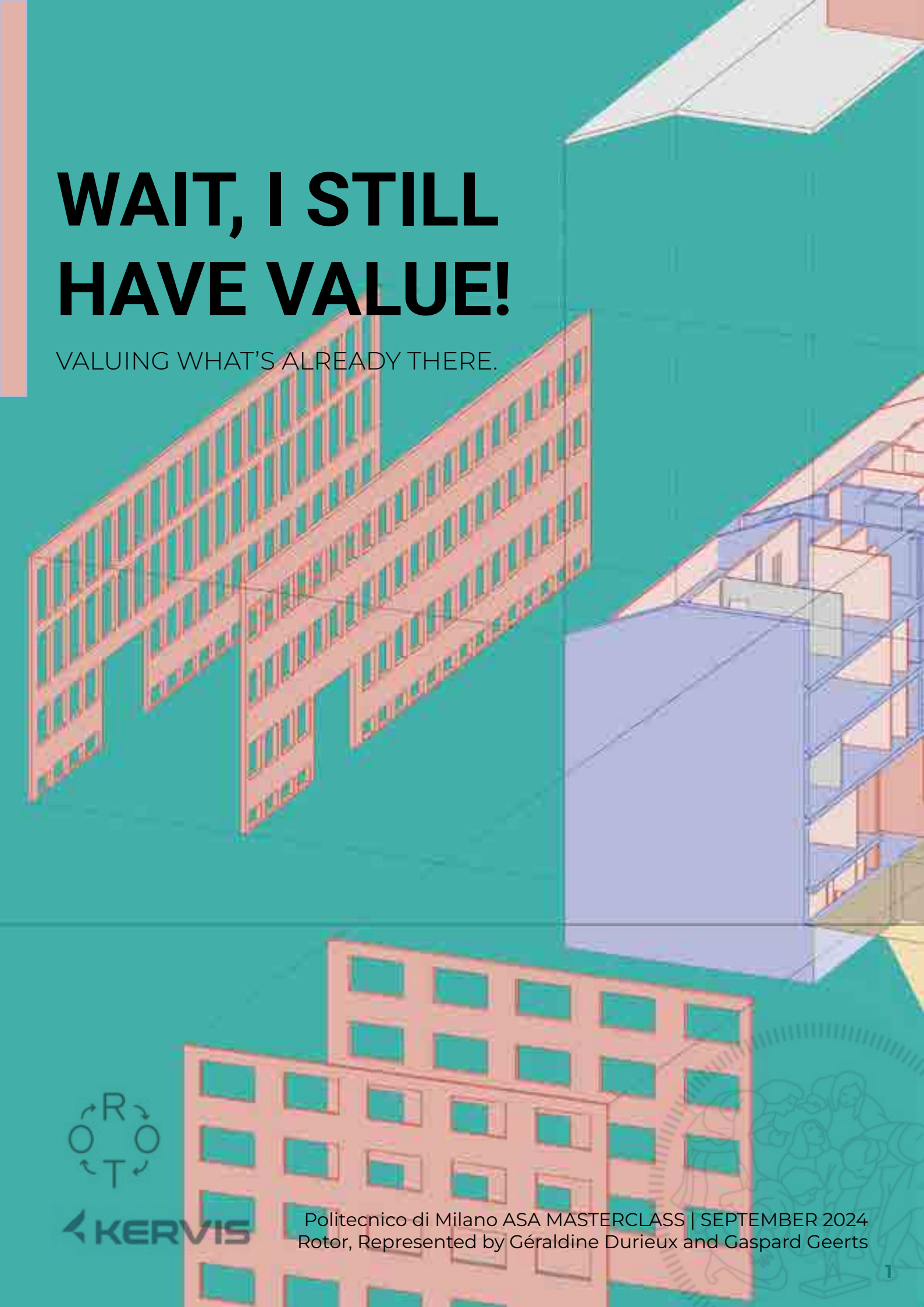
WAIT, I STILL HAVE VALUE!

VALUING WHAT'S ALREADY THERE.



Politecnico di Milano ASA MASTERCLASS | SEPTEMBER 2024
Rotor, Represented by Géraldine Durieux and Gaspard Geerts

Advanced School of Architecture ASA - edition IV
Masterclass: 4-11 September 2024

VALUING WHAT'S ALREADY THERE: WAIT, I STILL HAVE VALUE!

ROTOR - Géraldine Durieux and Gaspard Geerts,
with Arian Heidari Afshari (DAStU)
On invitation by KERVIS
and Pierre Alain-Croset (DAStU)

Foreword

The mission of the Advanced School of Architecture of the Politecnico di Milano is to strengthen the design skills of 20 students selected from the various Master's degree courses of the AUIC School, in particular through innovative experiences during an intense Masterclass concentrated in just one week. There is no doubt that the Masterclass by Gaspard Geerts and Géraldine Durieux, active members of the ROTOR collective, which devotes itself with extraordinary innovation to practices for the reuse of discarded building materials, enriched their training as future architects by proposing a very concrete working theme: how to act within a group of buildings that until recently were condemned to demolition, if one actually intends to act to preserve their substance by recycling the materials? In a very limited amount of time, the students were initiated into topics little discussed in architecture schools: how much does a building weigh? What are the quantities of materials and energy consumption to generate them, use them in a new building and then recycle them in a new life cycle?

The Masterclass offered students a concrete opportunity in Milan, where following the interruption of numerous construction sites and demolition and reconstruction projects, a new design season based on the redevelopment of existing buildings is now opening.

I would like to thank my colleagues Angelo Lunati and Giancarlo Floridi who proposed this concrete theme, on the basis of their professional assignment with their Onsite studio, the KERVIS property owner with the personal commitment of Laura Nigro, Gaspard Geerts and Géraldine Durieux for their passion, enthusiasm and immense commitment, and of course all the students who responded with extraordinary intellectual curiosity and talent to this new challenge.

-Pierre-Alain Croset director, Advanced School of Architecture

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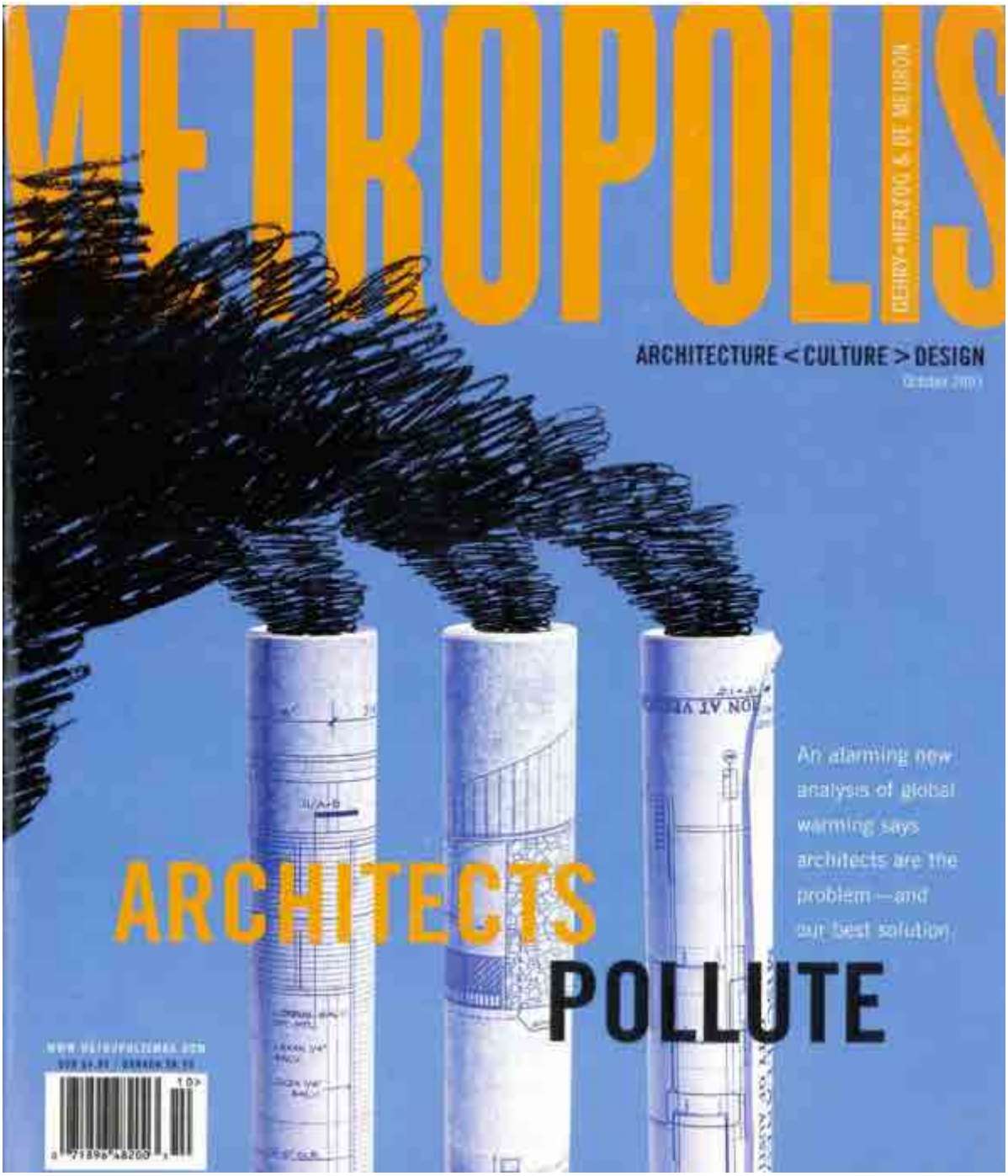
Introduction

Over the course of a week, the students from the ASA Masterclass led by Rotor were introduced to the concepts and notions of the circular economy, maintaining, reuse, recycling and waste, with all the nuances and differences that exist between these terms. To put these concepts into practice, they took a close look at a building in Via Lario 16, owned by Kervis. The building is part of a complex of offices and laboratories built in the 1950s. Having been emptied of their contents and occupants, these buildings were initially slated for demolition. Today, the future of these buildings is at the heart of new thinking.

The students were invited to explore the Via Lario building and identify materials with reuse potential. This exercise enabled them to see in a different light the materials that make up our built environment; to discover the tool of the reclamation inventory and the dismantling processes; to explore the complexity of the criteria that favour or hinder the potential for reuse of an element; to document the materials from historical, cultural and economic angles; to show and prove that, in lot of cases: “wait, I still have a value!”

At the end of the day, it is the actual demand for a material that confirms its potential for reuse. This demand can come from the market, but the reuse market in Milan has yet to be documented. In the case of Via Lario - Via Stelvio buildings, the demand could come from the project itself: in situ reuse can be a powerful lever for stimulating demand! Whether these buildings are renovated, which would be the most desirable scenario, or demolished, some elements could find a new life in the new project. Or into another of the owner’s projects. In any case, we hope that the students’ work has served to highlight the value of certain materials present in these buildings, and that it caught the eye of its owner.

-Géraldine Durieux and Gaspard Geerts (ROTOR)



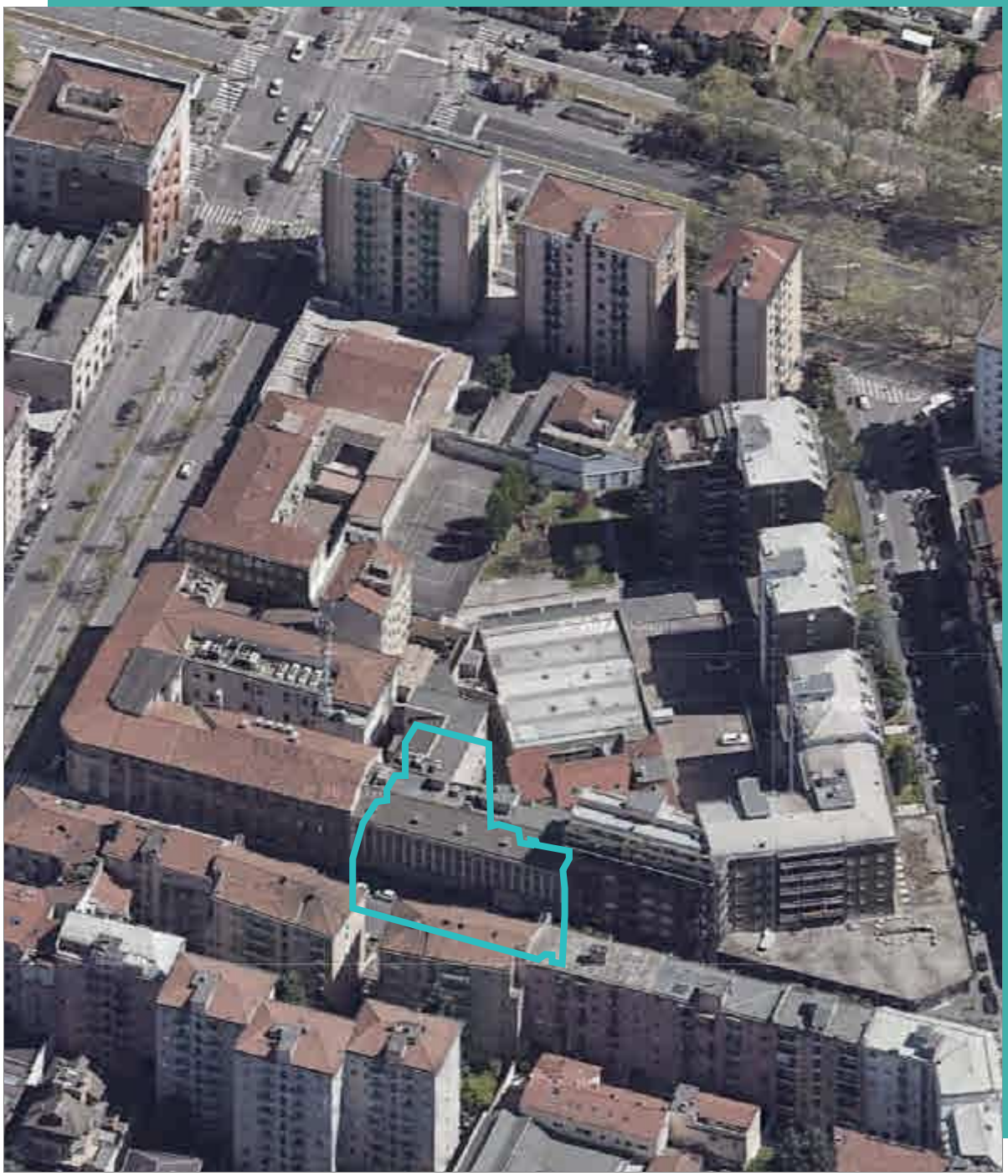
Metropolis Magazine: *Architects Pollute*, Christopher Hawthorne, 2003

According to the European Commission, buildings are responsible for approximately 36% of CO2 emissions and 40% of total energy consumption in the EU. Moreover, the sector generates over 35% of the EU's total waste, highlighting its substantial environmental footprint.

Assessing the Re-Use Potential, Rotor Studio

“A circular economy is about managing stocks: assets of cultural, natural and human nature, and manufactured objects. We have to learn how to maintain these stocks, because in industrialised countries we have a society of abundance. We have everything we need, but we have to learn how to look after it, and to care for it.”

-Walter Stahel in conversation with Ellen MacArthur, 26 June 2019.



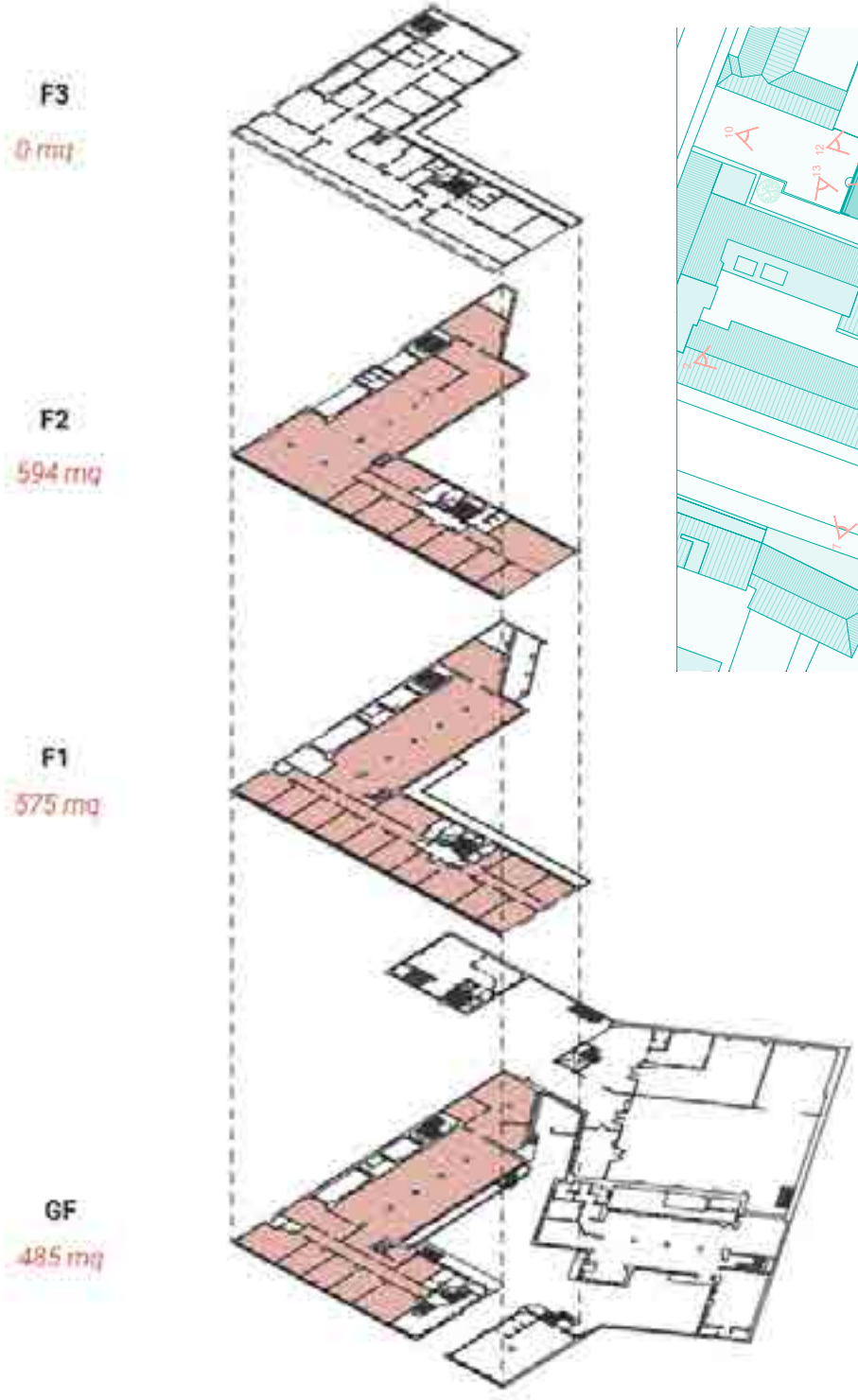


Diagram courtesy of Submission by Alessandro Moci, Claudia Xu and Olimpia Lu

View of Western Facade seen from Via Lario.

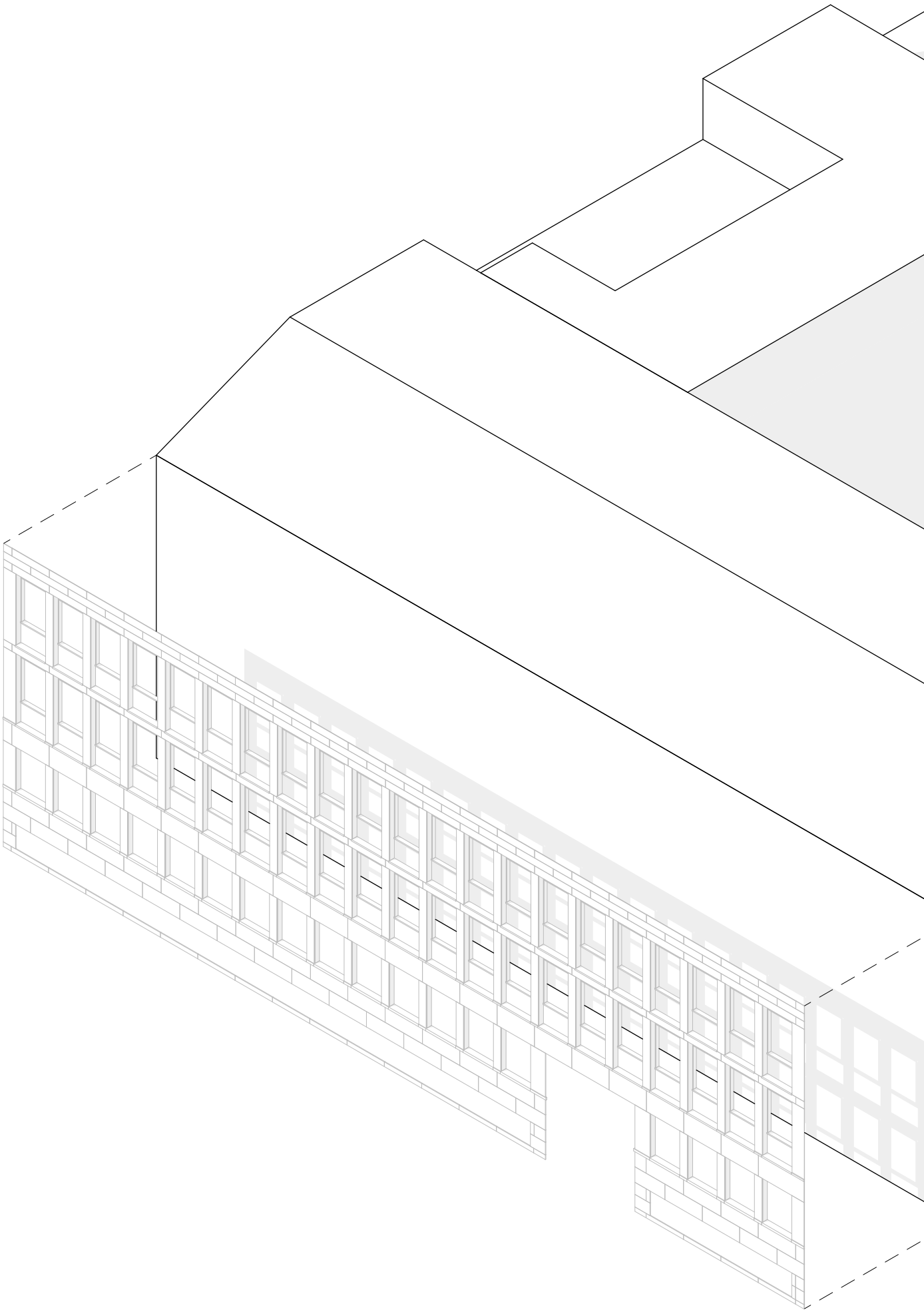
The site in question consists of a series of buildings along via Lario that extend to the interior of a Milanese city block. The buildings were a massive concrete construciton, with mostly brick walls, and finished in stone on the exterior. The Interior Spaces Hosted a variety of different Programs.

1

01.a–h / 01.x–y

FACADE

Teodora Misirkić,
Nils van der Velden,
Davida Zimmermann



OVERALL DATA

weight

21470 Kg

cladding material

embodied carbon

7375 $KgCo_2$

saved from the tile reuse

reuse rate

100% Reuseable Material

using the cladding material

Facade material	Two-storey building		Ten-storey building	
	Cleaning interval [y]	Index[1] [%]	Cleaning interval [y]	Index[1] [%]
Aluminium cladding				
Anodised surface (ground)	2	700	1	1,600
Batch coated surface	2	310	2	400
Coil coated surface	2	310	2	400
Copper cladding	n/a	n/a	n/a	n/a
Zinc cladding	3	470	n/a	n/a
Enamelled steel sheet cladding	1	310	1	400
Natural stone cladding				
With open or closed joints	20	100	20	100
Glass cladding				
Enamelled on reverse	1	440	1	240
Enamelled on reverse and coated with metal oxide	0.25	1,750	0.25	960
Concrete cladding with attachment	12	680	12	1,260
Large-format precast concrete components	12	680	12	1,260
Anchored clinker veneer, cavity wall	20	420	20	620
Timber or timber composite cladding[2]				
Solid timber formwork, fully coated	5	170	–	–
Solid timber formwork, heartwood, uncoated	10	20	–	–
Composite timber facade panels	10	100	–	–
Fibre cement panels				
large	2	310	2	200
small	10	380	n/a	n/a

[1] relative to natural stone (= 100 %) [2] according to information from Deutsche Gesellschaft für Holzforschung (DGfH)

D 1.8

Manuel of Natural Stone
Modern usage of classic building material
Edition Detail

KG	Building component	Labour costs [€/h]	Cleaning efficiency [m²/h]	Cleaning costs [€/m²]	Cleaning frequency [procedures/y]	Annual cleaning costs [€/m² y]
335	**Exterior wall cladding**	Referenced area: Exterior wall				
	Natural stone (soft)	17.00	1.5	14.783	0.25	2.83
	Aluminium, stainless steel, copper, plated steel	17.00	3	5.667	0.25	1.42
	Glass	17.00	20	0.850	0.25	0.21
	Ceramic, cast/artificial stone, natural stone (hard)	17.00	6	2.833	0.25	0.71

Manuel of Natural Stone
Modern usage of classic building material
Edition Detail

MAINTAINING

Natural stone facades are **easy to clean** with **higher cleaning intervals** compard to other cladding materials and has a **reasonable cost of cleaning**.

01.d

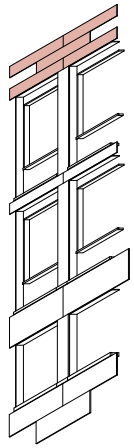
Travertine
Horizontal Cladding

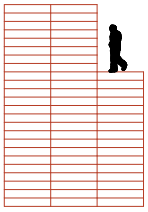
64 pc

1,805 x 0,327 x 0,015 m

1416 kg

178,42 kg CO2e





01.h

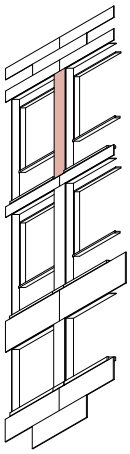
Travertine
Vertical Cladding

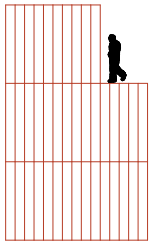
40 pc

3,025 x 0,365 x 0,015 m

1650 kg

207,90 kg CO2e





01.e

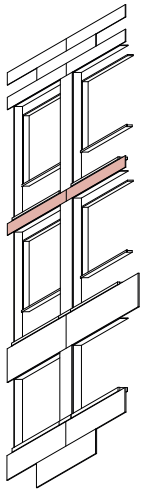
Travertine
Horizontal Cladding

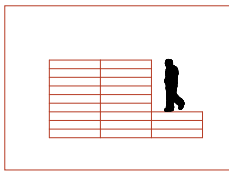
21 pc

1,805 x 0,305 x 0,015 m

433 kg

54,57 kg CO2e





01.f

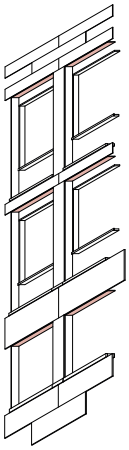
Travertine
Horizontal Cladding (over window)

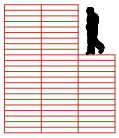
60 pc

1,430 x 0,216 x 0,015 m

675 kg

85,05 kg CO2e





01.f

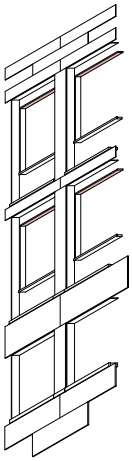
Travertine
Horizontal Cladding (over window)

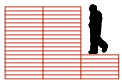
42 pc

1,430 x 0,151 x 0,028 m

617 kg

77,79 kg CO2e





01.g

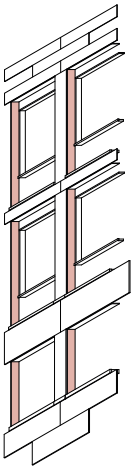
Travertine
Horizontal Cladding
(next to windows)

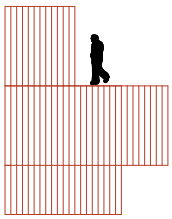
120 pc

2,950 (1,825) x 0,216 x 0,015 m

2880 kg

362,88 kg CO2e





01.g

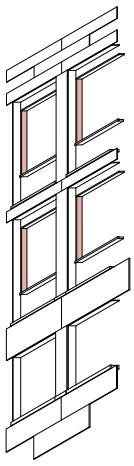
Travertine
Horizontal Cladding
(next to windows)

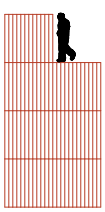
84 pc

1,820 x 0,151 x 0,028 m

2352 kg

296,35 kg CO2e





01.c

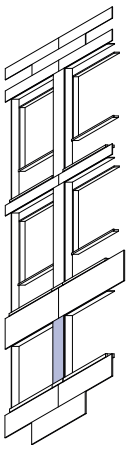
Serizzo Scuro (Granite)
Vertical Cladding

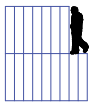
16 pc

1,840 x 0,355 x 0,028 m

745 kg

447 kg CO2e





01.b

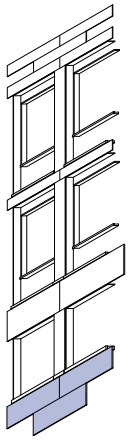
Serizzo Scuro (Granite)
Horizontal Cladding

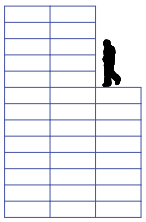
34 pc

1,805 x 0,645 x 0,028 m

2846 kg

1708 kg CO2e





01.a

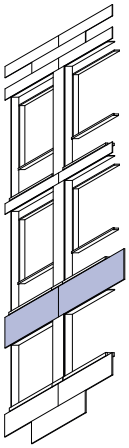
Serizzo Scuro (Granite)
Horizontal Cladding

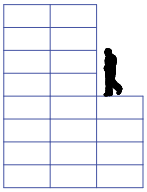
20 pc

1,805 x 0,890 x 0,028 m

2330 kg

1398 kg CO2e





01.y

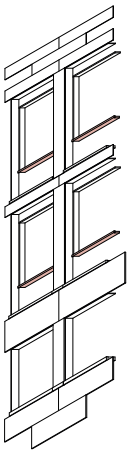
Travertine
Window Sills

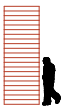
21 pc

1,350 x 0,180 x 0,046 m

587 kg

73,94 kg CO2e





01.x

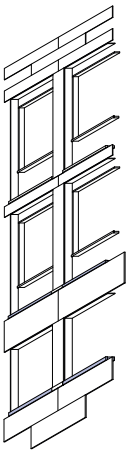
Serizzo Scuro (Granite)
Window Sills

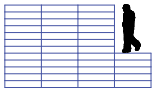
39 pc

1,410 x 0,265 x 0,100 m

3752 kg

2251 kg CO2e





01.x

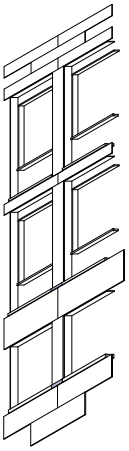
Serizzo Scuro (Granite)
Window Sills

38 pc

0,365 x 0,048 x 0,100 m

178 kg

106 kg CO2e

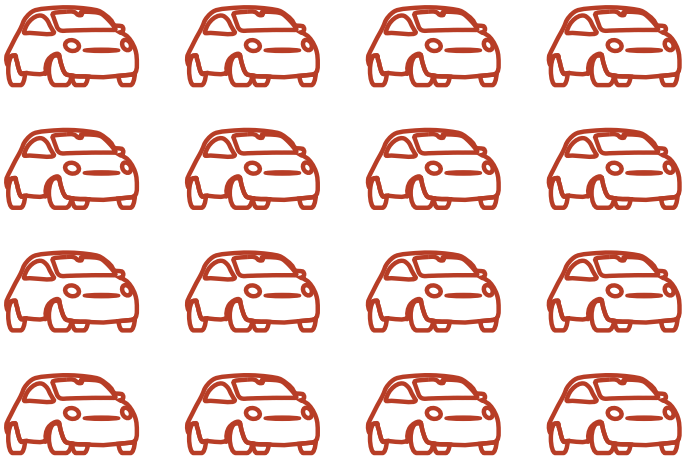


weight facade cladding material

Kg

15.9 x fiat 500

18316.48kg 1150kg



COMPARING

embodied carbon facade cladding material

$KgCo_2$

7375kgCO_2

82 times

a person flying Milano – Brussels

90kgCO_2

SCENARIOS

A)

Preservation

the current facade is kept by simple maintance acts.

B)

Deconstruction

carefully dismantling the cladding from top to bottom with tools as diamond saw, preasured water in order to avoid splintering.

B1: disassembly test/ expert opinion

feasibility and profitability of removal by checking the general condition and method of removal

B2: removal

ensuring integrity of the slabs

B3: cleaning and sorting

slabs sorted by quality and degree of cleaning
cleaning with water or by scraping

B4: operations

sawing for same dimensions
thorough cleaning with suitable method
finishes depending on type of rock
repair of lug/ clamp holes with suitable product

B5: storage and packaging

either stored outside, arranged on their edge in wooden crates or strapped on pallets.
sold by batch or m^2

C)

Traditional Demolition

21470Kg of cladding wasted.

ECONOMICAL ASSESSMENT

travertine surface on current facade **= 510m²**

serizzo scuro surface on current facade **= 151m²**

...if the same facade would be re–built

...with new **travertine** cost ≈ **60€**

...with new **serizzo scuro** cost ≈ **50€**

510m² x 60€ = 30600€

151m² x 50€ = 7550€

-38150€

OR

...if the facade material would be sold

510m² x 40€ = 20400€

151m² x 40€ = 6040€

+26440€

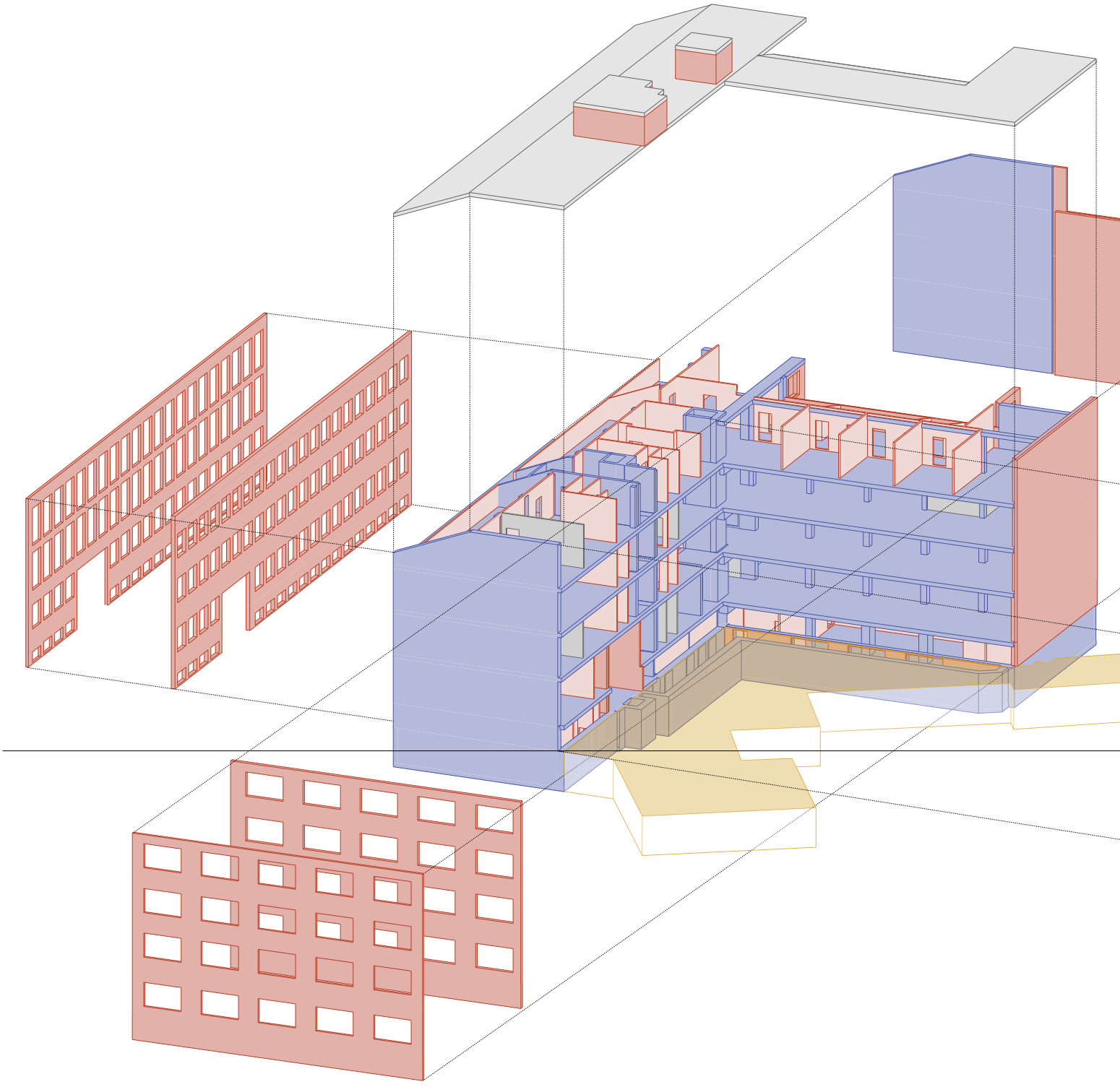
https://rotordc.com

2

02.a / 02.b / 02.c

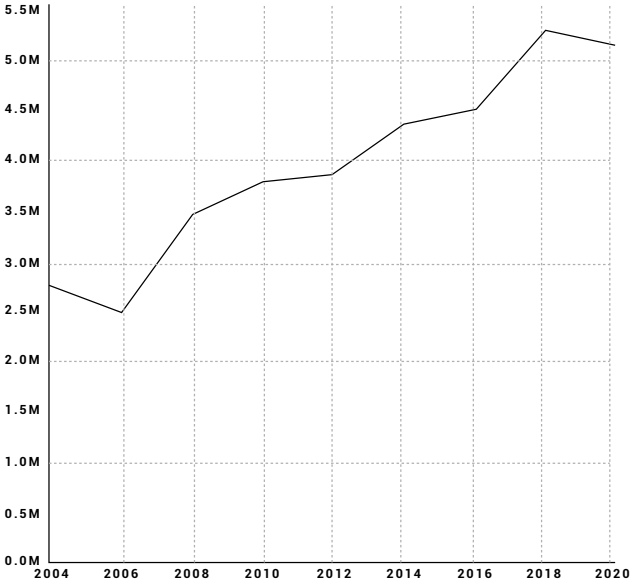
Structure, Masonry & Landscape

Hannah Novotny, Arianna Allegri, Gabi Castro



"In 2019, the total production of special waste, including inert materials from construction and demolition, amounted to 33,486,938 tons. Of this, special waste accounted for 18,869,786 tons, representing an increase of 2.4% compared to 2018, a figure that corresponds to about 23% of national production. Non-hazardous waste amounted to 15,949,732 tons, with an increase of 3.0% compared to 2018 (15,481,451 tons), while hazardous waste amounted to 2,920,055 tons, remaining nearly stable compared to 2018 (2,927,442 tons), with a variation of -0.5%.
Regarding special waste, there has also been an increase in material recovery over the years, rising from 63% in 2002 to 85.5% in 2019. In Lombardy's facilities, approximately 46 million tons of waste were managed, of which nearly 39 million were subjected to recovery operations."

https://www.sviluppogostenibile.regione.lombardia.it/it/b/11505/lombardia-cala-la-produzione-di-rifiuti-cresce-la-raccolta-differenzia

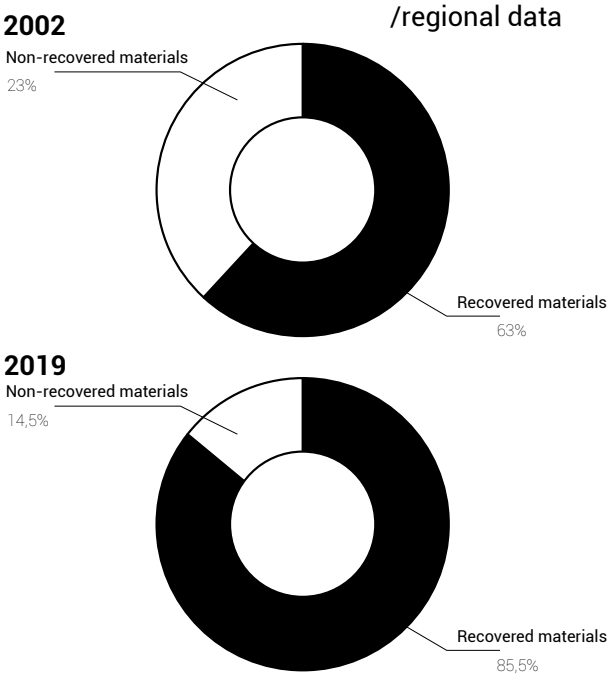


Construction Related Waste in Million Tonnes/ year in Lombardy, Italy.
The amount of construction weight is increasing rapidly.

On average, the structure of a building typically accounts for 40% to 60% of the total weight of the building.

Eurocast: Construction Related Waste in Million Tonnes/ year.

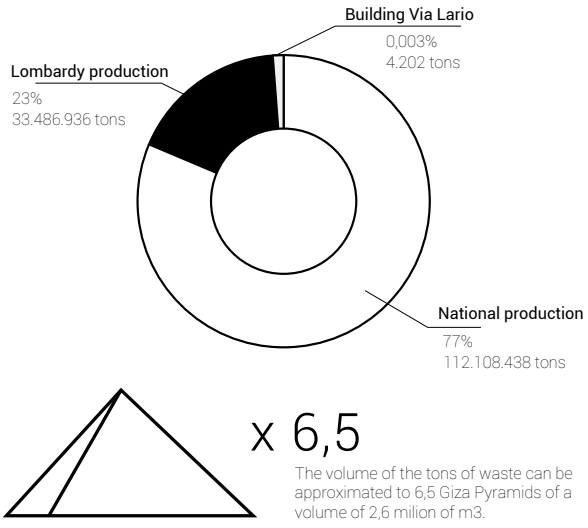
/regional data



"Over the years, there has been an increase in material recovery in Lombardy, which rose from 63% in 2002 to 85.5% in 2019."

https://www.arpalombardia.it/agenda/notizie/2022/rifiuti-dati-2020-in-lombardia-cala-la-produzione-e-cresce-la-raccolta-differenziata/

/national data



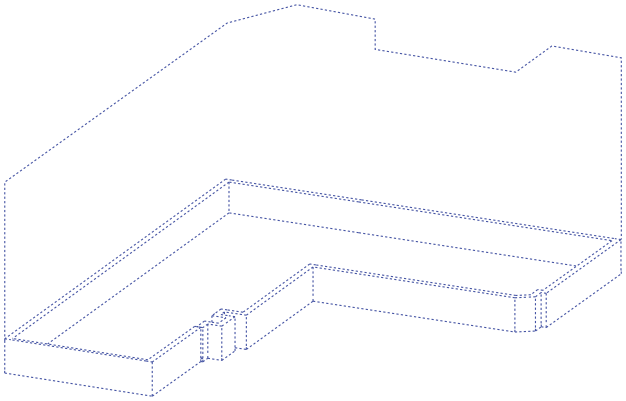
x 6,5

The volume of the tons of waste can be approximated to 6,5 Giza Pyramids of a volume of 2,6 milion of m3.

In 2019 the total production of "special waste" was 33.486.936 tons including inert waste from demolition and construction in Lombardy.
The waste increased by 2,4 % since 2018.

https://www.arpalombardia.it/agenda/notizie/2022/rifiuti-dati-2020-in-lombardia-cala-la-produzione-e-cresce-la-raccolta-differenziata/

/ option 1
total demolition

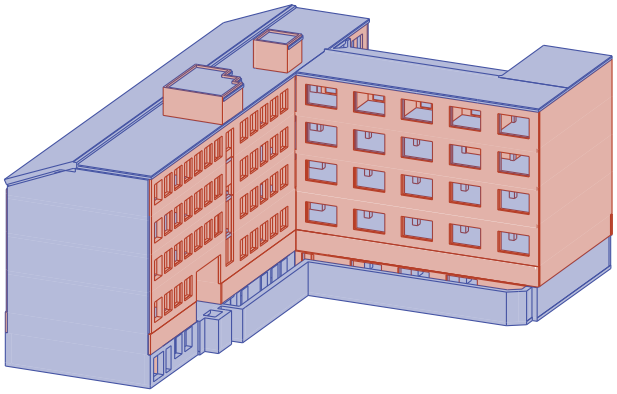


x 3.600

4.202,66 tons of waste. Calculate the sum weight of concrete structure, masonry bearing walls, stairs, and partitions.

4.202,66/ 4.202,66 tons of waste
= 100% waste, **0% preservation rate** [low]

/ option 3
total salvage (light partition walls removed)

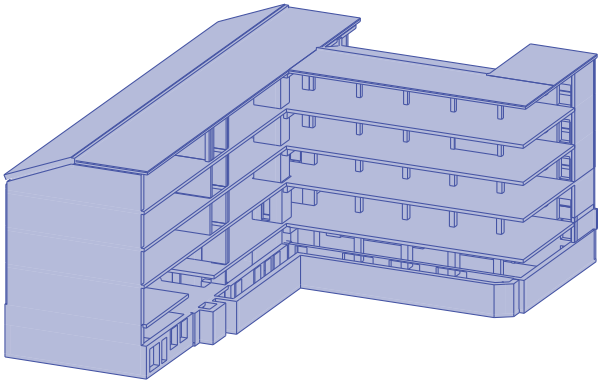


x 28

32,06 tons of waste. Calculate the sum weight of partition walls.

32,06 tons of waste/ 4.202,66 tons total building weight
= 1% waste, **99% preservation rate** [high]

/ option 2
partial demolition (masonry elements removed)

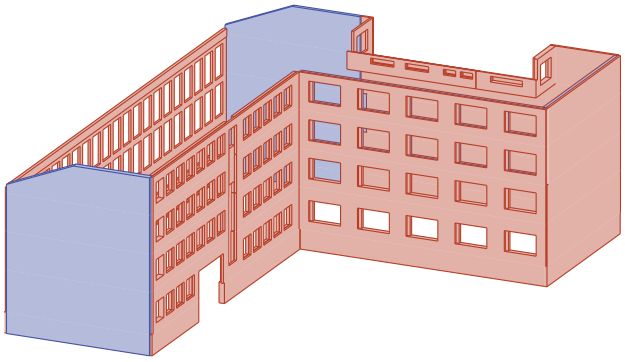


x 2.000

1.877,06 tons of waste. Calculate the sum weight of facade, masonry walls and partitions.

1.866,06 tons of waste/ 4.202,66 tons total building weight
= 55.3% waste, **44.7% preservation rate** [medium]

/ option 4
salvage facade (inner structure removed)

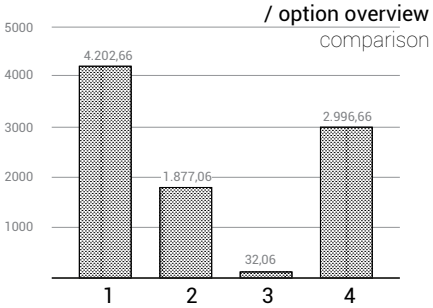


x 2.600

2.996,66 tons of waste. Calculate the sum weight of everything but the masonry bearing walls.

2.996,66 tons of waste/ 4.202,66 tons total building weight
= 71.3% waste rate, **28.7% preservation rate**

/ option overview
comparison

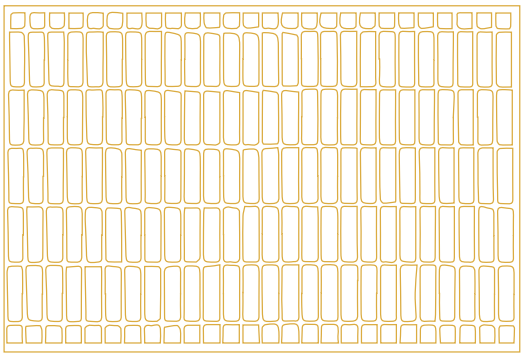


02.a / 02.b

Structure Study on Demolition

This graph shows clearly the total weight in tons of material it would be wasted with the demolition of the whole building compared to the material that could be preserved as seen in option 3.

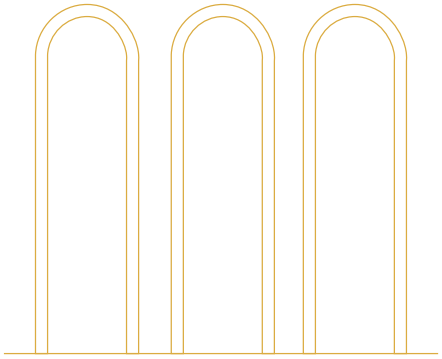
/ grating
cast iron



231 kg. The total equivalent weight of all these elements together totals the weight of a quarter of a Fiat 500 car.

463 kg CO2. The total equivalent embodied carbon of all these elements together totals the weight of 5 one-way flights from Milan to Brussels for one passenger.

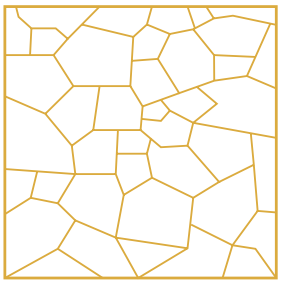
/ U-shape tubes
galvanized steel



870 kg. The total equivalent weight of all these elements together totals the weight of almost one Fiat 500 car.

2.007 kg CO2. The total equivalent embodied carbon of all these elements together totals the weight of 22 one-way flights from Milan to Brussels for one passenger.

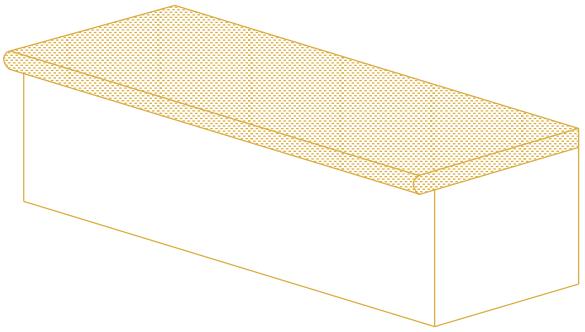
/ flagstone paving stone
flagstone



32.000 kg. The total equivalent weight of all these elements together totals the weight of 28 Fiat 500 cars.

2.240 kg CO2. The total equivalent embodied carbon of all these elements together totals the weight of 25 one-way flights from Milan to Brussels for one passenger.

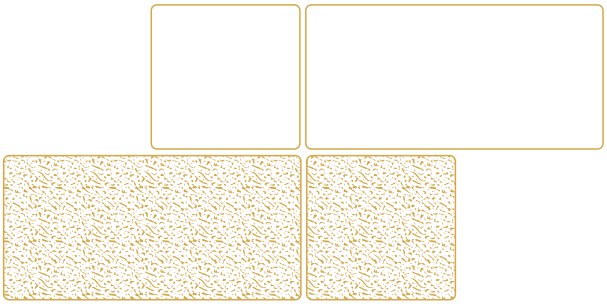
/ stone treads
gneiss



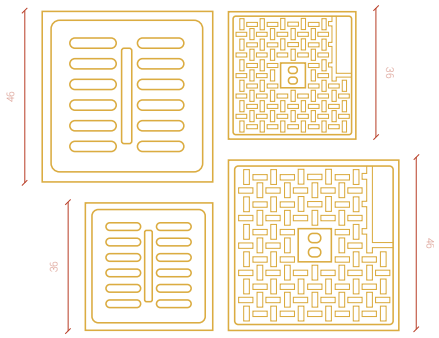
877 kg. The total equivalent weight of all these elements together totals the weight of almost one Fiat 500 car.

61 kg CO2. The total equivalent embodied carbon of all these elements together totals the weight of half one-way flight from Milan to Brussels for one passenger.

/ maroon paving stones
porphyry stone



/ manhole cover
cast iron



7.020 kg. The total equivalent weight of all these elements together totals the weight of 6 Fiat 500 cars.

522 kg. The total equivalent weight of all these elements together totals the weight of half Fiat 500 car.

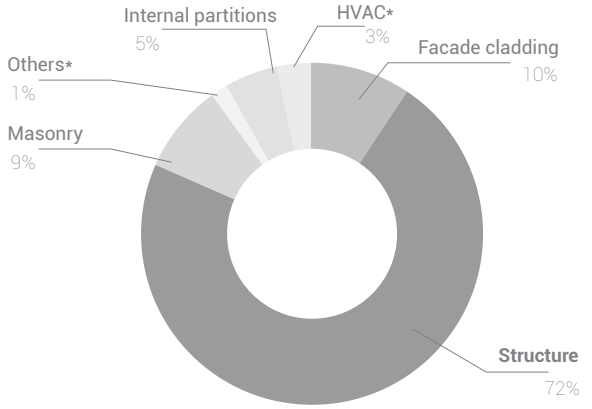
491,5 kg. The total equivalent embodied carbon of all these elements together totals the weight of 5.5 one way flights from Milan to Brussels for one passenger.

913 kg CO2. The total equivalent embodied carbon of all these elements together totals the weight of 10 one-way flights from Milan to Brussels for one passenger.

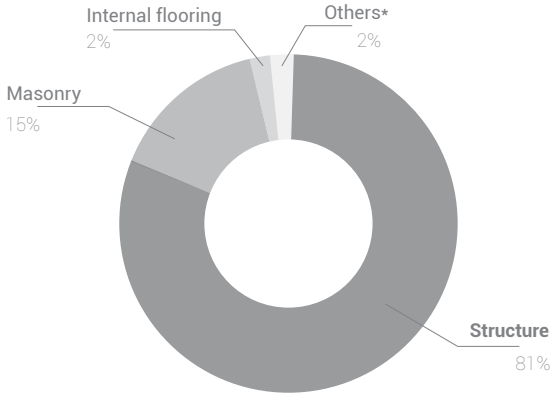
02.a / 02.b

Analysis Total Body

/ analysis
empodied carbon



/ analysis
total weight building



x 48.122

4.331 tons CO2 eq of embodied carbon.
1 ton CO2 eq / m2 of embodied carbon.

x 3.902

4.487 tons of total building weight.

x 0,63

1 ton/m2 of total building weight per m2.
Burj Khalifa weights 1,6 tons.

*Internal wall cladding, Sanitary, External windows, Internal flooring, Lighting, Doors

*Facade cladding, Internal wall cladding, Sanitary, External windows, Internal partitions, Lighting, HVAC, Doors

Inventory

The building inventory was created by a series of visits to the site and careful note taking, photography and physical testing of the spaces.[2]

02.a Structure	element	material	quantity	unit
	02.a / concrete	concrete		"columns/walls"
	02.a / masonry load bearing	brick, mortar		"ext walls"
	02.a / stairs	concrete	7	"flight"
	02.a / masonry hollow	hollow brick, mortar		"walls"
	02.a / gypsum plasterboard	gypsum		"int walls"

02.c Landscape	element	material	quantity	unit
	02.c / flagstone paving stones	flagstone	100	tiles
	02.c / maroon rough paving stones	porphyry stone (porfido)	152	paver
	02.c / maroon smooth paving stones	porphyry stone (porfido)	99	paver
	02.c / pea gravel landscape rocks	gravel	1	stones
	02.c / U-shape tubes	galvanized steel	61	pipe
	02.c U-shape tubes rounded	galvanized steel	33	pipe
	02.c / grate 90x130 cm	cast iron	4	grate
	02.c / grate on sides	cast iron	2	grate
	02.c / grate landing stairs	cast iron	1	grate
	02.c / grate treads	cast iron	8	grate

[2] Due to lack of clarity we tested the structure of the wall by physically hitting and seeing how the impact resonated.

 *02.c / stone treads*	*gneiss*	3	tread
 *02.c / stone treads*	*gneiss*	6	tread
 *02.c / stone treads*	*gneiss*	4	tread
 *02.c / stone treads*	*gneiss*	3	tread
 *02.c / manhole cover pattern*	*cast iron*	11	cover
 *02.c / manhole cover pattern large*	*cast iron*	6	cover
 *02.c / manhole cover perforated large*	*cast iron*	6	cover
 *02.c / manhole cover perforated*	*cast iron*	2	cover

 *02.c / stone treads*	*gneiss*	4	tread
 *02.c / stone treads*	*gneiss*	7	tread
 *02.c / trash can t1*	*plastic*	7	can
 *02.c / trash can t2*	*metal*	5	can

REUSE Catalog / Analysis

ASA Summer Program 2024

Arianna Allegri, Gabi Castro, & Hannah Novotny

Analysis

The results of our analysis indicated the following rates of weight and pollution.

02.a Structure	Material	Quantity of declared unit	Units of declared unit	Density of material (kg/m3)	Reference Depth (m)	Surface mass (kg/m2)	surface area (m2)	weight total (kg)	Embodied Carbon (kg CO2e per declared unit)	Embodied Carbon per kg (kg CO2e per kg)
02.a / concrete	concrete		"columns/ walls"	2500		0	921	2302500	276300	**0,120**
02.a / masonry load bearing	brick, mortar		"ext walls"	1800		0	670	1206000	180900	**0,150**
02.a / stairs	concrete	7	"flight"	2500	2,4	6000	0,55	23100	2772	**0,120**

02.b Masonry	Material	Quantity of declared unit	Units of declared unit	Density of material (kg/m3)	Reference Depth (m)	Surface mass (kg/m2)	surface area (m2)	weight total (kg)	Embodied Carbon (kg CO2e per declared unit)	Embodied Carbon per kg (kg CO2e per kg)
02.b / masonry hollow	hollow brick, mortar		"walls"	750		0	852	639000	47925	**0,075**
02.b / gypsum plasterboard	gypsum		"int walls"	668		0	48	32064	6412,8	**0,200**

02.c Landscape	Material	Quantity of declared unit	Units of declared unit	Density of material (kg/m3)	Reference Depth (m)	Surface mass (kg/m2)	surface area (m2)	weight total (kg)	Embodied Carbon (kg CO2e per declared unit)	Embodied Carbon per kg (kg CO2e per kg)
02.c / flagstone paving stones	flagstone	100		1600	0,05	80	400	32000	2240	**0,070**
02.c / manhole cover pattern	cast iron	11	"covers"	6850	0,02	137	0,1444	217,6108	435,2216	**2,000**
02.c / manhole cover pattern large	cast iron	6	"covers"	6850	0,02	137	0,2116	173,9352	347,8704	**2,000**
02.c / manhole cover perforated large	cast iron	6	"covers"	6850	0,02	137	0,1152	94,6944	94,6944	**1,000**
02.c / manhole cover perforated	cast iron	2	"covers"	6850	0,02	137	0,1296	35,5104	35,5104	**1,000**
02.c / maroon rough paving stones	porphyry stone (porfido)	152	"tiles"	2710	0,05	135,5	0,2112	4349,8752	304,491264	**0,070**
02.c / maroon smooth paving stones	porphyry stone (porfido)	99	"tiles"	2555	0,05	127,75	0,2112	2671,099 2	186,976944	**0,070**
02.c / pea gravel landscape rocks	gravel	1		1682	0,02	33,64	3	100,92	2,42208	**0,024**
02.c / U-shape tubes	galvanized steel	61		7000	1	7000	0,0012	512,4	1178,52	**2,300**
02.c U-shape tubes rounded	galvanized steel	33		7000	1,3	9100	0,0012	360,36	828,828	**2,300**
02.c / grate 90x130 cm	cast iron	4		6850	0,02	34,25	1,17	160,29	320,58	**2,000**
02.c / grate on sides	cast iron	2		6850	0,02	34,25	0,22	15,07	30,14	**2,000**
02.c / grate landing stairs	cast iron	1		6850	0,015	25,6875	1,16	29,7975	59,595	**2,000**
02.c / grate treads	cast iron	8		6850	0,015	10,275	0,318	26,1396	52,2792	**2,000**
02.c / stone treads	gneiss	3		2682	0,03	80,46	0,3193	77,072634	5,39508438	**0,070**
02.c / stone treads	gneiss	6		2682	0,03	80,46	0,3472	167,614272	11,73299904	**0,070**
02.c / stone treads	gneiss	4		2682	0,03	80,46	0,1891	60,859944	4,26019608	**0,070**
02.c / stone treads	gneiss	3		2682	0,03	80,46	0,2945	71,08641	4,9760487	**0,070**
02.c / stone treads	gneiss	4		2682	0,03	80,46	1,0609	341,440056	23,90080392	**0,070**
02.c / stone treads	gneiss	7		2682	0,03	80,46	0,2821	158,884362	11,12190534	**0,070**
02.c / trash can t1	plastic	7		/	/	8	1	56	4	**/**
02.c / trash can t2	metal	5		/	/	10	1	50	8	**/**

Embodied Carbon Emissions

In this section we will do an analysis on embodied carbon emitted from each demolition option.

Understanding the embodied carbon of materials helps assess the overall carbon footprint of a building. *By identifying high-carbon materials, you can prioritize their reuse, recycling, or proper disposal to reduce the environmental impact of demolition*. Reusing materials with high embodied carbon (like concrete or steel) reduces the need for new materials, thereby avoiding additional carbon emissions associated with new production.

02.a Structure			
02.a / concrete	2302500	276300	**0,120**
02.a / masonry load bearing	1206000	180900	**0,150**
02.a / stairs	23100	2772	**0,120**

02.b Masonry	kg	Kg CO2	C02/kg material
02.b / masonry hollow	639000	47925	**0,075**
02.b / gypsum plasterboard	32064	6412,8	**0,200**

02.c Landscape	kg	Kg CO2	C02/kg material
02.c / flagstone paving stones	32000	2240	**0,070**
02.c / manhole cover pattern	217,6108	435,2216	**2,000**
02.c / manhole cover pattern large	173,9352	347,8704	**2,000**
02.c / manhole cover perforated large	94,6944	94,6944	**1,000**
02.c / manhole cover perforated	35,5104	35,5104	**1,000**
02.c / maroon rough paving stones	4349,8752	304,491264	**0,070**
02.c / maroon smooth paving stones	2671,0992	186,976944	**0,070**
02.c / pea gravel landscape rocks	100,92	2,42208	**0,024**
02.c / U-shape tubes	512,4	1178,52	**2,300**
02.c U-shape tubes rounded	360,36	828,828	**2,300**
02.c / grate 90x130 cm	160,29	320,58	**2,000**
02.c / grate on sides	15,07	30,14	**2,000**
02.c / grate landing stairs	29,7975	59,595	**2,000**
02.c / grate treads	26,1396	52,2792	**2,000**
02.c / stone treads	77,072634	5,39508438	**0,070**
02.c / stone treads	167,614272	11,73299904	**0,070**
02.c / stone treads	60,859944	4,26019608	**0,070**
02.c / stone treads	71,08641	4,9760487	**0,070**
02.c / stone treads	341,440056	23,90080392	**0,070**
02.c / stone treads	158,884362	11,12190534	**0,070**
02.c / trash can t1	56	4	**/**
02.c / trash can t2	50	8	**/**

Analysis of Landscaping elements

Total Waste Comparison

02.b / landscape	kg
02.c / flagstone paving stones	32000
02.c / manhole cover pattern	217,6108
02.c / manhole cover pattern large	173,9352
02.c / manhole cover perforated large	94,6944
02.c / manhole cover perforated	35,5104
02.c / maroon rough paving stones	4349,8752
02.c / maroon smooth paving stones	2671,0992
02.c / pea gravel landscape rocks	100,92
02.c / U-shape tubes	512,4
02.c U-shape tubes rounded	360,36
02.c / grate 90x130 cm	160,29
02.c / grate on sides	15,07
02.c / grate landing stairs	29,7975
02.c / grate treads	26,1396
02.c / stone treads	77,072634
02.c / stone treads	167,614272
02.c / stone treads	60,859944
02.c / stone treads	71,08641
02.c / stone treads	341,440056
02.c / stone treads	158,884362
02.c / trash can t1	56
02.c / trash can t2	50

There are a total of **41,73** Tons of Material.

The weight of 35 fiat cars.

OPTION 1, total demolition:

Calculate the carbon emission based on material and volume.
Embodied carbon of all structural elements amounts to
514309,8 kg C02

40 balneare romano pools of C02 wasted.

OPTION 2, partial demolition:

Calculate the carbon emission based on material and volume.
Embodied carbon of masonry bearing wall, hollow masonry walls, and partition walls amounts to:
235237,8 kg C02

18 balneare romano pools of C02 wasted.

OPTION 3, total salvage:

Calculate the carbon emission based on material and volume.
Embodied carbon of only the gypsum partitions:
6412,8 kg C02

0,5 balneare romano pools of C02 wasted.

OPTION 4, shell:

Calculate the carbon emission based on material and volume.
333409,80 kg C02

26 balneare romano pools of C02 wasted.

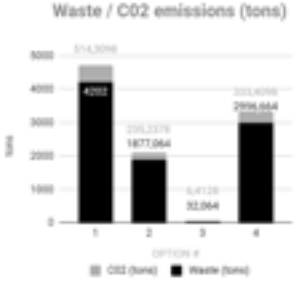
LANDSCAPING:

Calculate the carbon emission based on material and volume.
6190,52 kg C02

0,5 balneare romano pools of C02 wasted.

Conclusion

We have broken down the different options creating an accumulated score for each based on tons of waste material and tons of waste C02 emissions. Clearly, Complete demolition should not be an option as it is highly contaminating towards our environment and is significantly increasing the amount of future C02 emissions, but two other options seem to be a good compromise. The full salvage option however is clearly the most ambitious but the most sustainable for our planet.



Analysis of Total Options : 1 Total demolition ; 2 partial demolition ; 3 total salvage ; 4 shell

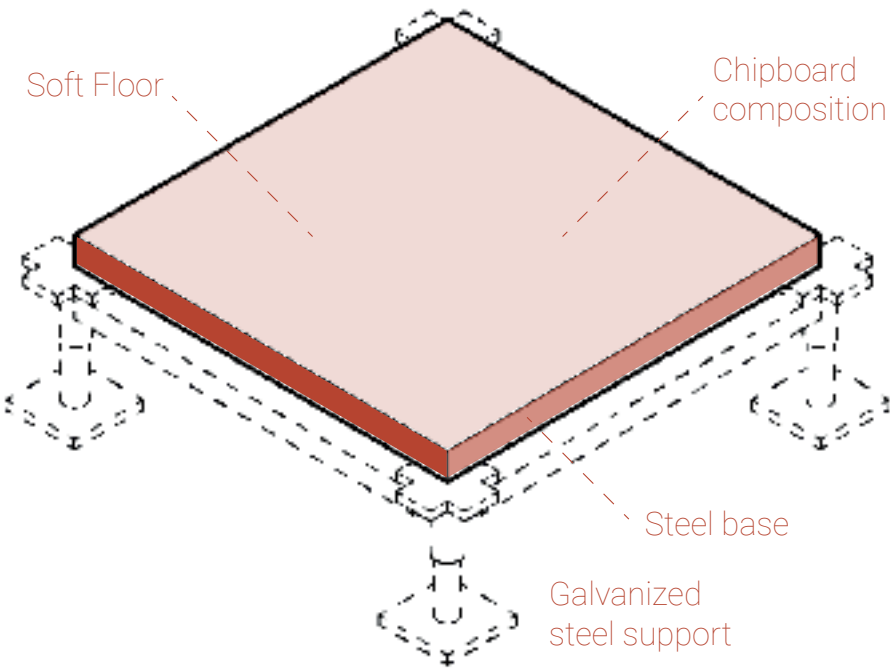
The future of architecture lies in embracing sustainability and circularity—creating spaces that are environmentally friendly, resource-efficient, and inspiring. After thorough analysis it is clear that through the intelligent reuse of building materials, we can contribute to a quantifiably greener, more sustainable future.

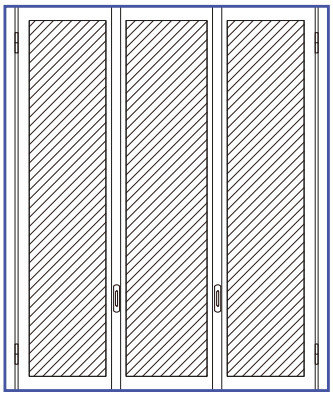
3

03.a / 03.b / 03.c

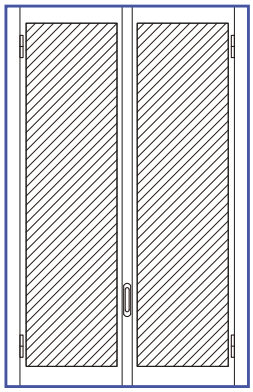
Raised floor, Windows & Stair

Alessandro Mocci,
Claudia Xu, Olimpia Li

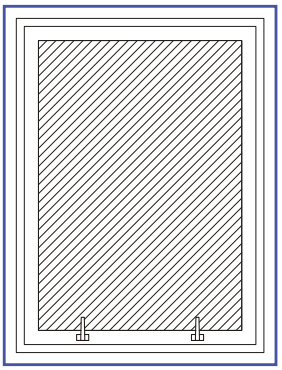

Soft Floor
Chipboard composition
Steel base
Galvanized steel support



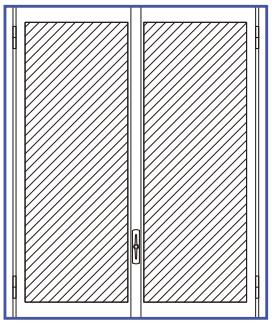
Typology: A
Measure: 160 cm X 190 cm
Surface: **3 m²**
Weight: **60 kg**
Material: Wood



Typology: B
Measure: 120 cm X 190 cm
Surface: **2,3 m²**
Weight: **46 kg**
Material: Wood

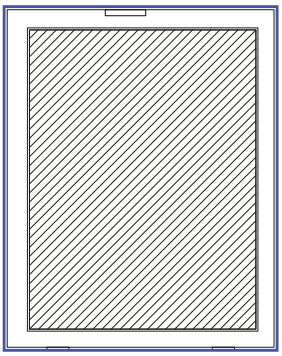


Typology: F
Measure: 135 cm X 178 cm
Surface: **2,4 m²**
Weight: **48 kg**
Material: Wood

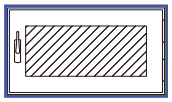


Typology: G
Measure: 130 cm X 155 cm
Surface: **2 m²**
Weight: **40 kg**
Material: Wood

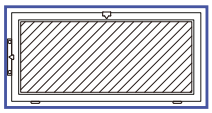
Typology: C
Measure: 135 cm X 170 cm
Surface: **2,3 m²**
Weight: **46 kg**
Material: Wood



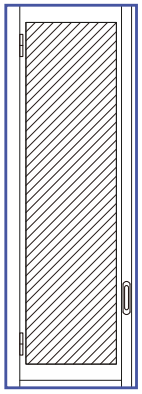
Typology: D
Measure: 135 cm X 170 cm
Surface: **3 m²**
Weight: **46 kg**
Material: Wood



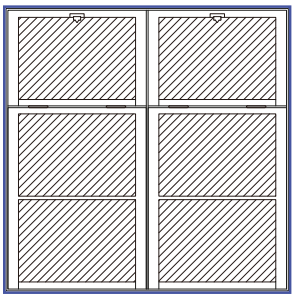
Typology: I
Measure: 80 cm X 45 cm
Surface: **0,4 m²**
Weight: **8 kg**
Material: Wood



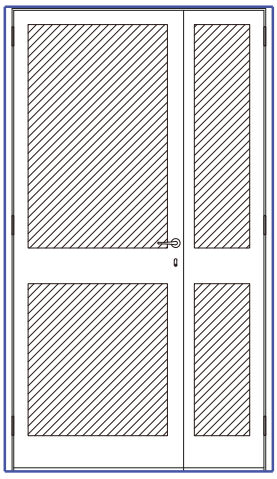
Typology: L
Measure: 100 cm X 50 cm
Surface: **0,5 m²**
Weight: **10 kg**
Material: Wood



Typology: P
Measure: 65 cm X 190 cm
Surface: **1,2 m²**
Weight: **25 kg**
Material: Wood



Typology: M
Measure: 160 cm X 160 cm
Surface: **2,6 m²**
Weight: **51 kg**
Material: Wood

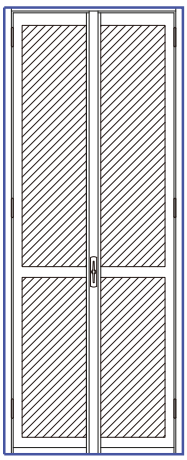


Typology: N
Measure: 150 cm X 260 cm
Surface: **3,9 m²**
Weight: **78 kg**
Material: Wood

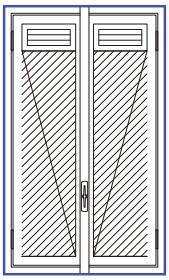
Execution of the milling to insert the colored gasket of a window.

Positioning the new glass in place. Once the gasket has been installed, the glass can be inserted into its housing.

Sealing of the glass to the frame on the interior side. The interior seal also prevents cold and moisture from entering.



Typology: O
Measure: 100 cm X 250 cm
Surface: **2,5 m²**
Weight: **50 kg**
Material: Wood



Typology: H
Measure: 90 cm X 150 cm
Surface: **1,4 m²**
Weight: **27 kg**
Material: Wood

A

B

C

D

E

F

G

H

I

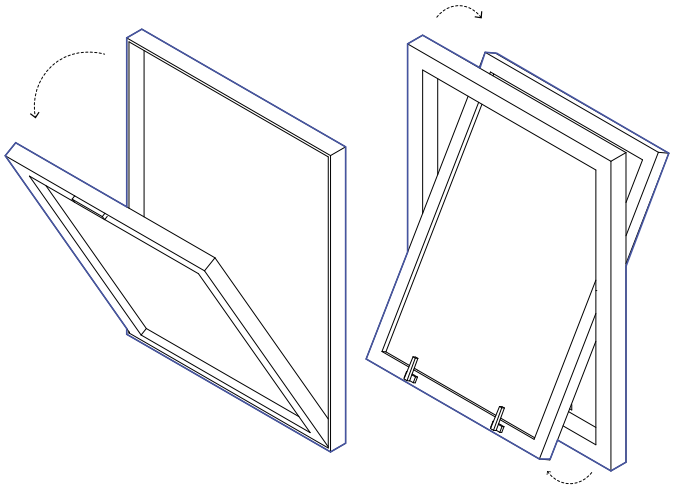
L

M

N

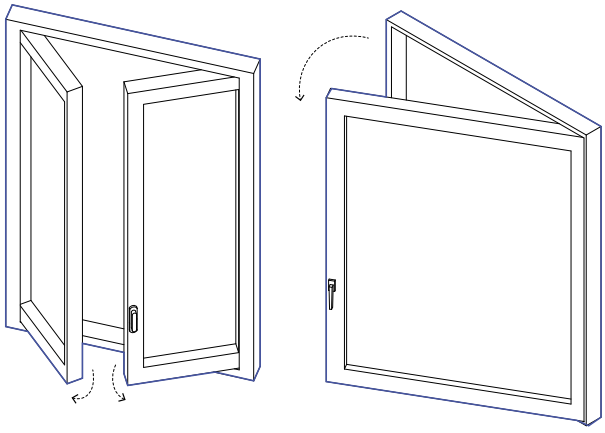
O

P



TILT WINDOW

HORIZONTAL PIVOT WINDOW



DOUBLE CASEMENT WINDOW

SINGLE CASEMENTI WINDOW

OVERALL DATA

total weight

8.000 Kilograms

of window units

embodied carbon

172.990 $kgCO_{2_{eq}}$

saved from the tile reuse

reuse rate

95% Reuseable Material

using the structure, columns

Reusable quantities

GF	*A-B-C-D-E-M-N-P*	*46 units*
F1	*A-B-F-G-H-M-P*	*62 units*
F2	*A-B-F-G-H-I-L-M-P*	*60 units*
F3	*B-G-H-I-L-M*	*37 units*
Tot.		***205** units*

Some numbers

Wood : **167 units**

PVC : **38 units**

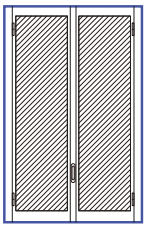
Double glazed : **167 units**

Single glazed : **38 units**

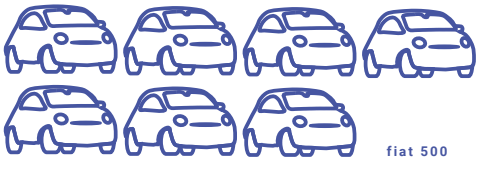
Tot surface : **440 m²**

Tot weight : **8 tons**

8 tons
Total weight

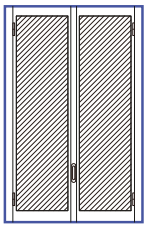


≈



(7)

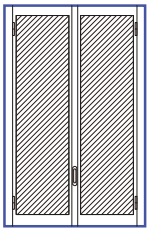
440 m²
Total surface



≈

(1)

138.400 kg$Co_{2_{eq}}$
Total emission



≈

X 690 flights

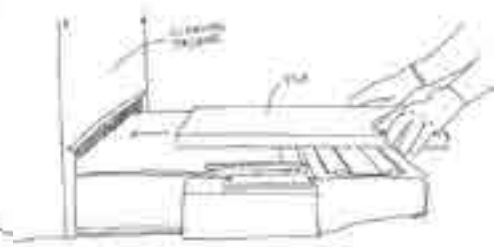
≈

X 17 people/yr

French companies

Storage

Glue cleaning process



REUSE

MATERIAL RECYCLING

chipboard/ gypsum

NEW PRODUCT

PETRAL

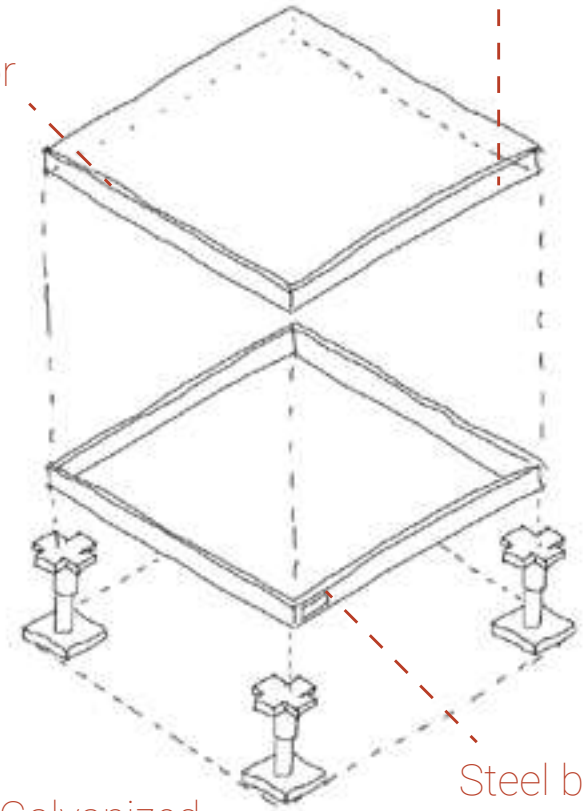
Cost-benefit analysis

Client savings **13€/mq** (landfill cost)

Client cost **~12€/mq** (dissasembly/ trasportation)

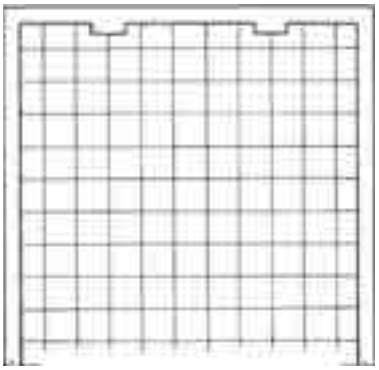
WIN-WIN

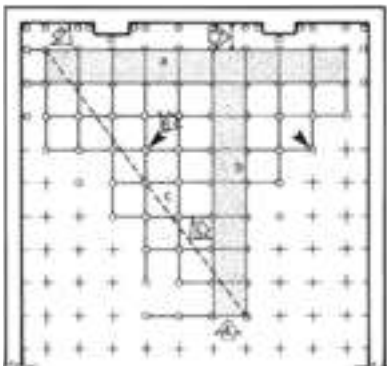
Soft Floor

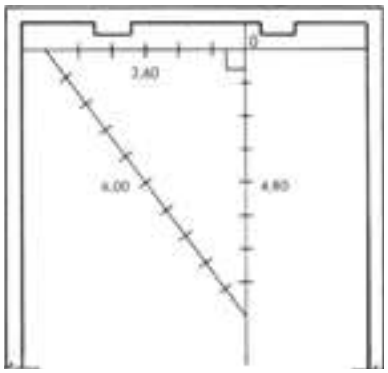


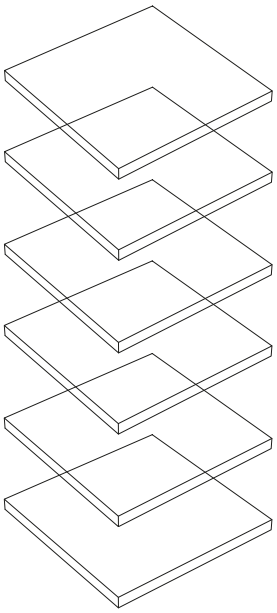
Steel base

Galvanized steel support









Easy to

Assemble

Disassemble

Assemble

Disassemble

REUSE

Installation equipment

Single hand in alluminium

Double hand in alluminium

Carpet panel lifter

Old equipment by Haussman

Installation equipment

Saw with diamond

Saw with aspirator

Installation equipment

Water or
dry saw "klipper"

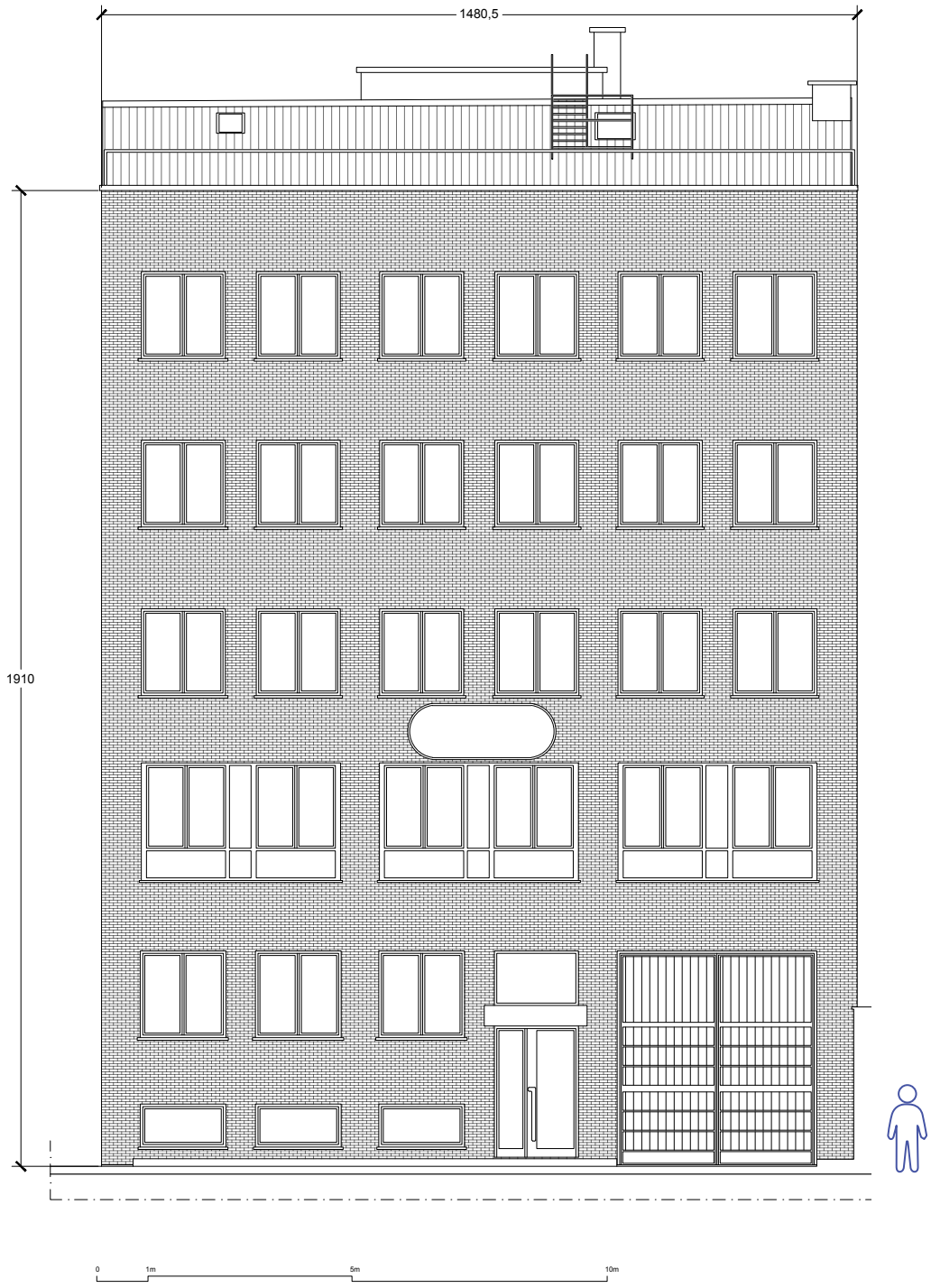
Shear

4

04.a / 04.b / 04.c

Internal doors and partitions, internal wall cladding

Alessandro Migliorati
Sonja Losonci Johnson
Valeria Chtcherbatova
Valeria Ragagnin



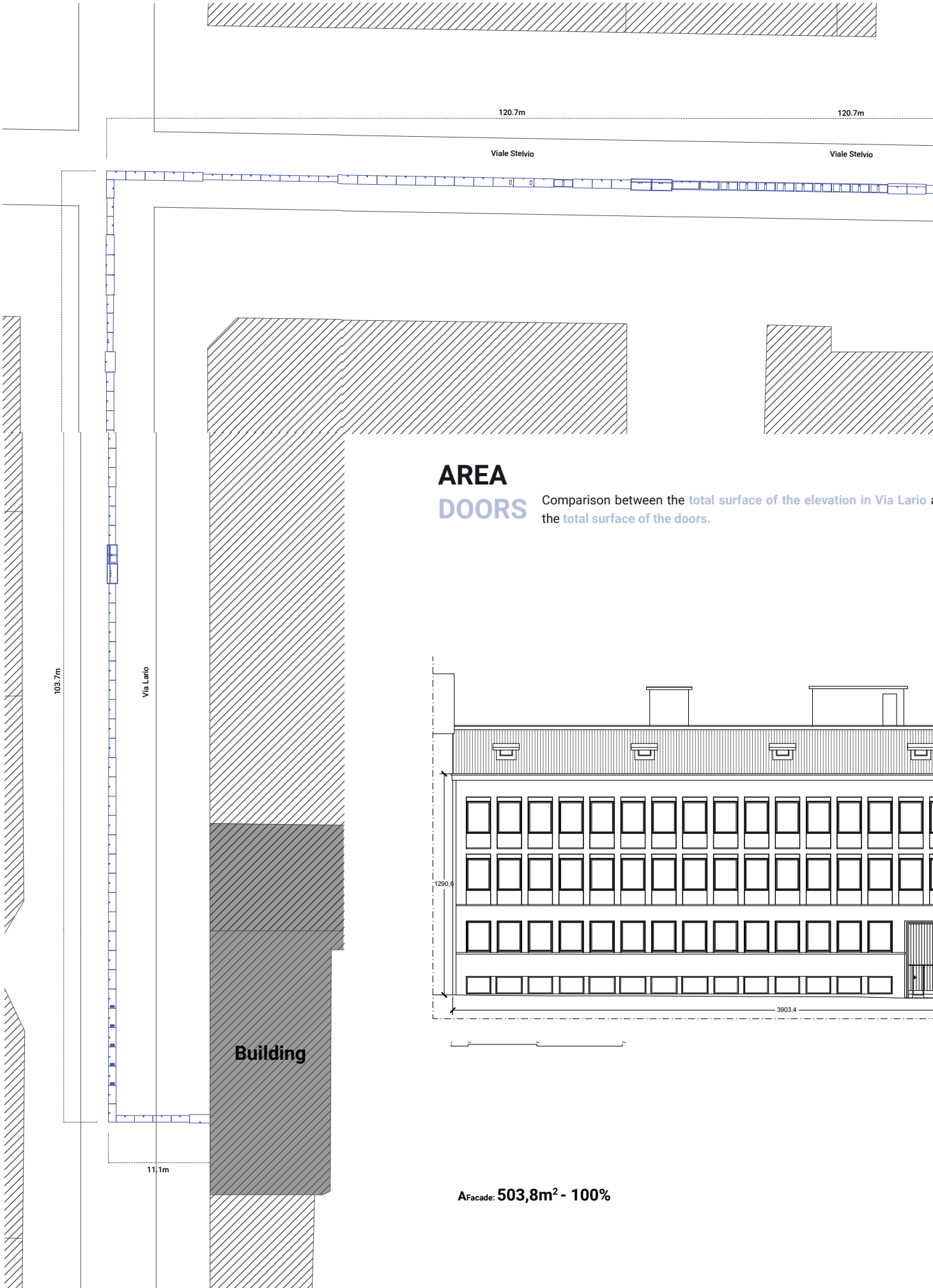
A_{Facade}: 282,8m² - 100%

LINEAR LENGHT

DOORS

Doors in the building have a cumulative lenght of 250.7 m.

By putting all the 115 doors on the street it is possible to reach the nearest supermarket.

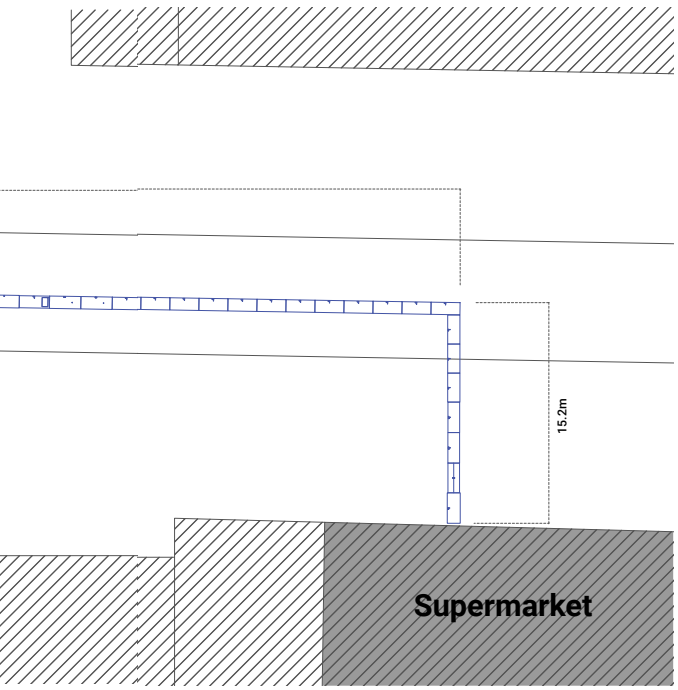


AREA

DOORS

Comparison between the total surface of the elevation in Via Lario a the total surface of the doors.

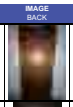
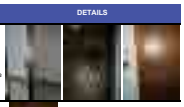
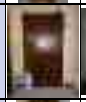
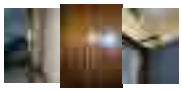
A_{Facade}: 503,8m² - 100%



and

A_{Doors}: **200,35 m² - 40%**

GROUND FLOOR
DOORS

TITLE	IMAGE FRONT	IMAGE BACK	DIMENTIONS [cm] w x l x h	MATERIAL	QUALITY 1 to 5	Number	NOTES	DETAILS
D001			92,5 x 7 x 223	wood	3/4	1	thickness made by two parts, dimensions: 2 + 5 cm it has a metal "door closer" the outside handle is round and made of plastic, while the inside one has a different shape and is made of metal	
D002			**door:** 81,5 x 4,5 x 210 **ventilation pannel:** 44 x 4,5 x 21	**door:** chipboard **ventilation pannel:** aluminum	3	4	very light, it souds like it is empty inside there is a hole in the lower part of the door due to the presence of a ventilation pannel	 / /
D003			82 x 4,5 x 210	chipboard	3	10	very light, it souds like it is empty inside	/ / /
D004			80,5 + 36 x 8 x 219	**front:** wood **back:** plastic	4	1	plastic thickness: 5,5 cm wood thickness: 2,5 cm it is made of two shutters: a smoller one (36 cm) and a larger one (80,5 cm) it has a metal "door closer" both handles are round and made of metal	
D005			85 + 25,5 x 6 x 204	**frame:** aluminum **pannel:** chipboard, glass	4	1	it is made of two shutters: a smoller one (25,5 cm) and a larger one (85 cm) the handel is made out of plastic	/ / /
D006			72 x 4,5 x 210,5	chipboard	3	1	very light, it souds like it is empty inside it has a metal handle	/ / /
D007			62 x 4,5 x 210	chipboard	3	2	very light, it souds like it is empty inside it has a medal sliding lock on the inside it has a metal handle	/ / /
D008		/	110 x 7 x 223	**front:** wood **back:** maybe plastic	4	1	the door was not open, so it was not possible to measure the thickness	/ / /
D009			**door:** 62 x 4,5 x 210 **ventilation pannel:** 44 x 4,5 x 21	chipboard	3	1	very light, it souds like it is empty inside there is a hole in the lower part of the door due to the presence of a ventilation pannel	/ / /
D010		/	67 x 4,5 x 210	chipboard	3	1	very light, it souds like it is empty inside it has a medal sliding lock on the inside it has a metal handle	/ / /
D011			73 x 5 x 196,5	black painted chipboard	3	1	it has a plastic round handel on the front and a plastic linear one on the back	/ / /

SECOND FLOOR
DOORS

THIRD FLOOR
DOORS

FIRST FLOOR
DOORS

TOTAL
DOORS

TYPE	DIMENTIONS [cm] w x t x h	QUALITY 1 to 5	NUMBER reusable ones
D001	92,5 x 7 x 223	3/4	1
D002	**door:** 81,5 x 4,5 x 210 **ventilation pannel:** 44 x 4,5 x 21	3	4
D003	82 x 4,5 x 210	3	18
D004	80,5 + 36 x 8 x 219	4	1
D005	85 + 25,5 x 6 x 204	4	1
D006	72 x 4,5 x 210,5	3	11
D007	62 x 4,5 x 210	3	7
D008	110 x ? x 223	4	1
D009	62 x 4,5 x 210	3	1
D010	67 x 4,5 x 210	3	1
D011	73 x 5 x 196,5	3	1
D012	90 x 0,5 x 219	4	2
D013	95 x 4,5 x 210	3	16
D014	94 x 5 x 222	3	2
D015	91 x 4 x 214	3	1
D016	82 x 5 x 208	4	1
D017	37 + 87 x 8 x 224	4	2
D018	**door**: 95 x 5 x 211 **glass**: 74 x 0.5 x 172	5	2
D019	**door:** 92 x 6 x 204 **glass:** 91 x 0.5 x 81 **chipboard:** 81 x 3 x 67	4	9
D020	28+82 x 5 x 207	4	2
D021	87 x 4,5 x 210	4/5	1
D022	**door**: 84 x 5 x210 **glass**: 40 x 62	3	1
D023	86 x 7,5 x 218	4	2
D024	84 x 5 x 200	3	18
D025	72 x 5 x 200	3	6
D026	81 x 4,5 x 210	4/5	1
D027	40+40 x 4.5 x 205	4/5	1
D028	89 x 4.5 x 210	3	1
		TOTAL	115

GROUND FLOOR
PARTITIONS

TITLE	IMAGE FRONT	IMAGE BACK	DIMENTIONS [cm] w x t x h	MATERIAL	QUALITY 1 to 5	NUMBERR of single modules	AREA [cm2]	NOTES
P001			**height:** 325 **general:** 467(114+117+117+119) x 6 x 325 **panel:** 100 x 101 **division:** 5	**frame:** aluminum **pannels:** aluminum, glass	4	4	40950	/

FIRST FLOOR
PARTITIONS

TITLE	IMAGE FRONT	IMAGE BACK	DIMENTIONS [cm] w x t x h	MATERIAL	QUALITY 1 to 5	Number of single modules	AREA [cm2]	NOTES
P002			**height:** 290 **general:** 300 (100+110+90) x 5 x 112 (white panel) + 90 (glass panael) **division:** 5	**frame:** aluminum **pannels:** aluminum, glass	4	3	31320	/
P003			**height:** 240 **general:** 410 (90 + 120+100) x 5 x 112 (white panel) + 90 (glass panel) **division:** 4	**frame:** aluminum **pannels:** chipboard, glass	4	3	25920	/

TOTAL
PARTITIONS

TYPE	DIMENTIONS [cm] w x t x h	QUALITY 1 to 5	NUMBER of single modules
P001	**height:** 325 **panel:** 100 x 101 **divisions:** 5	4	4
P002	**height:** 290 **division:** 5	4	3
P003	**height:** 240 **division:** 4	4	3
P004	**height:** 300 **divisions:** 4	4	8
P005	**height:** 300 **divisions:** horizontal - 8; vertical - 4	4	26
P006	**height:** 290 **divisions:** 3,5	4	14
		TOTAL	58

TILES

TYPE	DIMENTIONS [cm] w x t x h	QUALITY 1 to 5	NUMBER reusable ones
T001	20 x 20 x 0,5	4	2685
T002	20 x 25 x 0,5	4	11
T003	20 x 25 x 0,5	4/5	1159
T004	20 x 25 x 0,05	4/5	951
T005	20 x 3 x 1	4/5	526
		TOTAL	5332

GROUND FLOOR
TILES

TITLE	IMAGE	DIMENTIONS [cm] w x t x h	MATERIAL	QUALITY 1 to 5	Number reusable ones	NOTES
B1_T001		20 x 20 x 0,5	ceramic	4	622	withe and square
B2_T001		20 x 20 x 0,5	ceramic	4	322	withe and square

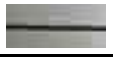
FIRST FLOOR
TILES

TITLE	IMAGE	DIMENTIONS [cm] w x t x h	MATERIAL	QUALITY 1 to 5	Number reusable ones	NOTES
B3_T001		20 x 20 x 0,5	ceramic	4	612	white, plain colour and square
B4_T001		20 x 20 x 0,5	ceramic	4	556	white, plain colour and square
B5_T001		20 x 20 x 0,5	ceramic	4	573	white, plain colour and square

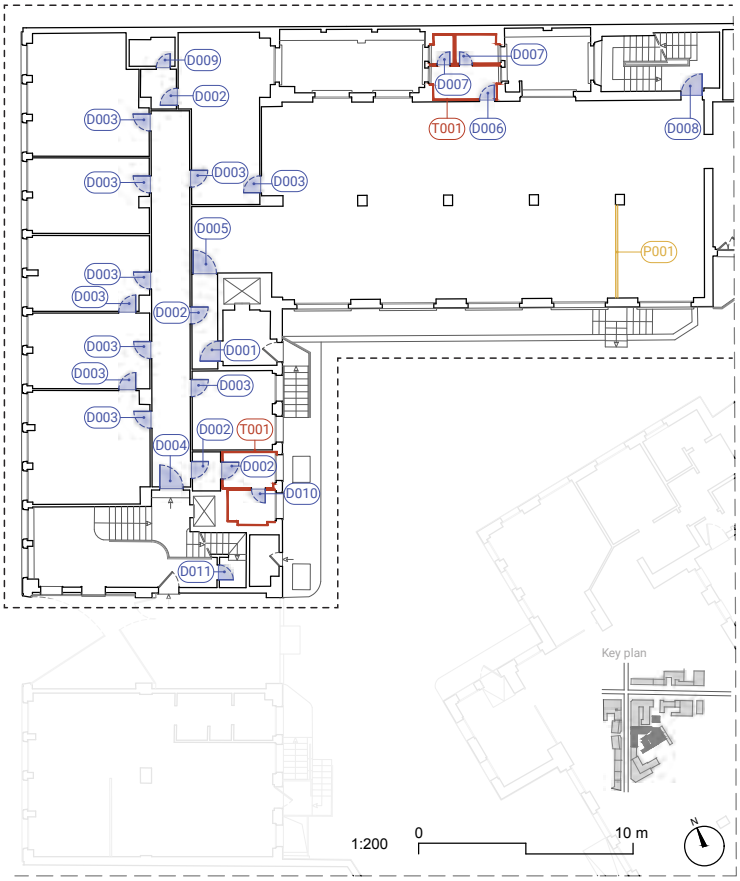
SECOND FLOOR
TILES

TITLE	IMAGE	DIMENTIONS [cm] w x t x h	MATERIAL	QUALITY 1 to 5	Number reusable ones	NOTES
B6_T002		20 x 25 x 0,5	ceramic	4	11	light blue, plain colour and rectangular
B6_T003		20 x 25 x 0,5	ceramic	4/5	141	light blue, marbled colour and rectangular
B7_T003		20 x 25 x 0,5	ceramic	4/5	518	light blue, marbled colour and rectangular
B8_T003		20 x 25 x 0,5	ceramic	4/5	500	light blue, marbled colour and rectangular

THIRD FLOOR
TILES

TITLE	IMAGE	DIMENTIONS [cm] w x t x h	MATERIAL	QUALITY 1 to 5	Number reusable ones	NOTES
B9_T004		20 x 25 x 0,5	ceramic	4/5	521	white, plain colour, tripartite and rectangular
B10_T004		20 x 25 x 0,5	ceramic	4/5	430	white, plain colour, tripartite and rectangular
B9_T005		20 x 3 x 1	ceramic	4/5	91	black, embossed and linear
B10_T005		20 x 3 x 1	ceramic	4/5	96	black, embossed and linear

GROUND FLOOR



Legend

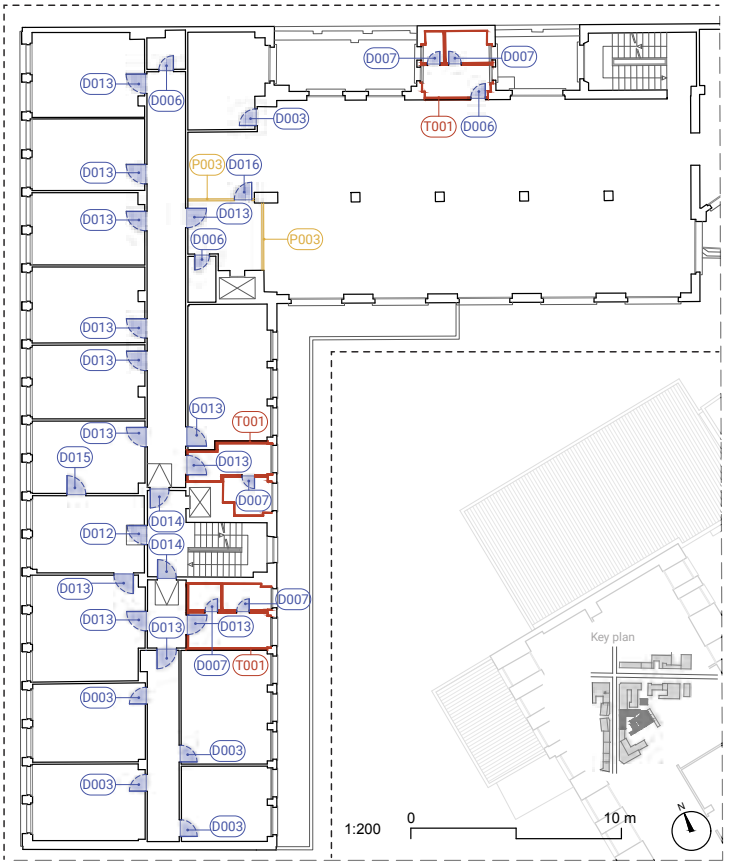
PARTITIONS	Type	Numbers
	P001	4

TILES	Type	Numbers
	T001	994

DOORS	Type	Numbers
	D001	1
	D002	4
	D003	10
	D004	1
	D005	1
	D006	1
	D007	3

	Type	Numbers
	D008	1
	D009	1
	D010	1
	D011	1

FIRST FLOOR



Legend

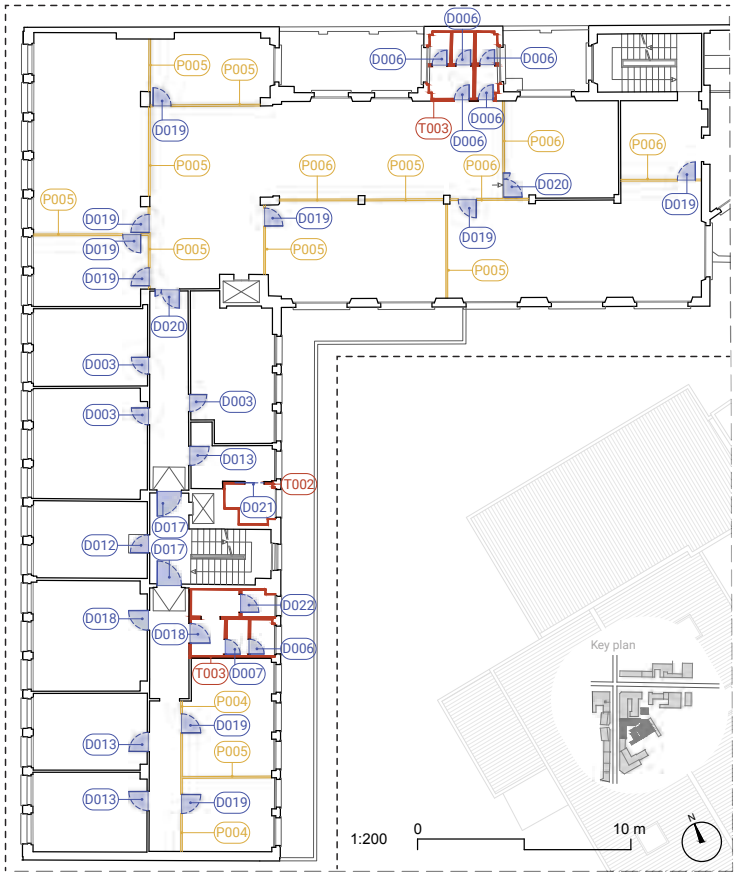
PARTITIONS	Type	Numbers
	P002	3
	P003	3

TILES	Type	Numbers

	Type	Numbers
	D016	1

DOORS	Type	Numbers
	D003	5
	D006	3
	D007	5
	D012	1

SECOND FLOOR



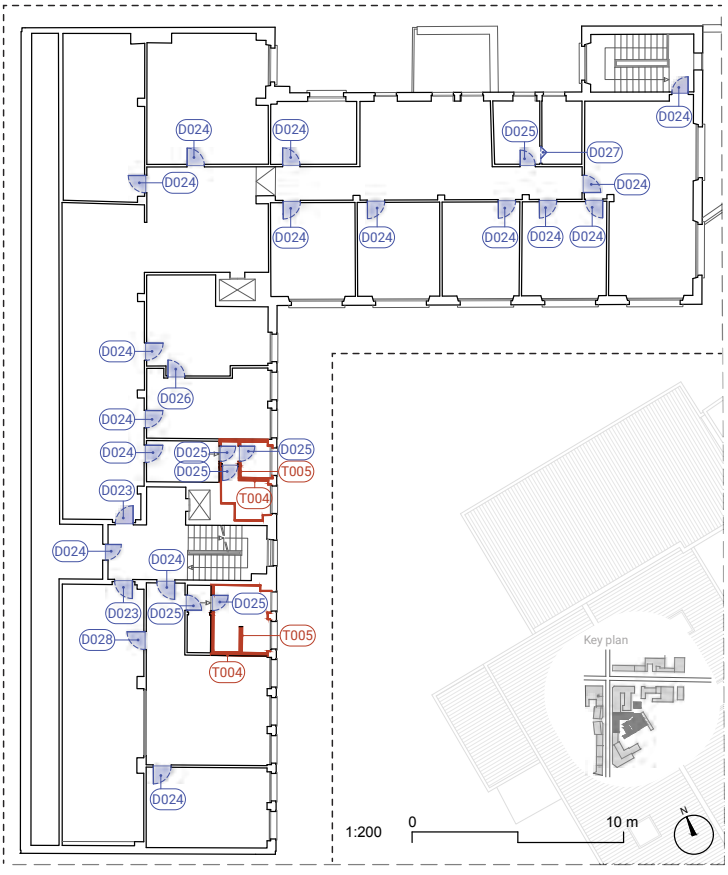
Legend

DOORS	Type	Numbers
	D003	3
	D006	7
	D012	1
	D013	3
	D017	2
	D018	2
	D019	9
	D020	2
	D021	1
	D022	1

PARTITIONS	Type	Numbers
	P004	8
	P005	26
	P006	14

TILES	Type	Numbers
	T002	11
	T003	1159

THIRD FLOOR



Legend

DOORS	Type	Numbers
	D023	2
	D024	18
	D025	6
	D026	1
	D027	1
	D028	1

TILES	Type	Numbers
	T004	951
	T005	187

OVERALL DATA

DOORS - reuse rate

54% - low quality

D001 - D002 - D003 - D006 - D007 - D009 - D010 - D011 - D013 - D014 - D015 - D023 - D024 - D025 - D028

43% - medium quality

D004 - D005 - D008 - D012 - D016 - D017 - D019 - D020 - D021 - D022 - D026 - D027

3% - historical quality

D018

embodied carbon

28 462 kg CO2 eq

saved from the door reuse

OVERALL DATA

PARTITIONS - reuse rate

95% - medium quality

partitions can be reused in others work spaces

embodied carbon

32 838 kg CO2 eq

saved from the partition reuse

TILES - reuse rate

95% - medium quality

if remuvable, tiles can be reused as internal walls cladding

embodied carbon

2 819 kg CO2 eq

saved from the tile reuse

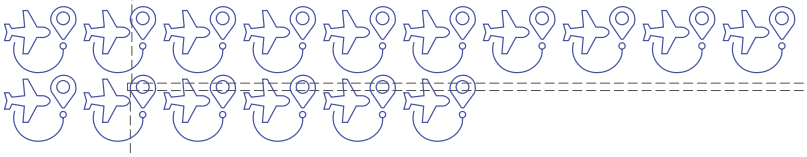
TOTAL WEIGHT and CO2

DOORS

Weight

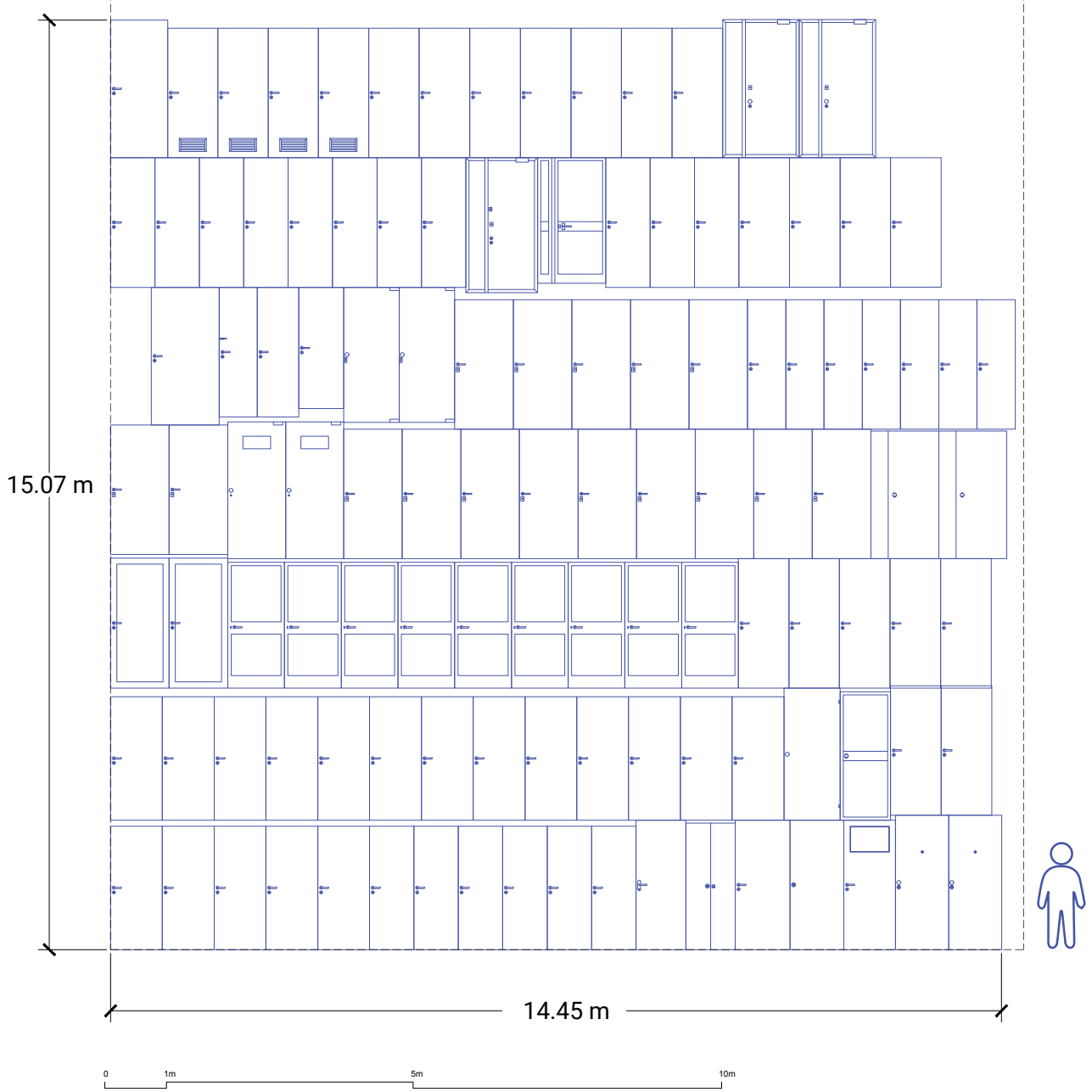
6345.6 kg The total weight of the doors, equal to **5.5** Fiat 500 cars at 1150kg each, 6345.6/1150 = 5.5

CO2



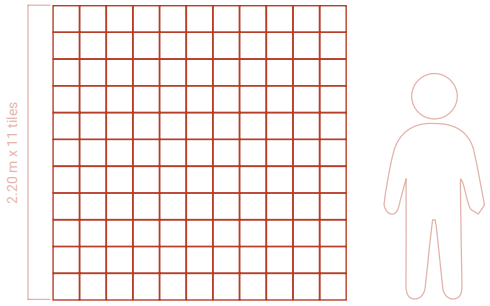
= 20 flights

28462 kg. The total equivalent embodied carbon of the doors is equal to **316** one way flights from Milan to Brussels for one passenger, 90 kgCO2eq x 316 = 28462 kgCO2eq



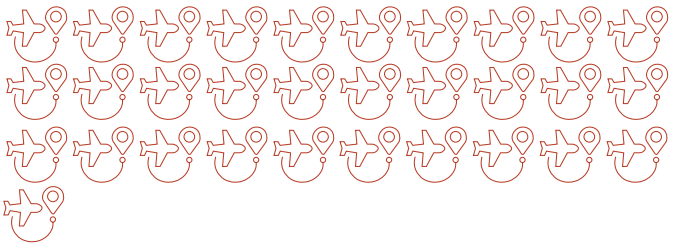
A_{Doors}: 200,35 m² - 70,8%

TOTAL WEIGHT and CO2
TILES



Weight

CO2



3862 kg. The total weight of the doors, equal to **3.4** Fiat 500 cars at 1150kg each, 3862/1150 = 3.4

2819 kg. The total equivalent embodied carbon of the doors is equal to **31** one way flights from Milan to Brussels for one passenger, 90 kgCO2eq x 31 = 2819 kgCO-

TOTAL WEIGHT and CO2
PARTITIONS

Weight

CO2

= 20 flights

6233 kg. The total weight of the doors, equal to **5.4** Fiat 500 cars at 1150kg each, 6233/1150 = 5.4

32838 kg. The total equivalent embodied carbon of the doors is equal to **365** one way flights from Milan to Brussels for one passenger, 90 kgCO2eq x 365 = 32838

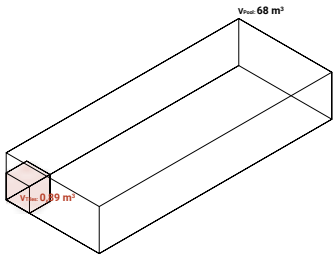
VERTICAL HEIGHT
DOORS

Doors in the building have a cumulative height of 239.6 m.

This is 2.2x the size of Tower Velasca, which sits at 106 m tall in the Milan skyline.

VOLUME
TILES

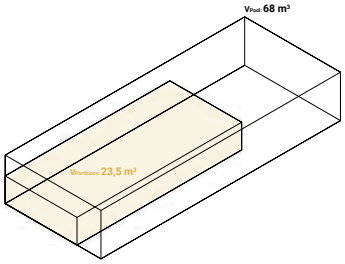
Comparison between the total volume of the tiles and the volume of a standard pool.



Vpool: 100%
Vtiles: 1,3%

VOLUME
PARTITIONS

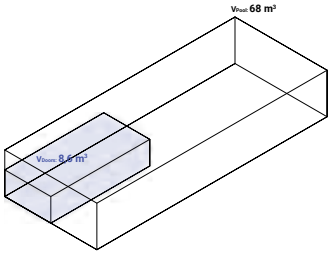
Comparison between the total volume of the internal partitions and the volume of a standard pool.



Vpool: 100%
Vpartitions: 35%

VOLUME
DOORS

Comparison between the total volume of the doors and the volume of a standard pool.



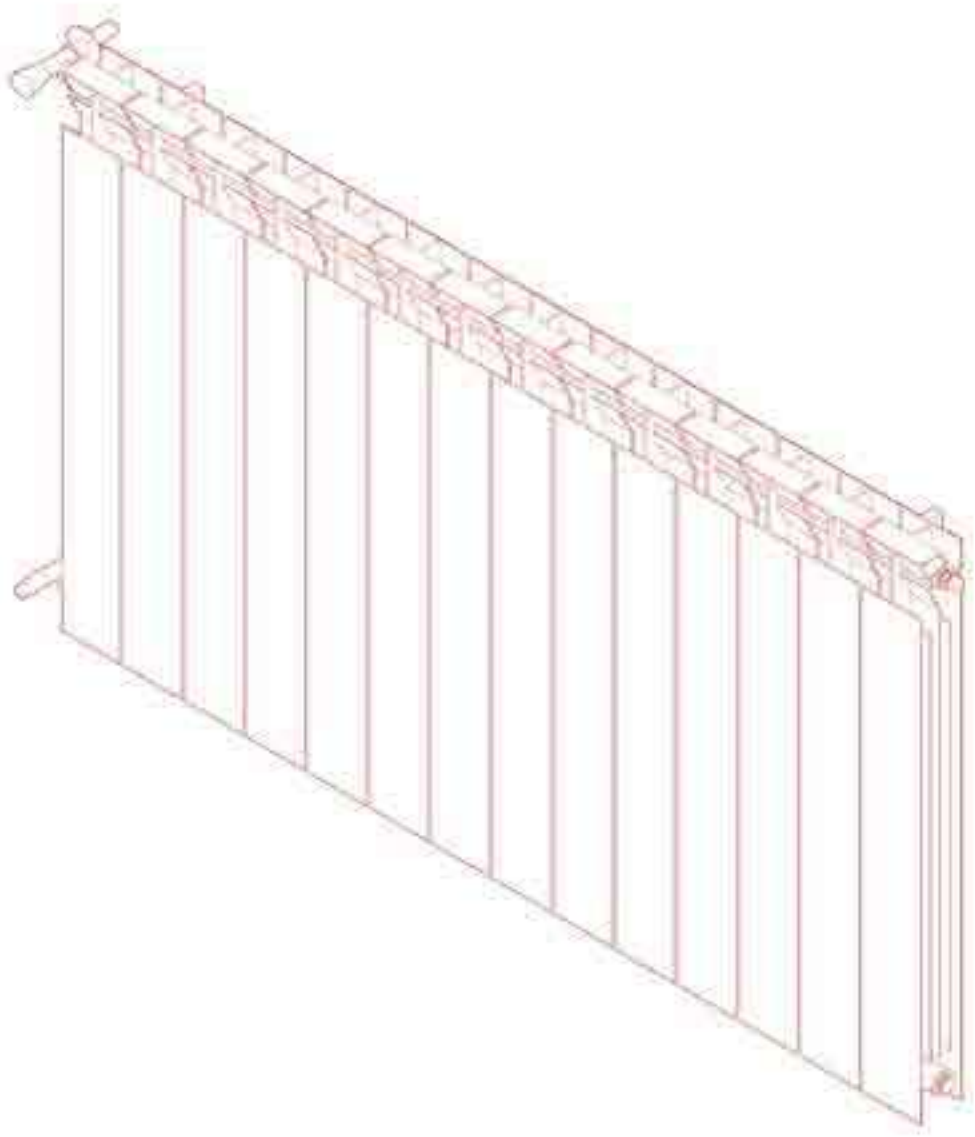
Vpool: 100%
Vdoors: 13%

5

05.a / 05.b

HVAC & Lighting

Gizem Bilgili, Andrea Filiberti, Caridad Pineda, Lan Wang



Radiator

Material	Steel
Quantity	78
Gross Density (kg/m³)	420
Total Surface Area (m²)	4.8
Total Weight (kg)	1471
Total Embodied Carbon ($kgCO_2e$)	2868

LIGHTING INVENTORY

IMAGE	CATEGORY	MATERIAL	QUANTITY (PC)	WEIGHT (KG)
	Fluorescent Lighting Fixture (type 2)	Plastic	1	4,902
	Fluorescent Lighting Fixture (type 3)	Plastic	1	2,394
	Fluorescent Lighting Fixture (type 5)	Plastic	4	10,640
	Fluorescent Lighting Fixture (type 8)	Aluminum	79	2532,582
	Fluorescent Lighting Fixture (type 9)	Plastic	6	137,940
	LED Lighting Fixture (type 10)	Plastic	18	1,163
	Fluorescent Lighting Fixture (type 12)	Plastic	17	19,380
	Fluorescent Lighting Fixture (type 13)	Plastic	3	18,240
	Fluorescent Lighting Fixture (type 14)	Plastic	38	102,091
	Fluorescent Lighting Fixture (type 15)	Plastic	2	16,553
	Fluorescent Lighting Fixture (type 17)	Plastic	8	7,782
	Fluorescent Lighting Fixture (type 19)	Plastic	3	8,828
	Fluorescent Lighting Fixture (type 20)	Plastic	2	1,642
	Fluorescent Lighting Fixture (type 22)	Plastic	103	4461,334

VAC INVENTORY

IMAGE	CATEGORY	MATERIAL	QUANTITY (PC)	WEIGHT (KG)
	Air Conditioner (type 1, wall mount)	Mixed	12	498,330
	Air Conditioner (type 1, ceiling mount)	Mixed	9	263,939
	Air Conditioner (type 2, ceiling mount)	Mixed	5	52,360
	Convector(type 3, wall mount)	Mixed	52	1737,645
	Air Conditioner (type 4, wall mount)	Mixed	2	46,934
	Air Conditioner (type 5, wall mount)	Mixed	6	151,200
	Air Conditioner (type 6, wall mount)	Mixed	4	27,720
	Air Condenser Unit	Mixed	6	319,410
	HVAC Rectangular Louvered Grille	Mixed	10	14,256
	HVAC Rectangular Louvered Grille	Aluminum	10	0,00053
	Rooftop Unit	Mixed	6	33486,075

HEATING INVENTORY

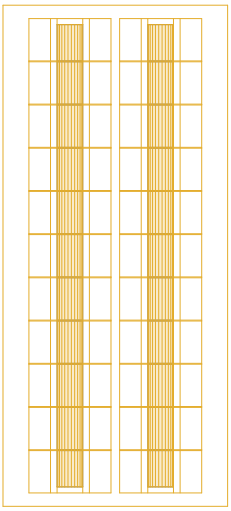
IMAGE	CATEGORY	MATERIAL	QUANTITY (PC)	WEIGHT (KG)
	Radiator (type 1)	Aluminum	**69**	**721.579**
	Radiator (type 2)	Aluminum	**5**	**74.246**
	Radiator (type 3)	Steel	**4**	**139.104**

Radiator

Material	Steel
Quantity	78
Gross Density (kg/m³)	420
Total Surface Area (m²)	4.8
Total Weight (kg)	1471
Total Embodied Carbon (kgCO₂e)	2868

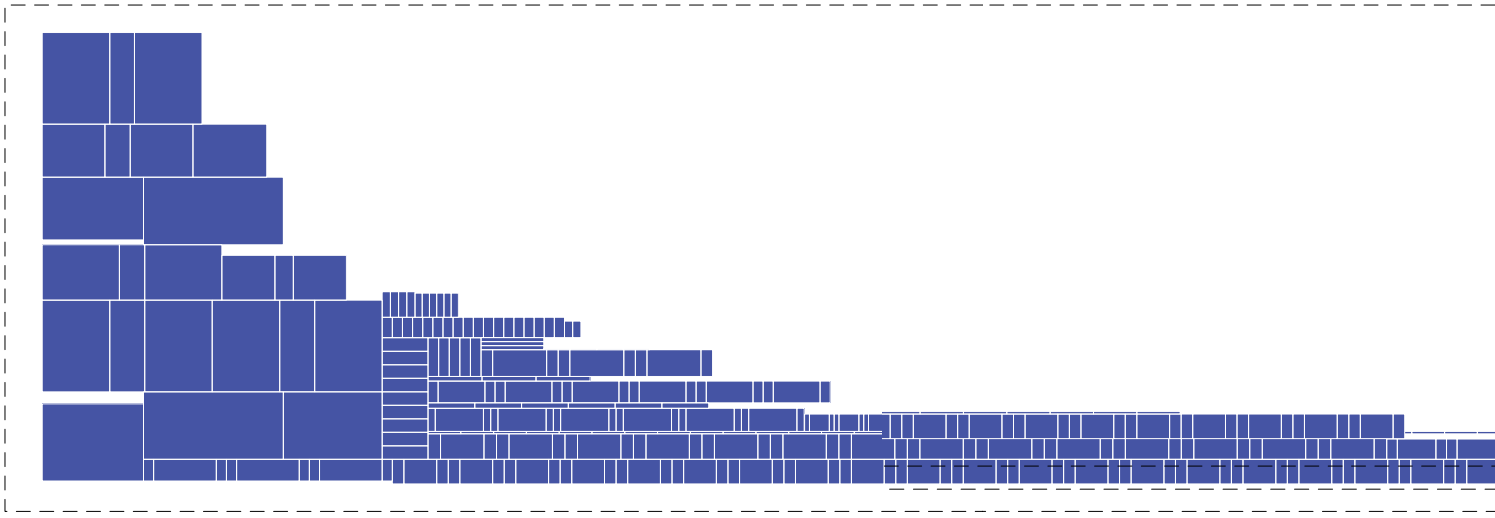
Convector

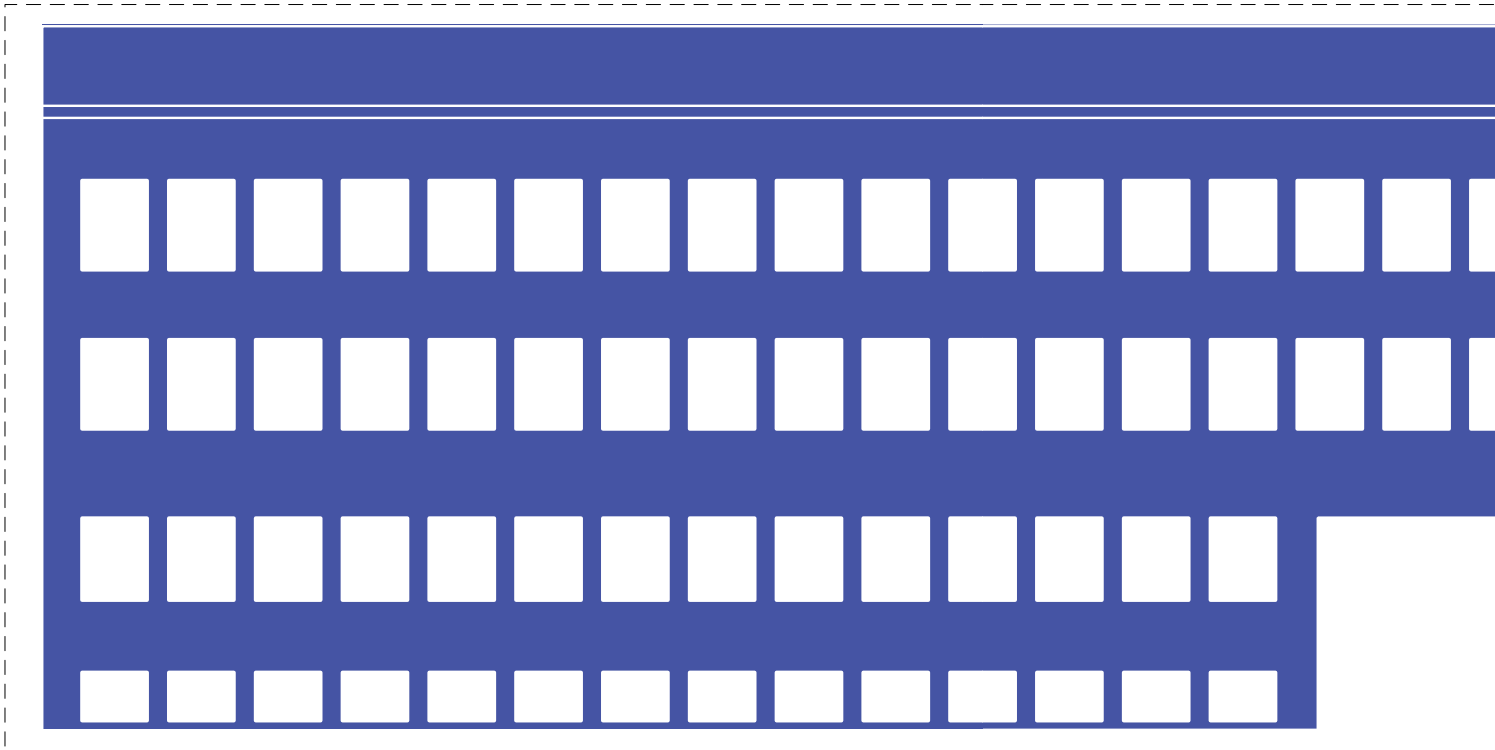
Material	Aluminum
Quantity	85
Gross Density (kg/m³)	350
Total Surface Area (m²)	30
Total Weight (kg)	2778
Total Embodied Carbon (kgCO₂e)	4861

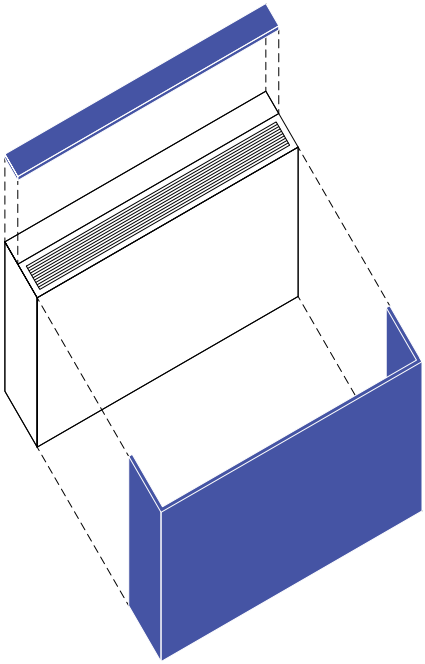


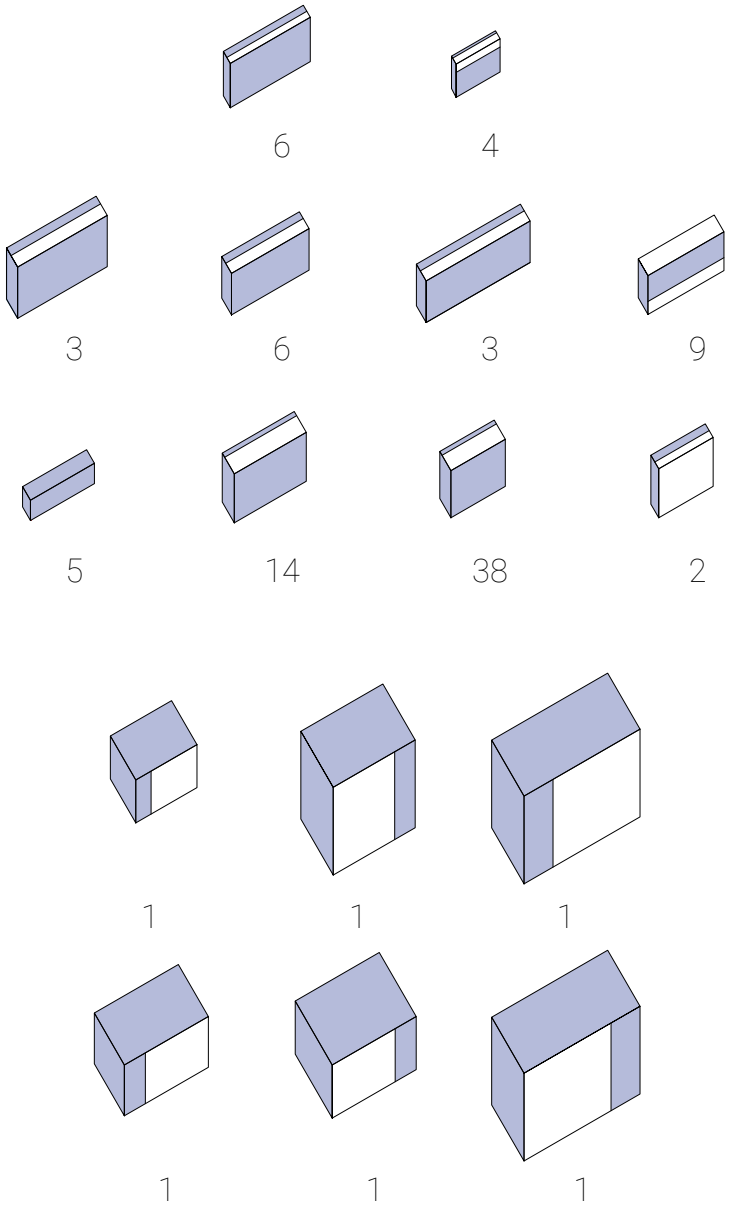
Lighting Fixtures

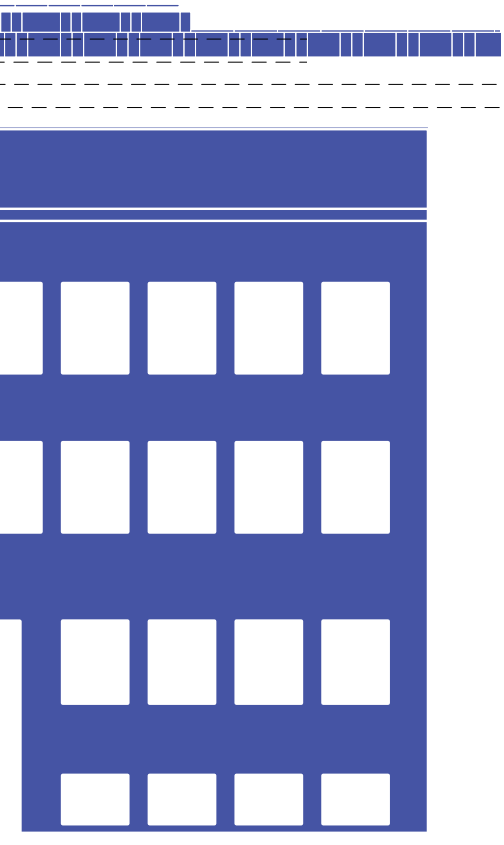
Material	Plastic, Aluminum (Casing)
Quantity	295
Casing Density (kg/m³)	380
Total Surface Area (m²)	75
Total Weight (kg)	2954
Total Embodied Carbon (kgCO₂e)	15,580











Reusing VAC panels

The VACs in the building have a total of 138 square meters of surface area. Of these, 102 square meters are in the form of flat, slab surfaces that are optimal for subsequent processing and recovery. About three-quarters of the cataloged material can thus be reused.

Building’s facade

307 mq

VAC’s panels

102 mq

OVERALL DATA

area

977 m²

lighting and HVAC

embodied carbon

20.445 Kilograms of CO_2

saved from the reuse of lighting and radiators

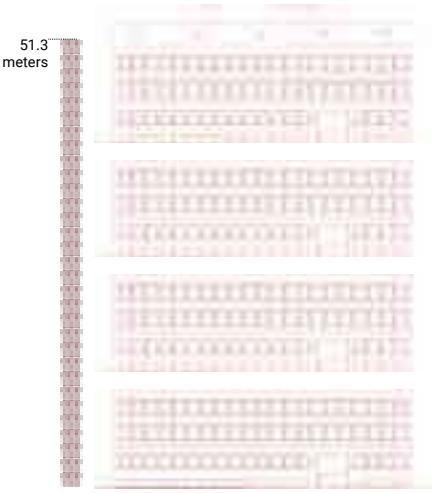
reuse rate

12% Reuseable Material

saved from the air conditioning equipment

7 person / month

The money saved from reusing the existing radiators is 7,362.5€. It is equal to monthly cost of single person livin in Milan approximately 7 months.

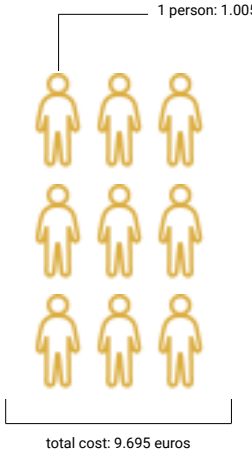


4x building facade height

If we put all the radiators can be reused top of each other, it would reach the height of 51.3 meters

16 roundtrip flights MXP-BRU

The carbon emission saved from reusing the radiators are 2.868 kg CO2e, which is equal to 16 roundtrip flight from Brussels to Milan

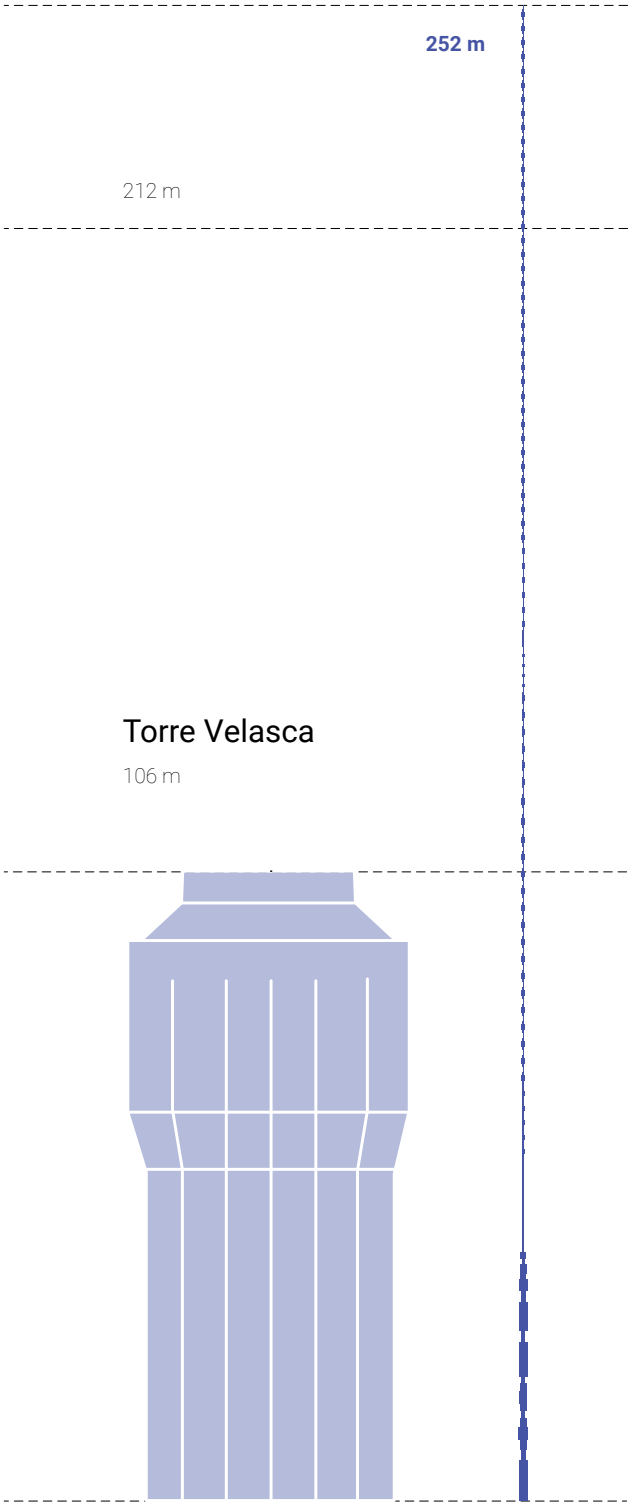


9 person / month

The money saved from reusing the existing lights is equal to 9.695€. It is equal to monthly cost of single person livin in Milan approxiamtely 9 months.

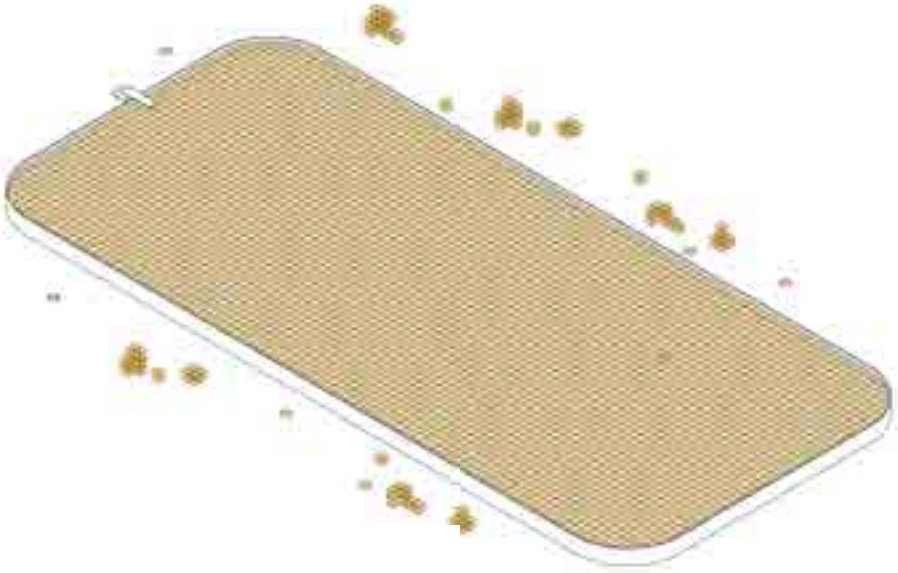
25% of building facade area

The area of the lamps reused at the building can cover quarter of the facade of the project building



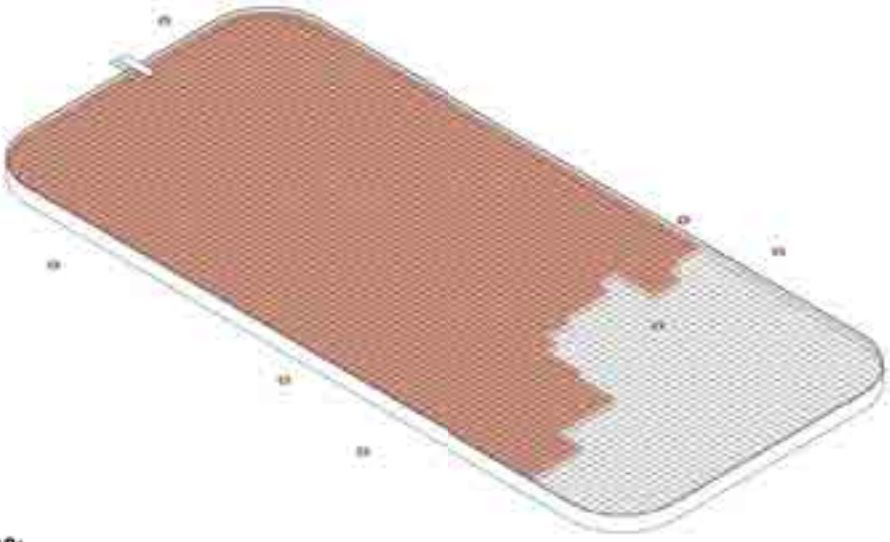
1/3 building's facade surface
2 Torre Velasca

Removing the surface panels of the HVACs allows a surface area equivalent to 1/3 of the building facade to be available for other work.



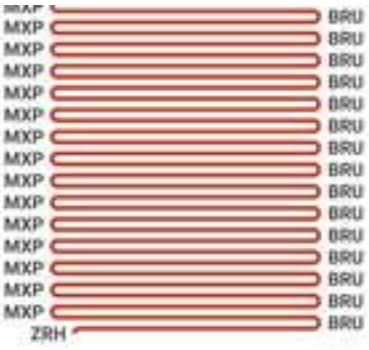
105%

The total lighting capacity of the fixtures onsite covers approximately 105% of the Guido Romano Pool's area.



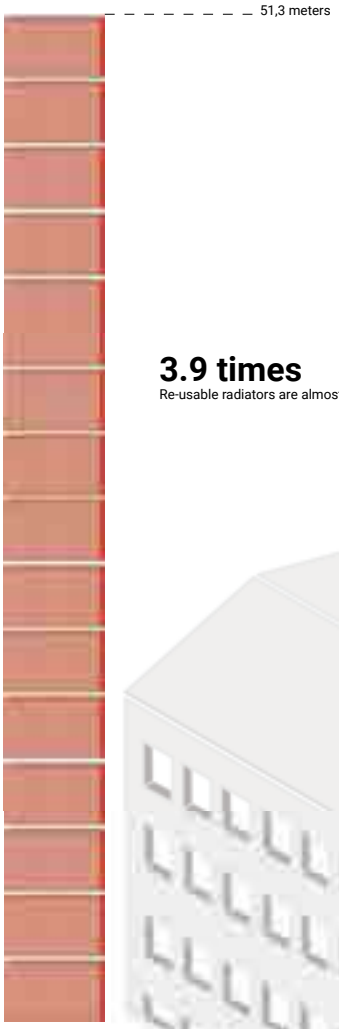
70%

The total heating capacity of the radiators onsite covers around 2,800 m² of space during winter in Milan, about 70% of the Guido Romano Pool's area.

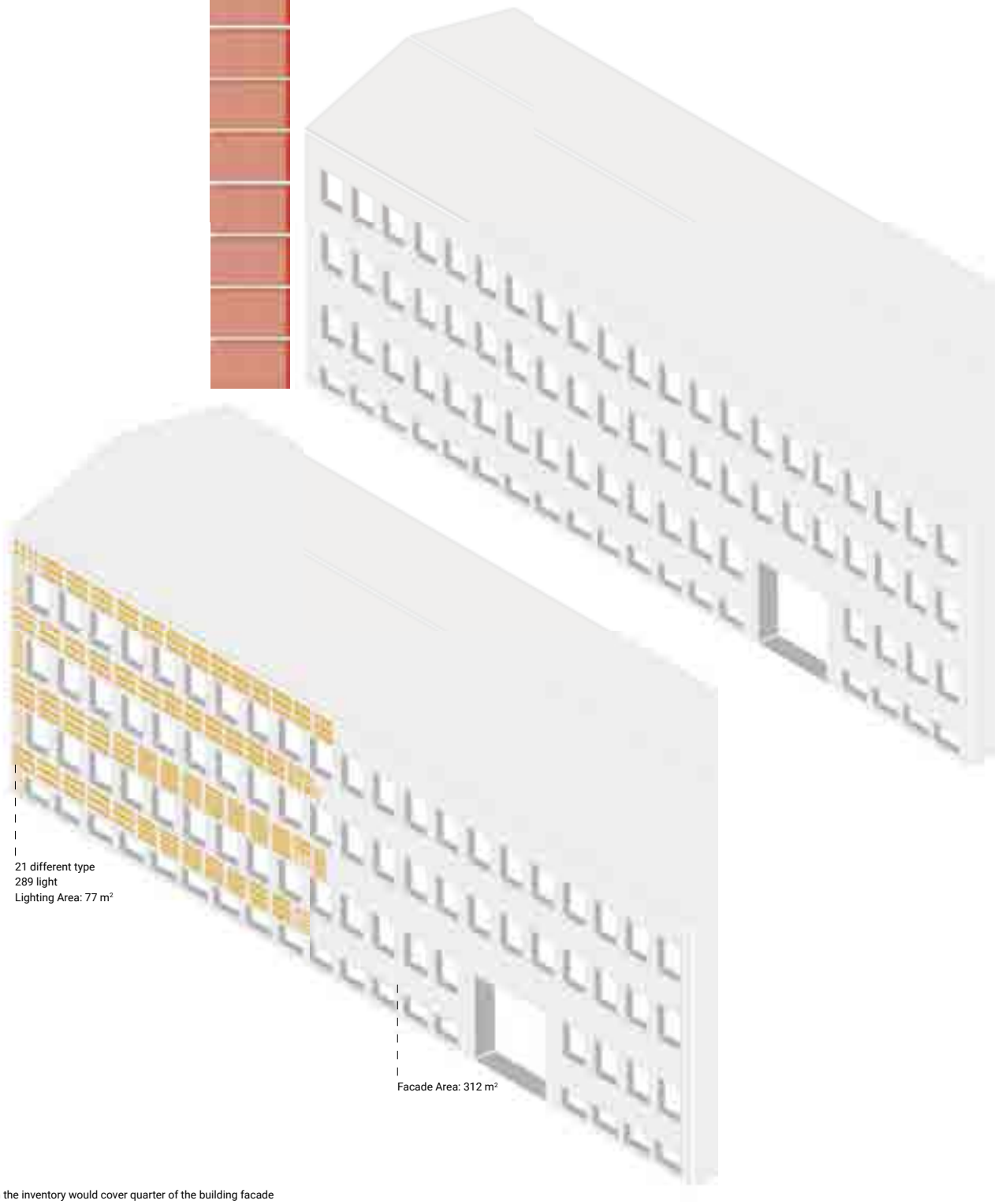


87 Round-Trip Flights

16 Round-Trip Flights



3.9 times
Re-usable radiators are almost 4 times higher than building



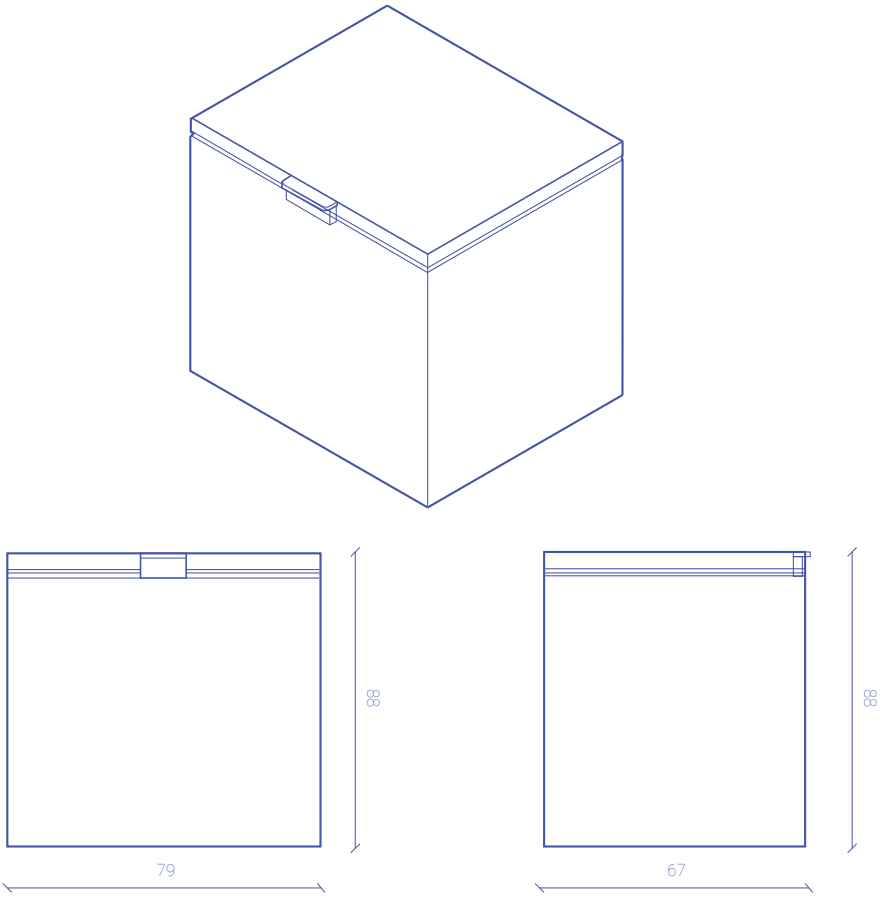
25%
Re-usable lights in the inventory would cover quarter of the building facade

6

06.a / 06.b / 06.c

Sanitary, Hardware & Technical equipements

Francesca Teresa Petrean,
Yujie Han, Wencan Fu



1unit
Lowfrost
Reference Prize: 300 Euro

SANITARY

material

Ceramic

Other material: glass, stainless steel

quantity

50

Sanitary wares in total

embodied carbon

2870 Kilograms

saved from the ceramic reuse

18

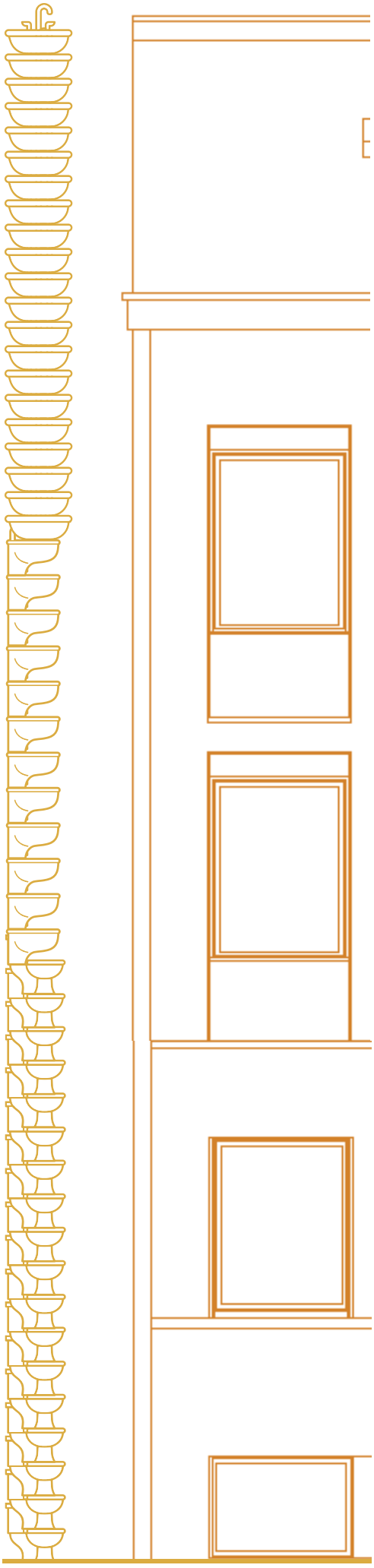
21

18

06.a / Sanitary

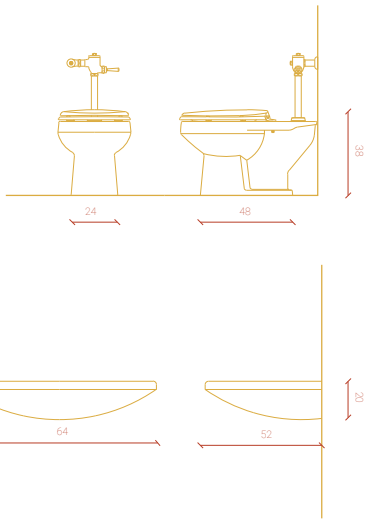
Total height

16m



06.a / Sanitary

Ceramic



1149 kg. The total equivalent weight of all these elements together totals the weight of about 1 Fiat 500 car.

2870 kg CO2. The total equivalent embodied carbon of all these elements together totals the weight of 31 one-way flights from Milan to Brussels for one passenger.

EQUIPMENT

quantity

9

Water Heaters and Freezer could be reuse

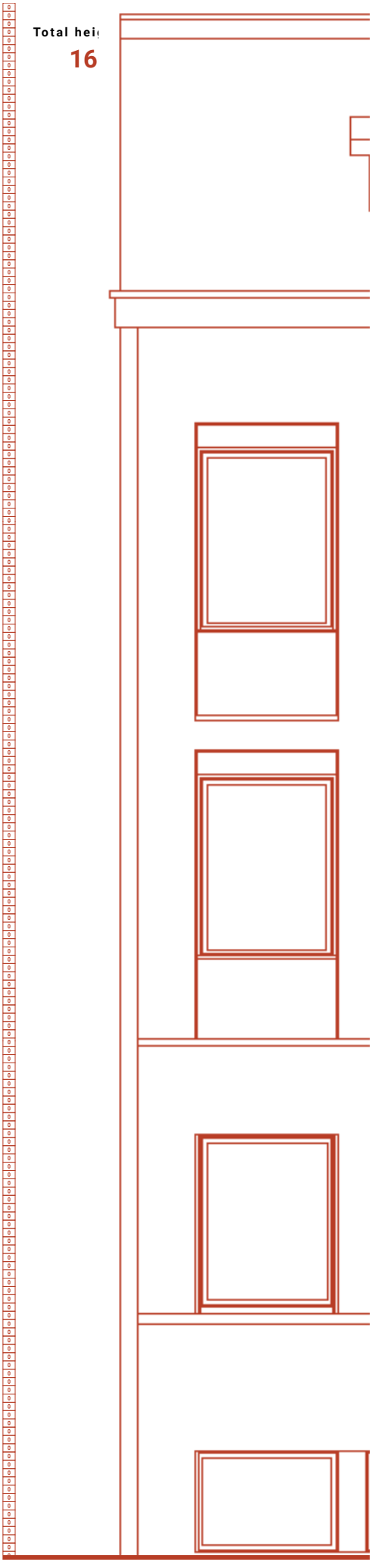
money

3280 euros

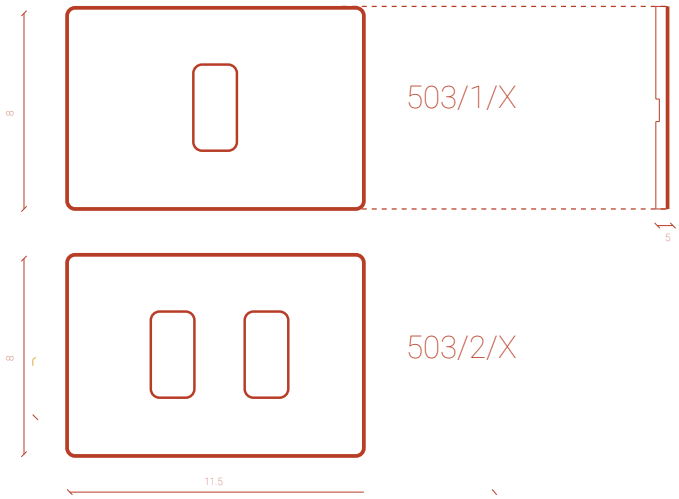
If buy new appliances

Total Area

1.73 m2



06.c / Hardware
Metal



133 kg. The total equivalent weight of all these elements together totals the weight of about 1/10 Fiat 500 car.

380 kg CO2. The total equivalent embodied carbon of all these elements together totals the weight of 4 one-way flights from Milan to Brussels for one passenger.

HARDWARE

material

Aluminum

Other material: steel, plastic, brass

Area

1.73 m2

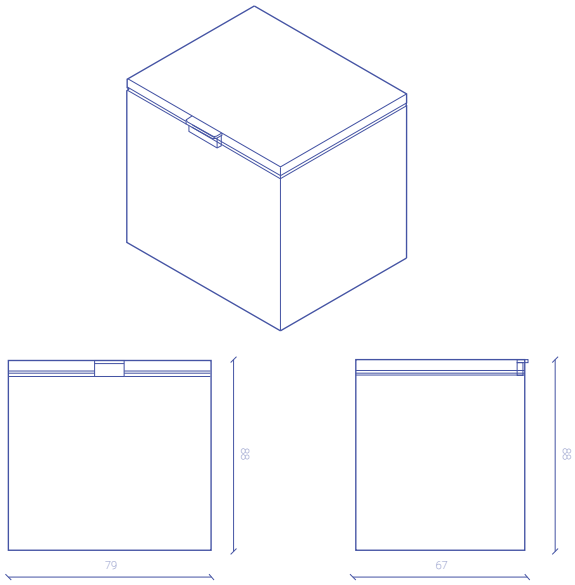
Of aluminum sheet

money

2510 euros

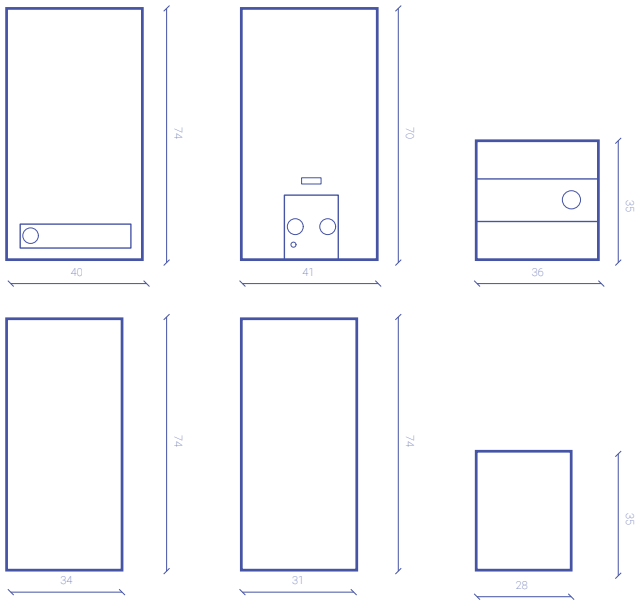
If buy new hardwares

06.b / Equipment
Freezer



1unit
Lowfrost
Reference Prize: 300 Euro

06.b / Equipment
Water heater

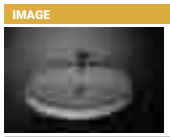
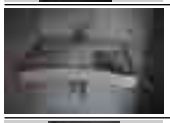


2 units
Mynute
Reference Prize:
670 Euro

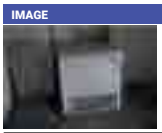
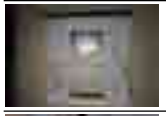
3 units
Valliant
Reference Prize:
500 Euro

3 units
Ariston
Reference Prize:
96 Euro

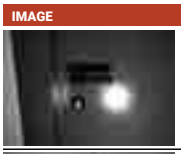
SANITARY EQUIPEMENT INVENTORY

IMAGE	NAME	QUANTITY	REUSE	CONDITION
	SINK	19	RESELL BIRDBATHS PLANTERS	☆☆☆
	TOILET	16	RESELL BIRDBATHS PLANTERS	☆☆☆
	BIDET	11	RESELL BIRDBATHS PLANTERS	☆☆☆
	ACCESSIBLE SINK	2	RESELL BIRDBATHS PLANTERS	☆☆
	ACCESSIBLE TOILET	2	RESELL BIRDBATHS PLANTERS	☆☆
	MIRROR	4	RESELL DECORATION	☆☆
	FRAMED MIRROR	2	RESELL DECORATION	☆☆☆
	FAUCET	32	RESELL	☆☆☆

TECHNICAL EQUIPEMENT INVENTORY

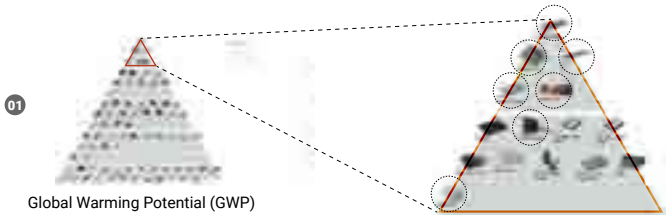
IMAGE	NAME	QUANTITY	REUSE	CONDITION
	FREEZER	1	RESELL	☆☆
	TELEPHONE	3	RESELL	☆☆
	WATER HEATER	8	RESELL	☆☆☆
	THERMOSTAT	8	RESELL	☆☆
	FRIDGE	1	RESELL	☆☆
	ELECTRICITY CABLES	N.D.	RESELL EXTENTION CORDS DIY PROJECTS	☆☆

HARDWARE INVENTORY

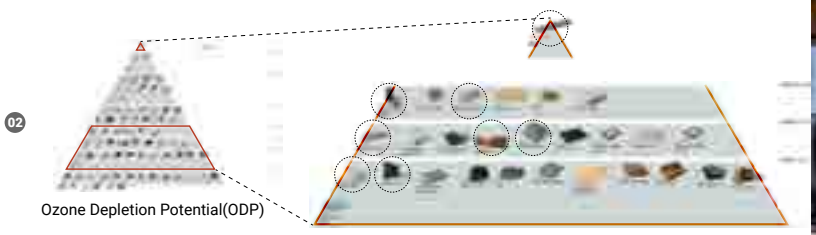
IMAGE	NAME	QUANTITY	REUSE	CONDITION
	DOOR KNOB	285	RESELL	☆☆
	PLATES CONNECTOR	200	RESELL	☆☆☆
	SHELF BRACKET	4	RESELL	☆☆☆
	WINDOW KNOB	387	RESELL	☆☆☆
	SWITCH COVER PLATE	188	RESELL	☆☆☆
	LIGHT FIXTURE	2	RESELL	☆☆
	CABINET HINGE	8	RESELL	☆☆☆

ENVIRONMENTAL VALUE

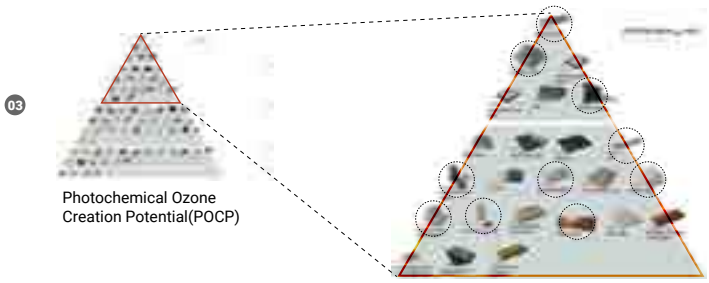
THE CONSTRUCTION MATERIAL PYRAMID
REUSE OR WASTE?



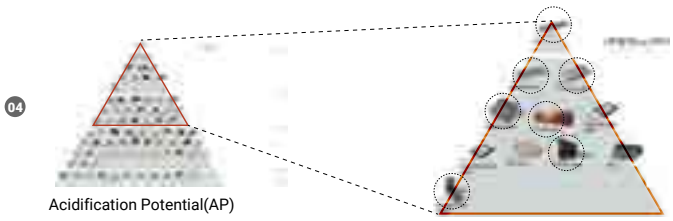
01 Global Warming Potential (GWP)



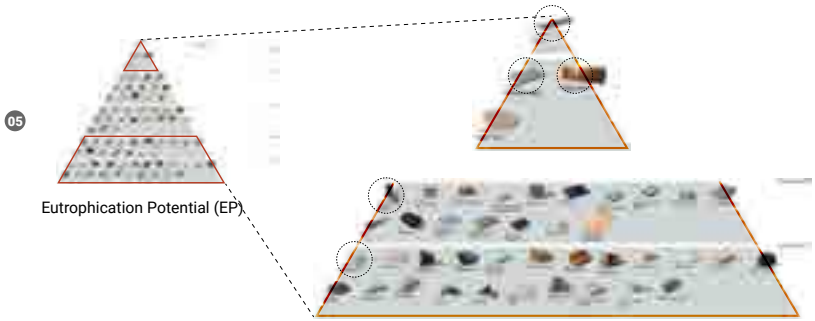
02 Ozone Depletion Potential(ODP)



03 Photochemical Ozone Creation Potential(POCP)



04 Acidification Potential(AP)



05 Eutrophication Potential (EP)

Risks, possibilities and advantages of the recycling and reuse of building material types.

Type of Material	Risks Related to Building Material Remainders	Possibilities and Advantages Related to the Reuse of Recycled Material
Ceramics	•Generation of additional waste, occupying a large area of land. •Waste that poses a potential risk of physical damage during the organization of people's work in storage and deposition.	•Reuse as fine aggregate and as a substitute for cement in concrete mixes. • Covering material on façades and internal walls. • Flooring material inside buildings and in urban spaces.
Metal	•Long-term storage poses arisk to the environment due to chemical decomposition, which can be a threat to soil and climate.	• Due to the specificity of the material, a large percentage can be transformed into reused building elements. • Self-compacting concrete ingredient.

Based on materials in topics (sanitary, hardware, equipment, etc.)

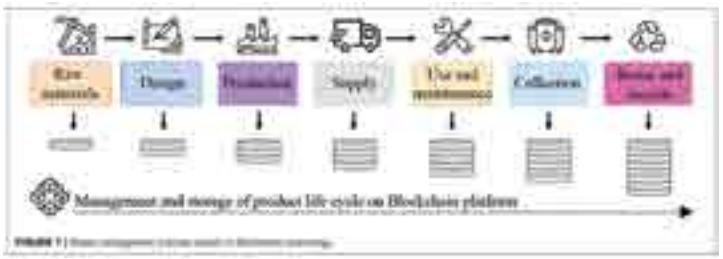
PROPOSAL

Source: ORIGINAL RESEARCH published: 20 November 2020 doi: 10.3389/frerg.2020.576462, Digital Transition and Waste Management in Architecture, Engineering, Construction, and Operations Industry.

The waste hierarchy pyramid (Figure 3) is divided into different level of WM strategy (EPA, US Environmental Protection Agency):
• Avoidance: the highest priority strategy to adopt in the design phase in order to reduce the amount of waste generated, in a construction project waste generation must be avoided or reduced during the preliminary phases of planning and design.

• Reducing source use, reuse, recovery: reuse, recycling, reprocessing and energy recovery strategies must be the second priority in the design phase. Designers should consider the use of construction technologies with a high level of reusability such as prefabricated and off-site products and the use of materials with a high percentage of recycled materials.

• Disposal: waste hierarchy recognizes that some types of waste, such as hazardous chemicals or asbestos, cannot be safely recycled and direct treatment or disposal is the most appropriate management option.



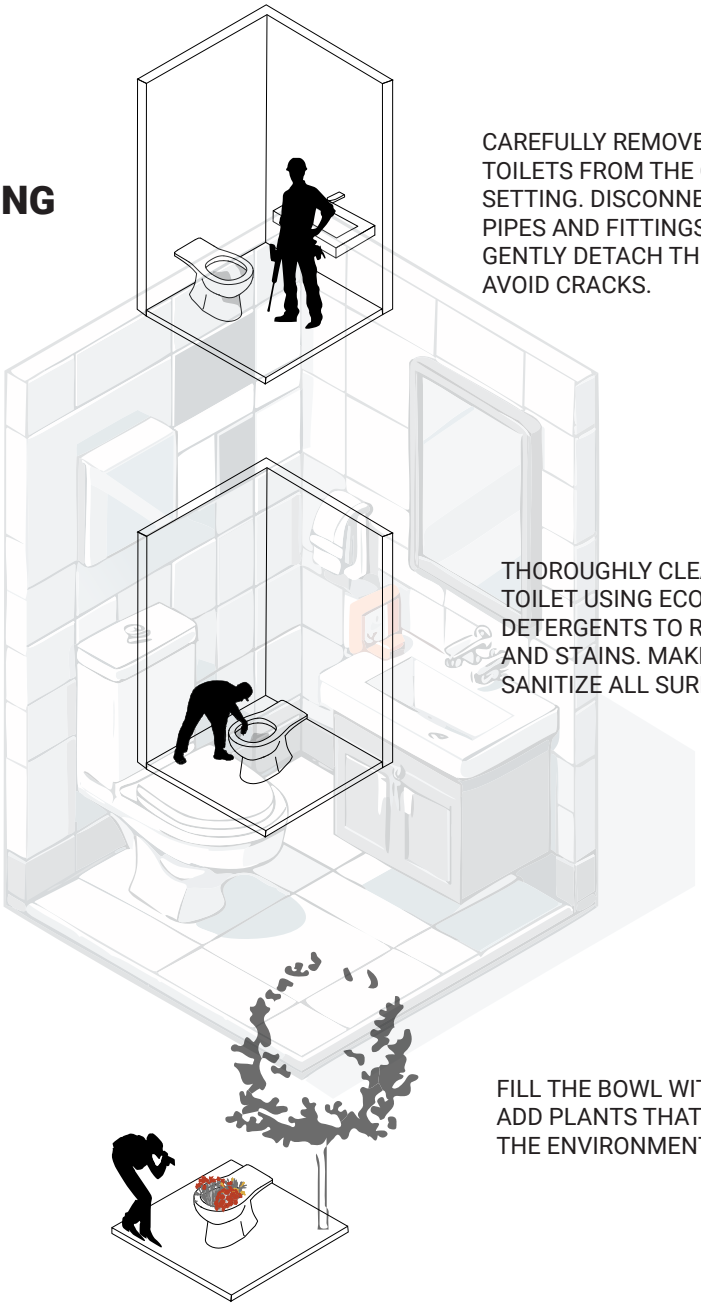
Blockchain as an Enabler for Waste Management Optimization.

A horizontal integration would allow to trace the entire life cycle of the product used during construction until its reduction to the state of waste would extend the radius of the circular economy, ensuring evidence from the design phase until the waste of construction and demolition. The latter integration is fundamental to support an efficient development of a green procurement based on a Blockchainbased BIM process through which is possible to track the product right from its raw material phase to the end of its life, such as recycle or reuse (Figure 7). The tracking of items from supplier to customer is characterized by all the information about the processing, the location and the quality of the items, giving a transparent development of the process and improving its control.

PROCEDURE

DISMANTLING

CAREFULLY REMOVE THE TOILETS FROM THE ORIGINAL SETTING. DISCONNECT WATER PIPES AND FITTINGS AND GENTLY DETACH THEM TO AVOID CRACKS.

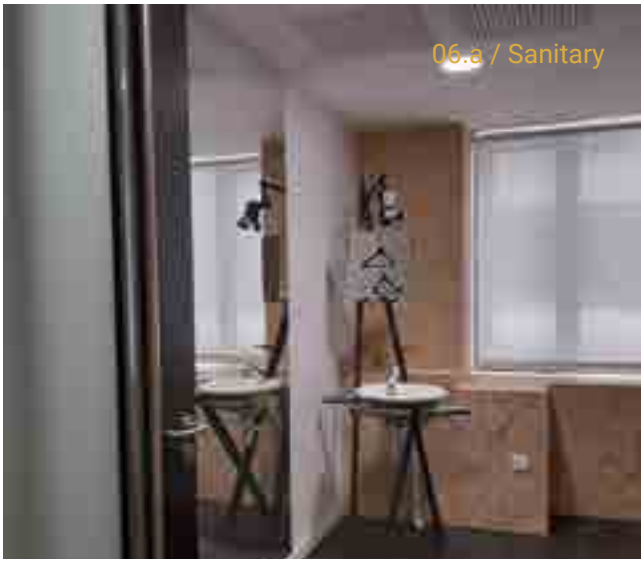


CLEANING

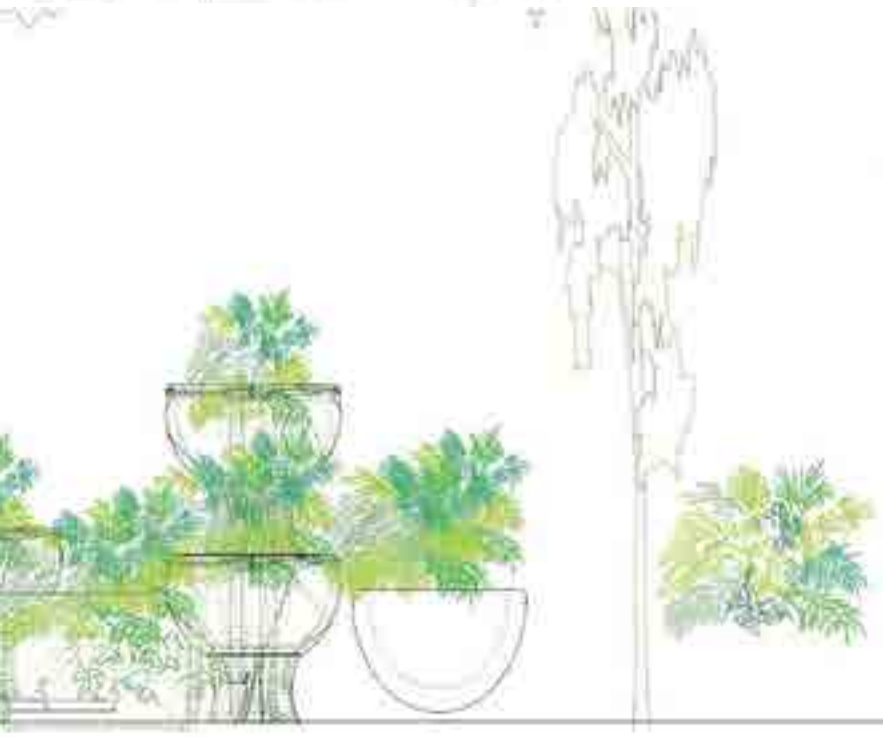
THOROUGHLY CLEAN THE TOILET USING ECO-FRIENDLY DETERGENTS TO REMOVE DIRT AND STAINS. MAKE SURE TO SANITIZE ALL SURFACES.

SETTING

FILL THE BOWL WITH SOIL AND ADD PLANTS THAT THRIVE IN THE ENVIRONMENT.



REUSE PROPOSAL



7.a

Final Exhibition

Viale Stelvio 13, (Ex- Olsa)

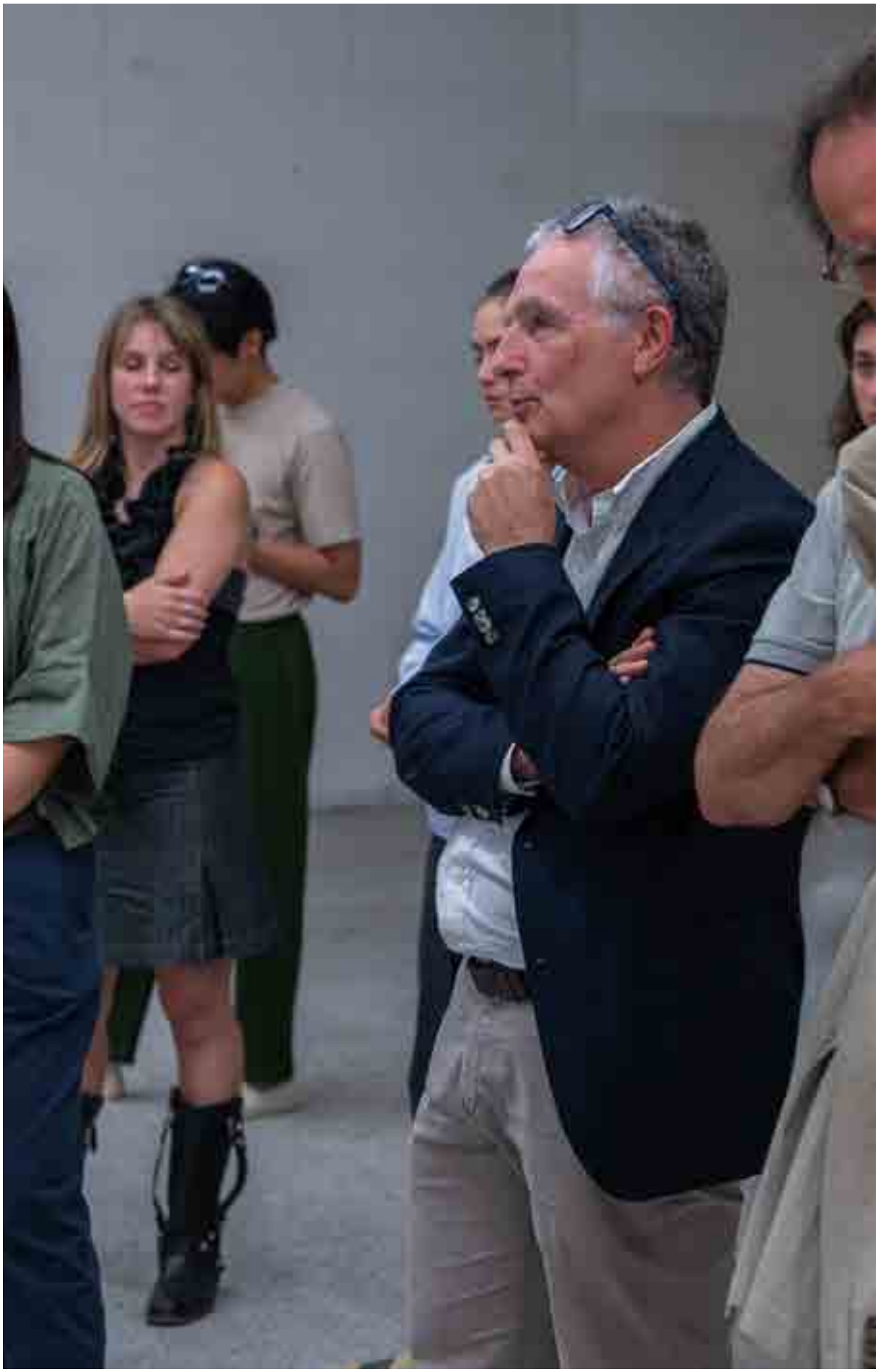
A series of Photographs taken by Pierluigi Gazzoli from the exhibition.

The students exhibited their work in one of the several abandoned buildings on the site, curating an exhibition from the very materials they surveyed and collected.

11.09.2024

Géraldine Durieux and Gaspard Geerts, *ROTOR*

(Photograph by Maria Castro)



Andrea Campioli, *Dean of the School of Architecture Urban Planning Construction Engineering*

Giancarlo Floridi *(ONSITESTUDIO)*

Special credits to:

Andrea Campioli, *Dean of the School of Architecture Urban Planning Construction Engineering*
Cristina Agazzi, *Office of the Dean of AUIC School*
Pierre-Alain Croset, *Director Advanced School of Architecture (ASA)*
Géraldine Durieux and Gaspard Geerts, *ROTOR*
Heidari Afshari, *Teaching assistant ASA*

The students of ASA, Lan Wang, Maria Gabriela Castro, Sonja Sigrid Losonci-Johnson, Hannah Novotny, Andrea Filiberti, Maria Caridad Pineda Fernandez De Cordova, Nils Van Der Velden, Shoshana Davida Zimmermann, Alessandro Mocci, Arianna Allegri, Valeria Ragagnin, Francesca Teresa Petrean, Valeria Chtcherbatova, Yujie Han, Teodora Misirkic, Gizem Bilgili, Alessandro Migliorati, Wencan Fu, Olimpia Li, Claudia Xu.

Laura Nigro, *KERVIS*
Angelo Lunati and Giancarlo Floridi, *ONSITESTUDIO*
Pierluigi Gazzoli, *photographer*