (m3)			0.00	m3	Q=nr*Par1
			2.B.3	rebar	REB	0			140	Kg Rebar/m3 Con			0.00	kg	Q=Par1*Qcon
	3.A-Horizontal elements	3.A.1-Ground floor slab (non-structural)	3.A.1.1	Concrete	CON1	1	0.15		196.89	Slab area (m2)			29.53	m3	Q=nr*Par1*e
			3.A.1.2	rebar	REB	1			30	Kg Rebar/m3 Con			886.01	kg	Q=Par1*Qcon
			3.A.1.3	Graded aggregate	AGG	1	0.25	1800	196.89	Slab area (m2)			88600.50	kg	Q=nr*Par1*e*d
		3.A.2-Flooring Type I: Ceramic flooring or	3.A.2.1	Ceramic tiles	CEFT	1			257.52	Floor area (m2)			257.52	m2	Q=nr*Par1
			3.A.2.2	Tile bond coat (adhesive)	ADH	1			257.52	Floor area (m2)	6.00	kg/m2	1545.12	kg	Q=nr*Par1*Par2
			3.A.2.3	Mortar bed	MOR	1	0.03	1600	257.52	Floor area (m2)			12360.96	kg	Q=nr*e*Par1*d
			3.A.2.4	Cleavage membrane	POLY	1	0.005		257.52	Floor area (m2)			1.29	m3	Q=nr*e*Par1
		3.A.3-Flooring Type II: Wood floating floor or	3.A.3.1	Laminated wood flooring	WFL	0			257.52	Floor area (m2)			0.00	m2	Q=nr*Par1
			3.A.3.2	Chipboard flooring (plywood)	PLYW	0	0.03		257.52	Floor area (m2)			0.00	m3	Q=nr*Par1*e
			3.A.3.3	Insulation layer	MWOOL	0	0.04		257.52	Floor area (m2)			0.00	m3	Q=nr*Par1*e

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Project name: Single-family house in concrete and bricks

						Auxiliary quantiites									
						nr.	thickness	density	Parameter 1		Parameter 2		Material		
Building part	Building element types / building elements		Ref.	Type of Material	Mat Code	1/0	e (m)	d (kg/m3)	Par. Value	Par. name (unit)	Par. Value	Par. name (unit)	**Quantities (Q)**	**Unit**	Formula
3 - Non-load bearing elements	3.B-Vertical elements		3.A.3.4	Timber battens	GLT	0			257.52	Floor area (m2)	0.045	m3 timb/m2 floor	0.00	**m3**	Q=nr*Par1*Par2
		3.A.4-Flooring Type III: Screed flooring	3.A.4.1	Wet screed (cement mostar)	MOR	0	0.05		257.52	Floor area (m2)			0.00	**m4**	Q=nr*Par1*e
			3.A.4.2	Sound insulation layer	POLY	0	0.005		257.52	Floor area (m2)			0.00	**m3**	Q=nr*e*Par1
		3.B.1-Internal partition Type I: Brick walls	3.B.1.1	Brick wall	CERB	1	0.110	805	221.66	Wall area (m2)			19627.99	**kg**	Q=nr*e*Par1*d
			3.B.1.2	Finishing coat (plastering mortars)	PLASM	1	0.02	1600	221.66	Wall area (m2)			7093.12	**kg**	Q=nr*e*Par1*d
		3.B.2-Internal partition Type II: Gypsum cardboard walls	3.B.2.1	Gypsum cardboard or fiberboard	GYP_F	0			221.66	Wall area (m2)			0.00	**m2**	Q=nr*Par1
			3.B.2.2	Galvanized steel (U, C) channel studs	ST-GC	0			221.66	Wall area (m2)	3.040	kg ST /m2 wall	0.00	**kg**	Q=nr*Par1*Par2
			3.B.2.3	Insulation layer	MWOOL	0	0.05		221.66	Wall area (m2)			0.00	**m3**	Q=nr*Par1
		3.B.3-Internal partition Type III: Structural Timber wall	3.B.3.1	Cross Laminated Timber (CLT) panels	CLT	0	0.100		221.66	Wall area (m2)			0.00	**m3**	Q=nr*Par1*e
			3.B.3.2	Steel in timber connect. (galvanized)	ST-G	0			4	kg Steel/m3 CLT			0.00	**kg**	Q=nr*Par1*Q CLT
			3.B.3.3	Insulation layer	MWOOL	0	0.050		221.66	Wall area (m2)			0.00	**m3**	Q=nr*Par1*e
			3.B.3.4	Timber battens	GLT	0			221.66	Wall area (m2)	0.045	m3 timb/m2 wall	0.00	**m3**	Q=nr*Par1*Par2
			3.B.3.5	Gypsum plasterboard	GYP_P	0			221.66	Wall area (m2)	2	number or boards	0.00	**m2**	Q=nr*Par1*Par2
		3.B.4-External party walls	3.B.4.1	Concrete blocks	CONB	1	0.20		0.00	Wall area (m2)			0.00	**m3**	Q=nr*Par1*e
			3.B.4.2	Insulation layer	MWOOL	1	0.05		0.00	Wall area (m2)			0.00	**m3**	Q=nr*Par1*e
			3.B.4.3	Finishing coat (plastering mortars)	PLASM	1	0.04	1600	0.00	Wall area (m2)			0.00	**kg**	Q=nr*e*Par1*d
		3.B.5-Parapets	3.B.5.1	Brick wall	CERB	1	0.110	805	26.40	Wall area (m2)			2337.72	**kg**	Q=nr*e*Par1*d
			3.B.5.2	Finishing coat (plastering mortars)	PLASM	1	0.02	1600	26.40	Wall area (m2)			844.80	**kg**	Q=nr*e*Par1*d
		3.B.6-Railings	3.B.6	Railings	ST-SL	1			5.50	long (m)	9.50	kg ST/m railing	52.25	**kg**	Q=nr*Par1*Par2
		3.B.7-Interior doors	3.B.7	Interior doors	WDOOR	1			7.64	door (m2)			7.64	**m2**	Q=nr*Par1
	3.C-Inclined elements	3.C.1-Stairs	3.C.1.1	Ceramic tiles	CEFT	1			10.80	stairs area (m2)	1.27	m2 title/m2 stairs	13.72	**m2**	Q=nr*Par1*Par2
			3.C.1.2	Tile bond coat (adhesive)	ADH	1			6.00	kg/m2 title			82.30	**kg**	Q=nr*Par1*m2 title
			3.C.1.3	Mostar	MOR	1		1600	10.80	stairs area (m2)	0.0715	m3 mor/m2 stairs	1235.52	**kg**	Q=nr*Par1*Par2*d
			3.C.1.4	Concrete	CON3	1	0.20		10.80	stairs area (m2)			2.16	**m3**	Q=nr*Par1*e
			3.C.1.5	Rebar	REB	1			137.6	Kg Rebar/m3 Con			297.22	**kg**	Q=nr*Par1*Qcon
			3.C.1.6	Structural steel	ST	0			10.80	stairs area (m2)	21.33	kg ST/m2 Stairs	0.00	**kg**	Q=nr*Par1*Par2
			3.C.1.7	Cross Laminated Timber (CLT) panels	CLT	0	0.160		10.80	stairs area (m2)			0.00	**m3**	Q=nr*Par1*e
			3.C.1.8	Steel in timber connect. (galvanized)	ST-G	0			4.00	kg Steel/m3 CLT			0.00	**kg**	Q=nr*Par1*Q CLT
		3.C.2-Ramps	3.C.2.1	Ceramic tiles	CEFT	1			0.00	ramp area (m2)			0.00	**m2**	Q=nr*Par1
			3.C.2.2	Tile bond coat (adhesive)	ADH	1			0.00	ramp area (m2)	6.00	kg/m2 title	0.00	**kg**	Q=nr*Par1*Par2
			3.C.2.3	Mostar	MOR	1	0.03	1600	0.00	ramp area (m2)			0.00	**kg**	Q=nr*e*Par1*d
			3.C.2.4	Concrete	CON3	1	0.10		0.00	ramp area (m2)			0.00	**m3**	Q=nr*e*Par1
			3.C.2.5	Rebar	REB	1			30	Kg Rebar/m3 Con			0.00	**kg**	Q=Par1*Qcon
4 - Facades	4.A-External wall systems	4.A.1-Facade type I: with bricks or,	4.A.1.1	External finish	PLASM	1	0.03	1600	374.42	Wall area (m2)			17972.16	**kg**	Q=nr*e*Par1*d
			4.A.1.2	Brick walls	CERB	1	0.22	805	374.42	Wall area (m2)			66309.78	**kg**	Q=nr*e*Par1*d
			4.A.1.3	Insulation layer	MWOOL	1	0.07	152	374.42	Wall area (m2)			26.21	**m3**	Q=nr*Par1*e
			4.A.1.4	Interior finish	GYP_P	1			374.42	Wall area (m2)			374.42	**m2**	Q=nr*Par1
		4.A.2-Facade type II: Timber panels or,	4.A.2.1	Gypsum plasterboard	GYP_P	0			374.42	Wall area (m2)			0.00	**m2**	Q=nr*Par1
			4.A.2.2	Cross Laminated Timber (CLT) panels	CLT	0	0.100		374.42	Wall area (m2)			0.00	**m3**	Q=nr*Par1*e
			3.B.3.2	Steel in timber connect (galvanized)	ST-G	0			4	kg Steel/m3 CLT			0.00	**kg**	Q=nr*Par1*Q CLT
			4.A.2.3	Insulation layer	MWOOL	0	0.05		374.42	Wall area (m2)			0.00	**m3**	Q=nr*Par1*e
			4.A.2.4	Timber battens	GLT	0			374.42	Wall area (m2)	0.045	m3 timb/m2 wall	0.00	**m3**	Q=nr*Par1*Par2
			4.A.2.5	External wooden cladding	WCLA	0			374.42	Wall area (m2)			0.00	**m2**	Q=nr*Par1
		4.A.3-Facade type III: Ventilated facade	4.A.3.1	Gypsum plasterboard	GYP_P	0			374.42	Wall area (m2)			0.00	**m2**	Q=nr*Par1
			4.A.3.2	Brick wall	CERB	0	0.12	1000	374.42	Wall area (m2)			0.00	**kg**	Q=nr*e*Par1*d
			4.A.3.3	Insulation layer	MWOOL	0	0.05		374.42	Wall area (m2)			0.00	**m3**	Q=nr*Par1*e
			4.A.3.4	Tiles for external cladding	N-STON	0	0.03	2750	374.42	Wall area (m2)			0.00	**kg**	Q=nr*Par1*e*d
	4.B-Facade openings	4.B.1-Windows	4.B.1	Windows	WIN_PVC	1			21.54	Surface (m2)			21.54	**m2**	Q=nr*Par1
		4.B.2-Exterior doors	4.B.2.1	Exterior glazed doors	DOOR_GL	1			4.00	Surface (m2)			4.00	**m3**	Q=nr*Par2
			4.B.2.2	Exterior front doors	DOOR_W	1			4.00	Surface (m2)			4.00	**m3**	Q=nr*Par3
		5.A.1-Finishing coat	5.A.1.1	Ceramic tiles or	CEFT	1		2300	134.33	roof area (m2)			134.33	**m2**	Q=nr*Par1

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Project name: Single-family house in concrete and bricks

						Auxiliary quantiites								
					nr.	thickness	density	Parameter 1		Parameter 2		Material		
Building part	Building element types / building elements		Ref.	Type of Material	Mat Code	1/0	e (m)	d (kg/m3)	Par. Value	Par. name (unit)	Par. Value	Par. name (unit)	**Quantities (Q)**	**Unit**	Formula
5 - Roof	5.A-Roof Type I: Flat roof or	5.A.1-Finishing coat	5.A.1.2	Gravel ballast	GRAV	0	0.15	1800	134.33	roof area (m2)			0.00	**kg**	Q=nr*Par1*e*d
		5.A.2-Waterproofing layer	5.A.2	Waterproofing layer	WP	1			134.33	roof area (m2)			134.33	**m2**	Q=nr*Par1
		5.A.3-Insulation layer	5.A.3	Insulation layer	MWOOL	1	0.07		134.33	Wall area (m2)			9.40	**m3**	Q=nr*Par1*e
		5.A.4-Screed to falls	5.A.4	Cement mostar	MOR	1	0.03	1600	134.33	Wall area (m2)			6447.84	**kg**	Q=nr*e*Par1*d
	5.B-Roof type II: Inclinated tiled roof	5.B.1-Roof tiles	5.B.1	Roof tiles	RTIL	1			86.22	roof tiles area (m2)	40	kg/m2	3670.14	**kg**	Q=nr*Par1*Par2/cos(Par3)
		5.B.2-Mostar	5.B.2	Cement mostar	MOR	1	0.02	1600	86.22	roof tiles area (m2)			2936.11	**kg**	Q=nr*e*Par1*d/cos(Par3)
		5.B.3-Waterproofing layer	5.B.3	Waterproofing layer	WP	1			86.22	roof tiles area (m2)			91.75	**m2**	Q=nr*Par1/cos(Par3)
		5.B.4-Decking	5.B.4	Ceramic deck or	CERB	1	0.03	1030	86.22	roof tiles area (m2)			2835.18	**kg**	Q=nr*e*Par1*d/cos(Par3)
			5.B.5	wooden deck (plywood)	PLYW	0	0.03		86.22	roof tiles area (m2)			0.00	**m3**	Q=nr*Par1*e
		5.B.5-Structure	5.B.6	Brick walls or	CERB	1	0.045	483	86.22	roof tiles area (m2)	0.80	wall separation (m)	1979.19	**kg**	Q=nr*e*(Par1^0.5/Par2)*(tg(Par
			5.B.7	Gulam timber beams	GLT	0	0.05		86.22	roof tiles area (m2)	0.60	wall separation (m)	0.00	**m3**	Q=nr*e*0.05*(((Par1^0.5)/cos(P
		5.B.6-Insulation layer	5.B.8	Insulation layer	MWOOL	1	0.05		86.22	roof tiles area (m2)			4.31	**m3**	Q=nr*Par1*e

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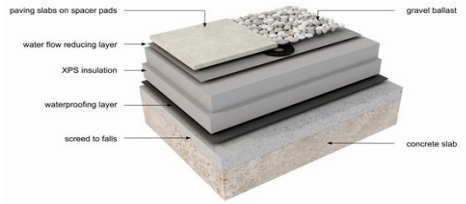
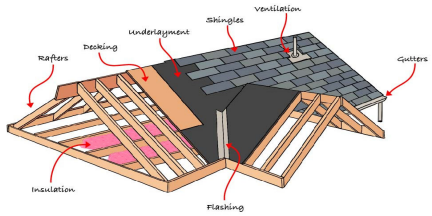
					Auxiliary quantiites										
					nr.	thickness	density	Parameter 1		Parameter 2		Material		
Building part	Building element types / building elements	Ref.	Type of Material	Mat Code	1/0	e (m)	d (kg/m3)	Par. Value	Par. name (unit)	Par. Value	Par. name (unit)	**Quantities (Q)**	**Unit**	Formula

5.A - Flat roof



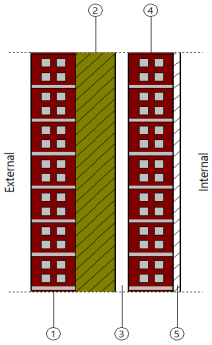
5.B - Tiled roof with timber structure



5.B - Tiled roof

Tiled roof with brick walls

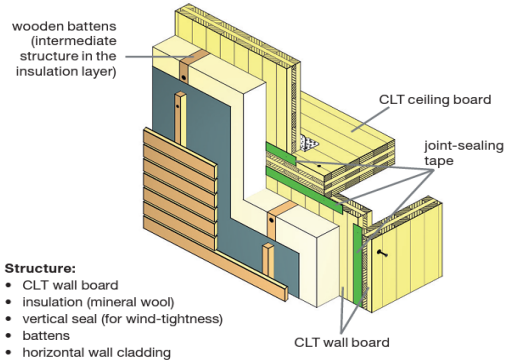
4.A.1 - Facade Type I: Facade with double brick wall



Layers
1 - M01 - 100 mm brick: 10.16 cm
2 - I04 - 89 mm batt insulation: 8.94 cm
3 - F04 - Wall air space resistance: 3.00 cm
4 - M01 - 100 mm brick: 10.16 cm
5 - G01 - 16 mm gyp board: 1.59 cm
Total thickness: 33.85 cm
Thermal description
Heat transfer coefficient (U): 0.39 W/(m²·K)
Thermal capacity: 51975.29 J/m²·K

4.A.2 - Facade Type II: with Timber walls

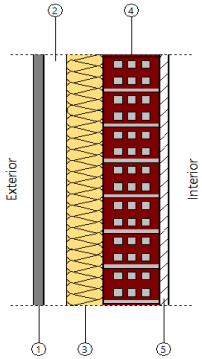
External wall
Insulation with mineral wool



Structure:

- CLT wall board
- insulation (mineral wool)
- vertical seal (for wind-tightness)
- battens
- horizontal wall cladding

4.A.3 - Facade Type III: Ventilated facade



Capas
1 - Caliza muy dura [2200 < d < 2590]: 2.00 cm
2 - Cámara de aire: 5.00 cm
3 - URSA TERRA Vento Plus P8792 80mm: 8.00 cm
4 - 1/2 pie LP métrico o catalán 40 mm< G < 60 mm: 12.00 cm
5 - Enlucido de yeso 1000 < d < 1300: 2.00 cm
Espesor total: 29.00 cm
Caracterización térmica
Transmitancia térmica (U): 0.33 W/(m²·K)
Capacidad térmica: 61992.71 J/m²·K

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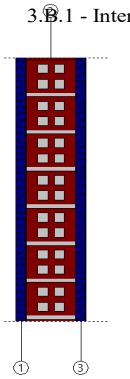
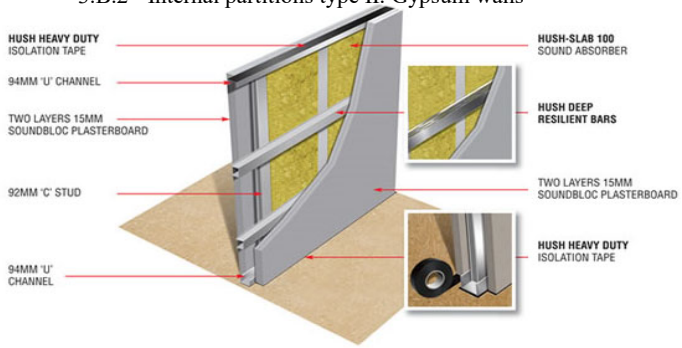
					Auxiliary quantiites										
					nr.	thickness	density	Parameter 1		Parameter 2		Material		
Building part	Building element types / building elements	Ref.	Type of Material	Mat Code	1/0	e (m)	d (kg/m3)	Par. Value	Par. name (unit)	Par. Value	Par. name (unit)	**Quantities (Q)**	**Unit**	Formula

3.B.1 - Internal partitions type I: brick walls



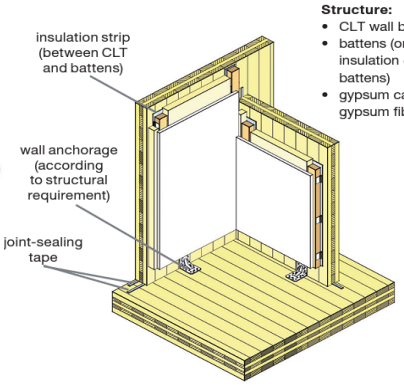
Layers
1 - Cement, sand: 2.00 cm
2 - M01 - 100 mm brick: 10.16 cm
3 - Cement, sand: 2.00 cm
Total thickness: 14.16 cm
Thermal description
Heat transfer coefficient (U): 2.42 W/(m²·K)
Thermal capacity: 70113.91 J/m²·K

3.B.2 - Internal partitions type II: Gypsum walls



3.B.3 - Internal partitions type III: Timber walls

Internal wall
Facing panel (spring clips)



Structure:
- CLT wall board
- battens (on spring clips), insulation (between battens)
- gypsum cardboard or gypsum fibreboard

3.A.2 - Flooring Type I: Ceramic flooring

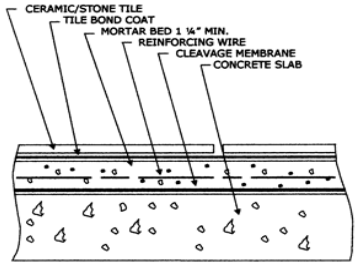
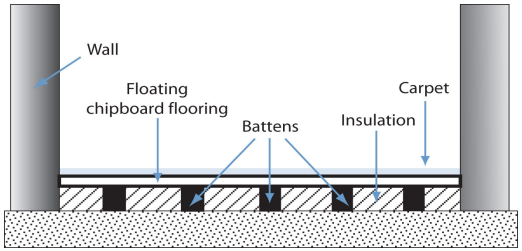
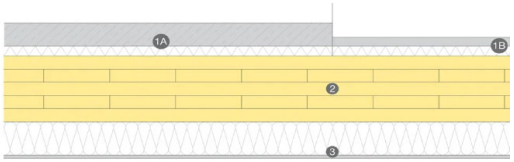


FIGURE F

3.A.3 - Flooring Type II: Wooden floating floor



3.A.4 - Flooring Type III Screed flooring



1A. Wet screed (50-70 mm) with impact sound insulation (20-30 mm).
1B. Dry screed (25 mm) with impact sound insulation (20-30 mm).
2. CLT floor 220 mm (140 mm or thicker).
3. Mineral wool and suspended ceiling (~70 mm) with single layer gypsum board ceiling.

5.4.3. Tab: Material Impact Data.

This tab lists all the materials that can be used in the building under study with their impacts and energy consumption for stages A1 to A5 of the building's construction.

This tab is a short data base on environmental impacts built form different data bases of Environmental product declarations (EPDs).

The sources consulted were:

https://co2data.fi/rakentaminen/
https://www.eco-platform.org/epd-data.html

The following pages of this tutorial contain the list of materials and their description.

Co-funded by the European Union

Erasmus+ Project 2022-1-NO01-KA220-HED-000087893

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BIM-LCA Construction Project

Description of Materials and Impact Data

Project name: Single-family house in concrete and bricks

			1		2	3	4	5	6
nr.	Building part	Type of Material	Mat Code	Material Name	Description	Quant. Studied in EPD	Unit	Cost €
1	Under foundation	Blinding concrete	CON0	Concrete C16/20	C16/20 ECOPact Prime concrete produced in the plant of Greenwich of Aggregate Industries for use as ready-mixed concrete of normal building construction and civil engineering.	1	m3	87.54
2	Structure	Concrete	CON1	Ready mixed concrete (C30/37, C35/45 SCC) - C30/37 (Foundation)	1m3 factory concrete for use in exposure classes XC2, XC3, XC4, XF1 and XA1. This corresponds to concrete exposed to moderate environmental impact as defined in DS/EN 206 DK NA. The SPD has been prepared on the basis of weighted average data from several manufacturers (average product, Industry level). The producers who provide data for the EPD cover approx. 80% of the total Danish production of factory concrete.	1	m3	118.28
3	Structure	Concrete	CON2	Ready mixed concrete (C30/37, C35/45 SCC) - C35/45 SCC (Floor)	1m3 factory concrete for use in exposure classes XC2, XC3, XC4, XF1 and XA1. This corresponds to concrete exposed to moderate environmental impact as defined in DS/EN 206 DK NA. The SPD has been prepared on the basis of weighted average data from several manufacturers (average product, Industry level). The producers who provide data for the EPD cover approx. 80% of the total Danish production of factory concrete.	1	m3	244.28
4	Structure	Concrete	CON3	Ready mixed concrete (C30/37, C35/45 SCC) - C30/37 (Inner wall, Column and Beams)	1m3 factory concrete for use in exposure classes XC2, XC3, XC4, XF1 and XA1. This corresponds to concrete exposed to moderate environmental impact as defined in DS/EN 206 DK NA. The SPD has been prepared on the basis of weighted average data from several manufacturers (average product, Industry level). The producers who provide data for the EPD cover approx. 80% of the total Danish production of factory concrete.	1	m3	408
5	Structure	Rebar	REB	STEEL DEFORMED BARS FOR CONCRETE REINFORCEMENT	STEEL DEFORMED BARS FOR CONCRETE REINFORCEMENT are used to reinforce concrete in building constructions	1000	kg	1800
6	Structure	Structural steel	ST	Hot rolled steel profiles	The hot rolled steel profiles are made of steel bloom produced in electric arc furnace (EAF) process using 100% of iron scrap. The profiles constitute intermediate products commonly used for construction of power poles, roads, steel structures, supporting structures for buildings, load-bearing structures of buildings such industrial halls and warehouses as well as in railway, mining and shipbuilding industry. A specific product technical data is available at manufacturer website: www.wostsa.pl.	1000	kg	2690
7	Structure / Pattitions /roof stucture	Gulam Timber / Timber battens	GLT	Glued laminated timber	This EPD is based on a declared unit of 1 m³ of glued laminated timber (moisture of 10% at a raw density of 464 kg/m³). The results refer to a representative average of Rubner glued laminated timber including standard beams as well as sophisticated 3D-beam components. The LCA covers 100% of the Rubner group's production referring to its sites located at Rohrbach (Austria), Ober-Grafendorf (Austria), Brixen (Italy) and Calitri (Italy).	1	m3	1134
8	Composite steel-concrete slabs	Galvanized steel plates	ST-G	Galvanized Structural Steel	The declaration covers galvanized structural steel produced at the production site in Brande, Denmark. The declaration covers all life cycle modules from A1-A5, C1-C4 and D and is based on product-specific data provided by Give Steel A/S and background data from GaBi professional 2020 and Ecoinvent v3.6.	1000	kg	2500
9	Walls and Lightweight concrete slabs	Concrete o ceramic blocks	CONB	Concrete blocks	Autoclaved aerated concrete blocks with a dry density of 375 kg/m3 , also called Planstein PP 2/040	1	m3	261.76
10	Walls / Lightweight concrete slabs / Inclinated roof	Ceramic blocks / brick wall /ceramic deck	CERB	Red bricks or ceramic blocks	Bricks such as "RT Ultima 150" and "RT 550 Unika" are used to build walls, pillars and partitions.	1000	kg	420
11	Lightweight concrete slabs	Precast concrete beams	CONBEAM	Precast concrete elements of structures	Precast concrete structures: filigree slabs, shell/double walls, one/three layer walls, balconies, stairs, columns, beams and other precast concrete products	1	kg	0.3
12	Walls, slabs	Cross Laminated Timber (CLT) panels	CLT	Cross Laminated Timber - CLT	Cross Laminated Timber - CLT -Gross Density: 424.0 kg/m^3	1	m3	1355.7
13	Under the Ground slab	Graded aggregate	AGG	Aggregates	Aggregates from Uddevalla quarry - Glimmingen. Product variation: Sub base 0/150, Macadam 100/250, Macadam 150/300	1000	kg	50
14	Roof	Roof tiles	RTIL	Roof tiles (produced using natural gas) - Red tile	The product is produced using certified green electricity and natural gas. The declared unit is in tonnes - the mass required for roofing must be calculated using information from producer (dens=40 kg/m2)	1000	kg	3100
15	Flooting, roof	Ceramic tiles	CEFT	Ceramic Floor Tiles	Ceramic Floor Tiles 1 kg/m2	1	m2	32.21
16	Roof, fooring	Tile bond coat (adhesive)	ADH	Mineral adhesives H40® Gel, Bioflex®, H40® Sin Limites® & H40® Sem Limites	The International EPD System: Construction products / Aggregates The International EPD System: Construction products / Cement and building limes	1	kg	0.6
17	Roof, flooring	Mortar bed / Wet screed	MOR	Cement mortars	Cement mortars (1600 kg/m3)	1	kg	0.25
18	Flooring	Cleavage membrane / Sound insuolation layer	POLY	POLYETHYLENE FOAM BASED PRODUCTS	This product is a flexible material made mostly of polyethylene. It is soft and resilient and gives the impression of being a soundproofing and cushioning material. Foamed polyethylene packaging protects against scratches damage during transport moisture, including sea moisture. Foam also has insulating properties, which means that it protects against heat loss. Polyethylene foam products in the form of rolls, sheets and bags. Dens=935 kg/m3	0.001069519	m3	1.73
19	Flooring	Laminated wood flooring	WFL	Multi-layered engineered wood flooring	Multi-layered engineered wood floors are floor coverings in accordance with EN 13489 for private and commercial use in interior areas, which are either laid "floating" on screed or on other existing floors such as wood or tiles, in connection with suitable underlay materials, or are glued to the screed across the whole floor area.	1	m2	29.71
20	Flooring	Chipboard flooring (plywood)	PLYW	S-P-02010 SELEX® Plywood	m3 of plywood products produced in Chile and installed across different countries across the world	1	m3	1430.67
21	Flooring, partition, facades, roof	Insulation layer	MWOOL	Mineral wool insulation (high bulk density range)	Mineral wool is the generic term for insulating materials made of glass wool and stone wool. These are non-combustible insulating materials, which consist mainly of amorphous fibres obtained from a silicate melt. The mineral wool insulation materials described in this declaration are produced in the form of rolls, boards and mats in the high bulk density range (> 120 kg/m³). The ready-made products are supplied in thicknesses between 10 mm and 400 mm.	1	m3	96.5
22	Flooring, partition, facades, roof	Insulation layer	POLYU1	S-P-07206 Insulation board with a core of rigid polyurethane (PIR) for buildings	6 cm/m2: thermal resistance (m2k/w): 2.33 Thermal Resistance (m2K/W) grammage (kg/m^2): 2.46 grammage (kg/m^2)	0.06	m3	30.69
23	Flooring, partition, facades, roof	Insulation layer	POLYU2	Polyurethane thermal insulation spray foam	Polyurethane thermal insulation spray foam (blowing agent HFO; density 40 kg/m3)	0.13	m3	290.4
24	Flooring, partition, facades, roof	Insulation layer	EPS	EUROTHERM EPS INSULATION (white); 0,035-0,039 W/mK	Expanded polystyrene foam EPS, wall insulation, External Thermal Insulation Composite System (ETICS), pitched roof insulation and ceiling insulation. Gross density: 16.0 kg/m^3	1	m3	114.5

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Erasmus+ Project 2022-1-NO01-KA220-HED-000087893

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BIM-LCA Construction Project

Description of Materials and Impact Data

Project name: Single-family house in concrete and bricks

			1	2	3	4	5	6
nr.	Building part	Type of Material	Mat Code	Material Name	Description	Quant. Studied in EPD	Unit	Cost €
25	Flooring, partition, facades, roof	Insulation layer	CELL	Cellulose Fibre Insulation - Thermal insulation for use in pitched roofs, walls and floor spaces in dwellings.	One m² of installed in-situ insulation, thickness 300mm with an R-value of 9.09 m²K/W, at a density of 37 kg/m³. Reference service life of 50 years	0.3	m3	203.13
26	Flooring, partition, facades, roof	Insulation layer	CORK	S-P-02315 Cork-based thermal insulation panels: Slim and Lisoflex	Cork-based thermal insulation panels: grammage (kg/m^2): 3.3 grammage (kg/m^2); layer thickness (m): 0.02 layer thickness (m); thermal resistance (m2k/w): 0.465 Thermal Resistance (m2K/W).	0.02	m3	53.84
27	Partition walls	Finishing coat (plastering mortars) / Esternal finishing /Interior finishing	PLASM	Mineral pre-made mortar: rendering and plastering mortar – normal/finishing render or plaster with special properties	Rendering and plastering mortars produced in the factory for use as a base coat or finishing render/plaster on walls, ceilings, piers, and separating walls of structures which comply with the applicable standards or on similar backgrounds. 1600 kg/m3	1	kg	1.5
28	Partition walls	Gypsum cardboard or fiberboard	GYP_F	Gypsum fibreboards 12,5 mm	conversion factor to 1kg: 16.66 - gross density: 1175.0 kg/m^3 layer thickness: 0.0125 m grammage: 16.66 kg/m^2	1	m2	36.9
29	Partition walls, facades	Gypsum plasterboard	GYP_P	STANDARD GYPSUM PLASTERBOARD STD 12,5 mm	grammage (kg/m^2): 8.6 grammage (kg/m^2) thermal conductivity (w/m.k): 0.21 Thermal Conductivity (W/m.K) thermal resistance (m2k/w): 0.06 Thermal Resistance (m2K/W) layer thickness (m): 0.0125 layer thickness (m)	1	m2	36.9
30	Partition walls	Galvanized steel (U, C) channel studs	ST-GC	Cold-rolled steel profiles for framing and partition systems	The raw material is hot dipped sheet rolled galvanised steel, grade DX51D+Z steel for forming. The steel profile sections are manufactured in accordance with EN 14195:2014 Metal framing components for gypsum board systems.	1000	kg	2820
31	Railings	Railings	ST-SL	Welded and Pickled Stainless Steel Products	Products from Øglænd System AS that are made from stainless steel, and then machined, welded and pickled. Stainless steel forms a protective chromium oxide layer when the alloy is exposed to air, hindering direct contact between the alloy and the corrosive environment.	1	kg	14.47
32	Interior doors	Interior doors	WDOOR	Wooden interior doors	This EPD describes an average of the doors produced by the member companies of the VHI. In addition to standard doors, the member companies of the VHI also produce so-called functional doors. These offer additional functions such as moisture, smoke, fire, sound, burglary and radiation protection. For these purposes, the doors are given a modified design.	2.6814	m2	394.28
33	Facades	External wooden cladding	WCLA	Wood Plastic Composite products: Cladding: WEO 35	FIBERDECK wood plastic composite combines the proven strength of high-density, recycled polyethylene plastic and realistic wood fibers with an outer shell of polymer that completely encapsulates the board in an impermeable layer of protection from weather, sun, water, scuffs and scrapes	50.75	m2	2869.79
34	Facades	Tiles for external cladding	N-STON	Slabs for façade claddings and for interior claddings and flooring in natural semi-rijo limestone:	Slabs for façade claddings and for interior claddings and flooring in natural semi-rijo limestone. Dens: 2750 kg/m3	1	kg	2.5
35	Facades	Tiles for external cladding	PORCE	EXTRUDED PORCELAIN VENTILATED FAÇADE GA16 & GA20	EXTRUDED PORCELAIN VENTILATED FAÇADE GA16 & GA20. 324 kg/m2	324	kg	560
36	Facades	Tiles for external cladding	A-STON	S-P-07728 STONEO Ventilated Facade Panels	The engineering stone facade panels are made of a high-quality material comprising a selected combination of aggregates, bound by stable polyester resins.The panels are used for facade cladding and are mounted as a component of ventilated facades (rainscreen claddings).	1	kg	2.25
37	Windows	Windows	WIN_PVC	Passiv PVC Double Glazed Window	The Passiv PVC windows cover a range of different sizes and shapes of windows. The LCA has been executed based on a Double-glazed 1230 mm x 1480 mm window, with a thermal performance of U window = 1.2 W/m2K, U glass = 1.2 W/m2K and a life expectancy of 50 years. After which the results have been scaled back to a functional unit of 1m2.	1	m2	146.96
38	Windows	Windows	WIN_WOOD	Hardwood double glazed window	The raw materials for the Hardwood windows comprise glass, argon, hardwood/softwood profiles, warm edge spacer and associated hardware (hinges, handles, recievers and gears).	1	m2	299.17
39	Windows	Windows	WIN_AL	Aluminium Windows	The aluminium windows are assembled with extruded aluminium profiles and comes in different frame widths of 45 mm - 50 mm and 70 mm - 75 mm. They consist of an aluminium profile frame and an aluminium profile sash with an insulating glass unit (IGU). The aluminium profiles are powder coated and thermally broken with a reinforced polyamide strip.	1	m2	127.72
40	Facades	Exterior glazed doors	DOOR_GL	Exterior facade folding doors with thermally modified beech and double glazing, painted	Folding door in the facade of buildings, for renovation and in new buildings	1	m2	150.14
41	Facades	Exterior front doors	DOOR_W	Wooden full doors	Exterior doors manufactured by Porta KMI Poland Sp. z o. o. Sp. k. are dedicated for communication in domestic as well as commercial premises. Among company's products, wooden and steel doorsare distinguish. Depending on the customer's needs, doors possess various functionalities and can be produced from a wide range of materials.	2.307	m2	632.54
42	Roof	Gravel ballast	GRAV	S-P-05225 Aggregates from Nyrand gravel pit-Svebølle	S-P-05225 Aggregates from Nyrand gravel pit-Svebølle	1000	kg	123.75
43	Roof	Waterproofing layer	WP	PTM reinforced bitumen membrane for roof waterproofing	System of PTM reinforced bitumen membrane for roof waterproofing: ·PTM BituFlex (top layer) & PTM DuraFlex Kombi (bottom layer) .	1	m2	4.2

5.4.4. Tab: Results - Tables.

This tab shows in table format the impacts and budget of the building as well as the energy consumption until the completion of its construction (A1-A5).

See next pages.

BIM-LCA

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Enviromental Impacts	
Abiotic depletion potential for fossil resources (ADPF)	Eutrophication potential (EP)
Abiotic depletion potential for non fossil resources (ADPE)	Photochemical Ozone Creation Potential (POCP)
Acidification potential (AP)	Ozone Depletion Potential (ODP)
Global warming potential (GWP)	

BIM-LCA Construction Project

LCA - Enviromental Impact results

Energy consumption	Table Caption and Summary	
	IMPACTS A1-A3	PRODUCTION
Total use of renewable primary energy resources (PERT)	IMPACTS A4	TRANSPORT
Total use of non renewable primary energy resource (PENRT)	IMPACTS A5	INSTALLATION

Project name: Single-family house in concrete and bricks

UNIT IMPACTS * QUANTITIES

Module	Building part	Building element types / building elements		Ref.	Type of Material	Mat Code	Quantities (Q)	Unit	Cost (Euros)	Energy Consumption (A1-A3) PERT (MJ)	Energy Consumption (A1-A3) PENRT (MJ)	Energy Consumption (A4) PERT (MJ)	Energy Consumption (A4) PENRT (MJ)	Energy Consumption (A5) PERT (MJ)	Energy Consumption (A5) PENRT (MJ)
A1-A3	1- Foundations	1.A - Piles		1.A.1	Concrete	CON1	0.00	m3	0.00	0	0	0	0	0	0
				1.A.2	Rebar	REB	0.00	kg	0.00	0	0	0	0	0	0
		1.B-Basement	1.B.1-Pile Caps	1.B.1.1	Concrete	CON1	0.00	m3	0.00	0	0	0	0	0	0
				1.B.1.2	Rebar	REB	0.00	kg	0.00	0	0	0	0	0	0
				1.B.1.3	Blinding concrete	CON0	0.00	m3	0.00	0	0	0	0	0	0
			1.B.2-Footings	1.B.2.1	Concrete	CON1	53.89	m3	6374.11	10239.1	75446	184.3038	3179.51	0	6.52069
				1.B.2.2	Rebar	REB	3411.24	kg	6140.23	5403.399408	24543.85022	40.934844	2237.771472	0	0.10233711
				1.B.2.3	Blinding concrete	CON0	7.38	m3	646.13	233.90389	6630.3523	6.7078528	211.98232	5.1194616	309.19009
			1.B.3-Foundation beams	1.B.3.1	Concrete	CON1	9.53	m3	1127.21	1810.7	13342	32.5926	562.27	0	1.15313
				1.B.3.2	Rebar	REB	846.26	kg	1523.28	1340.482176	6088.86948	10.155168	555.149184	0	0.02538792
				1.B.3.3	Blinding concrete	CON0	2.39	m3	208.96	75.64403	2144.2421	2.1693056	68.55464	1.6556232	99.99143
			1.B.4-Foundation slab	1.B.4.1	Concrete	CON1	0.00	m3	0.00	0	0	0	0	0	0
				1.B.4.2	Rebar	REB	0.00	kg	0.00	0	0	0	0	0	0
				1.B.4.3	Blinding concrete	CON0	0.00	m3	0.00	0	0	0	0	0	0
		1.C - Retaining walls		1.C.1	Concrete	CON3	0.00	m3	0.00	0	0	0	0	0	0
				1.C.2	Rebar	REB	0.00	kg	0.00	0	0	0	0	0	0
		1-Total Fundations							**16019.91**	19103.2295	128195.3141	276.8636	6815.2376	6.7751	416.9831
	2 - Load bearing structural frame	2.A-Frames	2.A.1-Beams	2.A.1.1	Gulam Timber	GLT	0.00	m3	0.00	0	0	0	0	0	0
				2.A.1.2	Steel in timber connect (galvanized)	ST-G	0.00	kg	0.00	0	0	0	0	0	0
				2.A.1.3	Structural steel	ST	0.00	kg	0.00	0	0	0	0	0	0
				2.A.1.4	Concrete	CON3	19.68	m3	8029.44	3739.2	27552	67.3056	1161.12	0	31.8816
				2.A.1.5	Rebar	REB	2707.97	kg	4874.34	4289.421312	19483.82976	32.495616	1776.427008	0	0.08123904
			2.A.2-Columns	2.A.2.1	Gulam Timber	GLT	0.00	m3	0.00	0	0	0	0	0	0
				2.A.2.2	Steel in timber connect (galvanized)	ST-G	0.00	kg	0.00	0	0	0	0	0	0
				2.A.2.3	Structural steel	ST	0.00	kg	0.00	0	0	0	0	0	0
				2.A.2.4	Concrete	CON3	10.89	m3	4443.12	2069.1	15246	37.2438	642.51	0	17.6418
				2.A.2.5	Rebar	REB	2203.05	kg	3965.48	3489.626448	15850.92317	26.436564	1445.198832	0	0.06609141
			2.A.3-Mass concrete slabs or	2.A.3.1	Concrete	CON2	68.10	m3	16636.08	12939.475	95343.5	232.91055	4018.0475	0	15.3230625
				2.A.3.2	Rebar	REB	6129.23	kg	11032.61	9708.6924	44099.77388	73.5507	4020.7716	0	0.18387675
			2.A.4-Composite slabs or	2.A.4.1	Concrete	CON2	0.00	m3	0.00	0	0	0	0	0	0
				2.A.4.2	Rebar	REB	0.00	kg	0.00	0	0	0	0	0	0
				2.A.4.3	Galvanized steel plates	ST-G	0.00	kg	0.00	0	0	0	0	0	0
			2.A.5-Lightweight concrete slabs or	2.A.5.1	Concrete blocks or	CONB	0.00	m3	0.00	0	0	0	0	0	0
				2.A.5.2	Ceramic blocks	CERB	0.00	kg	0.00	0	0	0	0	0	0
				2.A.5.3	Precast concrete beams	CONBEAM	0.00	kg	0.00	0	0	0	0	0	0
				2.A.5.4	Concrete (cast in place)	CON2	0.00	m3	0.00	0	0	0	0	0	0
				2.A.5.5	Rebar	REB	0.00	kg	0.00	0	0	0	0	0	0
			2.A.6-Mass timber structural floors	2.A.6.1	Cross Laminated Timber (CLT) panels	CLT	0.00	m3	0.00	0	0	0	0	0	0
				2.A.6.2	Steel in timber connect (galvanized)	ST-G		kg	0.00	0	0	0	0	0	0
				2.A.6.3	Steel in connections (galvanized)	ST-G	0.00	kg	0.00	0	0	0	0	0	0
		2.B-Load-bearing walls		2.B.1	Structural steel	ST	0.00	kg	0.00	0	0	0	0	0	0
				2.B.2	Concrete	CON3	0.00	m3	0.00	0	0	0	0	0	0
				2.B.3	rebar	REB	0.00	kg	0.00	0	0	0	0	0	0
		2- Total structural elements							**48981.07**	36235.5152	217576.0268	469.9428	13064.0749	0.0000	65.1777
	3 - Non-load bearing elements	3.A-Horizontal elements	3.A.1-Ground floor slab (non-structural)	3.A.1.1	Concrete	CON1	29.53	m3	3493.22	5611.365	41346.9	101.00457	1742.4765	0	3.5735535
				3.A.1.2	rebar	REB	886.01	kg	1594.81	1403.43192	6374.805975	10.63206	581.21928	0	0.02658015
				3.A.1.3	Graded aggregate	AGG	88600.50	kg	4430.03	1151.8065	2569.4145	0	1333.083123	0	29144.33707
			3.A.2-Flooring Type I: Ceramic flooring or	3.A.2.1	Ceramic tiles	CEFT	257.52	m2	8294.72	10506.816	48413.76	3.270504	2366.6088	517.6152	2678.208
				3.A.2.2	Tile bond coat (adhesive)	ADH	1545.12	kg	927.07	3012.984	11356.632	0	2085.912	0	0.8343648
				3.A.2.3	Mortar bed	MOR	12360.96	kg	3090.24	4697.1648	64771.4304	0	0	0	0
				3.A.2.4	Cleavage membrane	POLY	1.29	m3	2082.76	4340.803474	107268.0246	21.3091362	1480.80438	0.068983814	0.934231056
			3.A.3-Flooring Type II: Wood floating floor or	3.A.3.1	Laminated wood flooring	WFL	0.00	m2	0.00	0	0	0	0	0	0
				3.A.3.2	Chipboard flooring (plywood)	PLYW	0.00	m3	0.00	0	0	0	0	0	0
				3.A.3.3	Insulation layer	MWOOL	0.00	m3	0.00	0	0	0	0	0	0
				3.A.3.4	Timber battens	GLT	0.00	m3	0.00	0	0	0	0	0	0
			3.A.4-Flooring Type III: Screed flooring	3.A.4.1	Wet screed (cement mostar)	MOR	0.00	m4	0.00	0	0	0	0	0	0
				3.A.4.2	Sound insulation layer	POLY	0.00	m3	0.00	0	0	0	0	0	0
		3.B-Vertical elements	3.B.1-Internal partition Type I: Brick walls	3.B.1.1	Brick wall	CERB	19627.99	kg	8243.76	6045.421844	81063.61109	40.23738565	802.7849137	18.74473332	196.27993
				3.B.1.2	Finishing coat (plastering mortars)	PLASM	7093.12	kg	10639.68	5546.81984	24896.8512	139.734464	2078.28416	16.8106944	87.245376
			3.B.2-Internal partition Type II: Gypsum cardboard walls	3.B.2.1	Gypsum cardboard or fiberboard	GYP_F	0.00	m2	0.00	0	0	0	0	0	0
				3.B.2.2	Galvanized steel (U, C) channel studs	ST-GC	0.00	kg	0.00	0	0	0	0	0	0
				3.B.2.3	Insulation layer	MWOOL	0.00	m3	0.00	0	0	0	0	0	0
			3.B.3-Internal partition Type III: Structural Timber wall	3.B.3.1	Cross Laminated Timber (CLT) panels	CLT	0.00	m3	0.00	0	0	0	0	0	0
				3.B.3.2	Steel in timber connect (galvanized)	ST-G	0.00	kg	0.00	0	0	0	0	0	0
				3.B.3.3	Insulation layer	MWOOL	0.00		0.00	0	0	0	0	0	0
				3.B.3.4	Timber battens	GLT	0.00	m3	0.00	0	0	0	0	0	0
				3.B.3.5	Gypsum plasterboard	GYP_P	0.00	m2	0.00	0	0	0	0	0	0
			3.B.4-External party walls	3.B.4.1	Concrete blocks	CONB	0.00	m3	0.00	0	0	0	0	0	0
				3.B.4.2	Insulation layer	MWOOL	0.00	m3	0.00	0	0	0	0	0	0
				3.B.4.3	Finishing coat (plastering mortars)	PLASM	0.00	kg	0.00	0	0	0	0	0	0
			3.B.5-Parapets	3.B.5.1	Brick wall	CERB	2337.72	kg	981.84	720.01776	9654.7836	4.792326	95.612748	2.2325226	23.3772
				3.B.5.2	Finishing coat (plastering mortars)	PLASM	844.80	kg	1267.20	660.6336	2965.248	16.64256	247.5264	2.002176	10.39104
			3.B.6-Railings	3.B.6	Railings	ST-SL	52.25	kg	756.06	514.14	3370.125	0.000788975	6.53125	98.7525	397.518
			3.B.7-Interior doors	3.B.7	Interior doors	WDOOR	7.64	m2	1123.41	5230.761587	3971.893936	0	0	124.854479	44.22048184
		3.C-Inclined elements	3.C.1-Stairs	3.C.1.1	Ceramic tiles	CEFT	13.72	m2	441.79	559.6128	2578.608	0.1741932	126.05004	27.56916	142.6464
				3.C.1.2	Tile bond coat (adhesive)	ADH	82.30	kg	49.38	160.4772	604.8756	0	111.0996	0	0.04443984
				3.C.1.3	Mostar	MOR	1235.52	kg	308.88	469.4976	6474.1248	0	0	0	0
				3.C.1.4	Concrete	CON3	2.16	m3	881.28	410.4	3024	7.3872	127.44	0	3.4992
				3.C.1.5	Rebar	REB	297.22	kg	534.99	470.790144	2138.46912	3.566592	194.973696	0	0.00891648
				3.C.1.6	Structural steel	ST	0.00	kg	0.00	0	0	0	0	0	0
				3.C.1.7	Cross Laminated Timber (CLT) panels	CLT	0.00	m3	0.00	0	0	0	0	0	0
				3.C.1.8	Steel in timber connect. (galvanized)	ST-G	0.00	kg	0.00	0	0	0	0	0	0
			3.C.2-Ramps	3.C.2.1	Ceramic tiles	CEFT	0.00	m2	0.00	0	0	0	0	0	0
				3.C.2.2	Tile bond coat (adhesive)	ADH	0.00	kg	0.00	0	0	0	0	0	0
				3.C.2.3	Mostar	MOR	0.00	kg	0.00	0	0	0	0	0	0
				3.C.2.4	Concrete	CON3	0.00	m3	0.00	0	0	0	0	0	0
				3.C.2.5	Rebar	REB	0.00	kg	0.00	0	0	0	0	0	0
		3-Total non-load bearing elements							**49141.11**	51512.9441	422843.5578	348.7518	13380.4069	808.6504	32733.1448
	4 - Facades	4.A-External wall systems	4.A.1-Facade type I: with bricks or,	4.A.1.1	External finish	PLASM	17972.16	kg	26958.24	14054.22912	63082.2816	354.051552	5265.84288	42.5940192	221.057568
				4.A.1.2	Brick walls	CERB	66309.78	kg	27850.11	20423.41286	273859.3997	135.9350531	2712.070084	63.32584181	663.09782
				4.A.1.3	Insulation layer	MWOOL	26.21	m3	2529.21	11503.30566	55013.5306	66.4932478	1154.52407	250.168723	1230.793424
				4.A.1.4	Interior finish	GYP_P	374.42	m2	13816.10	1411.5634	16549.364	6.36514	2429.9858	212.67056	1127.0042
			4.A.2-Facade type II: Timber panels or,	4.A.2.1	Gypsum plasterboard	GYP_P	0.00	m2	0.00	0	0	0	0	0	0
				4.A.2.2	Cross Laminated Timber (CLT) panels	CLT	0.00	m3	0.00	0	0	0	0	0	0
				4.A.2.3	Steel in timber connect (galvanized)	ST-G	0.00	kg	0.00	0	0	0	0	0	0
				4.A.2.4	Insulation layer	MWOOL	0.00	m3	0.00	0	0	0	0	0	0
				4.A.2.5	Timber battens	GLT	0.00	m3	0.00	0	0	0	0	0	0
				4.A.2.6	External wooden cladding	WCLA	0.00	m2	0.00	0	0	0	0	0	0
			4.A.3-Facade type III: Ventilated facade	4.A.3.1	Gypsum plasterboard	GYP_P	0.00	m2	0.00	0	0	0	0	0	0
				4.A.3.2	Brick wall	CERB	0.00	kg	0.00	0	0	0	0	0	0
				4.A.3.3	Insulation layer	MWOOL	0.00	m3	0.00	0	0	0	0	0	0
				4.A.3.4	Tiles for external cladding	N-STON	0.00	kg	0.00	0	0	0	0	0	0
		4.B-Facade openings	4.B.1-Windows	4.B.1	Windows	WIN_PVC	21.54	m2	3165.52	1011.64764	25950.4227	0.1703814	12.29934	2.059224	44.8032
			4.B.2-Exterior doors	4.B.2.1	Exterior glazed doors	DOOR_GL	4.00	m3	600.56	5600	4080	1.228	22.08	4.04	13.56
				4.B.2.2	Exterior front doors	DOOR_W	4.00	m4	1096.73	1691.205202	1763.502384	0	0	75.9774599	26.90940616
		4- Total facades							**76016.46**	55695.3639	440298.5009	564.2434	11596.8022	650.8358	3327.2256
	5 - Roof	5.A-Roof Type I: Flat roof or	5.A.1-Finishing coat	5.A.1.1	Ceramic tiles or	CEFT	134.33	m2	4326.77	5480.664	25254.04	1.705991	1234.4927	270.0033	1397.032
				5.A.1.2	Gravel ballast	GRAV	0.00	kg	0.00	0	0	0	0	0	0
			5.A.2-Waterproofing layer	5.A.2	Waterproofing layer	WP	134.33	m2	564.19	2417.94	37746.73	12.801649	185.3754	347.9147	6797.098
			5.A.3-Insulation layer	5.A.3	Insulation layer	MWOOL	9.40	m3	907.40	4127.02059	19737.1069	23.8556647	414.206555	89.7525895	441.569576
			5.A.4-Screed to falls	5.A.4	Cement mostar	MOR	6447.84	kg	1611.96	2450.1792	33786.6816	0	0	0	0
		5.B-Roof type II: Inclinated tiled roof	5.B.1-Roof tiles	5.B.1	Roof tiles	RTIL	3670.14	kg	11377.42	3963.747206	16845.92562	7.523779419	161.8530109	3.780240391	32.92112263
			5.B.2-Mostar	5.B.2	Cement mostar	MOR	2936.11	kg	734.03	1115.721436	15385.21138	0	0	0	0
			5.B.3-Waterproofing layer	5.B.3	Waterproofing layer	WP	91.75	m2	385.36	1651.561336	25782.70752	8.744099739	126.6197024	237.6413255	4642.722422
			5.B.4-Decking	5.B.4	Ceramic deck or	CERB	2835.18	kg	1190.78	873.2355303	11709.29461	5.812119601	115.958874	2.70759718	28.35180293
				5.B.5	wooden deck (plywood)	PLYW	0.00	m3	0.00	0	0	0	0	0	0
			5.B.5-Structure	5.B.6	Brick walls or	CERB	1979.19	kg	831.26	609.5906241	8174.056097	4.057340193	80.94888483	1.890126773	19.79190338
				5.B.7	Gulam timber beams	GLT	0.00	m3	0.00	0	0	0	0	0	0
			5.B.6-Insulation layer	5.B.8	Insulation layer	MWOOL	4.31	m3	416.01	1892.0979	9048.789	10.937007	189.89955	41.148495	202.44456
		5-Total Roofs							**22345.18**	24581.7578	203470.5427	75.4377	2509.3547	994.8384	13561.9314
	Total building (A1-A5)								**212503.73**	162547.053	1208913.3997	1659.8016	44856.5216	1466.2614	36542.5311

Ref.	Env impacts A1-A3 GWP (kg CO2-eq)	ADPF (MJ)	ADPE (kg Sb-eq)	AP (kg SO2-eq.)	EP (kg Phosphat-eq.)	POCP (kg Ethen-eq)	ODP (kq CFC 11-eq)	Env impacts A4 GWP (kg CO2-eq.)	ADPF (MJ)	ADPE (kg Sb-eq)	AP (kg SO2-eq.)	EP (kg Phosphat-eq.)	POCP (kg Ethen-eq)	ODP (kq CFC 11-eq)
1.A.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.A.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.2.1	15196.98	73290.4	0.00371841	23.49604	7.5446	0.856851	0.000180532	233.8826	3168.732	1.65981E-05	0.544289	0.1309527	-0.1816093	3.85852E-14
1.B.2.2	1797.721899	22258.32143	0.003477074	6.822474	2.906373924	0.641312556	0.000183879	139.860717	2166.135495	0.000243562	0.81869688	0.143271954	0.030701133	2.68123E-05
1.B.2.3	938.8632	6608.2093	2.42835E-05	1.9131552	0.08303625	1.6725346	2.24382E-05	15.027716	211.98232	9.77983E-07	0.037355241	0.000111232	0.018489405	3.54878E-06
1.B.3.1	2687.46	12960.8	0.00065757	4.15508	1.3342	0.151527	3.19255E-05	41.3602	560.364	2.93524E-06	0.096253	0.0231579	-0.0321161	6.82348E-15
1.B.3.2	445.981128	5521.8726	0.000862597	1.692528	0.721016928	0.159097632	4.5617E-05	34.696824	537.37764	6.04232E-05	0.20310336	0.035543088	0.007616376	6.65164E-06
1.B.3.3	303.6264	2137.0811	7.85323E-06	0.6187104	0.02685375	0.5408942	7.25648E-06	4.859932	68.55464	3.16278E-07	0.012080607	3.59721E-05	0.005979435	1.14767E-06
1.B.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.4.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.C.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Total Fundations	21370.6326	122776.6844	0.0087	38.6980	12.6161	4.0222	0.0005	469.6880	6713.1461	0.0003	1.7118	0.3331	-0.1509	0.0000
2.A.1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1.4	5549.76	26764.8	0.00135792	8.58048	2.7552	0.312912	0.000065928	85.4112	1157.184	6.06144E-06	0.198768	0.478224	-0.663216	1.40909E-14
2.A.1.5	1427.099136	17669.4912	0.002760232	5.415936	2.307188736	0.509097984	0.00014597	111.026688	1719.55968	0.000193349	0.64991232	0.113734656	0.024371712	2.12846E-05
2.A.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.2.4	3070.98	14810.4	0.00075141	4.74804	1.5246	0.173151	3.64815E-05	47.2626	640.332	3.35412E-06	0.109989	0.264627	-0.366993	7.79724E-15
2.A.2.5	1161.005769	14374.88168	0.002245566	4.406094	1.876996044	0.414172836	0.000118753	90.324927	1398.934845	0.000157298	0.52873128	0.092527974	0.019827423	1.73159E-05
2.A.3.1	19204.905	92619.4	0.004699073	29.69269	9.53435	1.08282975	0.000228143	295.56485	4004.427	2.09756E-05	0.68783525	1.65489075	-2.29505425	4.87614E-14
2.A.3.2	3230.101575	39993.19313	0.006247519	12.25845	5.2220997	1.1522943	0.00033039	251.298225	3892.057875	0.000437627	1.471014	0.25742745	0.055163025	4.81757E-05
2.A.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.4.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.6.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.6.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.6.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.B.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.B.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2- Total structural elements	33643.8515	206232.1660	0.0181	65.1017	23.2204	3.6445	0.0009	880.8885	12812.4954	0.0008	3.6462	2.8614	-3.2259	0.0001
3.A.1.1	8328.447	40165.56	0.002037812	12.876606	4.13469	0.46958265	9.89372E-05	128.17539	1736.5698	9.09632E-06	0.29828835	0.071766405	-0.099527895	2.1146E-14
3.A.1.2	466.924635	5781.182625	0.000903105	1.77201	0.75487626	0.16656894	4.77592E-05	36.326205	562.613175	6.32608E-05	0.2126412	0.03721221	0.007974045	6.964E-06
3.A.1.3	203.78115	2569.4145	0.000177201	0.886005	1.77201	0.1063206	4.07562E-06	116.5096575	10851.34624	0.059185134	6.910839	1.417608	0.354402	0.0886005
3.A.2.1	3038.736	41975.76	0.0888444	7.571088	0.9064704	0.5382168	0.000507314	156.05712	2224.9728	6.69552E-06	0.2600952	0.03064488	0.012953256	2.88422E-05
3.A.2.2	794.19168	10383.2064	0.000893079	2.394936	0.74320272	0.129172032	4.92893E-05	38.318976	4244.135616	0.142769088	2.472192	0.540173952	0.142769088	0.050185498
3.A.2.3	7107.552	64647.8208	0.102843187	26.3288448	1.2979008	19.2830976	0.000537702	406.1440627	4467.250944	0.024351091	2.825344627	0.554982382	1.51357483	0.504574387
3.A.2.4	3339.635244	107219.8684	0.016987114	0.014614907	1.291189185	15.20533278	0.005680727	100.4057604	1480.80438	0.000355152	0.405716322	0.006729835	0.40932804	2.3115E-05
3.A.3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1.1	6163.189802	73212.41389	0.005240674	19.58873701	4.043366558	1.018692837	9.93176E-06	57.90257935	800.8221144	4.65183E-06	0.243387113	0.060454218	-0.088914808	1.94317E-11
3.B.1.2	2652.82688	22910.7776	0.006107176	6.5256704	0.671718464	0.544042304	1.76619E-05	154.630016	2071.19104	1.60305E-05	0.117745792	0.026528269	-0.001666883	3.24865E-12
3.B.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.4.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.5.1	734.04408	8719.6956	0.000624171	2.33304456	0.48157032	0.121327668	1.18289E-06	6.896274	95.378976	5.5404E-07	0.028987728	0.007200178	-0.010589872	2.31434E-12
3.B.5.2	315.9552	2728.704	0.000727373	0.777216	0.08000256	0.06479616	2.10355E-06	18.41664	246.6816	1.90925E-06	0.01402368	0.003159552	-0.000198528	3.86918E-13
3.B.6	246.62	3317.875	0.03223825	3.213375	0.1614525	1.51525	1.34283E-05	18.9145	2080.22925	0.01133825	1.30625	0.26125	0.05225	0.02460975
3.B.7	-53.99343626	3562.854479	0.007604669	0.515345267	0.107630715	0.101675766	2.8068E-10	1.626926233	179.0445141	0.000977295	0.113970314	0.022794063	0.005698516	0.002116999
3.C.1.1	161.8488	2235.708	0.00473202	0.4032504	0.04828032	0.02866644	2.70205E-05	8.311896	118.50624	3.56616E-07	0.01385316	0.001632204	0.000689915	1.53619E-06
3.C.1.2	42.300144	553.02912	4.75671E-05	0.1275588	0.039584376	0.006879946	2.62524E-06	2.0409408	226.0506528	0.00760415	0.1316736	0.028770682	0.00760415	0.002672974
3.C.1.3	710.424	6461.7696	0.010279526	2.6316576	0.1297296	1.9274112	5.37451E-05	40.59548064	446.516928	0.002433974	0.282402806	0.055472377	0.151286953	0.050433926
3.C.1.4	609.12	2937.6	0.00014904	0.94176	0.3024	0.034344	0.000007236	9.3744	127.008	6.6528E-07	0.021816	0.052488	-0.072792	1.54656E-15
3.C.1.5	156.632832	1939.3344	0.000302952	0.594432	0.253228032	0.055876608	1.60211E-05	12.185856	188.73216	2.12212E-05	0.07133184	0.012483072	0.002674944	2.33612E-06
3.C.1.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3-Total non-load bearing elements	35018.2360	401322.5744	0.2807	89.4962	17.2193	41.3173	0.0071	1312.8327	32147.8544	0.2491	15.7306	3.1914	2.3875	0.7233
4.A.1.1	6721.58784	58050.0768	0.01547403	16.5343872	1.701963552	1.378464672	4.47507E-05	391.793088	5247.87072	4.06171E-05	0.298337856	0.067215878	-0.004223458	8.23125E-12
4.A.1.2	20821.27155	247335.4869	0.017704712	66.17716244	13.65981509	3.441477686	3.35527E-05	195.6138569	2705.439106	1.57154E-05	0.822241297	0.204234129	-0.300383312	6.56467E-11
4.A.1.3	4544.70996	51920.8214	0.001003034	26.602541	3.64572754	1.571515624	1.45672E-08	84.918456	1142.72984	6.98218E-06	0.125595445	0.027362614	-0.028175105	2.10855E-14
4.A.1.4	812.4914	14377.728	0.000225775	1.666169	0.01160702	2.3176598	4.79258E-05	183.09138	2415.009	6.29026E-06	0.5092112	0.000143403	0.7900262	3.93141E-06
4.A.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.B.1	12847.533	22832.63694	10.082874	4.70431446	0.5696253	0.348767064	2.11904E-05	7797.48	12.0624	0.00557886	0.0031233	0.000497574	0.000141949	1.3484E-07
4.B.2.1	172	0	0	1.372	0.00564	0.888	0.00000528	1.668	0	0	0.00532	0.00000492	0.0048	2.116E-16
4.B.2.2	9.085392284	1620.286086	0.002990377	0.483953186	0.095722583	0.269293455	4.03988E-06	0.990030342	108.9536194	0.000594712	0.06935414	0.013870828	0.003467707	0.001288253
4- Total facades	45928.6791	396137.0361	10.1203	117.5405	19.6901	10.2152	0.0002	8655.5548	11632.0647	0.0062	1.8332	0.3133	0.4657	0.0013
5.A.1.1	1585.094	21895.79	0.04634385	3.949302	0.4728416	0.2807497	0.00026463	81.40398	1160.6112	3.49258E-06	0.1356733	0.01598527	0.006756799	1.5045E-05
5.A.1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.A.2	467.4684	0	0	0.9282203	0.02511971	0.9429966	5.56126E-06	13.97032	0	0	0.01571661	5.02394E-05	0.01356733	1.3836E-12
5.A.3	1630.49754	18627.5411	0.000359857	9.5441465	1.30797121	0.563809876	5.22624E-09	30.466044	409.97516	2.50499E-06	0.045059655	0.009816836	-0.010108333	7.56479E-15
5.A.4	3707.508	33722.2032	0.053646029	13.7338992	0.6770232	10.0586304	0.000280481	211.8566789	2330.249376	0.012702245	1.473782789	0.28949512	0.789525112	0.263200829
5.B.1	1031.308301	16515.61336	0.001471725	14.0933234	1.181783889	0.741367533	7.74399E-06	11.89124162	160.3849564	1.01296E-06	0.008661522	0.001724964	-0.000111572	8.51472E-13
5.B.2	1688.262699	15355.85029	0.024428427	6.253912258	0.308291449	4.580330105	0.000127721	96.47173477	1061.109808	0.005784135	0.671106444	0.131825424	0.35952068	0.119851971
5.B.3	319.3018582	0	0	0.634016046	0.017157887	0.644108921	3.79859E-06	9.542354384	0	0	0.010735149	3.43158E-05	0.009267094	9.4506E-13
5.B.4	890.246612	10575.22249	0.000756993	2.829509932	0.58404714	0.147145857	1.4346E-06	8.363781865	115.675356	6.71938E-07	0.035156236	0.008732355	-0.012843367	2.80683E-12
5.B.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.B.6	621.4657662	7382.379961	0.000528444	1.975231957	0.40771321	0.102719979	1.00147E-06	5.838611498	80.7509658	4.69068E-07	0.02454196	0.006095906	-0.008965732	1.9594E-12
5.B.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.B.8	747.5274	8540.091	0.000164982	4.375665	0.5996601	0.25848756	2.39605E-09	13.96764	187.9596	1.14845E-06	0.020658312	0.004500684	-0.004634325	3.4682E-15
5-Total Roofs	12688.6806	132614.6914	0.1277	58.3172	5.5816	18.3203	0.0007	483.7724	5506.7164	0.0185	2.4411	0.4683	1.1420	0.3831
Total building (A1-A5)	135961.3993	1126468.4609	10.4278	310.8364	72.7459	59.1991	0.0086	11318.9640	63305.5606	0.2565	22.9218	6.6992	-0.5237	0.7247

Ref.	Env impacts A5 GWP (kg CO2-eq.)	ADPF (MJ)	ADPE (kg Sb-eq)	AP (kg SO2-eq.)	EP (kg Phosphat-eq.)	POCP (kg Ethen-eq)	ODP (kq CFC 11-eq)
1.A.1	0	0	0	0	0	0	0
1.A.2	0	0	0	0	0	0	0
1.B.1.1	0	0	0	0	0	0	0
1.B.1.2	0	0	0	0	0	0	0
1.B.1.3	0	0	0	0	0	0	0
1.B.2.1	0.97002	13.25694	3.50824E-05	0.004171086	0.01708313	0.00080835	6.25124E-08
1.B.2.2	0.000286203	0.003411237	1.05748E-08	1.25875E-06	5.15097E-06	2.43221E-07	1.88641E-11
1.B.2.3	29.088521	308.82104	1.11675E-06	0.16474392	0.001959656	0.18297499	3.30743E-06
1.B.3.1	0.17154	2.34438	6.20403E-06	0.000737622	0.00302101	0.00014295	1.10548E-08
1.B.3.2	7.10015E-05	0.000846264	2.62342E-09	3.12271E-07	1.27786E-06	6.03386E-08	4.67984E-12
1.B.3.3	9.407167	99.87208	3.61153E-07	0.05327784	0.000633749	0.05917373	1.06961E-06
1.B.4.1	0	0	0	0	0	0	0
1.B.4.2	0	0	0	0	0	0	0
1.B.4.3	0	0	0	0	0	0	0
1.C.1	0	0	0	0	0	0	0
1.C.2	0	0	0	0	0	0	0
1-Total Fundations	39.6376	424.2987	0.0000	0.2229	0.0227	0.2431	0.0000
2.A.1.1	0	0	0	0	0	0	0
2.A.1.2	0	0	0	0	0	0	0
2.A.1.3	0	0	0	0	0	0	0
2.A.1.4	4.6248	64.72752	0.000171019	0.1968	0.7872	0.003936	3.0504E-07
2.A.1.5	0.000227199	0.002707968	8.3947E-09	9.9924E-07	4.08903E-06	1.93078E-07	1.49751E-11
2.A.2.1	0	0	0	0	0	0	0
2.A.2.2	0	0	0	0	0	0	0
2.A.2.3	0	0	0	0	0	0	0
2.A.2.4	2.55915	35.81721	9.46341E-05	0.1089	0.4356	0.002178	1.68795E-07
2.A.2.5	0.000184836	0.002203047	6.82945E-09	8.12924E-07	3.3266E-06	1.57077E-07	1.21828E-11
2.A.3.1	2.2473825	31.05474	8.2404E-05	0.009738658	0.039908065	0.001886439	1.4642E-07
2.A.3.2	0.000514242	0.006129225	1.90006E-08	2.26168E-06	9.25513E-06	4.37014E-07	3.38946E-11
2.A.4.1	0	0	0	0	0	0	0
2.A.4.2	0	0	0	0	0	0	0
2.A.4.3	0	0	0	0	0	0	0
2.A.5.1	0	0	0	0	0	0	0
2.A.5.2	0	0	0	0	0	0	0
2.A.5.3	0	0	0	0	0	0	0
2.A.5.4	0	0	0	0	0	0	0
2.A.5.5	0	0	0	0	0	0	0
2.A.6.1	0	0	0	0	0	0	0
2.A.6.2	0	0	0	0	0	0	0
2.A.6.3	0	0	0	0	0	0	0
2.B.1	0	0	0	0	0	0	0
2.B.2	0	0	0	0	0	0	0
2.B.3	0	0	0	0	0	0	0
2- Total structural elements	9.4323	131.6105	0.0003	0.3154	1.2627	0.0080	0.0000
3.A.1.1	0.531603	7.265241	1.92263E-05	0.002285893	0.00936212	0.000443003	3.42589E-08
3.A.1.2	7.43358E-05	0.000886005	2.74662E-09	3.26936E-07	1.33787E-06	6.31722E-08	4.89961E-12
3.A.1.3	0.26402949	37.389411	9.77264E-06	0.001159781	0.004752176	0.000224425	1.74543E-08
3.A.2.1	285.8472	2070.4608	0.002678208	0.669552	0.09760008	0.04661112	2.13742E-05
3.A.2.2	0.004604458	0.064276992	1.70581E-07	2.0272E-05	8.28184E-05	3.91224E-06	3.0408E-10
3.A.2.3	0.036835661	0.504574387	1.36218E-06	0.161953298	0.000660941	3.13227E-05	2.4314E-09
3.A.2.4	0.042377491	0.930619338	2.68471E-07	0.00061038	0.000104379	0.000208276	1.20391E-09
3.A.3.1	0	0	0	0	0	0	0
3.A.3.2	0	0	0	0	0	0	0
3.A.3.3	0	0	0	0	0	0	0
3.A.3.4	0	0	0	0	0	0	0
3.A.4.1	0	0	0	0	0	0	0
3.A.4.2	0	0	0	0	0	0	0
3.B.1.1	46.12578355	191.5692117	3.98448E-06	0.078315692	0.012954475	-0.002610523	1.55061E-11
3.B.1.2	295.783104	78.733632	5.17798E-06	0.038728435	0.008582675	0.002588989	4.05017E-12
3.B.2.1	0	0	0	0	0	0	0
3.B.2.2	0	0	0	0	0	0	0
3.B.2.3	0	0	0	0	0	0	0
3.B.3.1	0	0	0	0	0	0	0
3.B.3.2	0	0	0	0	0	0	0
3.B.3.3	0	0	0	0	0	0	0
3.B.3.4	0	0	0	0	0	0	0
3.B.3.5	0	0	0	0	0	0	0
3.B.4.1	0	0	0	0	0	0	0
3.B.4.2	0	0	0	0	0	0	0
3.B.4.3	0	0	0	0	0	0	0
3.B.5.1	5.493642	22.8161472	4.74557E-07	0.009327503	0.001542895	-0.000310917	1.8468E-12
3.B.5.2	35.22816	9.37728	6.16704E-07	0.004612608	0.001022208	0.000308352	4.82381E-13
3.B.6	0.99275	13.8985	3.66795E-05	0.004362875	0.01781725	0.000841225	6.53125E-08
3.B.7	30.31610353	9.163213247	1.06049E-06	0.00994391	0.002254903	0.000581818	1.14113E-14
3.C.1.1	15.22476	110.27664	0.000142646	0.0356616	0.005198364	0.002482596	1.13843E-06
3.C.1.2	0.000245242	0.003423514	9.08548E-09	1.07972E-06	4.41107E-06	2.08373E-07	1.61959E-11
3.C.1.3	0.00368185	0.050433926	1.36154E-07	0.016187783	6.60633E-05	3.13081E-06	2.43027E-10
3.C.1.4	0.5076	7.10424	1.87704E-05	0.0216	0.0864	0.000432	3.348E-08
3.C.1.5	2.49364E-05	0.000297216	9.2137E-10	1.09673E-07	4.48796E-07	2.11915E-08	1.6436E-12
3.C.1.6	0	0	0	0	0	0	0
3.C.1.7	0	0	0	0	0	0	0
3.C.1.8	0	0	0	0	0	0	0
3.C.2.1	0	0	0	0	0	0	0
3.C.2.2	0	0	0	0	0	0	0
3.C.2.3	0	0	0	0	0	0	0
3.C.2.4	0	0	0	0	0	0	0
3.C.2.5	0	0	0	0	0	0	0
3-Total non-load bearing elements	716.4026	2559.6088	0.0029	1.0543	0.2484	0.0518	0.0000
4.A.1.1	749.439072	199.490976	1.31197E-05	0.098127994	0.021746314	0.006559838	1.02621E-11
4.A.1.2	155.8279877	647.1834723	1.34609E-05	0.26457603	0.043764456	-0.008819201	5.23847E-11
4.A.1.3	580.276116	1155.048258	2.11588E-05	0.581586586	0.082926542	0.034832293	2.91449E-10
4.A.1.4	90.23522	999.7014	9.32306E-06	0.2321404	0.001067097	0.33585474	2.4824E-06
4.A.2.1	0	0	0	0	0	0	0
4.A.2.2	0	0	0	0	0	0	0
4.A.2.3	0	0	0	0	0	0	0
4.A.2.4	0	0	0	0	0	0	0
4.A.2.5	0	0	0	0	0	0	0
4.A.2.6	0	0	0	0	0	0	0
4.A.3.1	0	0	0	0	0	0	0
4.A.3.2	0	0	0	0	0	0	0
4.A.3.3	0	0	0	0	0	0	0
4.A.3.4	0	0	0	0	0	0	0
4.B.1	10489.98	43.7262	5.66502E-08	0.0057081	0.00060312	0.000374796	3.85566E-07
4.B.2.1	62.8	0	0	0.02532	0.000001568	0.02876	7.24E-15
4.B.2.2	18.44820113	5.576072822	6.4534E-07	0.006051149	0.001372172	0.000354053	6.94408E-15
4- Total facades	12147.0066	3050.7264	0.0001	1.2135	0.1515	0.3979	0.0000
5.A.1.1	149.1063	1080.0132	0.001397032	0.349258	0.05091107	0.02431373	1.11494E-05
5.A.1.2	0	0	0	0	0	0	0
5.A.2	255.227	0	0	0.5453798	0.007750841	0.5077674	2.12241E-05
5.A.3	208.184634	414.394617	7.59112E-06	0.208654789	0.029751408	0.01249672	1.04562E-10
5.A.4	0.019214563	0.263200829	7.10552E-07	0.0844796	0.000344766	1.63388E-05	1.26829E-09
5.B.1	27.74623044	31.67327628	2.33054E-07	0.011817839	0.001981874	-0.000340222	2.00389E-12
5.B.2	0.008749605	0.119851971	3.23559E-07	0.038468901	0.000156994	7.4401E-06	5.77533E-10
5.B.3	174.3314743	0	0	0.372518835	0.005294172	0.346827881	1.4497E-05
5.B.4	6.662673689	27.67135966	5.75542E-07	0.011312369	0.001871219	-0.000377079	2.23979E-12
5.B.5	0	0	0	0	0	0	0
5.B.6	4.651097295	19.3168977	4.01776E-07	0.007896969	0.001306266	-0.000263232	1.56356E-12
5.B.7	0	0	0	0	0	0	0
5.B.8	95.44554	189.98577	3.48027E-06	0.09566109	0.013640004	0.005729319	4.79383E-11
5-Total Roofs	921.3829	1763.4382	0.0014	1.7254	0.1130	0.8962	0.0000
Total building (A1-A5)	12912.4790	6166.2444	0.0034	2.8062	1.6853	0.7009	0.0000

Erasmus+ Project 2022-1-NO01-KA220-HED-000087893

This Erasmus+ Project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the European Commission and Erasmus+ National Agencies cannot be held responsible for any use which may be made of the information contained therein

BIM-LCA Construction Project

LCA - Enviromental Impact results

Project name: Single-family house in concrete and bricks

Module	Building part	Building element types / building elements		Ref.	Type of Material	Mat Code	Quantities (Q)	Unit	Cost (Euros)
A1-A3	1- Foundations	1.A - Piles		1.A.1	Concrete	CON1	0.00	m3	0.00
				1.A.2	Rebar	REB	0.00	kg	0.00
		1.B-Basement	1.B.1-Pile Caps	1.B.1.1	Concrete	CON1	0.00	m3	0.00
				1.B.1.2	Rebar	REB	0.00	kg	0.00
				1.B.1.3	Blinding concrete	CON0	0.00	m3	0.00
			1.B.2-Footings	1.B.2.1	Concrete	CON1	53.89	m3	6374.11
				1.B.2.2	Rebar	REB	3411.24	kg	6140.23
				1.B.2.3	Blinding concrete	CON0	7.38	m3	646.13
			1.B.3-Foundation beams	1.B.3.1	Concrete	CON1	9.53	m3	1127.21
				1.B.3.2	Rebar	REB	846.26	kg	1523.28
				1.B.3.3	Blinding concrete	CON0	2.39	m3	208.96
			1.B.4-Foundation slab	1.B.4.1	Concrete	CON1	0.00	m3	0.00
				1.B.4.2	Rebar	REB	0.00	kg	0.00
				1.B.4.3	Blinding concrete	CON0	0.00	m3	0.00
		1.C - Retaining walls		1.C.1	Concrete	CON3	0.00	m3	0.00
				1.C.2	Rebar	REB	0.00	kg	0.00
		1-Total Fundations							**16019.91**
	2 - Load bearing structural frame	2.A-Frames	2.A.1-Beams	2.A.1.1	Gulam Timber	GLT	0.00	m3	0.00
				2.A.1.2	Steel in timber connect (galvanized)	ST-G	0.00	kg	0.00
				2.A.1.3	Structural steel	ST	0.00	kg	0.00
				2.A.1.4	Concrete	CON3	19.68	m3	8029.44
				2.A.1.5	Rebar	REB	2707.97	kg	4874.34
			2.A.2-Columns	2.A.2.1	Gulam Timber	GLT	0.00	m3	0.00
				2.A.2.2	Steel in timber connect (galvanized)	ST-G	0.00	kg	0.00
				2.A.2.3	Structural steel	ST	0.00	kg	0.00
				2.A.2.4	Concrete	CON3	10.89	m3	4443.12
				2.A.2.5	Rebar	REB	2203.05	kg	3965.48
			2.A.3-Mass concrete slabs or	2.A.3.1	Concrete	CON2	68.10	m3	16636.08
				2.A.3.2	Rebar	REB	6129.23	kg	11032.61
			2.A.4-Composite slabs or	2.A.4.1	Concrete	CON2	0.00	m3	0.00
				2.A.4.2	Rebar	REB	0.00	kg	0.00
				2.A.4.3	Galvanized steel plates	ST-G	0.00	kg	0.00
			2.A.5-Lightweight concrete slabs or	2.A.5.1	Concrete blocks or	CONB	0.00	m3	0.00
				2.A.5.2	Ceramic blocks	CERB	0.00	kg	0.00
				2.A.5.3	Precast concrete beams	CONBEAM	0.00	kg	0.00
				2.A.5.4	Concrete (cast in place)	CON2	0.00	m3	0.00
				2.A.5.5	Rebar	REB	0.00	kg	0.00
			2.A.6-Mass timber structural floors	2.A.6.1	Cross Laminated Timber (CLT) panels	CLT	0.00	m3	0.00
				2.A.6.2	Steel in timber connect (galvanized)	ST-G		kg	0.00
				2.A.6.3	Steel in connections (galvanized)	ST-G	0.00	kg	0.00
		2.B-Load-bearing walls		2.B.1	Structural steel	ST	0.00	kg	0.00
				2.B.2	Concrete	CON3	0.00	m3	0.00
				2.B.3	rebar	REB	0.00	kg	0.00
		2- Total structural elements							**48981.07**
	3 - Non-load bearing elements	3.A-Horizontal elements	3.A.1-Ground floor slab (non-structural)	3.A.1.1	Concrete	CON1	29.53	m3	3493.22
				3.A.1.2	rebar	REB	886.01	kg	1594.81
				3.A.1.3	Graded aggregate	AGG	88600.50	kg	4430.03
			3.A.2-Flooring Type I: Ceramic flooring or	3.A.2.1	Ceramic tiles	CEFT	257.52	m2	8294.72
				3.A.2.2	Tile bond coat (adhesive)	ADH	1545.12	kg	927.07
				3.A.2.3	Mortar bed	MOR	12360.96	kg	3090.24
				3.A.2.4	Cleavage membrane	POLY	1.29	m3	2082.76
			3.A.3-Flooring Type II: Wood floating floor or	3.A.3.1	Laminated wood flooring	WFL	0.00	m2	0.00
				3.A.3.2	Chipboard flooring (plywood)	PLYW	0.00	m3	0.00
				3.A.3.3	Insulation layer	MWOOL	0.00	m3	0.00
				3.A.3.4	Timber battens	GLT	0.00	m3	0.00
			3.A.4-Flooring Type III: Screed flooring	3.A.4.1	Wet screed (cement mostar)	MOR	0.00	m4	0.00
				3.A.4.2	Sound insulation layer	POLY	0.00	m3	0.00
		3.B-Vertical elements	3.B.1-Internal partition Type I: Brick walls	3.B.1.1	Brick wall	CERB	19627.99	kg	8243.76
				3.B.1.2	Finishing coat (plastering mortars)	PLASM	7093.12	kg	10639.68
			3.B.2-Internal partition Type II: Gypsum cardboard walls	3.B.2.1	Gypsum cardboard or fiberboard	GYP_F	0.00	m2	0.00
				3.B.2.2	Galvanized steel (U, C) channel studs	ST-GC	0.00	kg	0.00
				3.B.2.3	Insulation layer	MWOOL	0.00	m3	0.00
			3.B.3-Internal partition Type III: Structural Timber wall	3.B.3.1	Cross Laminated Timber (CLT) panels	CLT	0.00	m3	0.00
				3.B.3.2	Steel in timber connect (galvanized)	ST-G	0.00	kg	0.00
				3.B.3.3	Insulation layer	MWOOL	0.00		0.00
				3.B.3.4	Timber battens	GLT	0.00	m3	0.00
				3.B.3.5	Gypsum plasterboard	GYP_P	0.00	m2	0.00
			3.B.4-External party walls	3.B.4.1	Concrete blocks	CONB	0.00	m3	0.00
				3.B.4.2	Insulation layer	MWOOL	0.00	m3	0.00
				3.B.4.3	Finishing coat (plastering mortars)	PLASM	0.00	kg	0.00
			3.B.5-Parapets	3.B.5.1	Brick wall	CERB	2337.72	kg	981.84
				3.B.5.2	Finishing coat (plastering mortars)	PLASM	844.80	kg	1267.20
			3.B.6-Railings	3.B.6	Railings	ST-SL	52.25	kg	756.06
			3.B.7-Interior doors	3.B.7	Interior doors	WDOOR	7.64	m2	1123.41
		3.C-Inclined elements	3.C.1-Stairs	3.C.1.1	Ceramic tiles	CEFT	13.72	m2	441.79
				3.C.1.2	Tile bond coat (adhesive)	ADH	82.30	kg	49.38
				3.C.1.3	Mostar	MOR	1235.52	kg	308.88
				3.C.1.4	Concrete	CON3	2.16	m3	881.28
				3.C.1.5	Rebar	REB	297.22	kg	534.99
				3.C.1.6	Structural steel	ST	0.00	kg	0.00
				3.C.1.7	Cross Laminated Timber (CLT) panels	CLT	0.00	m3	0.00
				3.C.1.8	Steel in timber connect. (galvanized)	ST-G	0.00	kg	0.00
			3.C.2-Ramps	3.C.2.1	Ceramic tiles	CEFT	0.00	m2	0.00
				3.C.2.2	Tile bond coat (adhesive)	ADH	0.00	kg	0.00
				3.C.2.3	Mostar	MOR	0.00	kg	0.00
				3.C.2.4	Concrete	CON3	0.00	m3	0.00
				3.C.2.5	Rebar	REB	0.00	kg	0.00
		3-Total non-load bearing elements							**49141.11**
	4 - Facades	4.A-External wall systems	4.A.1-Facade type I: with bricks or,	4.A.1.1	External finish	PLASM	17972.16	kg	26958.24
				4.A.1.2	Brick walls	CERB	66309.78	kg	27850.11
				4.A.1.3	Insulation layer	MWOOL	26.21	m3	2529.21
				4.A.1.4	Interior finish	GYP_P	374.42	m2	13816.10
			4.A.2-Facade type II: Timber panels or,	4.A.2.1	Gypsum plasterboard	GYP_P	0.00	m2	0.00
				4.A.2.2	Cross Laminated Timber (CLT) panels	CLT	0.00	m3	0.00
				4.A.2.3	Steel in timber connect (galvanized)	ST-G	0.00	kg	0.00
				4.A.2.4	Insulation layer	MWOOL	0.00	m3	0.00
				4.A.2.5	Timber battens	GLT	0.00	m3	0.00
				4.A.2.6	External wooden cladding	WCLA	0.00	m2	0.00
			4.A.3-Facade type III: Ventilated facade	4.A.3.1	Gypsum plasterboard	GYP_P	0.00	m2	0.00
				4.A.3.2	Brick wall	CERB	0.00	kg	0.00
				4.A.3.3	Insulation layer	MWOOL	0.00	m3	0.00
				4.A.3.4	Tiles for external cladding	N-STON	0.00	kg	0.00
		4.B-Facade openings	4.B.1-Windows	4.B.1	Windows	WIN_PVC	21.54	m2	3165.52
			4.B.2-Exterior doors	4.B.2.1	Exterior glazed doors	DOOR_GL	4.00	m3	600.56
				4.B.2.2	Exterior front doors	DOOR_W	4.00	m4	1096.73
		4- Total facades							**76016.46**
	5 - Roof	5.A-Roof Type I: Flat roof or	5.A.1-Finishing coat	5.A.1.1	Ceramic tiles or	CEFT	134.33	m2	4326.77
				5.A.1.2	Gravel ballast	GRAV	0.00	kg	0.00
			5.A.2-Waterproofing layer	5.A.2	Waterproofing layer	WP	134.33	m2	564.19
			5.A.3-Insulation layer	5.A.3	Insulation layer	MWOOL	9.40	m3	907.40
			5.A.4-Screed to falls	5.A.4	Cement mostar	MOR	6447.84	kg	1611.96
		5.B-Roof type II: Inclinated tiled roof	5.B.1-Roof tiles	5.B.1	Roof tiles	RTIL	3670.14	kg	11377.42
			5.B.2-Mostar	5.B.2	Cement mostar	MOR	2936.11	kg	734.03
			5.B.3-Waterproofing layer	5.B.3	Waterproofing layer	WP	91.75	m2	385.36
			5.B.4-Decking	5.B.4	Ceramic deck or	CERB	2835.18	kg	1190.78
				5.B.5	wooden deck (plywood)	PLYW	0.00	m3	0.00
			5.B.5-Structure	5.B.6	Brick walls or	CERB	1979.19	kg	831.26
				5.B.7	Gulam timber beams	GLT	0.00	m3	0.00
			5.B.6-Insulation layer	5.B.8	Insulation layer	MWOOL	4.31	m3	416.01
		5-Total Roofs							**22345.18**
	Total building (A1-A5)								**212503.73**

IMPACTS PER UNIT AREA AND YEAR

Ref.	Energy Consumption (A1-A3) (/m2/yr) PERT (MJ/m2/yr)	PERT (MJ/m2/yr)	Energy Consumption (A4) (/m2/yr) PERT (MJ/m2/yr)	PERT (MJ/m2/yr)	Energy Consumption (A5) (/m2/yr) PERT (MJ/m2/yr)	PERT (MJ/m2/yr)	Env imp A1-A3 (/m2/yr) GWP (kg CO2-eq./m2/yr)	ADPF (MJ/m2/yr)	ADPE (kg Sb-eq./m2/yr)	AP (kg SO2-eq./m2/yr)	EP (kg Phosphat-eq./m2/yr)	POCP (kg Ethen-eq./m2/yr)	ODP (kg CFC 11-eq./m2/yr)
1.A.1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.A.2	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1.1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1.2	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1.3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.2.1	0.795208139	5.859428394	0.014313747	0.246933054	0	0.000506422	1.180256291	5.692016154	2.88786E-07	0.001824793	0.000585943	6.65464E-05	1.40208E-08
1.B.2.2	0.419648913	1.906170411	0.003179158	0.173793994	0	7.9479E-06	0.139618041	1.728667399	2.70043E-07	0.00052986	0.00022572	4.98068E-05	1.42808E-08
1.B.2.3	0.018165881	0.514938824	0.000520958	0.016463368	0.000397597	0.024012899	0.07291575	0.513219113	1.88595E-09	0.000148583	6.44892E-06	0.000129896	1.74264E-09
1.B.3.1	0.140625971	1.036191364	0.002531267	0.043668065	0	8.95565E-05	0.208718546	1.006585896	5.10694E-08	0.0003227	0.000103619	1.17682E-05	2.47946E-09
1.B.3.2	0.104107034	0.472885172	0.00078869	0.043115034	0	1.97172E-06	0.034636621	0.42885	6.69926E-08	0.000131448	5.5997E-05	1.23561E-05	3.54279E-09
1.B.3.3	0.005874808	0.166530141	0.000168477	0.005324219	0.000128582	0.007765721	0.023580801	0.16597399	6.09912E-10	4.80514E-05	2.08557E-06	4.20079E-05	5.63566E-10
1.B.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.4.3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.C.2	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Total Fundations	1.4836	9.9561	0.0215	0.5293	0.0005	0.0324	1.6597	9.5353	0.0000	0.0030	0.0010	0.0003	0.0000
2.A.1.1	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1.2	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1.3	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1.4	0.290400746	2.139794967	0.005227213	0.090177074	0	0.002476048	0.431015843	2.078657968	1.05461E-07	0.000666393	0.000213979	2.4302E-05	5.12022E-09
2.A.1.5	0.333133062	1.513189637	0.002523735	0.137964198	0	6.30934E-06	0.110834043	1.372281081	2.1437E-07	0.000420623	0.000179185	3.95385E-05	1.13366E-08
2.A.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.2.4	0.160694315	1.184063374	0.002892498	0.049899814	0	0.00137013	0.238504194	1.150232992	5.83574E-08	0.000368751	0.000118406	1.34476E-05	2.83329E-09
2.A.2.5	0.271017897	1.231044048	0.002053166	0.112239735	0	5.13291E-06	0.090168202	1.116408953	1.74399E-07	0.000342194	0.000145775	3.21663E-05	9.22282E-09
2.A.3.1	1.004929714	7.404745263	0.018088735	0.312057122	0	0.001190048	1.49152726	7.193181112	3.64948E-07	0.002306049	0.000740475	8.40967E-05	1.77185E-08
2.A.3.2	0.754014632	3.424959139	0.005712232	0.312268686	0	1.42806E-05	0.250862191	3.106026182	4.85207E-07	0.000952039	0.000405568	8.94916E-05	2.56593E-08
2.A.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.4.3	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.1	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.2	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.3	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.4	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.5	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.6.1	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.6.2	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.6.3	0	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1	0	0	0	0	0	0	0	0	0	0	0	0	0
2.B.2	0	0	0	0	0	0	0	0	0	0	0	0	0
2.B.3	0	0	0	0	0	0	0	0	0	0	0	0	0
2- Total structural elements	2.8142	16.8978	0.0365	1.0146	0.0000	0.0051	2.6129	16.0168	0.0000	0.0051	0.0018	0.0003	0.0000
3.A.1.1	0.435800326	3.211160298	0.007844406	0.13532747	0	0.000277536	0.646819432	3.119412861	1.58264E-07	0.001000047	0.000321116	3.64696E-05	7.68385E-09
3.A.1.2	0.108995955	0.495092107	0.000825727	0.045139739	0	2.06432E-06	0.036263175	0.44898902	7.01386E-08	0.000137621	5.86266E-05	1.29364E-05	3.70917E-09
3.A.1.3	0.089453751	0.199550676	0	0.103532395	0	2.263462028	0.015826433	0.199550676	1.37621E-08	6.88106E-05	0.000137621	8.25727E-06	3.16529E-10
3.A.2.1	0.816	3.76	0.000254	0.1838	0.0402	0.208	0.236	3.26	0.0000069	0.000588	0.0000704	0.0000418	3.94E-08
3.A.2.2	0.234	0.882	0	0.162	0	0.0000648	0.06168	0.8064	6.936E-08	0.000186	0.00005772	0.000010032	3.828E-09
3.A.2.3	0.3648	5.0304	0	0	0	0	0.552	5.0208	7.9872E-06	0.0020448	0.0001008	0.0014976	4.176E-08
3.A.2.4	0.3371236	8.33085	0.00165495	0.115005	5.35755E-06	0.000072556	0.259369	8.32711	1.31929E-06	1.13505E-06	0.000100279	0.001180905	4.41187E-07
3.A.3.1	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.3.2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.3.3	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.3.4	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1.1	0.469510861	6.295713816	0.003124991	0.062347384	0.001455789	0.015243859	0.478657176	5.685959451	4.07011E-07	0.001521337	0.000314023	7.91156E-05	7.71339E-10
3.B.1.2	0.430787499	1.933585834	0.010852319	0.161407592	0.001305584	0.006775814	0.206028804	1.779339671	4.74307E-07	0.000506809	5.21683E-05	4.22524E-05	1.37169E-09
3.B.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.1	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.3	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.4	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.5	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.4.3	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.5.1	0.055919366	0.749827866	0.000372191	0.007425656	0.000173386	0.001815564	0.057008705	0.677205312	4.84756E-08	0.000181193	3.74006E-05	9.42278E-06	9.18675E-11
3.B.5.2	0.051307363	0.230292637	0.001292526	0.019223858	0.000155497	0.000807008	0.024538304	0.211921715	5.64906E-08	6.03616E-05	6.21331E-06	5.03232E-06	1.6337E-10
3.B.6	0.039930103	0.261736952	6.12749E-08	0.000507242	0.007669501	0.030872787	0.019153464	0.257679015	2.50375E-06	0.000249563	1.2539E-05	0.00011768	1.04289E-09
3.B.7	0.406241192	0.308472657	0	0	0.009696682	0.003434334	-0.004193339	0.27670507	5.90608E-07	4.00237E-05	8.35902E-06	7.89653E-06	2.17987E-14
3.C.1.1	0.043461696	0.200264678	1.35285E-05	0.009789534	0.002141128	0.011078472	0.012569804	0.173633737	3.67507E-07	3.1318E-05	3.74964E-06	2.22635E-06	2.09852E-09
3.C.1.2	0.012463281	0.04697698	0	0.008628425	0	3.45137E-06	0.003285193	0.042950382	3.69424E-09	9.90671E-06	3.07428E-06	5.34323E-07	2.03886E-10
3.C.1.3	0.036463001	0.502805592	0	0	0	0	0.055174278	0.501846039	7.98348E-07	0.000204385	1.00753E-05	0.00014969	4.17405E-09
3.C.1.4	0.031873253	0.234855545	0.000573719	0.009897484	0	0.000271761	0.047306617	0.228145387	1.1575E-08	7.31407E-05	2.34856E-05	2.66729E-06	5.61976E-10
3.C.1.5	0.036563385	0.166081789	0.000276995	0.015142412	0	6.92488E-07	0.012164712	0.150616216	2.35284E-08	4.61659E-05	1.96667E-05	4.33959E-06	1.24426E-09
3.C.1.6	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1.7	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1.8	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.4	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
3-Total non-load bearing elements	4.0007	32.8397	0.0271	1.0392	0.0628	2.5422	2.7197	31.1683	0.0000	0.0070	0.0013	0.0032	0.0000
4.A.1.1	1.091505834	4.899214166	0.027497014	0.408965741	0.003308016	0.017168186	0.522024529	4.508393663	1.20177E-06	0.001284125	0.000132181	0.000107057	3.47551E-09
4.A.1.2	1.586161297	21.26898102	0.010557242	0.210629861	0.00491813	0.051498743	1.617060543	19.20903129	1.37502E-06	0.005139575	0.001060874	0.000267278	2.60584E-09
4.A.1.3	0.893391244	4.272563731	0.005164123	0.089664808	0.019429071	0.095588181	0.352959767	4.032371963	7.78995E-08	0.002066056	0.000283141	0.00012205	1.13134E-12
4.A.1.4	0.109627477	1.285287667	0.000494341	0.188722103	0.016516819	0.087527509	0.063101227	1.116630009	1.75346E-08	0.000129401	9.01446E-07	0.000179998	3.7221E-09
4.A.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.5	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.6	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.3.1	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.3.2	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.3.3	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.3.4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.B.1	0.078568472	2.015410275	1.32325E-05	0.000955214	0.000159927	0.00347959	0.997789143	1.773270965	0.000783075	0.000365355	4.42393E-05	2.70866E-05	1.64573E-09
4.B.2.1	0.434917676	0.316868593	9.53712E-05	0.001714818	0.000313762	0.001053122	0.013358186	0	0	0.000106555	4.38024E-07	6.89655E-05	4.10065E-10
4.B.2.2	0.131345542	0.136960421	0	0	0.005900704	0.002089889	0.000705607	0.125837689	2.32244E-07	3.75857E-05	7.43419E-06	2.09144E-05	3.13753E-10
4- Total facades	4.3255	34.1953	0.0438	0.9007	0.0505	0.2584	3.5670	30.7655	0.0008	0.0091	0.0015	0.0008	0.0000
5.A.1.1	0.425649581	1.961326499	0.000132494	0.095875482	0.020969501	0.108498913	0.123104536	1.700511805	3.59924E-06	0.000306718	3.67227E-05	2.18041E-05	2.05522E-08
5.A.1.2	0	0	0	0	0	0	0	0	0	0	0	0	0
5.A.2	0.18778658	2.931557161	0.000994226	0.014396971	0.027020402	0.527888941	0.036305405	0	0	7.20892E-05	1.95089E-06	7.32368E-05	4.31909E-10
5.A.3	0.320520394	1.53286012	0.001852723	0.032168884	0.006970534	0.034294002	0.12663075	1.446686945	2.79479E-08	0.000741235	0.000101582	4.37877E-05	4.0589E-13
5.A.4	0.190290401	2.624004473	0	0	0	0	0.287939422	2.618996831	4.16636E-06	0.001066628	5.25802E-05	0.000781192	2.17832E-08
5.B.1	0.307839951	1.308319791	0.000584326	0.012570131	0.000293588	0.002556782	0.080095395	1.282666461	1.143E-07	0.001094542	9.17819E-05	5.75775E-05	6.01428E-10
5.B.2	0.086651245	1.194875068	0	0	0	0	0.131117016	1.192594772	1.89721E-06	0.000485703	2.39431E-05	0.000355726	9.91929E-09
5.B.3	0.128266646	2.002384865	0.000679101	0.009833776	0.018456145	0.360571794	0.024798218	0	0	4.92401E-05	1.33255E-06	5.0024E-05	2.95013E-10
5.B.4	0.067818851	0.909389143	0.000451392	0.009005815	0.000210282	0.002201911	0.069139998	0.821312713	5.8791E-08	0.000219751	4.53594E-05	1.14279E-05	1.11417E-10
5.B.5	0	0	0	0	0	0	0	0	0	0	0	0	0
5.B.6	0.047343167	0.634828836	0.000315109	0.006286804	0.000146795	0.001537116	0.048265437	0.573344203	4.1041E-08	0.000153404	3.16646E-05	7.97763E-06	7.77781E-11
5.B.7	0	0	0	0	0	0	0	0	0	0	0	0	0
5.B.8	0.146947647	0.702763979	0.00084941	0.014748334	0.003195751	0.015722628	0.058055871	0.663256524	1.28131E-08	0.000339831	4.65719E-05	2.00751E-05	1.86087E-13
5-Total Roofs	1.9091	15.8023	0.0059	0.1949	0.0773	1.0533	0.9855	10.2994	0.0000	0.0045	0.0004	0.0014	0.0000
Total building (A1-A5)	12.6240	93.8889	0.1289	3.4837	0.1139	2.8380	10.5593	87.4859	0.0008	0.0241	0.0056	0.0046	0.0000

Ref.	Env imp A4 (/m2/yr) GWP (kg CO2-eq./m2/yr)	ADPF (MJ/m2/yr)	ADPE (kg Sb-eq./m2/yr)	AP (kg SO2-eq./m2/yr)	EP (kg Phosphat-eq./m2/yr)	POCP (kg Ethen-eq./m2/yr)	ODP (kg CFC 11-eq./m2/yr)	Env imp A5 (/m2/yr) GWP (kg CO2-eq./m2/yr)	ADPF (MJ/m2/yr)	ADPE (kg Sb-eq./m2/yr)	AP (kg SO2-eq./m2/yr)	EP (kg Phosphat-eq./m2/yr)	POCP (kg Ethen-eq./m2/yr)	ODP (kg CFC 11-eq./m2/yr)
1.A.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.A.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.2.1	0.018164228	0.24609599	1.2891E-09	4.2272E-05	1.017E-05	-1.4104E-05	2.99668E-18	7.53355E-05	0.00102959	2.7246E-09	3.2394E-07	1.3267E-06	6.278E-08	4.85495E-12
1.B.2.2	0.010862125	0.16823047	1.8916E-08	6.3583E-05	1.1127E-05	2.3844E-06	2.08235E-09	2.22276E-08	2.6493E-07	8.2128E-13	9.7759E-11	4.0004E-10	1.8889E-11	1.46506E-15
1.B.2.3	0.001167111	0.01646337	7.5954E-11	2.9012E-06	8.6387E-09	1.436E-06	2.75612E-10	0.002259127	0.02398424	8.6731E-11	1.2795E-05	1.5219E-07	1.4211E-05	2.56868E-10
1.B.3.1	0.003212193	0.04352004	2.2796E-10	7.4754E-06	1.7985E-06	-2.4943E-06	5.29938E-19	1.33225E-05	0.00018207	4.8183E-10	5.7287E-08	2.3462E-07	1.1102E-08	8.58559E-13
1.B.3.2	0.00269469	0.04173483	4.6927E-09	1.5774E-05	2.7604E-06	5.9152E-07	5.16592E-10	5.51426E-09	6.5724E-08	2.0374E-13	2.4252E-11	9.9243E-11	4.6861E-12	3.63454E-16
1.B.3.3	0.000377441	0.00532422	2.4563E-11	9.3823E-07	2.7937E-09	4.6439E-07	8.91325E-11	0.000730597	0.00775645	2.8049E-11	4.1378E-06	4.9219E-08	4.5957E-06	8.30704E-11
1.B.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.B.4.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.C.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Total Fundations	0.0365	0.5214	0.0000	0.0001	0.0000	0.0000	0.0000	0.0031	0.0330	0.0000	0.0000	0.0000	0.0000	0.0000
2.A.1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1.4	0.006633364	0.08987139	4.7075E-10	1.5437E-05	3.7141E-06	-5.1508E-06	1.09435E-18	0.00035918	0.00502699	1.3282E-08	1.5284E-05	6.1137E-05	3.0568E-07	2.36906E-11
2.A.1.5	0.008622762	0.13354766	1.5016E-08	5.0475E-05	8.8331E-06	1.8928E-06	1.65305E-09	1.76451E-08	2.1031E-07	6.5196E-13	7.7605E-11	3.1757E-10	1.4995E-11	1.16302E-15
2.A.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.2.4	0.003670596	0.04973066	2.6049E-10	8.5422E-06	2.0552E-06	-2.8502E-05	6.05564E-19	0.000198753	0.0027817	7.3497E-09	8.4576E-06	3.383E-05	1.6915E-07	1.31093E-11
2.A.2.5	0.007014983	0.1086467	1.2216E-08	4.1063E-05	7.1861E-06	1.5399E-06	1.34482E-09	1.43551E-08	1.711E-07	5.304E-13	6.3135E-11	2.5836E-10	1.2199E-11	9.46167E-16
2.A.3.1	0.02295471	0.3109993	1.629E-09	5.342E-05	0.00012853	-0.00017824	3.787E-18	0.00017454	0.00241183	6.3998E-09	7.5634E-07	3.0994E-06	1.4651E-07	1.13716E-11
2.A.3.2	0.019516793	0.30227228	3.3988E-08	0.00011424	1.9993E-05	4.2842E-06	3.74151E-09	3.9938E-08	4.7602E-07	1.4757E-12	1.7565E-10	7.1879E-10	3.394E-11	2.63239E-15
2.A.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.4.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.5.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.6.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.6.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.A.6.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.B.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.B.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2- Total structural elements	0.0684	0.9951	0.0000	0.0003	0.0002	-0.0003	0.0000	0.0007	0.0102	0.0000	0.0000	0.0001	0.0000	0.0000
3.A.1.1	0.009954597	0.13486873	7.0646E-10	2.3166E-05	5.5737E-06	-7.7297E-06	1.64228E-18	4.12863E-05	0.00056425	1.4932E-09	1.7753E-07	7.271E-07	3.4405E-08	2.66068E-12
3.A.1.2	0.002821234	0.04369472	4.9131E-09	1.6515E-05	2.89E-06	6.193E-07	5.40851E-10	5.77321E-09	6.8811E-08	2.1331E-13	2.5391E-11	1.039E-10	4.9062E-12	3.80522E-16
3.A.1.3	0.009048591	0.84275755	4.5965E-06	0.00053672	0.0001101	2.7524E-05	6.88106E-06	2.05056E-05	0.00290381	7.5898E-10	9.0073E-08	3.6907E-07	1.743E-08	1.35557E-12
3.A.2.1	0.01212	0.1728	5.2E-10	0.0000202	0.00000238	1.006E-06	2.24E-09	0.0222	0.1608	2.08E-07	0.000052	0.00000758	0.00000362	1.66E-09
3.A.2.2	0.002976	0.329616	1.1088E-05	0.000192	4.1952E-05	1.1088E-05	3.8976E-06	3.576E-07	4.992E-06	1.3248E-11	1.5744E-09	6.432E-09	3.0384E-10	2.3616E-14
3.A.2.3	0.03154272	0.346944	1.8912E-06	0.00021943	4.3102E-05	0.00011755	3.91872E-05	2.8608E-06	3.9187E-05	1.0579E-10	1.2578E-05	5.1331E-08	2.4326E-09	1.88832E-13
3.A.2.4	0.0077979	0.115005	2.7583E-08	3.151E-05	5.2267E-07	0.00003179	1.7952E-09	3.2912E-06	7.2276E-05	2.0851E-11	4.7405E-08	8.1065E-09	1.6176E-08	9.35E-14
3.A.3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.A.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1.1	0.004496938	0.06219495	3.6128E-10	1.8902E-05	4.6951E-06	-6.9055E-06	1.50914E-15	0.003582307	0.01487801	3.0945E-10	6.0823E-06	1.0061E-06	-2.0274E-07	1.20426E-15
3.B.1.2	0.012009166	0.16085671	1.245E-09	9.1446E-06	2.0603E-06	-1.2946E-07	2.52303E-16	0.022971661	0.00611476	4.0214E-10	3.0078E-06	6.6656E-07	2.0107E-07	3.14552E-16
3.B.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.4.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.4.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.B.5.1	0.000535591	0.0074075	4.3029E-11	2.2513E-06	5.5919E-07	-8.2245E-07	1.79741E-16	0.000426658	0.00177199	3.6856E-11	7.2441E-07	1.1983E-07	-2.4147E-08	1.4343E-16
3.B.5.2	0.001430308	0.01915825	1.4828E-10	1.0891E-06	2.4538E-07	-1.5418E-08	3.00496E-17	0.002735955	0.00072828	4.7896E-11	3.5823E-07	7.9389E-08	2.3948E-08	3.74636E-17
3.B.6	0.001468973	0.16155866	8.8057E-07	0.00010145	2.029E-05	4.0579E-06	1.91129E-06	7.71008E-05	0.00107941	2.8487E-09	3.3884E-07	1.3838E-06	6.5333E-08	5.07242E-12
3.B.7	0.000126353	0.01390529	7.5901E-08	8.8514E-06	1.7703E-06	4.4257E-07	1.64414E-07	0.002354466	0.00071165	8.2362E-11	7.7228E-07	1.7512E-07	4.5186E-08	8.86244E-19
3.C.1.1	0.000645534	0.00920365	2.7696E-11	1.0759E-06	1.2676E-07	5.3581E-08	1.19307E-10	0.001182414	0.00856451	1.1078E-08	2.7696E-06	4.0373E-07	1.9281E-07	8.84147E-11
3.C.1.2	0.000158507	0.01755597	5.9057E-07	1.0226E-05	2.2344E-06	5.9057E-07	2.07594E-07	1.90464E-08	2.6588E-07	7.0561E-13	8.3856E-11	3.4258E-10	1.6183E-11	1.25783E-15
3.C.1.3	0.003152802	0.03467823	1.8903E-07	2.1932E-05	4.3082E-06	1.175E-05	3.91689E-06	2.85947E-07	3.9169E-06	1.0574E-11	1.2572E-06	5.1307E-09	2.4315E-10	1.88744E-14
3.C.1.4	0.000728052	0.00986393	5.1668E-11	1.6943E-06	4.0764E-06	-5.6533E-06	1.20112E-19	3.94222E-05	0.00055174	1.4578E-09	1.6775E-06	6.7102E-06	3.3551E-08	2.60019E-12
3.C.1.5	0.000946401	0.01465767	1.6481E-09	5.5399E-06	9.6948E-07	2.0775E-07	1.81432E-10	1.93666E-09	2.3083E-08	7.1557E-14	8.5176E-12	3.4855E-11	1.6458E-12	1.27649E-16
3.C.1.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.C.2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3-Total non-load bearing elements	0.1020	2.4967	0.0000	0.0012	0.0002	0.0002	0.0001	0.0556	0.1988	0.0000	0.0001	0.0000	0.0000	0.0000
4.A.1.1	0.030428168	0.40756995	3.1545E-09	2.317E-05	5.2202E-06	-3.2801E-07	6.39271E-16	0.058204339	0.01549324	1.0189E-09	7.621E-06	1.6889E-06	5.0946E-07	7.96995E-16
4.A.1.2	0.015192129	0.21011487	1.2205E-09	6.3858E-05	1.5862E-05	-2.3329E-05	5.09838E-15	0.012102205	0.05026277	1.0454E-09	2.0548E-05	3.3989E-06	-6.8493E-07	4.0684E-15
4.A.1.3	0.006595096	0.08874882	5.4226E-10	9.7542E-06	2.1251E-06	-2.1882E-06	1.63758E-18	0.045066489	0.08970552	1.6433E-09	4.5168E-05	6.4404E-06	2.7052E-06	2.2635E-14
4.A.1.4	0.014219585	0.18755895	4.8853E-10	3.9547E-05	1.1137E-08	6.1356E-05	3.05329E-10	0.007008016	0.07764068	7.2406E-10	1.8029E-05	8.2875E-08	2.6084E-05	1.92793E-10
4.A.2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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4.A.3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.A.3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.B.1	0.605582479	0.00093681	4.3328E-07	2.4257E-07	3.8644E-08	1.1024E-08	1.04722E-11	0.814692451	0.00339595	4.3997E-12	4.4331E-07	4.6841E-08	2.9108E-08	2.99445E-11
4.B.2.1	0.000129543	0	0	4.1317E-07	3.8211E-10	3.7279E-07	1.64337E-20	0.004877291	0	0	1.9664E-06	1.2178E-10	2.2336E-06	5.62286E-19
4.B.2.2	7.68896E-05	0.00846176	4.6188E-08	5.3863E-06	1.0773E-06	2.6932E-07	1.00051E-07	0.001432759	0.00043306	5.012E-11	4.6996E-07	1.0657E-07	2.7497E-08	5.39304E-19
4- Total facades	0.6722	0.9034	0.0000	0.0001	0.0000	0.0000	0.0000	0.9434	0.2369	0.0000	0.0001	0.0000	0.0000	0.0000
5.A.1.1	0.006322148	0.09013756	2.7125E-10	1.0537E-05	1.2415E-06	5.2476E-07	1.16845E-09	0.011580172	0.08387801	1.085E-07	2.7125E-05	3.954E-06	1.8883E-06	8.65905E-10
5.A.1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.A.2	0.001084989	0	0	1.2206E-06	3.9018E-09	1.0537E-06	1.07456E-16	0.019821917	0	0	4.2356E-05	6.0196E-07	3.9435E-05	1.64835E-09
5.A.3	0.002366111	0.03184026	1.9455E-10	3.4995E-06	7.6241E-07	-7.8505E-07	5.87511E-19	0.016168425	0.03218349	5.8956E-10	1.6205E-05	2.3106E-06	9.7054E-07	8.12073E-15
5.A.4	0.01645361	0.18097619	9.8651E-07	0.00011446	2.2483E-05	6.1318E-05	2.04412E-05	1.49228E-06	2.0441E-05	5.5184E-11	6.561E-06	2.6776E-08	1.2689E-09	9.85003E-14
5.B.1	0.00092352	0.01245612	7.867E-11	6.7269E-07	1.3397E-07	-8.6651E-09	6.61286E-17	0.00215488	0.00245987	1.81E-11	9.1782E-07	1.5392E-07	-2.6423E-08	1.5563E-16
5.B.2	0.007492368	0.08240989	4.4922E-07	5.2121E-05	1.0238E-05	2.7922E-05	9.30817E-06	6.79528E-07	9.3082E-06	2.5129E-11	2.9876E-06	1.2193E-08	5.7783E-10	4.48534E-14
5.B.3	0.000741096	0	0	8.3373E-07	2.6651E-09	7.1972E-07	7.3397E-17	0.013539257	0	0	2.8931E-05	4.1117E-07	2.6936E-05	1.1259E-09
5.B.4	0.000649564	0.0089838	5.2185E-11	2.7304E-06	6.7819E-07	-9.9747E-07	2.17989E-16	0.000517449	0.00214906	4.4699E-11	8.7856E-07	1.4533E-07	-2.9285E-08	1.73951E-16
5.B.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.B.6	0.000453449	0.00627143	3.643E-11	1.906E-06	4.7343E-07	-6.9631E-07	1.52174E-16	0.000361222	0.00150023	3.1203E-11	6.1331E-07	1.0145E-07	-2.0444E-08	1.21432E-16
5.B.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.B.8	0.001084781	0.01459767	8.9193E-11	1.6044E-06	3.4954E-07	-3.5992E-07	2.69354E-19	0.00741267	0.01475503	2.7029E-10	7.4294E-06	1.0593E-06	4.4496E-07	3.72308E-15
5-Total Roofs	0.0376	0.4277	0.0000	0.0002	0.0000	0.0001	0.0000	0.0716	0.1370	0.0000	0.0001	0.0000	0.0001	0.0000
Total building (A1-A5)	0.8791	4.9166	0.0000	0.0018	0.0005	0.0000	0.0001	1.0028	0.4789	0.0000	0.0002	0.0001	0.0001	0.0000

5.4.5. Tab: Graphical results.

Finally, the ***graphical results*** tab shows the results of the LCA performed by the Excel app using graphs.

See next pages.

Erasmus+ Project 2022-1-NO01-KA220-HED-000087893

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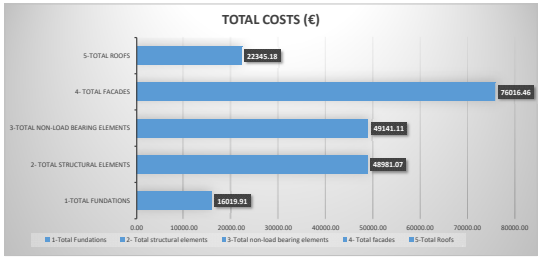
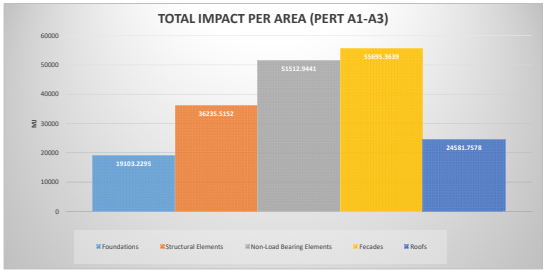
BIM-LCA Construction Project

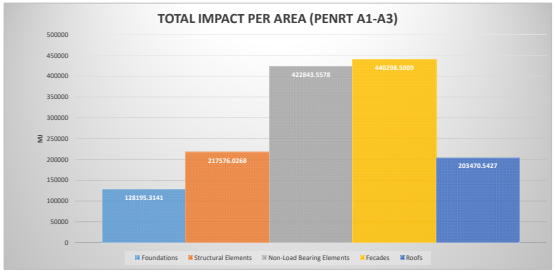
Graphical Results

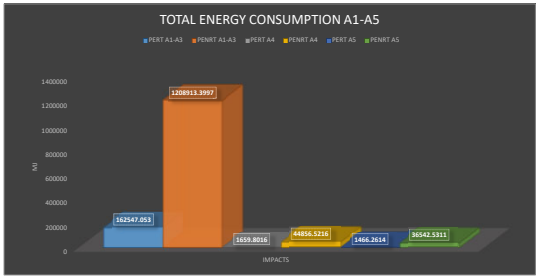
Project name: Single-family house in concrete and bricks

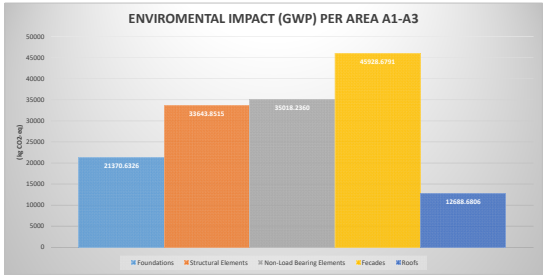
Enviromental Impacts	
Abiotic depletion potential for fossil resources (ADPF)	Eutrophication potential (EP)
Abiotic depletion potential for non fossil resources (ADPE)	Photochemical Ozone Creation Potential (POCP)
Acidification potential (AP)	Ozone Depletion Potential (ODP)
Global warming potential (GWP)	

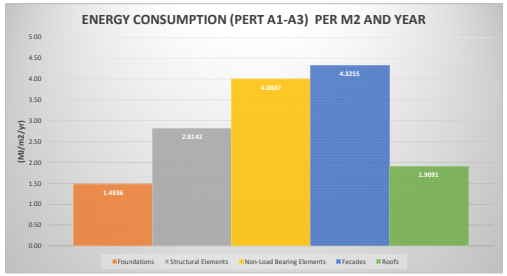


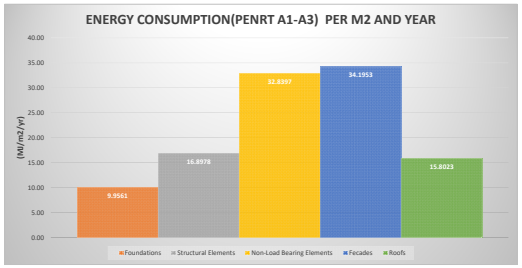


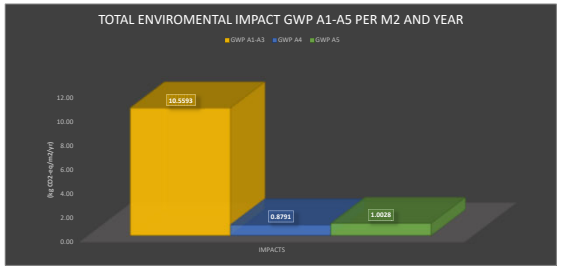












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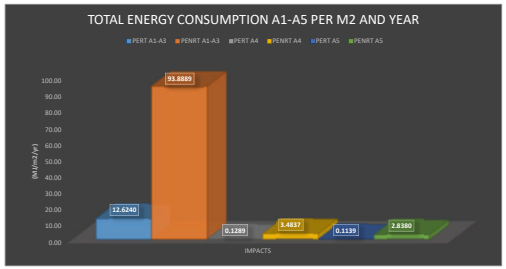

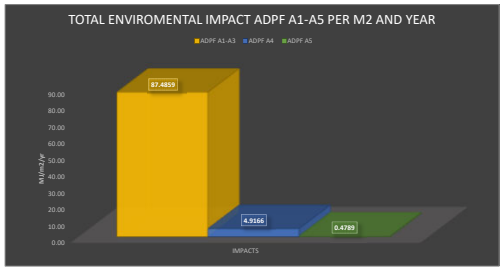

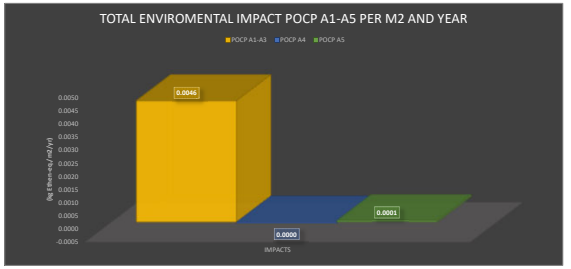

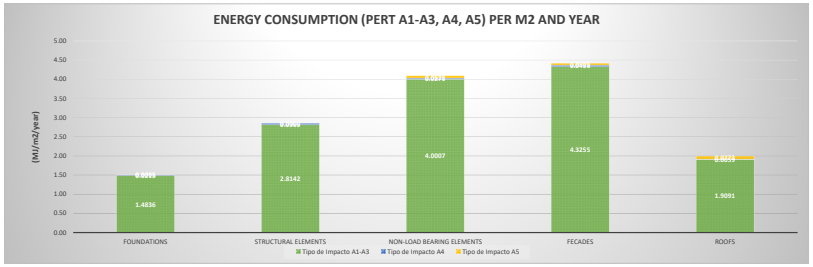

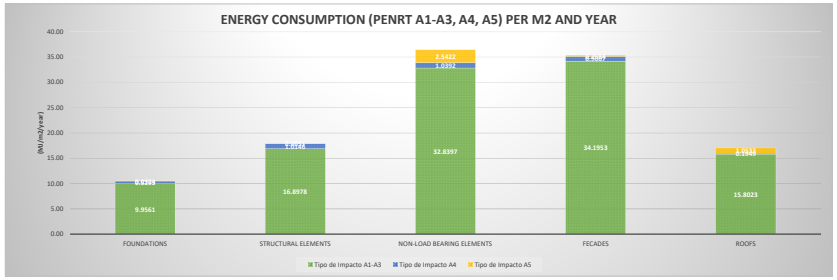

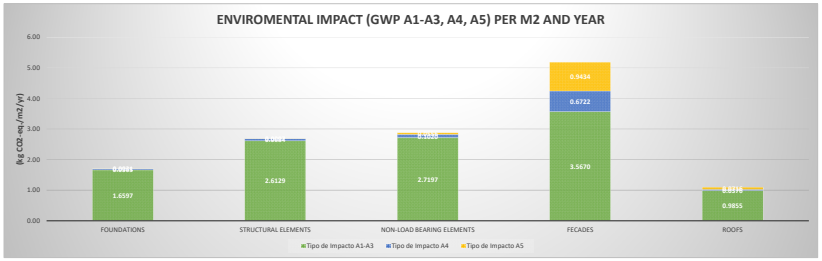

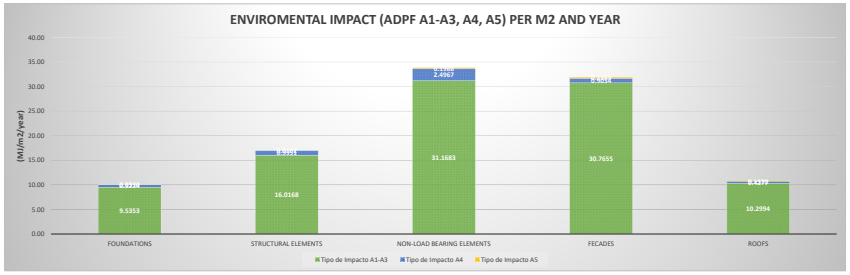

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BIM-LCA Construction Project

Graphical Results

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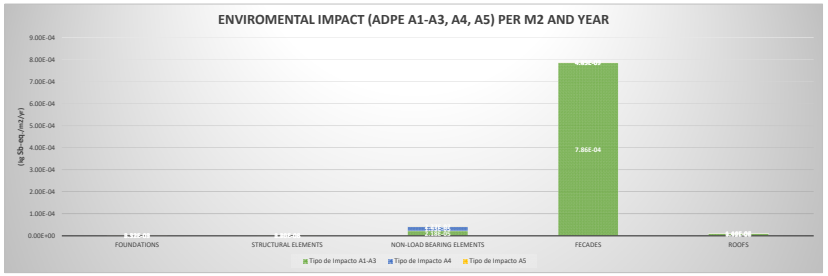
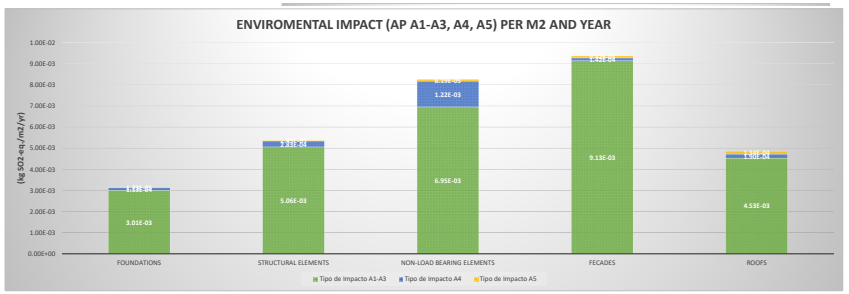
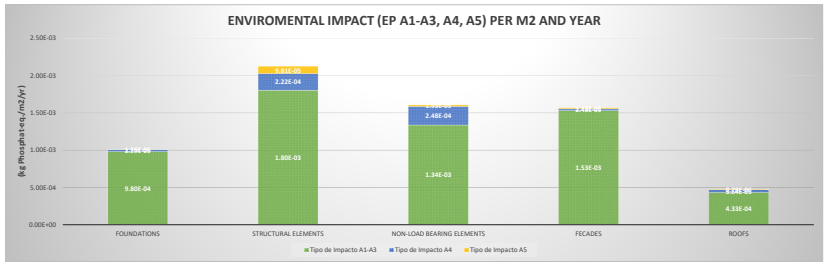
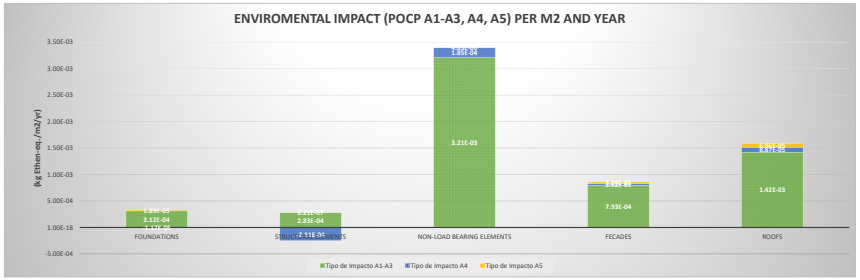
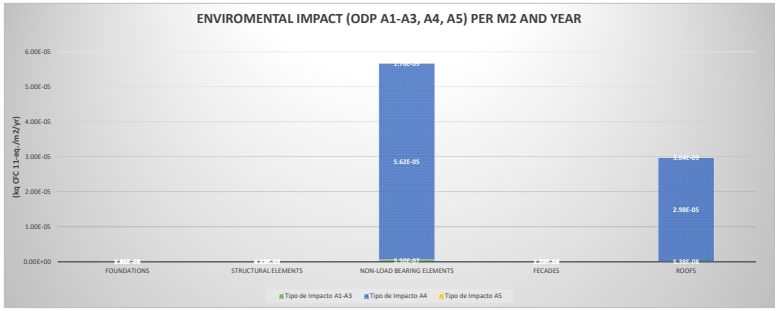










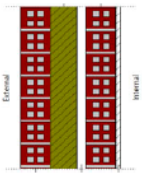
5.5 – Exercise 1.

Using this LCA Excel app, available on the BIM-LCA construction Project website (https://bimlca.eu/), answer the following questions:

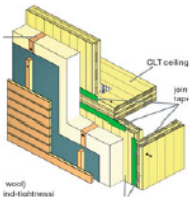
- Which is more expensive a double brick façade or a wooden façade?
- Which type of insulation has the most environmental impacts and its manufacture, transport and installation require higher energy consumption.
- Which type of structural slab is more harmful to the environment, a mass concrete slab or a lightened slab?

Para responder a estas cuestiones el estudiante debe cambiar las siguientes opciones de la pestaña *Building & Material inputs:*

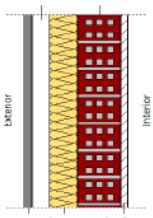
h) Type of facades 1



(1) Double bricks wall

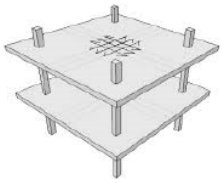


(2) Timber

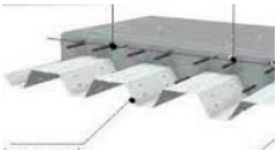


(3) Ventilated facade

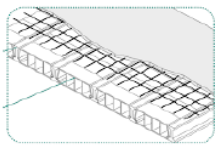
c) Type of structural slabs 1 (enter 1, 2, 3 or 4)



(1)-Mass concrete slabs



(2) Composite slab slabs



(3) Lightweight concrete slabs

(4) Timber slabs

m) Material in the insulation layers of the facades and roofs 1 (enter 1,2,...or 6)

1	MWOOL	Mineral wool insulation
2	POLYU1	Insulation board with a core of rigid polyurethane
3	POLYU2	Polyurethane thermal insulation spray foam
4	EPS	Expanded Polystyrene for insulation
5	CELL	Cellulose Fibre Insulation
6	CORK	Cork-based thermal insulation panels

5.6 – Exercise 2.

In this second proposed exercise, the following is requested:

1. Enter the following areas and volumes of the building elements in the excel. These values correspond to the **same single-family house shown in this tutorial but with a steel structure.**

Footing volume (m3):	24.88
Volume of Foundation beams (m3):	12.37
Footing plant area (m2):	9.05
Foundation beam plant area (m2):	4.52
Volume of piles (m3):	0.00
Volume of pile caps (m3):	0.00
Pile cap plant area (m2):	0.00
Foundation slab volume (m3):	0.00
Foundation slab plant area (m2):	0.00

Column volume (m3):	4.87
beam volume (m3):	1.41
Retaining wall volume (m3):	0.00
Area of slabs (including beams) (m2):	351.13
Partition area (m2):	221.66
Facade area (m2):	374.42
Exterior party wall (m2):	0.00
Stairs (m2):	10.80
Ramps (m2):	0.00
Steel volume in stiffening elements (m3):	0.00
Concrete volume in stiffening walls (m3):	0.00

Interior door surface (m2):	7.64
Main door surface (m2):	4.00
Exterior glazed door surface (m2):	4.00
Windows surface (m2):	21.54
Flat roof area (m2):	134.33
Inclined roof area (horizontal projection (m2):	86.22
roof inclination angle (deg):	20.00
parapets (m2):	26.40
Railing (m):	5.50

2. Select steel beams and columns and composite slabs from the options on the *Building & Material inputs tab.*

3. Make a copy of the Excel to study a third case. It is now the same **house but with a timber structure and timber walls and facades**. The volumes and areas in this case are as follows:

Footing volume (m3):	24.83
Volume of Foundation beams (m3):	2.89
Footing plant area (m2):	59.43
Foundation beam plant area (m2):	11.56
Volume of piles (m3):	0.00
Volume of pile caps (m3):	0.00
Pile cap plant area (m2):	0.00
Foundation slab volume (m3):	0.00
Foundation slab plant area (m2):	0.00

Column volume (m3):	5.76
beam volume (m3):	2.80
Retaining wall volume (m3):	0.00
Area of slabs (including beams) (m2):	351.13
Partition area (m2):	221.66
Facade area (m2):	374.42
Exterior party wall (m2):	0.00
Stairs (m2):	10.80
Ramps (m2):	0.00
Steel volume in stiffening elements (m3):	0.00
Concrete volume in stiffening walls (m3):	0.00

Interior door surface (m2):	7.64
Main door surface (m2):	4.00
Exterior glazed door surface (m2):	4.00
Windows surface (m2):	21.54
Flat roof area (m2):	134.33
Inclined roof area (horizontal projection (m2):	86.22
roof inclination angle (deg):	20.00
parapets (m2):	26.40
Railing (m):	5.50

4. For this third case of timber house, student will also have to select the appropriate options from the *Building & Material inputs tab.*

5. To compare the results of the housing budget, greenhouse gas emissions and energy consumption in the three cases studied. These are:

    - Single-family house with concrete structure and brick walls
    - Single-family house with steel structure and brick walls.
    - Single-family house with timber structure and walls.

References

https://co2data.fi/rakentaminen/

https://www.eco-platform.org/epd-data.html

https://bimlca.eu/

6 - Deliverables

To evaluate the success of the application, Students will write a report with the results of the two proposed practical exercises.

7- What we have learned

What is Open BIM.

The importance of working with interoperable BIM formats.

Cype Open BIM solutions as an example of Open BIM approach.

One Open BIM Workflow to performance LCA of buildings.

The existence of a new excel tool to perform building LCAs developed in the BIM-LCA Construction Project.

An introduction of several software of the Open BIM – LCA workflow.