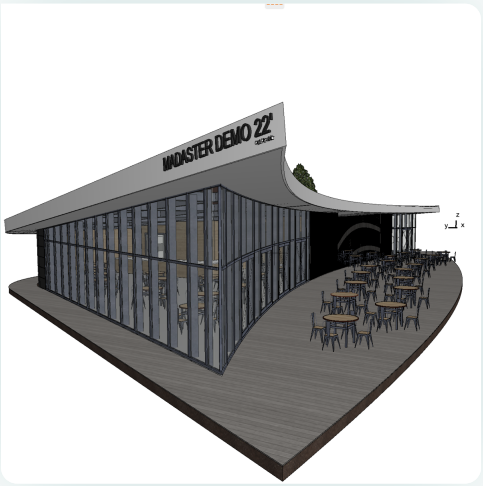
madaster

Material passport

MADASTER DEMO 22



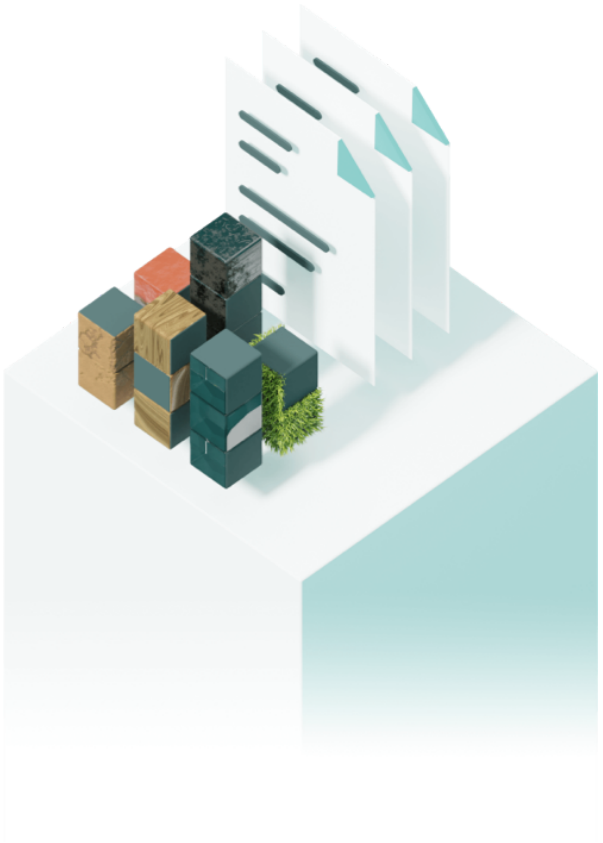
ADDRESS
Hoofdstraat 1
Antwerpen
Belgium

OWNER
Madaster Belgie

PUBLISHED ON
6/10/2024

What is a Material Passport?

This Materials Passport is a Madaster product that represents the registration of the materials and products of a building or buildings, or of part of a building. This registration is based on one or more source files from, and imported by, the user. These source files are mentioned in section [2] of this document. The current version of the Materials Passport, version 1.0, contains views of the material and product quantities within the so-called “Building” frame. This means views of the materials and products used in the different layers of the building, based on the classification coding, and on a classification into seven "materials families".

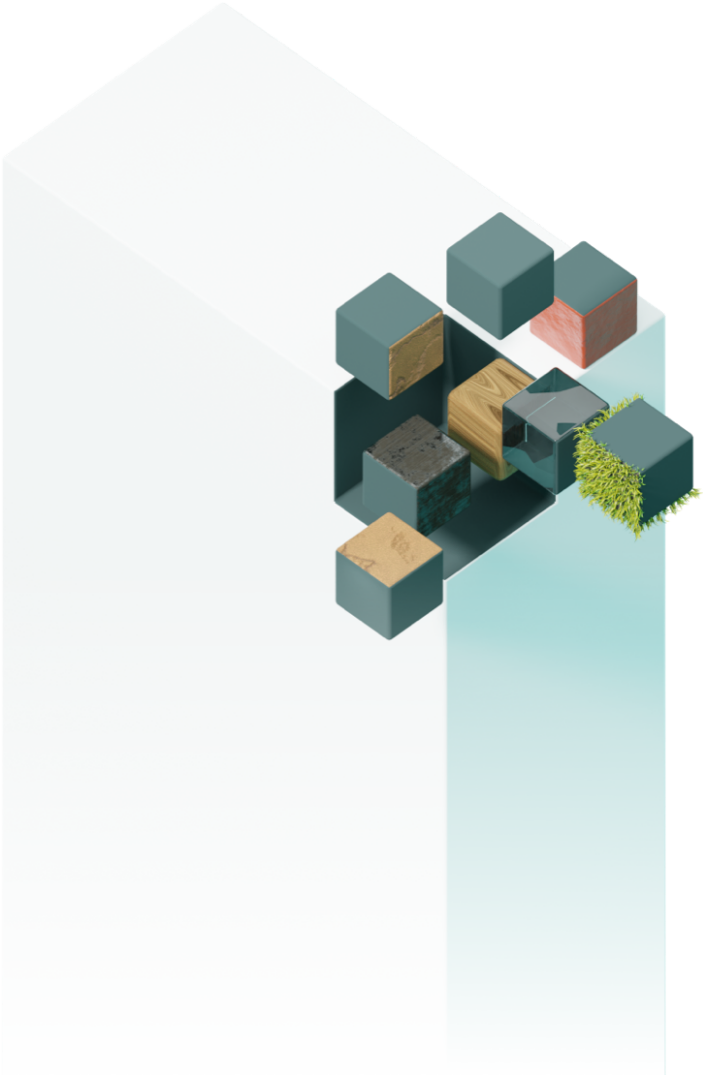


“Waste is material without an identity”

- Thomas Rau

Disclaimer

This Materials Passport was realized without any intervention by (personnel and/or employees of) Madaster Services B.V. (hereinafter referred to as: 'Madaster') and/or the Madaster Foundation and is the sole and exclusive result of data imported by, or on behalf of the user, from the user's source files. The imported data includes data on quantities, the classification of materials into material families, as well as the classification coding. The various representations of materials in the Materials Passport are based on this data. Therefore, all information in the Materials Passport is based for 100% on the data contained in the source files provided and processed by the user. Consequently, the quality of the Materials Passport is fully dependent on that data being correct and complete and on the following conditions: The correct assignment of materials and products to all elements within the BIM model that has been exported to IFC. The inclusion of volume and surface attributes in the Base Quantity properties of the BIM model that has been exported to IFC. The presence of a classification code for all elements within the BIM model that has been exported to IFC. The activated files within the platform being complementary, without any overlapping elements. All values displayed have the accuracy specified in the validation attributes of the source files. The user has full responsibility for the correctness and completeness of the information and data to be entered on the Madaster Platform. Consequently, Madaster cannot be held accountable in any way for the incorrect, and/or incomplete and/or injudicious entry by the user of the required information.



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General information

Building

NAME
MADASTER DEMO 22

ADDRESS
Hoofdstraat 1
Antwerpen
Belgium

DELIVERY DATE
9/22/2022

GROSS SURFACE AREA
270 m^2

BUILDING PHASE
New

USAGE
Community (Conference complex/small complex < 2000 m2)

Building owner

NAME
Madaster Belgie

Cadaster information

CADASTRAL DESIGNATION
Almere K 7860

CADASTRAL SURFACE AREA
672 m^2

LOT NUMBER
7860

Labels

BREEAM
Excellent

LEED
Gold

Energy

ENERGY LABEL
A+++

ENERGY INDEX
5

WELL score

NEW AND EXISTING BUILDINGS
Gold

NEW AND EXISTING INTERIORS
Platinum

CORE AND SHELL
Gold

Lifespan

EXPECTED LIFESPAN BUILDING (YEARS)
60

EXPECTED LIFESPAN STRUCTURE (YEARS)
100

EXPECTED LIFESPAN SKIN (YEARS)
20

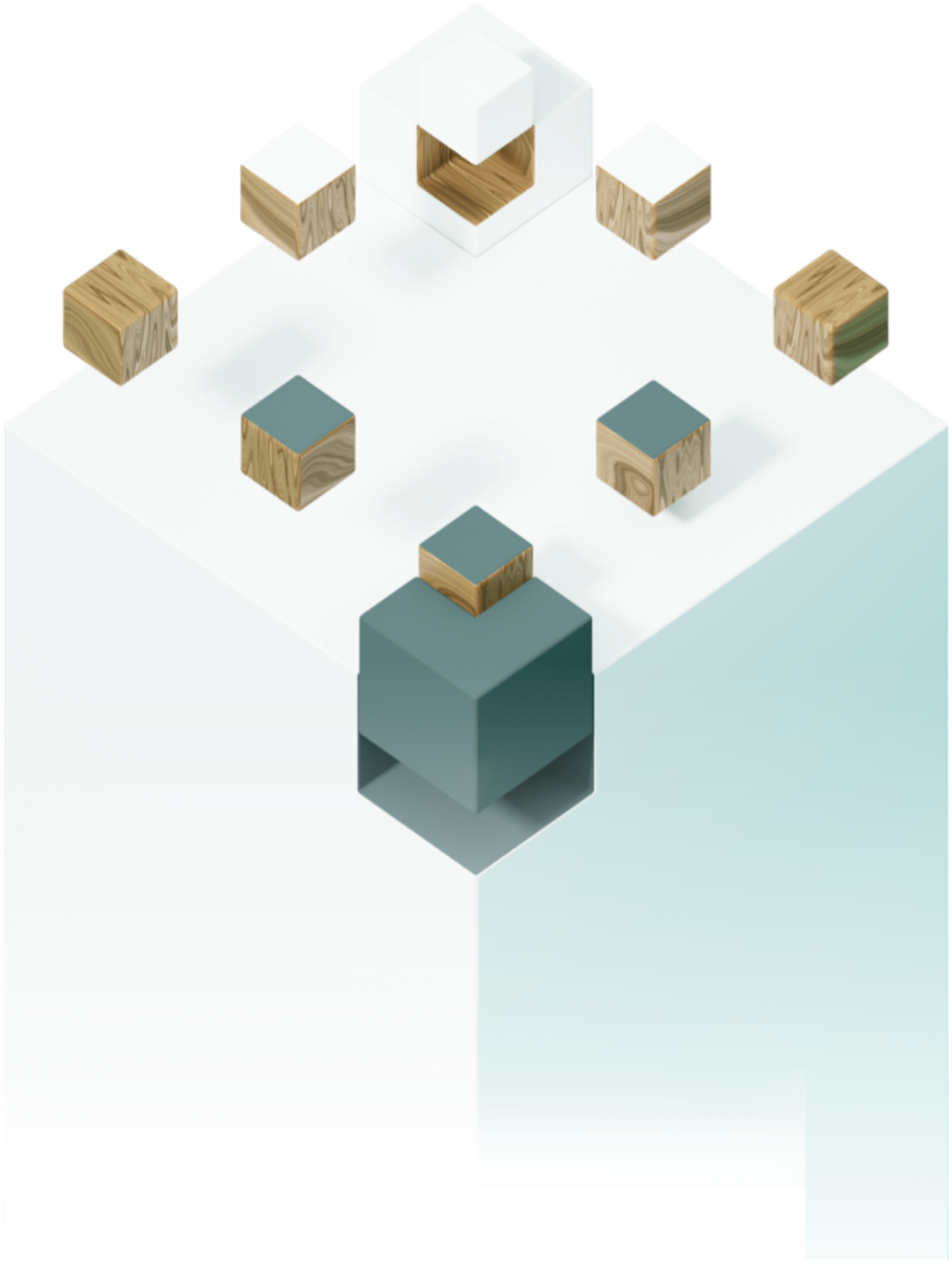
EXPECTED LIFESPAN SERVICES (YEARS)
15

EXPECTED LIFESPAN SPACE PLAN (YEARS)
10

EXPECTED LIFESPAN STUFF (YEARS)
5

EXPECTED LIFESPAN SURROUNDINGS (YEARS)
20

Source Information



Source Information

Sources

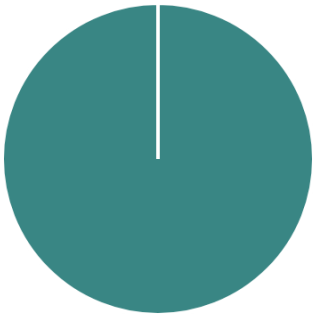
Madaster primarily uses IFC building files to calculate the material quantities. To do this, you must include the “base quantities” of the objects in the export. The objects must be assigned a material property, as well as a classification code. Madaster does not calculate quantities: all geometric information and all quantities are imported directly from the IFC model. On the Madaster Platform, the quality of the source files is displayed under “Source file quality”. All calculations on the Madaster Platform are made within these frameworks. Consequently, any missing and/or incomplete and/or incorrect information in the source files immediately results in inaccurate results. Therefore, Madaster cannot warrant the quality of these results. As a secondary source of information, a Microsoft Excel file (based on a Madaster Excel template) can be imported containing geometric information about the building, information on the building parts and/or components, materials, as well as classification codes.

Active Source files

Name	Classification method	Date exported
220922 DM2- Interior.ifc	Omniclass	9/27/2022
220922 DM2- Construction.ifc	Omniclass	9/27/2022
220922 DM2- installation.ifc	Omniclass	9/27/2022
220922 DM2- architecture.ifc	Omniclass	9/27/2022

Applied Material and Product Databases

EPEA Generic - BENELUX (100%)



100%

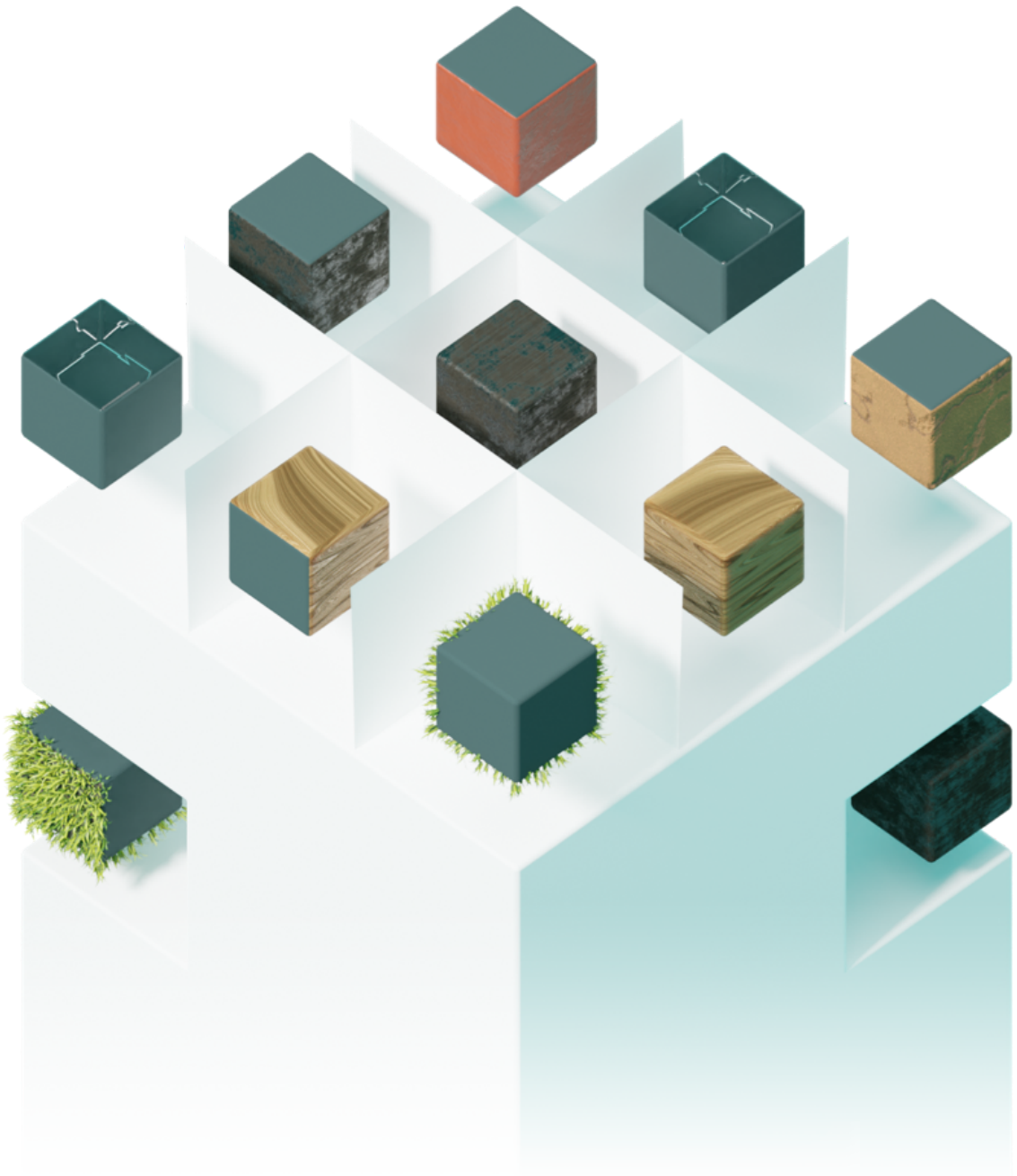
Completeness of Source Information

0
(0%)
Elements unlinked

0
(0%)
Elements with unknown layer

664
(22.9%)
Elements with insufficient geometry

Object in Detail



Mass

Total mass and mass/m² demonstrate the quantity and intensity of materials temporarily stored within the building. While mass cannot be eliminated, the goal is to use less materials to achieve the same goal.

Total Mass

331.26 t

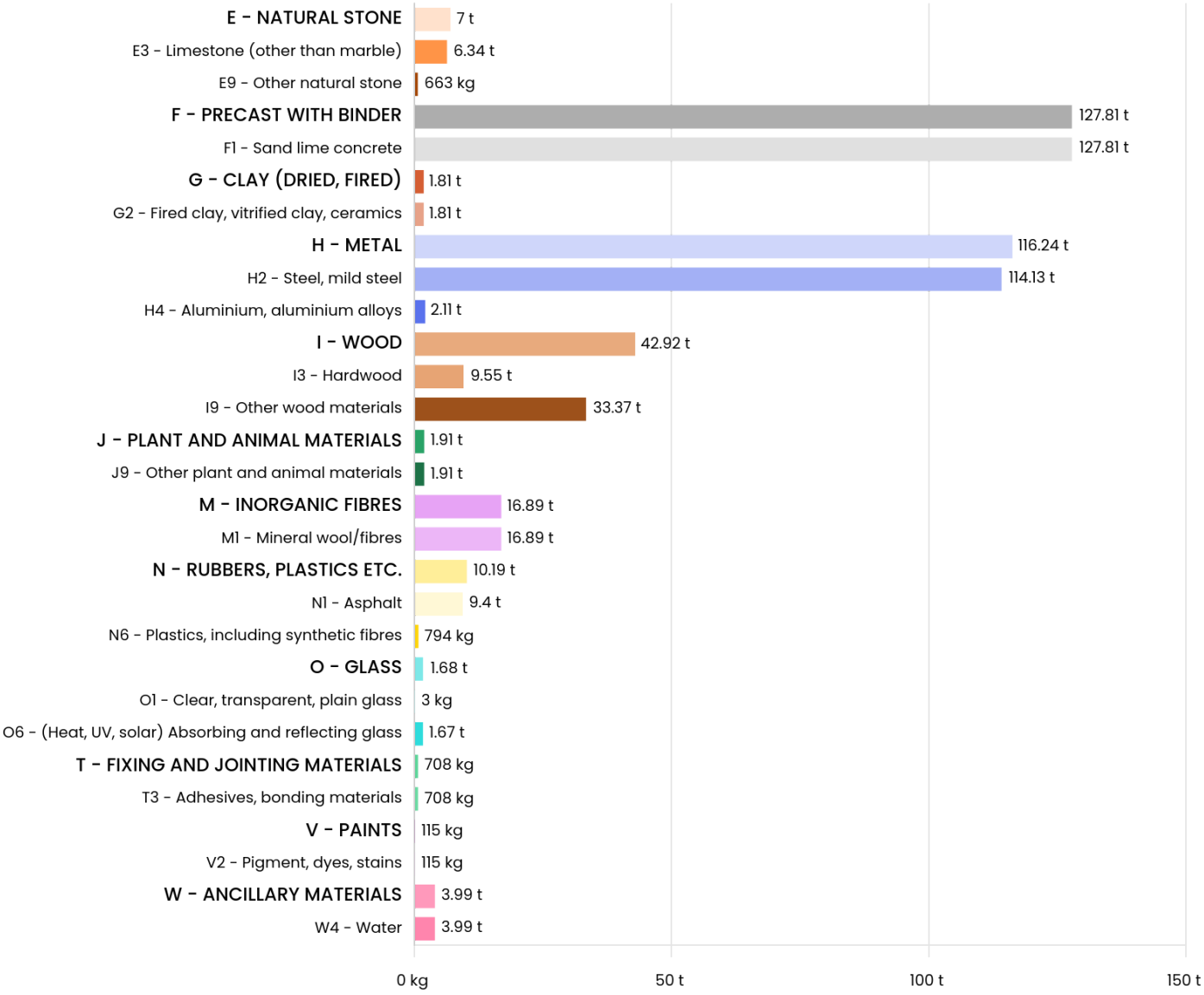
Material Intensity

1.23 t /m²

Construction Materials

The building is comprised of material subfamilies, grouped into the following material families.

Material families



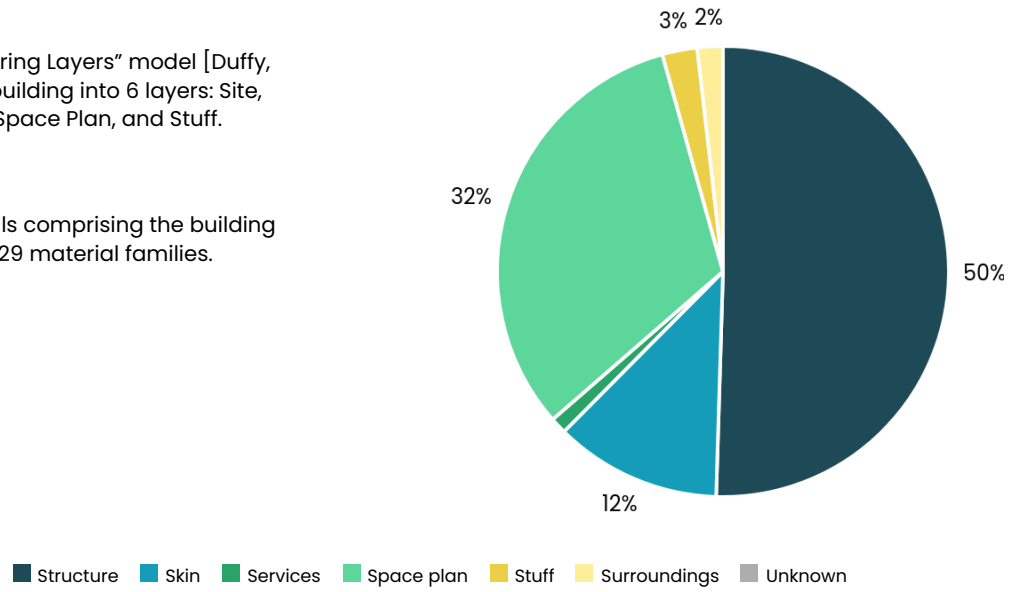
Mass by Shearing Layer

Shearing Layers

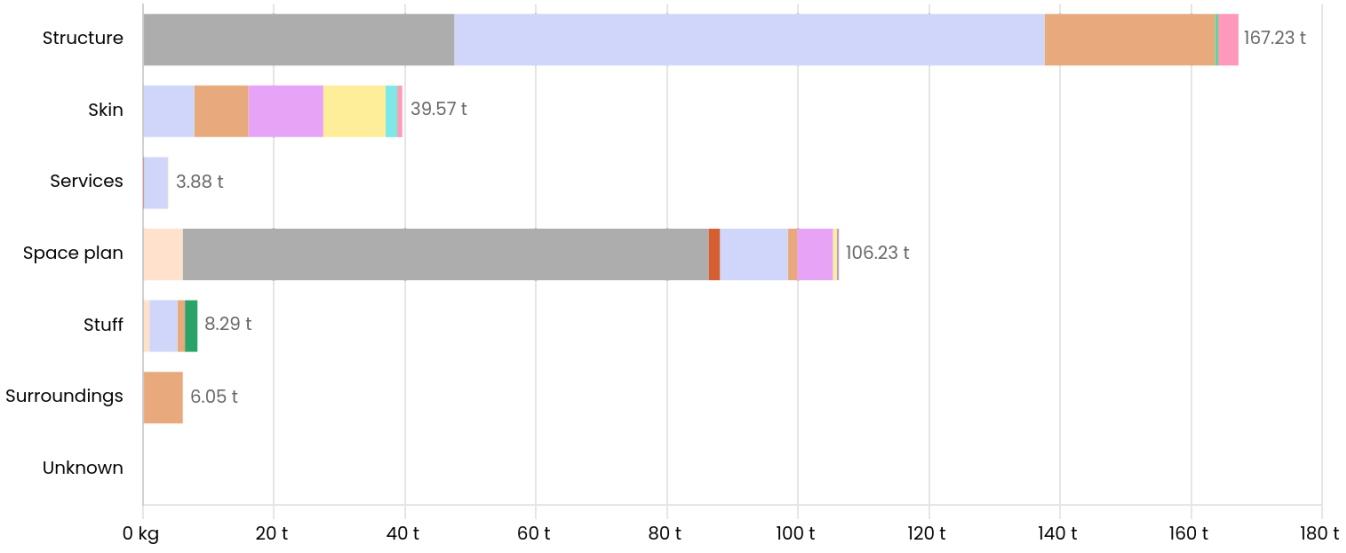
Madaster uses the “Shearing Layers” model [Duffy, Brand, 1994] to divide a building into 6 layers: Site, Structure, Skin, Services, Space Plan, and Stuff.

Material families

The 2903 unique materials comprising the building have been grouped into 29 material families.



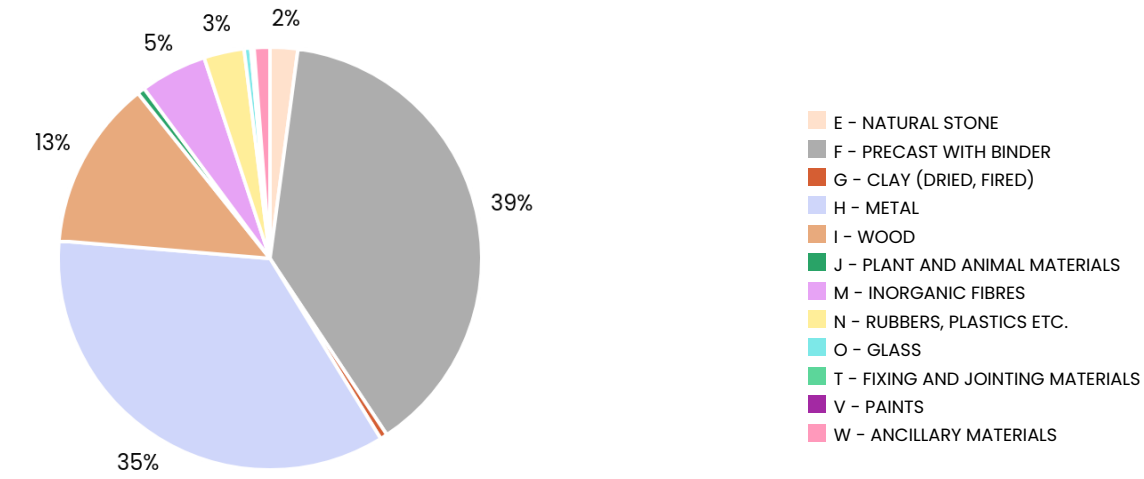
Layer Composition



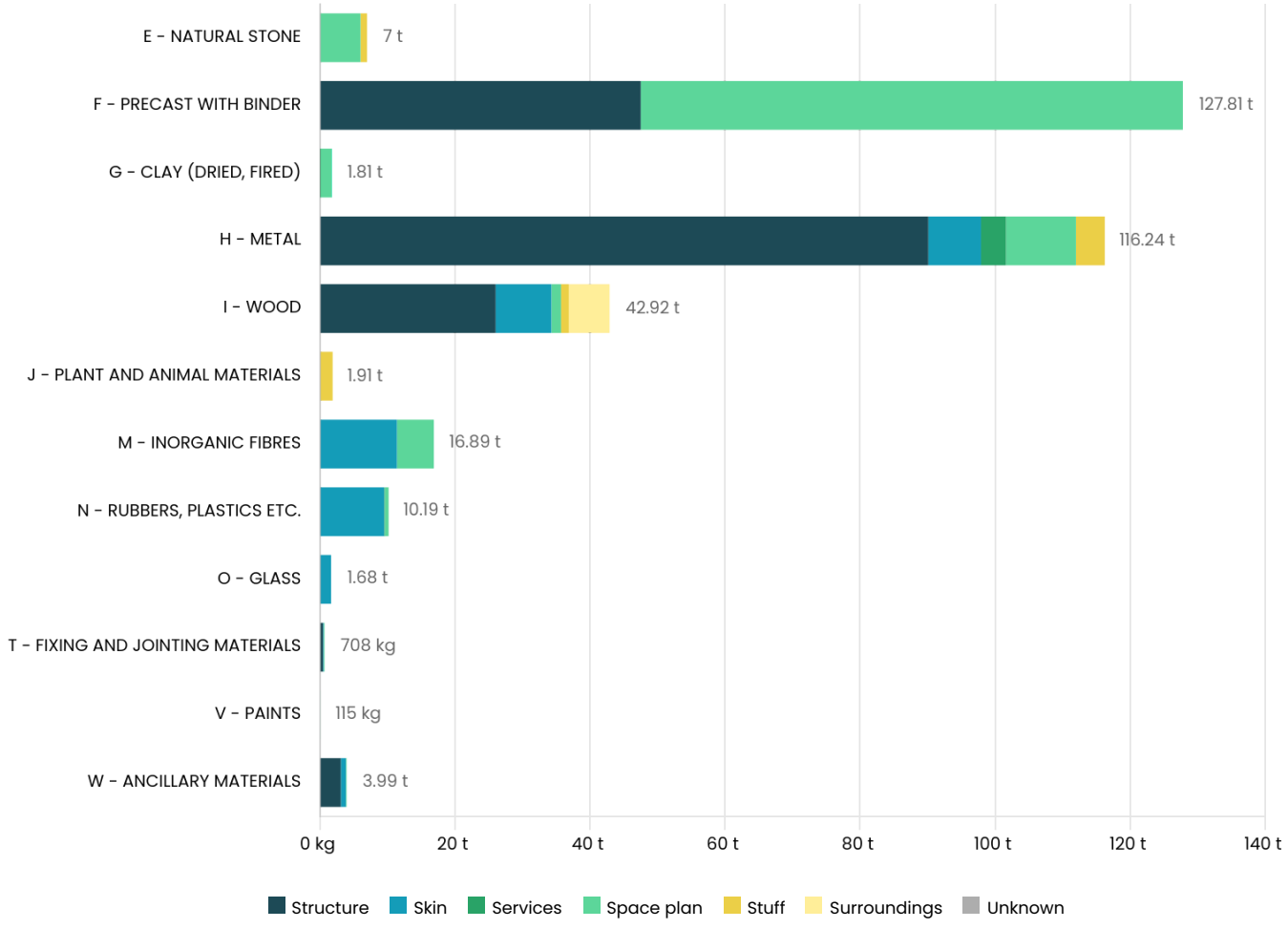
- E - NATURAL STONE
- F - PRECAST WITH BINDER
- G - CLAY (DRIED, FIRED)
- H - METAL
- I - WOOD
- J - PLANT AND ANIMAL MATERIALS
- M - INORGANIC FIBRES
- N - RUBBERS, PLASTICS ETC.
- O - GLASS
- T - FIXING AND JOINTING MATERIALS
- V - PAINTS
- W - ANCILLARY MATERIALS

Mass by Material Families

Material families



Material Family Allocation Across Building Shearing Layers



Mass details

Material family	Total	Structure	Skin	Services	Space plan	Stuff	Surroundings	Unknown
E - NATURAL STONE	2.1% 7 t	0% 0 kg	0% 0 kg	0% 0 kg	1.8% 6.03 t	0.3% 971 kg	0% 0 kg	0% 0 kg
E3 - Limestone (other than marble)	1.9% 6.34 t	0% 0 kg	0% 0 kg	0% 0 kg	1.6% 5.37 t	0.3% 971 kg	0% 0 kg	0% 0 kg
E9 - Other natural stone	0.2% 663 kg	0% 0 kg	0% 0 kg	0% 0 kg	0.2% 663 kg	0% 0 kg	0% 0 kg	0% 0 kg
F - PRECAST WITH BINDER	38.6% 127.81 t	14.3% 47.52 t	0% 0 kg	0% 0 kg	24.2% 80.29 t	0% 0 kg	0% 0 kg	0% 0 kg
F1 - Sand lime concrete	38.6% 127.81 t	14.3% 47.52 t	0% 0 kg	0% 0 kg	24.2% 80.29 t	0% 0 kg	0% 0 kg	0% 0 kg
G - CLAY (DRIED, FIRED)	0.5% 1.81 t	0% 0 kg	0% 0 kg	0% 68 kg	0.5% 1.75 t	0% 0 kg	0% 0 kg	0% 0 kg
G2 - Fired clay, vitrified clay, ceramics	0.5% 1.81 t	0% 0 kg	0% 0 kg	0% 68 kg	0.5% 1.75 t	0% 0 kg	0% 0 kg	0% 0 kg
H - METAL	35.1% 116.24 t	27.2% 90.1 t	2.4% 7.82 t	1.1% 3.7 t	3.1% 10.36 t	1.3% 4.27 t	0% 0 kg	0% 0 kg
H2 - Steel, mild steel	34.5% 114.13 t	27.2% 90.1 t	1.9% 6.25 t	1% 3.17 t	3.1% 10.36 t	1.3% 4.27 t	0% 0 kg	0% 0 kg
H4 - Aluminium, aluminium alloys	0.6% 2.11 t	0% 0 kg	0.5% 1.57 t	0.2% 536 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg
I - WOOD	13% 42.92 t	7.9% 26.04 t	2.5% 8.25 t	0% 0 kg	0.4% 1.43 t	0.3% 1.15 t	1.8% 6.05 t	0% 0 kg
I3 - Hardwood	2.9% 9.55 t	0% 0 kg	0.6% 1.92 t	0% 0 kg	0.1% 437 kg	0.3% 1.14 t	1.8% 6.05 t	0% 0 kg
I9 - Other wood materials	10.1% 33.37 t	7.9% 26.04 t	1.9% 6.33 t	0% 0 kg	0.3% 993 kg	0% 5 kg	0% 0 kg	0% 0 kg
J - PLANT AND ANIMAL MATERIALS	0.6% 1.91 t	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0.6% 1.91 t	0% 0 kg	0% 0 kg
J9 - Other plant and animal materials	0.6% 1.91 t	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0.6% 1.91 t	0% 0 kg	0% 0 kg
M - INORGANIC FIBRES	5.1% 16.89 t	0% 0 kg	3.4% 11.43 t	0% 0 kg	1.7% 5.47 t	0% 0 kg	0% 0 kg	0% 0 kg
M1 - Mineral wool/fibres	5.1% 16.89 t	0% 0 kg	3.4% 11.43 t	0% 0 kg	1.7% 5.47 t	0% 0 kg	0% 0 kg	0% 0 kg
N - RUBBERS, PLASTICS ETC.	3.1% 10.19 t	0% 0 kg	2.9% 9.53 t	0% 107 kg	0.2% 562 kg	0% 0 kg	0% 0 kg	0% 0 kg
N1 - Asphalt	2.8% 9.4 t	0% 0 kg	2.8% 9.4 t	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg
N6 - Plastics, including synthetic fibres	0.2% 794 kg	0% 0 kg	0% 126 kg	0% 107 kg	0.2% 562 kg	0% 0 kg	0% 0 kg	0% 0 kg
O - GLASS	0.5% 1.68 t	0% 0 kg	0.5% 1.67 t	0% 0 kg	0% 876 g	0% 0 kg	0% 0 kg	0% 0 kg
O1 - Clear, transparent, plain glass	0% 3 kg	0% 0 kg	0% 3 kg	0% 0 kg	0% 876 g	0% 0 kg	0% 0 kg	0% 0 kg
O6 - (Heat, UV, solar) Absorbing and reflecting glass	0.5% 1.67 t	0% 0 kg	0.5% 1.67 t	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg
T - FIXING AND JOINTING MATERIALS	0.2% 708 kg	0.1% 474 kg	0% 115 kg	0% 0 kg	0% 119 kg	0% 91 g	0% 0 kg	0% 0 kg
T3 - Adhesives, bonding materials	0.2% 708 kg	0.1% 474 kg	0% 115 kg	0% 0 kg	0% 119 kg	0% 91 g	0% 0 kg	0% 0 kg

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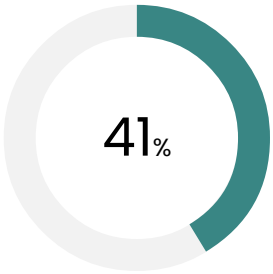
V - PAINTS	0% 115 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 115 kg	0% 0 kg	0% 0 kg	0% 0 kg
V2 - Pigment, dyes, stains	0% 115 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 115 kg	0% 0 kg	0% 0 kg	0% 0 kg
W - ANCILLARY MATERIALS	1.2% 3.99 t	0.9% 3.11 t	0.2% 757 kg	0% 0 kg	0% 119 kg	0% 596 g	0% 0 kg	0% 0 kg
W4 - Water	1.2% 3.99 t	0.9% 3.11 t	0.2% 757 kg	0% 0 kg	0% 119 kg	0% 596 g	0% 0 kg	0% 0 kg

Madaster Circularity Indicator (MCI)

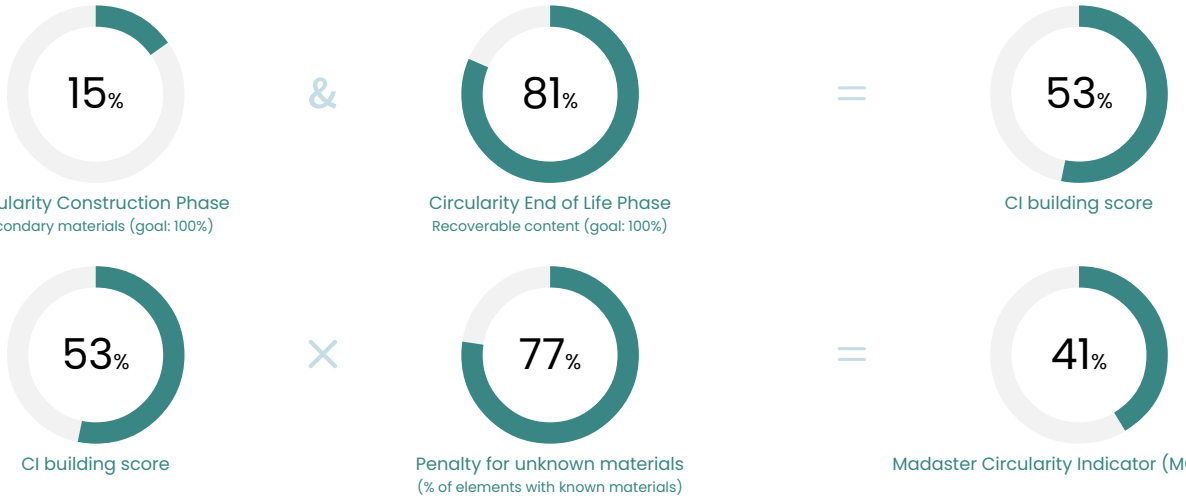
Circularity measures the degree of secondary materials used during construction, and potential for reuse & recycling at their end of use.



Madaster Circularity Indicator (MCI)

The Madaster Circularity Indicator (MCI) assesses the total circularity of a building based on three phases: 1) input in the construction process, 2) the utility during the use phase, and 3) the destination of the materials at the end-of-life phase. A building with a high score is constructed with reused and recycled materials and has a higher-than-average utility. A fully circular building has a score of 100%. The MCI is based on the Material Circularity Indicator that has been developed by the Ellen MacArthur Foundation. All rights reserved.

MCI Calculation Components



MCI by Shearing Layer

	Structure	Skin	Services	Space plan	Stuff	Surroundings	Unknown
Madaster Circularity Indicator (MCI) Score	56%	37%	34%	54%	28%	55%	
CI building score	56%	37%	69%	54%	46%	55%	
Score Subcomponents							
Circularity Construction Phase Secondary materials (goal: 100%)	21%	8%	36%	7%	19%	0%	-
Circularity End of Life Phase Recoverable content (goal: 100%)	82%	53%	96%	91%	60%	100%	-

Circularity Construction Phase

	Structure	Skin	Services	Space plan	Stuff	Surroundings	Unknown
Secondary materials (goal: 100%)	21% 35.13 t	8% 3.32 t	36% 1.39 t	7% 6.92 t	19% 1.59 t	0% 0 kg	-
Mass of product (t)	167.23 t	39.57 t	3.88 t	106.23 t	8.29 t	6.05 t	0 kg
Mass Composition							
Applied recycled materials (% of mass)	21% 35.13 t	8% 3.32 t	36% 1.39 t	7% 6.92 t	19% 1.59 t	0% 0 kg	-
Applied renewables sustainably produced material (% of mass)	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	-
Applied reused components (% of mass)	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	-
Recycling							
Efficiency of recycling process for construction phase (%)	100%	100%	100%	100%	100%	0%	-
Mass of waste generated during recycling process (t)	0 kg	0 kg	0 kg	0 kg	0 kg	0 kg	-

Circularity End-Of-Life Phase

	Structure	Skin	Services	Space plan	Stuff	Surroundings	Unknown
Recoverable content (goal: 100%)	82%	53%	96%	91%	60%	100%	-
Mass of product (t)	167.23 t	39.57 t	3.88 t	106.23 t	8.29 t	6.05 t	0 kg
Mass Composition							
Materials for recycling which are going to be collected (% of mass)	82% 136.75 t	53% 20.85 t	96% 3.72 t	91% 96.8 t	60% 4.95 t	100% 6.05 t	-
Components for reuse which are going to be collected (% of mass)	0% 136.75 t	0% 20.85 t	0% 3.72 t	0% 96.8 t	0% 4.95 t	0% 6.05 t	-
Mass of potential landfill & energy incineration (t)	30.49 t	18.72 t	160 kg	9.43 t	3.34 t	0 kg	-
Recycling							
Efficiency of recycling process for end of life phase (%)	100%	100%	100%	100%	100%	0%	-
Mass of potential landfill & energy incineration of the recycling process (t)	0 kg	0 kg	0 kg	0 kg	0 kg	0 kg	-

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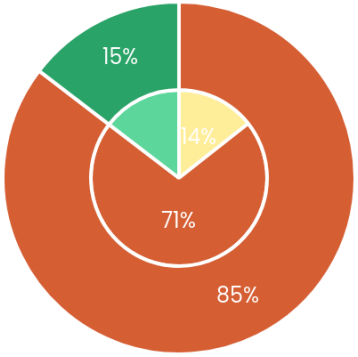
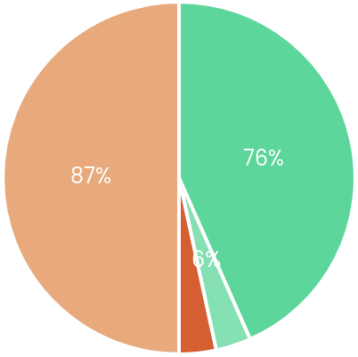
Feedstock Input & Output Flows

Material flows



Input



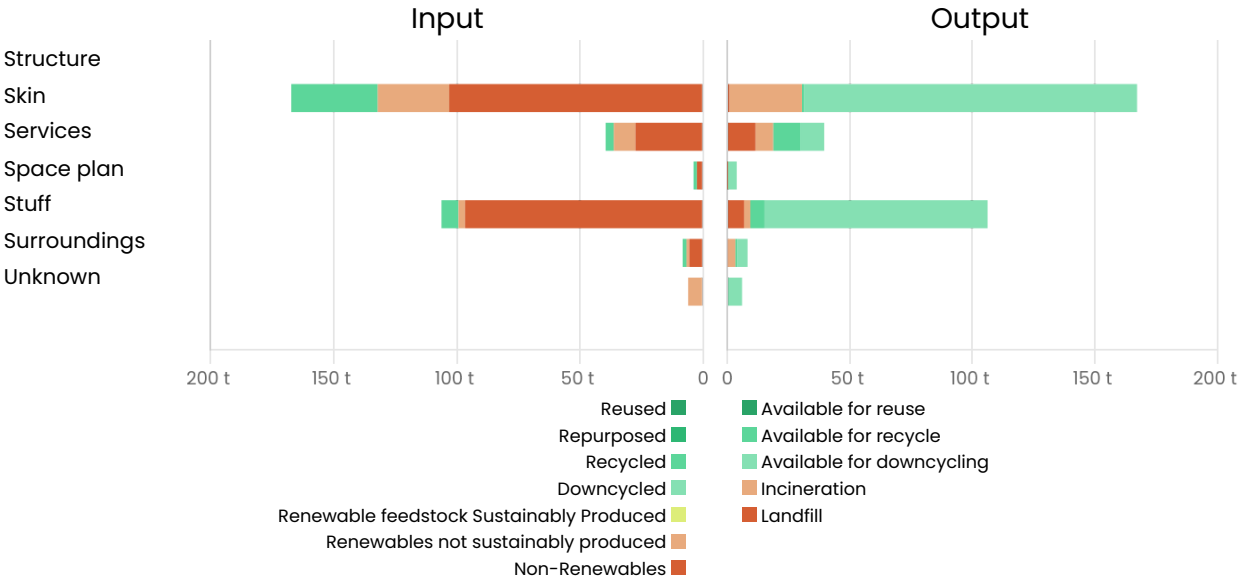
Output

Primary Feedstock	282.91 t	85.4%
Renewables:	47.65 t	14.4%
Renewable feedstock Sustainably Produced:	0 kg	0%
Non-Renewables:	235.25 t	71%
Secondary	48.36 t	14.6%
Reused:	0 kg	0%
Repurposed:	0 kg	0%
Recycled:	48.36 t	14.6%
Downcycled:	0 kg	0%

Waste	62.13 t	18.8%
Landfill:	19.59 t	5.9%
Incineration:	42.55 t	87.2%
Recoverable	250.52 t	75.6%
Available for reuse:	0 kg	0%
Available for recycle:	250.52 t	75.6%
Available for downcycling:	18.61 t	5.6%

Input/Output flows by Shearing Layers

The feedstock view displays material sourcing and end-of-life potential.



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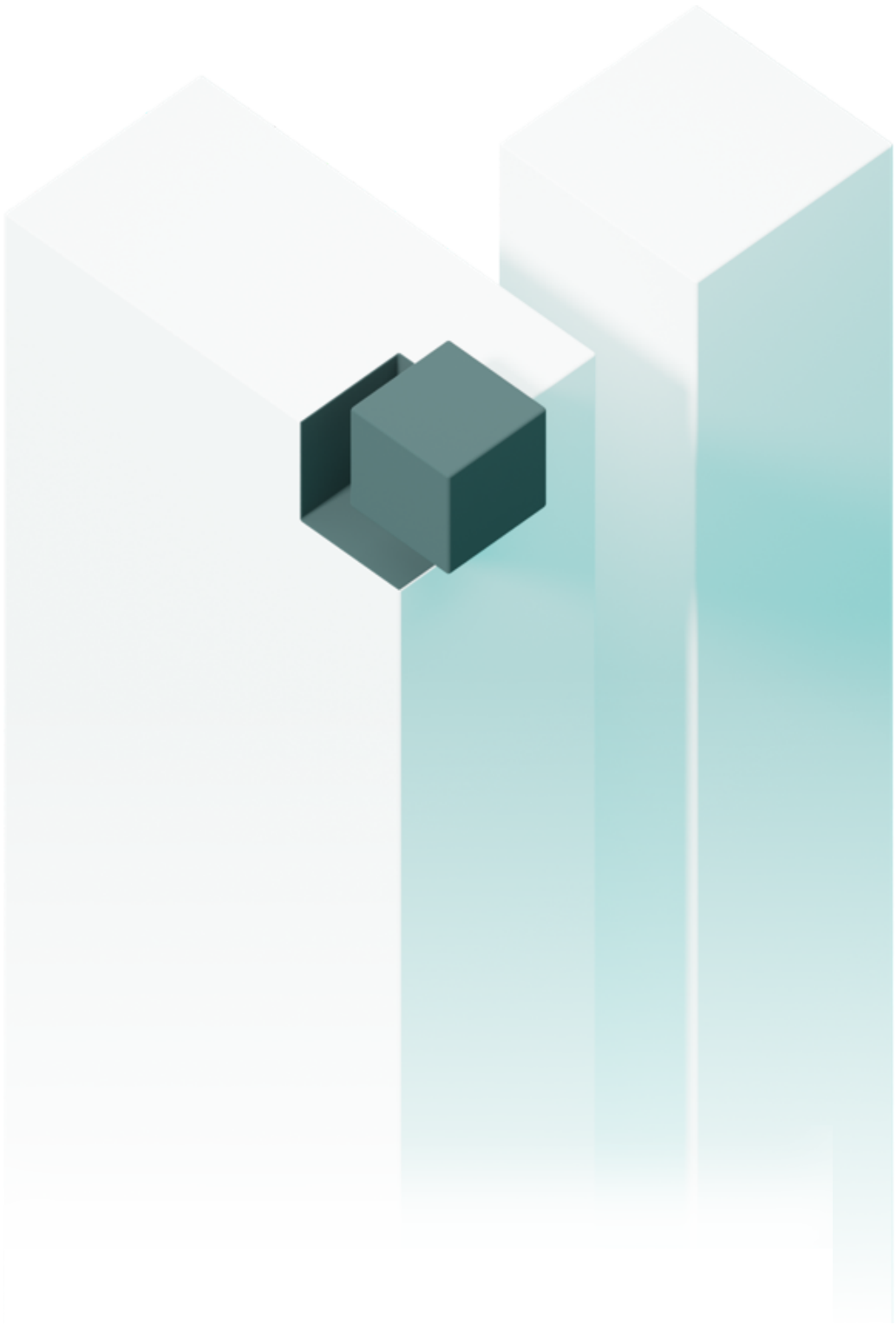
Feedstock Input

	Structure	Skin	Services	Space plan	Stuff	Surroundings	Unknown
							
Mass of product (t)	167.23 t	39.57 t	3.88 t	106.23 t	8.29 t	6.05 t	
Mass Composition							
Primary Feedstock	79% 132.11 t	92% 36.25 t	64% 2.48 t	93% 99.31 t	81% 6.7 t	100% 6.05 t	-
Non-Renewables	62% 103.08 t	69% 27.48 t	64% 2.48 t	91% 96.65 t	67% 5.56 t	0% 0 kg	-
Renewables	17% 29.03 t	22% 8.76 t	0% 0 kg	3% 2.66 t	14% 1.15 t	100% 6.05 t	-
Renewable feedstock Sustainably Produced	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	-
Secondary	21% 35.13 t	8% 3.32 t	36% 1.39 t	7% 6.92 t	19% 1.59 t	0% 0 kg	-
Downcycled	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	-
Recycled	21% 35.13 t	8% 3.32 t	36% 1.39 t	7% 6.92 t	19% 1.59 t	0% 0 kg	-
Repurposed	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	-
Reused	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	-
Scarcity							
Physically scarce	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	-
Socioeconomic scarce	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	-

Feedstock Output

	Structure	Skin	Services	Space plan	Stuff	Surroundings	Unknown
							
Mass of product (t)	167.23 t	39.57 t	3.88 t	106.23 t	8.29 t	6.05 t	0 kg
Mass Composition							
Available for reuse	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	0% 0 kg	-
Available for recycle	81% 135.91 t	24% 9.65 t	94% 3.65 t	86% 91.03 t	51% 4.23 t	100% 6.05 t	-
Available for downcycling	1% 838 kg	28% 11.2 t	2% 68 kg	5% 5.77 t	9% 728 kg	0% 0 kg	-
Incineration	82% 870 kg	82% 11.51 t	98% 64 kg	98% 6.86 t	63% 285 kg	100% 0 kg	-
Landfill	1% 29.62 t	29% 7.21 t	2% 96 kg	6% 2.57 t	3% 3.06 t	0% 0 kg	-

Environmental



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Embodied Carbon (GWP)

The total environmental impact for A1-A3 (EN 15804).

Total

125.95 $t\ CO_2e$

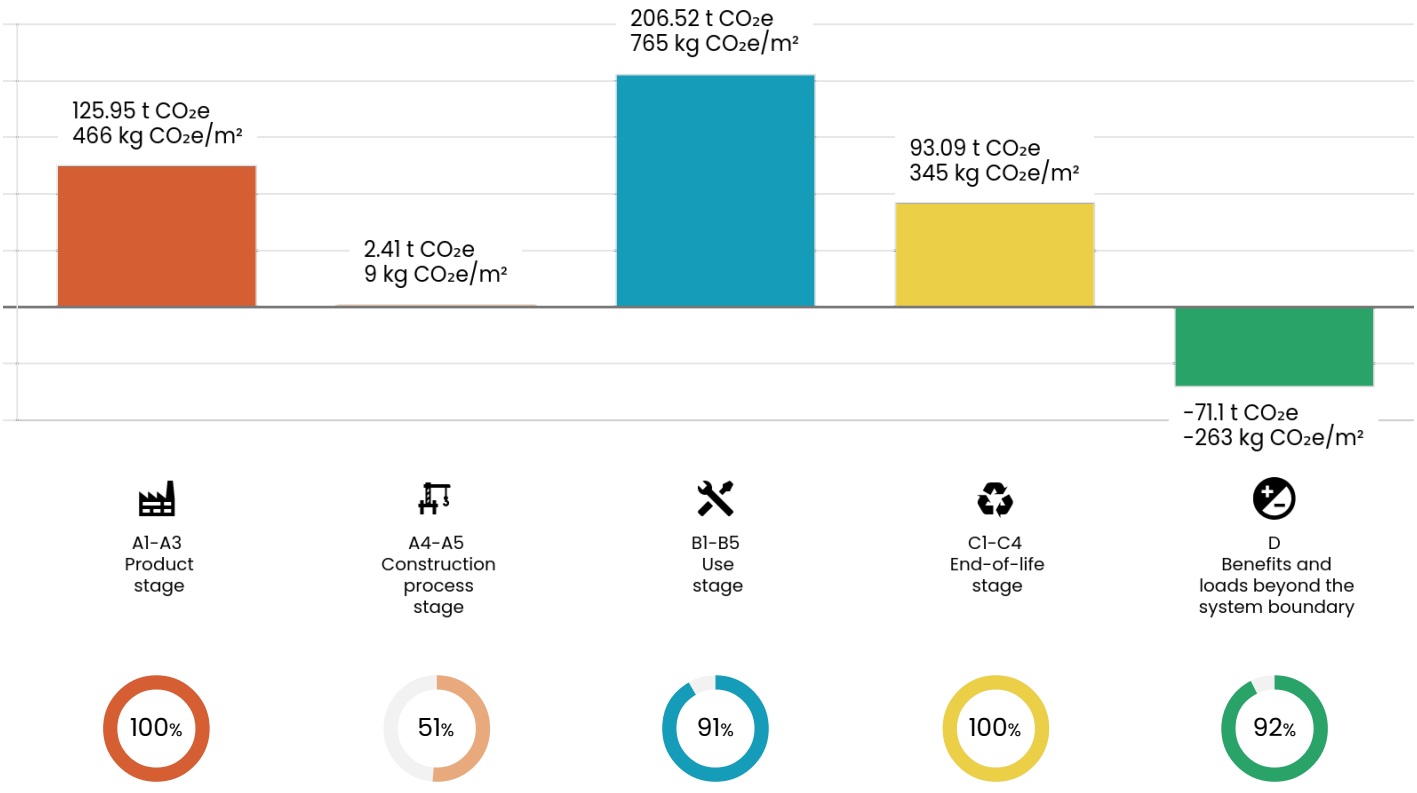
Per m2

466 $kg\ CO_2e/m^2$

Life Cycle Assessment (LCA)

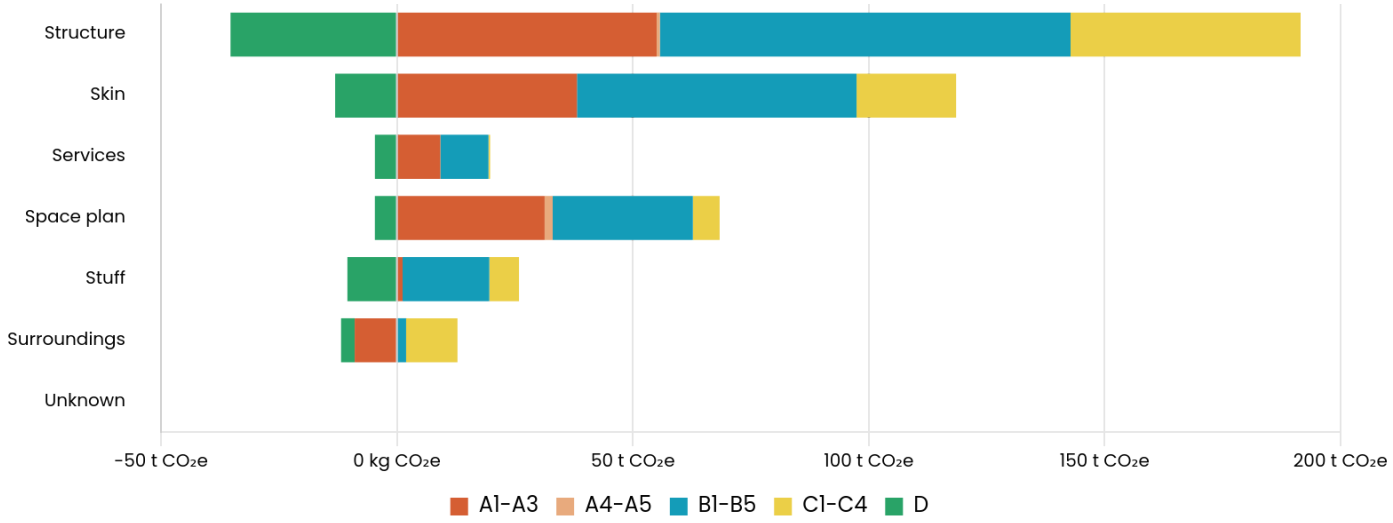
A Life Cycle Assessment (LCA) analyses the environmental impacts of a building during its lifecycle. A lifecycle is defined by the following phases: the production of construction products (A1-A3), the process of constructing a building on site (A4-A5), the use of the building (B1-B5), the disassembly of a building (C1-C4), and the potential to recycle a building after disassembly (D).

Embodied Carbon (GWP) across Lifecycle



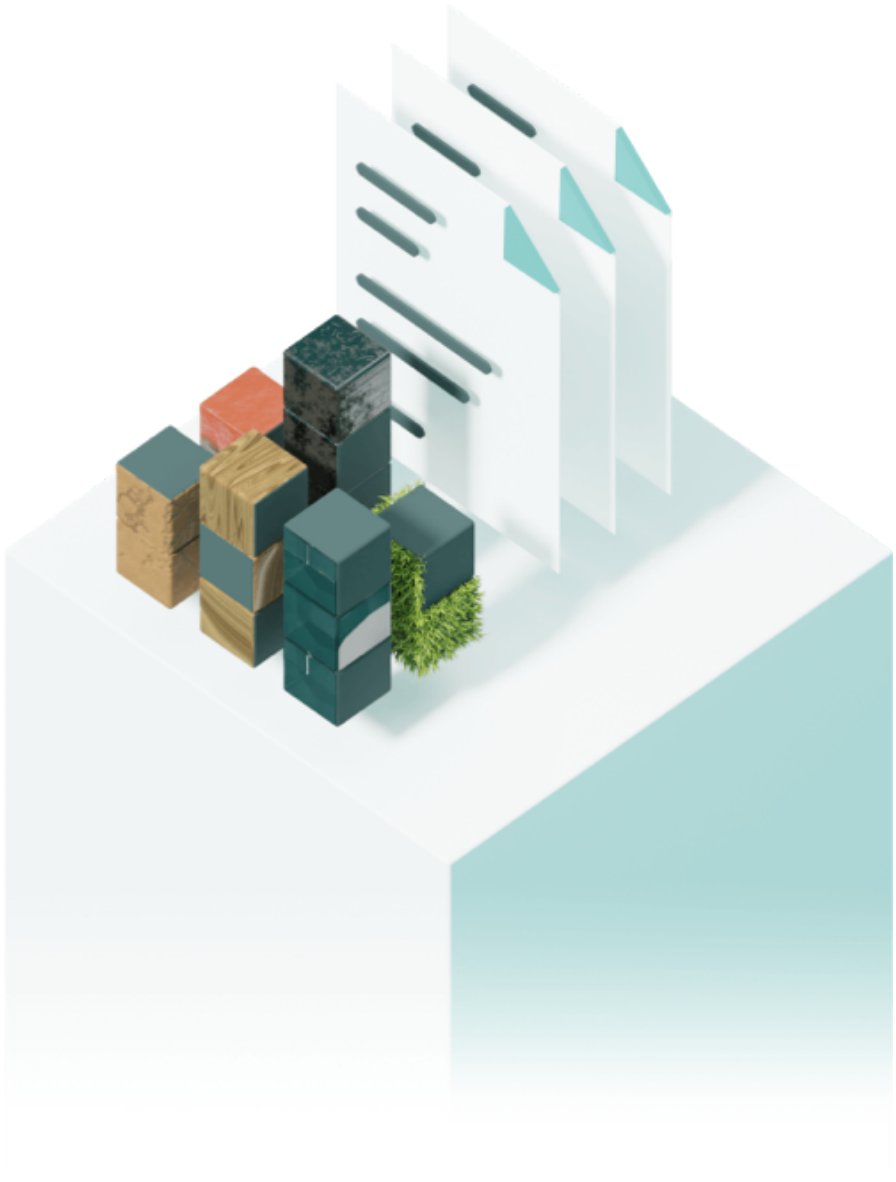
% of known building mass with Embodied Carbon (GWP) data

Embodied Carbon (GWP) by Shearing Layers



	Structure	Skin	Services	Space plan	Stuff	Surroundings	Unknown
A1-A3	55.04 t CO_2e	38.16 t CO_2e	9.19 t CO_2e	31.3 t CO_2e	1.2 t CO_2e	-8.95 t CO_2e	-
A4-A5	688 kg CO_2e	-	12 kg CO_2e	1.71 t CO_2e	-	-	-
B1-B5	87.05 t CO_2e	59.26 t CO_2e	10.19 t CO_2e	29.71 t CO_2e	18.37 t CO_2e	1.94 t CO_2e	-
C1-C4	48.76 t CO_2e	21.1 t CO_2e	358 kg CO_2e	5.68 t CO_2e	6.3 t CO_2e	10.89 t CO_2e	-
D	-35.27 t CO_2e	-13.1 t CO_2e	-4.67 t CO_2e	-4.68 t CO_2e	-10.5 t CO_2e	-2.89 t CO_2e	-

Financial



Material Value

Material value measures the present monetary value of materials, accounting for the costs of disassembly, transportation and processing for re-sale.

Net Present Value (NPV)

244,189.989 €

904.407 €/m²

Current value

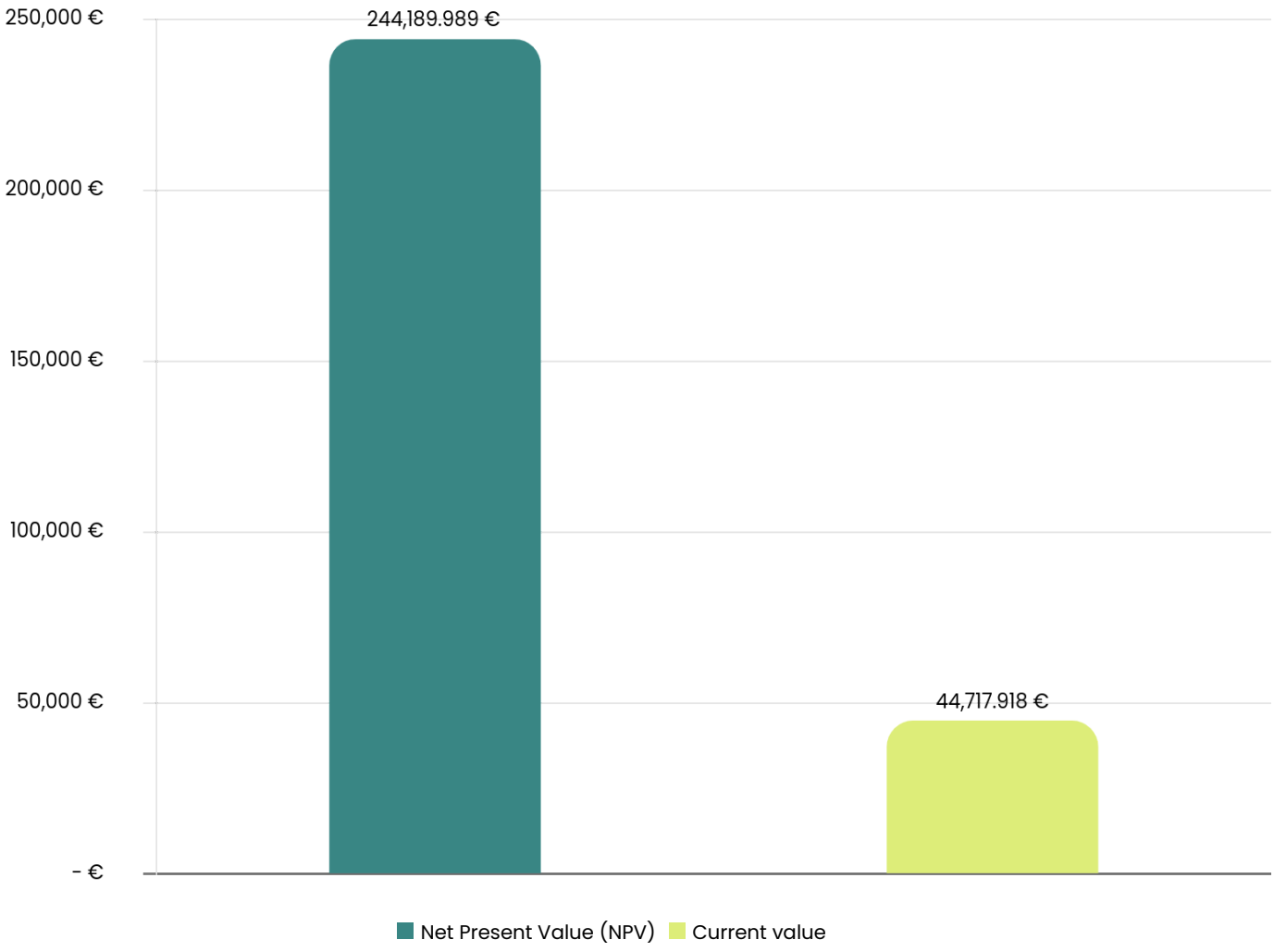
44,717.918 €

165.622 €/m²

Madaster Financial Module

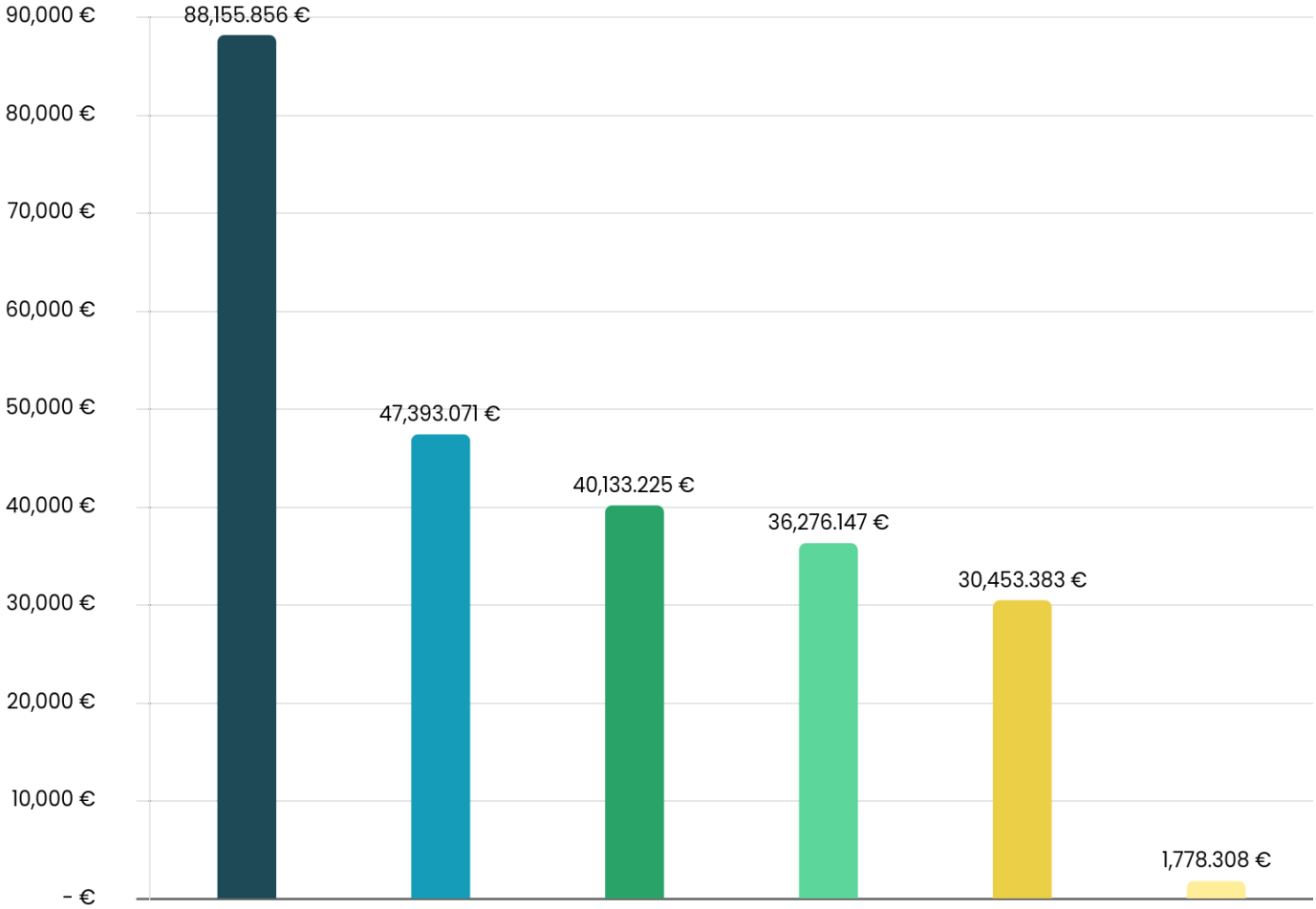
The Madaster Financial module was developed to measure and optimize the residual value of buildings. The Madaster Financial Module visualizes the value of the materials and products at the time of construction and demolition.

Material Value



Material Value

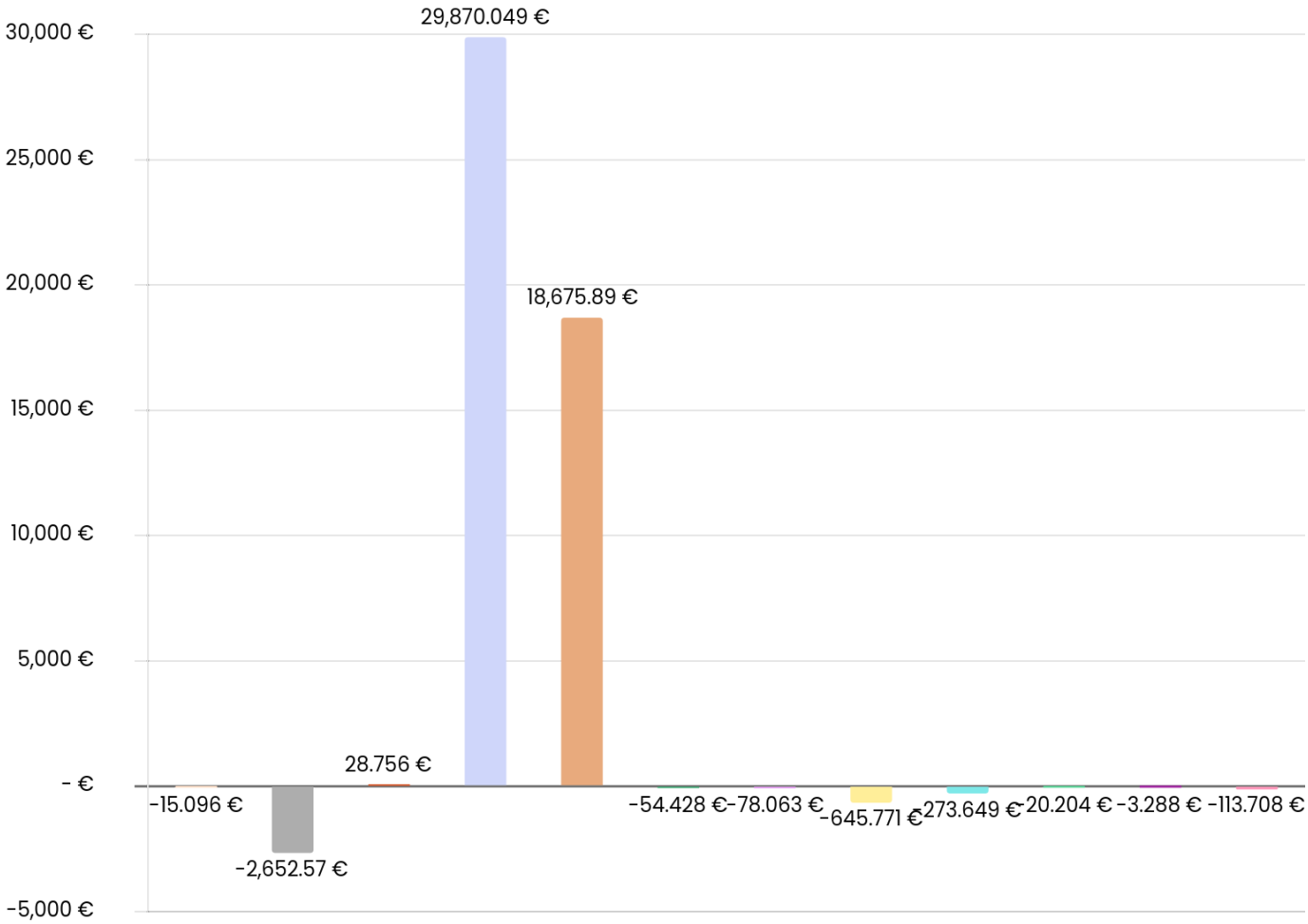
Material Value by Building Layer (End of Life)



	Total	Structure	Skin	Services	Space plan	Stuff	Surroundings
Expiration year cash flow	0	2122	2042	2037	2032	2027	2042
NPV value end of life	€244,190	€88,156	€47,393	€40,133	€36,276	€30,453	€1,778

MADASTER DEMO 22

Material Value by Material Family (Current value)



Material Family	Quantity	Current value
E - NATURAL STONE	7 t	-€15
F - PRECAST WITH BINDER	127.81 t	-€2,653
G - CLAY (DRIED, FIRED)	1.81 t	€29
H - METAL	116.24 t	€29,870
I - WOOD	42.92 t	€18,676
J - PLANT AND ANIMAL MATERIALS	1.91 t	-€54
M - INORGANIC FIBRES	16.89 t	-€78
N - RUBBERS, PLASTICS ETC.	10.19 t	-€646
O - GLASS	1.68 t	-€274
T - FIXING AND JOINTING MATERIALS	708 kg	-€20
V - PAINTS	115 kg	-€3
W - ANCILLARY MATERIALS	3.99 t	-€114