



MODULAR



SAHAR GOLCHIN FAR

Architectural engineering studio: P5 presentation

Mentors: Mo smit, Marcel Bilow, Bob Geldermans

Causes of Housing Shortage



Population increase

The Netherlands has become home to lots of international students and expats over the past decade. (Randstad)



lack of free space

Agricultural space takes up 53 percent of the Netherlands.



Nitrogen Regulations

New nitrogen regulations and the PFAS standards imposed by the government



shortage of construction workers

one-fifth of construction companies have needed to refuse an order as a result of staff shortages.



Problem

Current

331000 homes are Needed.
4.2 % shortage in the Dutch housing stock.



Implications: High prices



Low-income earners
Middle-income earners



The Netherlands
314.000 euros



Amsterdam
500.000 euros



Action

Current

331000 homes are Needed.
4.2 % shortage in the Dutch housing stock.

By 2030

845,000 homes need to be built by 2030.

Amsterdam plans

Amsterdam plans to build more than 52.500 homes by the end of 2025.



40 percent will be social housing



40 percent will be mid-priced



20 percent will be expensive rentals and sale properties.





AFFORDABLE HOUSING

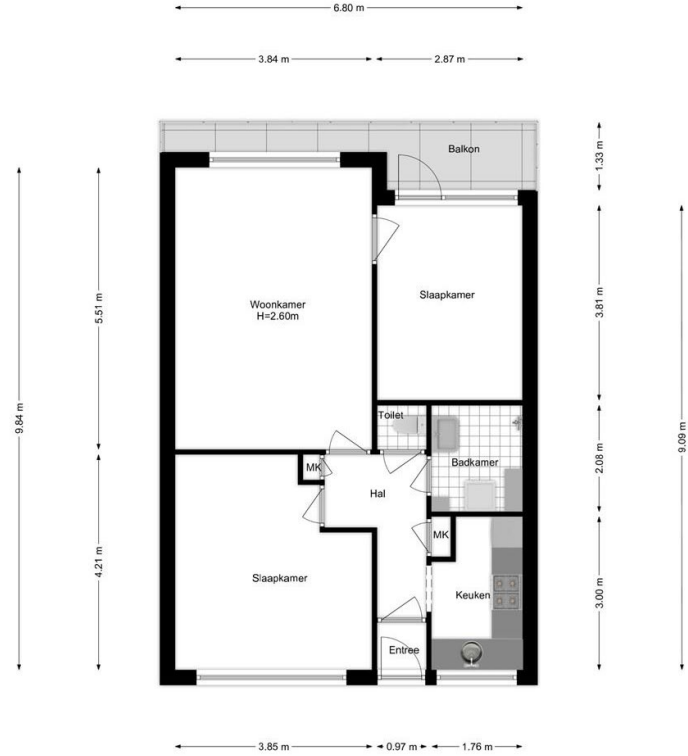


Excessive Repetition In : façades and volumes





Plan organization and types





Lack of social meeting spaces



Lack of green integration



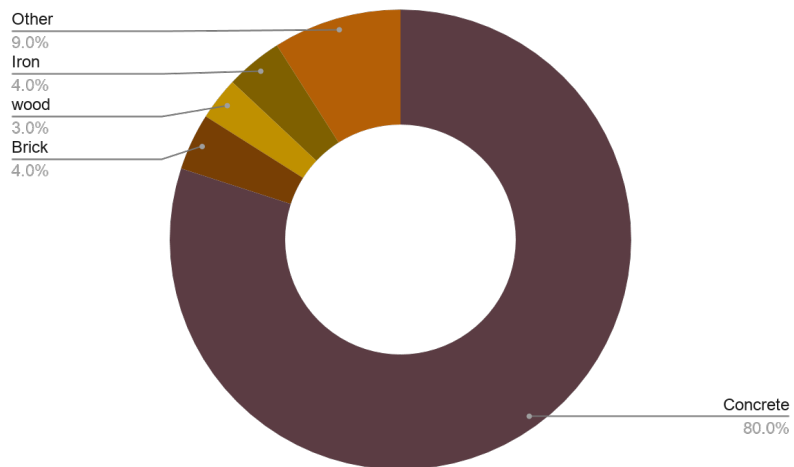


Use of energy and resources





Materiality: Concrete and Brick



Quality of affordable housing



Excessive Repetition In : façades and volumes



Plan organizations and types



Lack of social meeting spaces



Lack of green integration



Waste of energy and resources



Materiality : Brick and concrete



Quality of affordable housing



Façades and volumes



Plan organizations and types



Social meeting spaces



Green integration



Use of energy and natural resources



Materiality



Quality of affordable housing

Lively environments



Façades and volumes



Plan organizations and types



Social meeting spaces



Green integration



Use of energy and natural resources



Materiality

Circular use of resources

Quality of affordable housing



Façades and volumes



Plan organizations and types



Social meeting spaces



Green integration



Use of energy and natural resources



Materiality





Timber



CO2 storage



Healthy indoors environment



Lightweight for transport



Ease of reuse



Material costs

LVL skeleton

Smith et al. (2009)

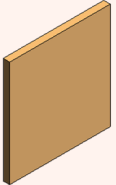
6% more expensive



CLT

Fanella (2018) , Solid timber NL

16 to 29 % more expensive



Concrete



Prefabrication



Prefabrication



Speed up the production and design



Fewer construction workers needed



Eliminates a multitude of subcontractors' marginal fees

→ Cost reduction



Prefabrication



Produce higher quality products



Safer work environment



Less disturbance and traffic



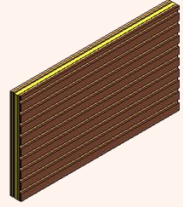
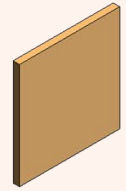
Prefab levels



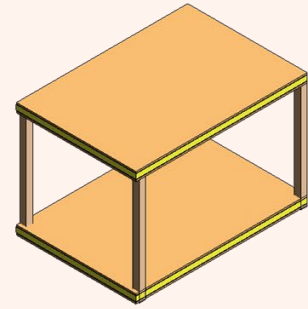
Material



Components



Panels



Modules



Modules



Skeleton modules (LVL or Glulam)

- Sustainer homes
- Modulin
- Pattern buildings



CLT modules

- Finch buildings
- HoutKern ModuleBD6



2017 Sauerbruch Hütte Hamburg



2020- DP6 architectuurstudio



Sustainer homes



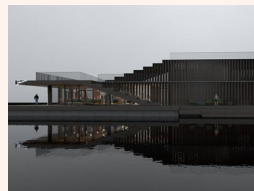
Spain Student housing



2015- PPA architecture France



Finch buildings



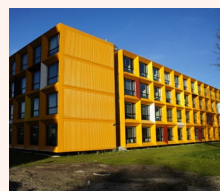
Pattern buildings



2018 Amsterdam SE Jansel



2017- Karmijn- Demeeuw



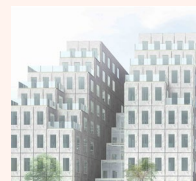
2016- plegt-vos



2020- SeARCH Rotterdam



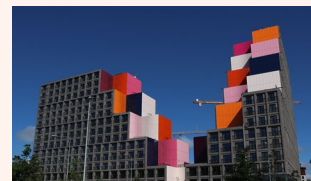
2010 Philadelphia



2015- India pod hotel



Hotel Brooklyn Garrison architects



Hotel Brooklyn Garrison architects



2015- Refugee Accommodation DE



2016- Wohnen 500- AT



2015- Residential complex FI



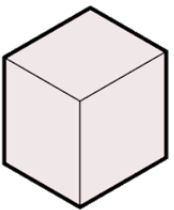
2015- Residential NO



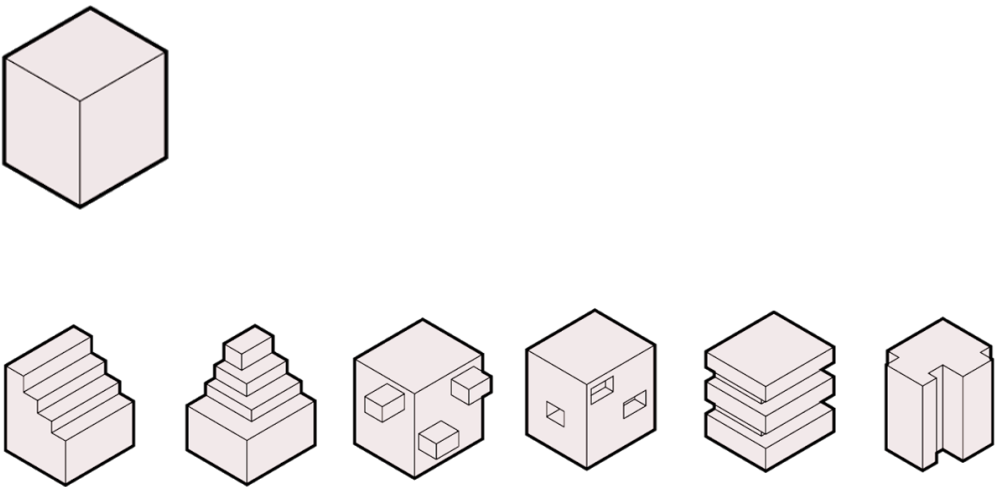
AEMSEN

Cases for modules

Intermediate Volume Variation

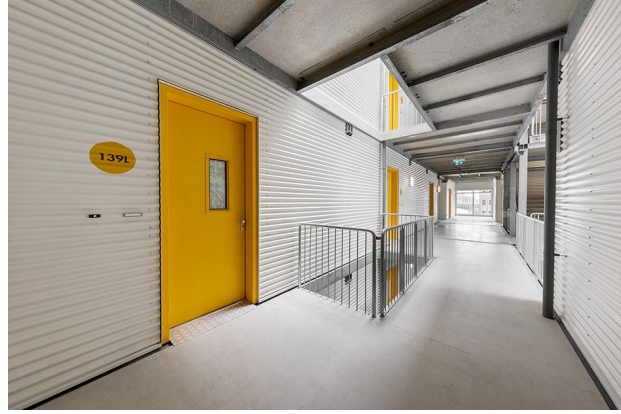


Intermediate Volume Variation





Facade



Circulation



Circulation



Studios



+ Single function or housing type



Family housing



Unit plans

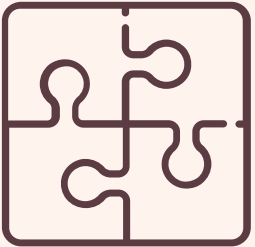


MODULAR HABITAT

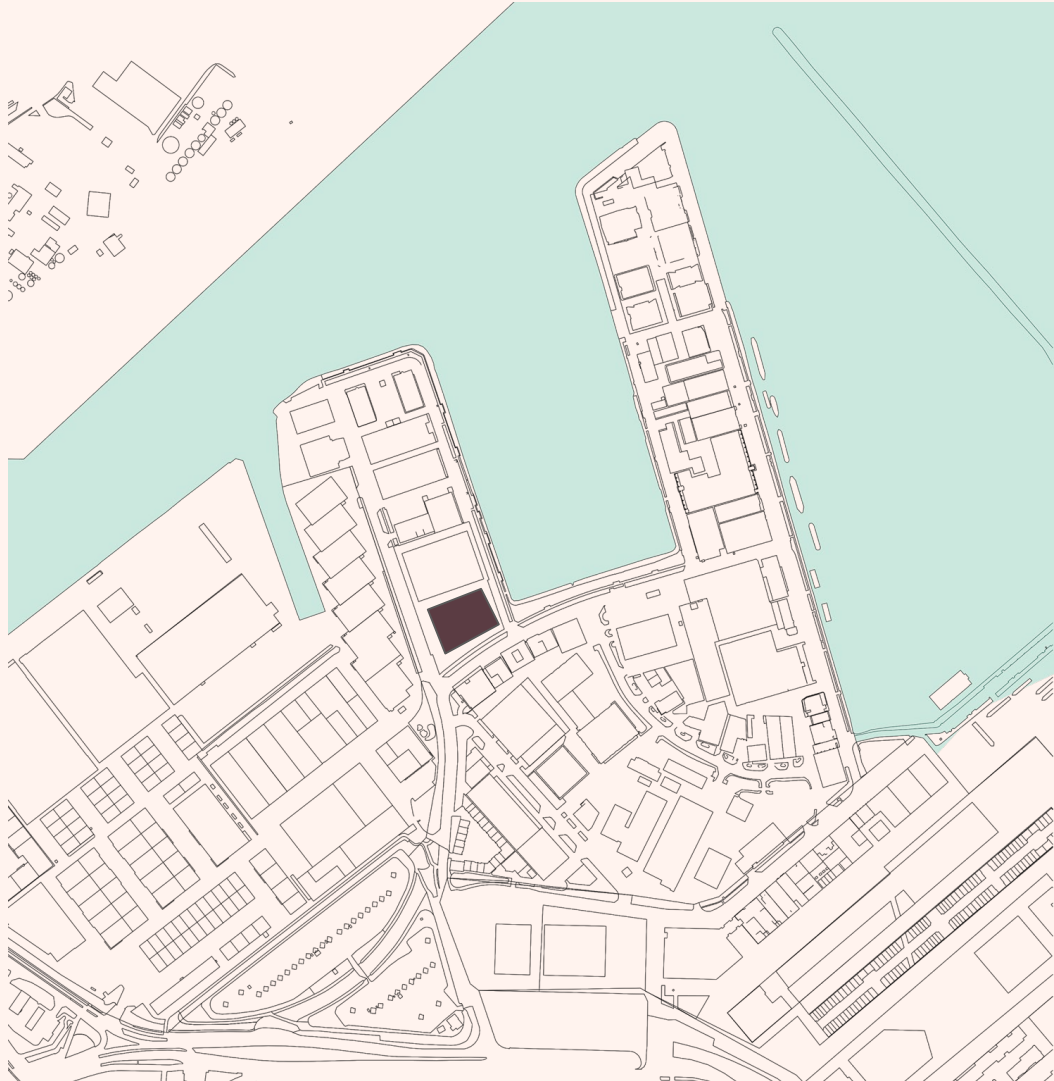
Affordable

Circular

Lively



DESIGN
OBJECTIVE



Minervahaven

Offices and residential
A part of wood transport harbours
Not more than 8 floors

The Design





Facade





Ground floor





Green house

Green house



Ground floor



Ground floor

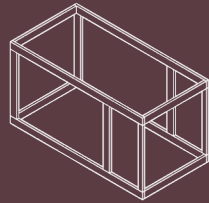




Galleries



Meeting point



SYSTEM DEVELOPMENT

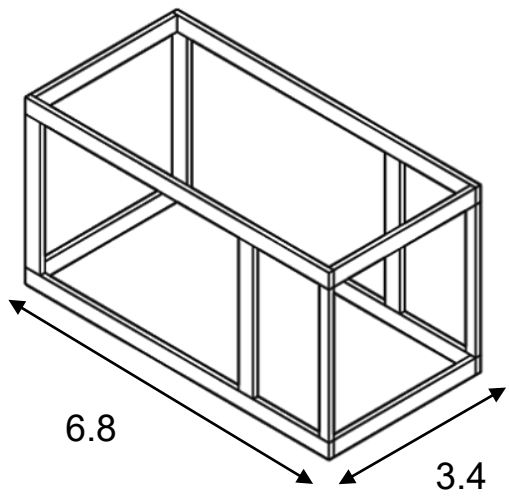
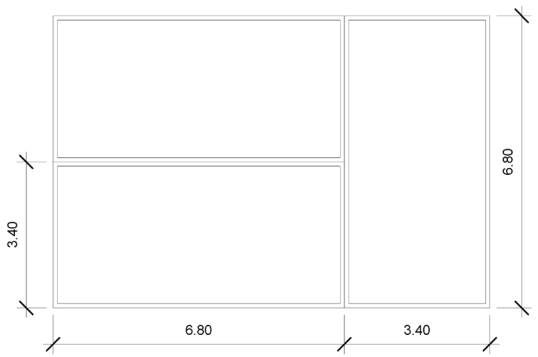
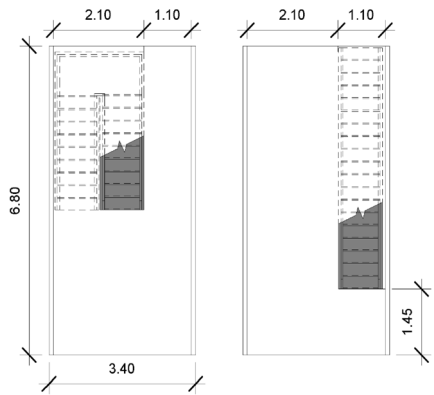


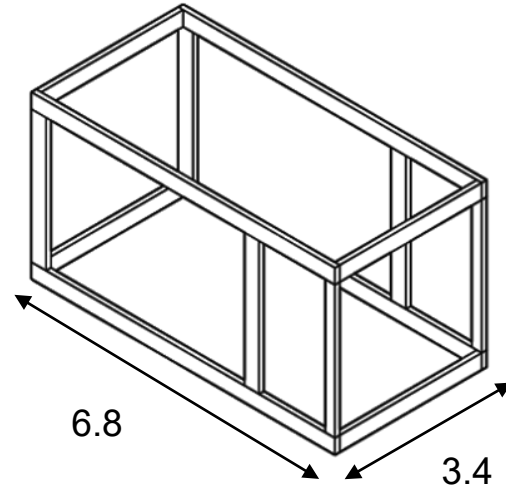
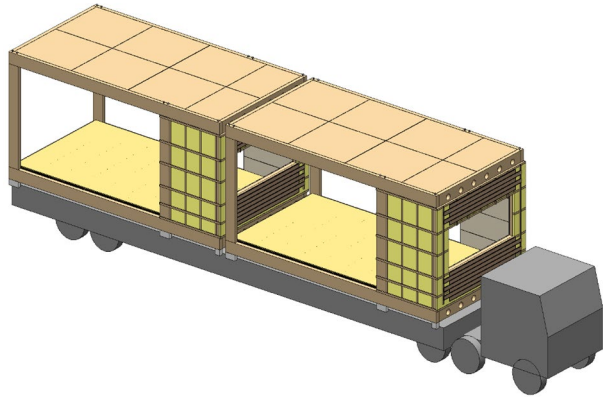
Modules

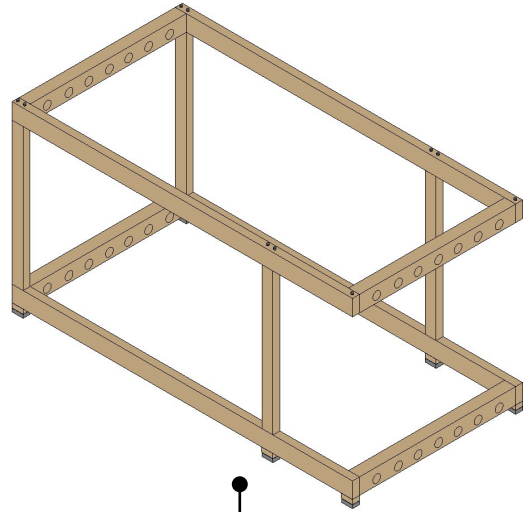


Skeleton modules (LVL or Glulam)



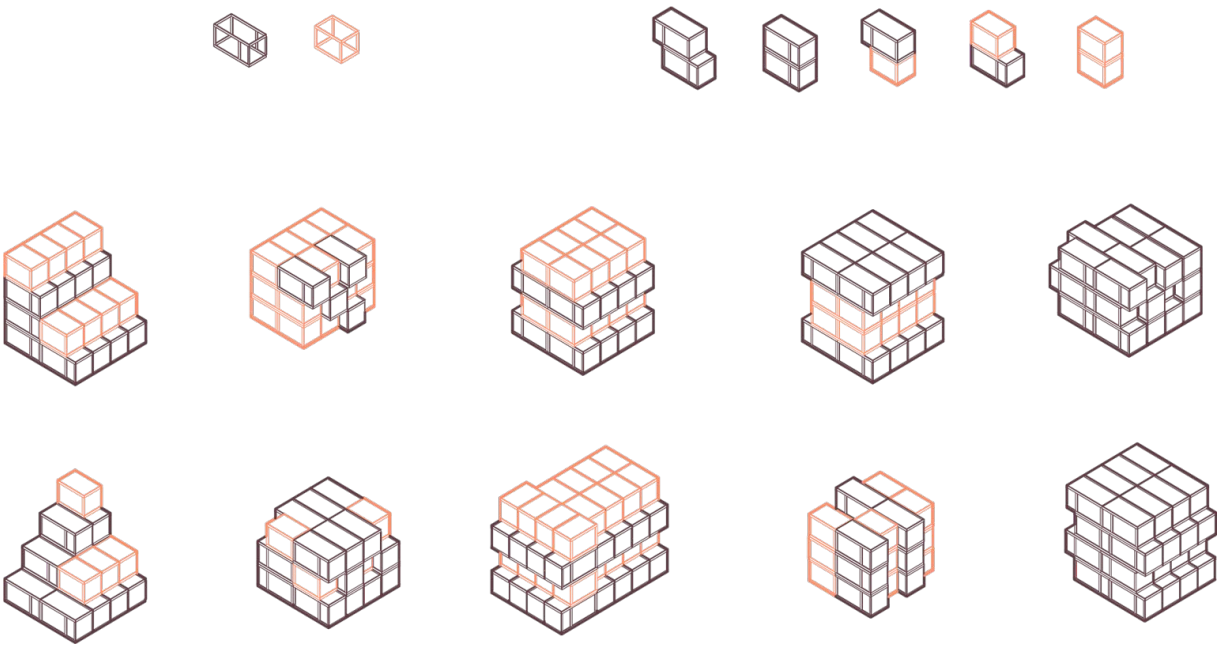






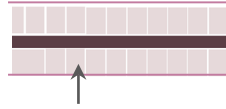
●
|
Column at $\frac{1}{4}$

Additional module



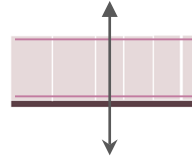
Layouts

Corridor



- Cross ventilation
- Only one sided view
- Long boring corridor

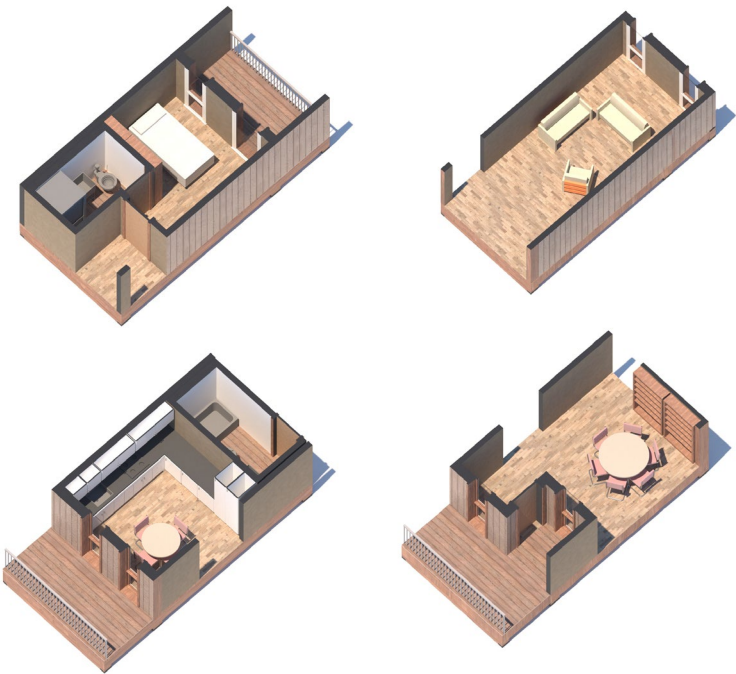
Gallery



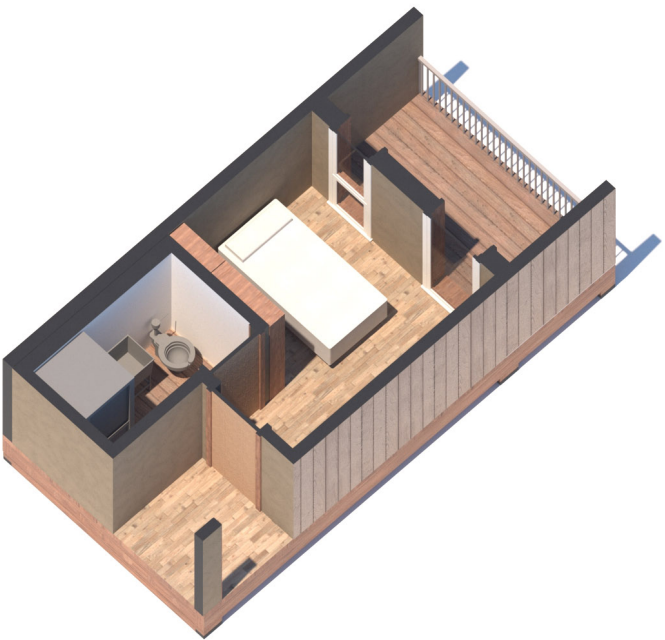
- + Cross ventilation
- + Two sides of views
- + Galleries with outside view



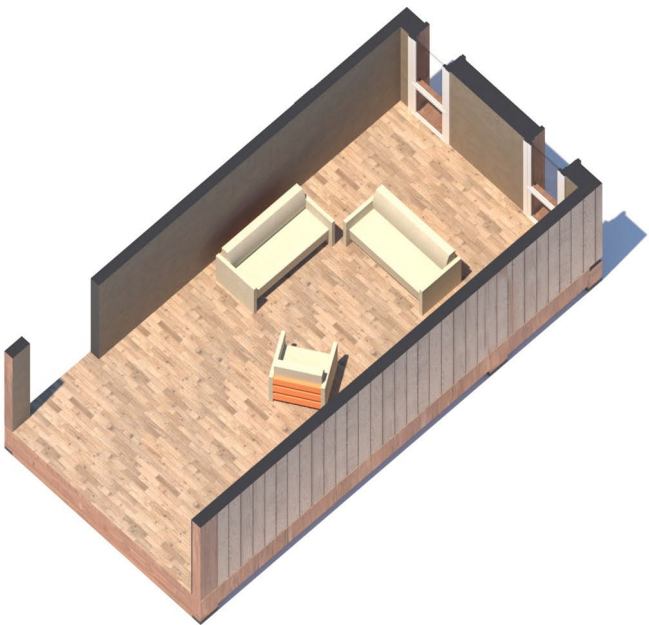
Module types



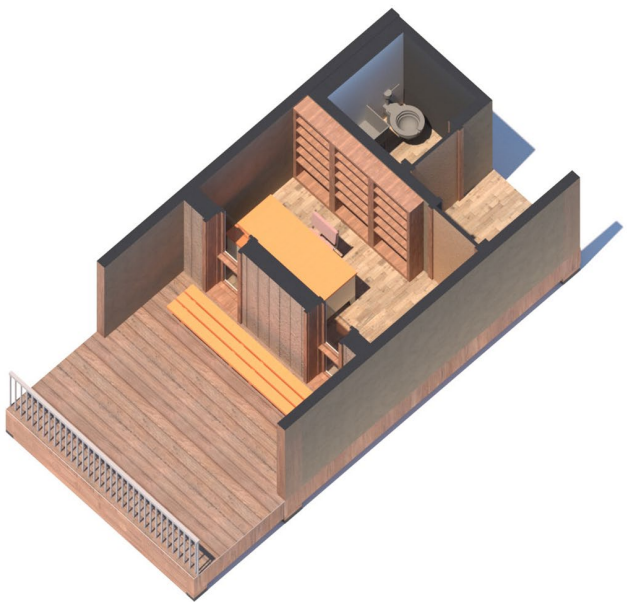
Bedroom



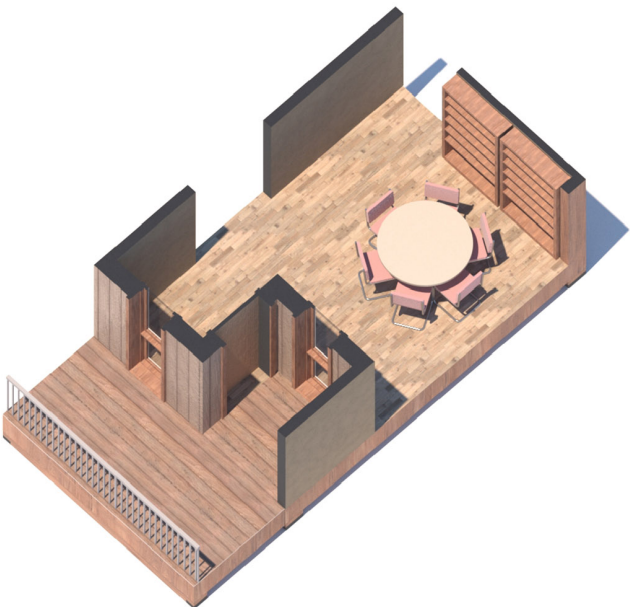
Living room



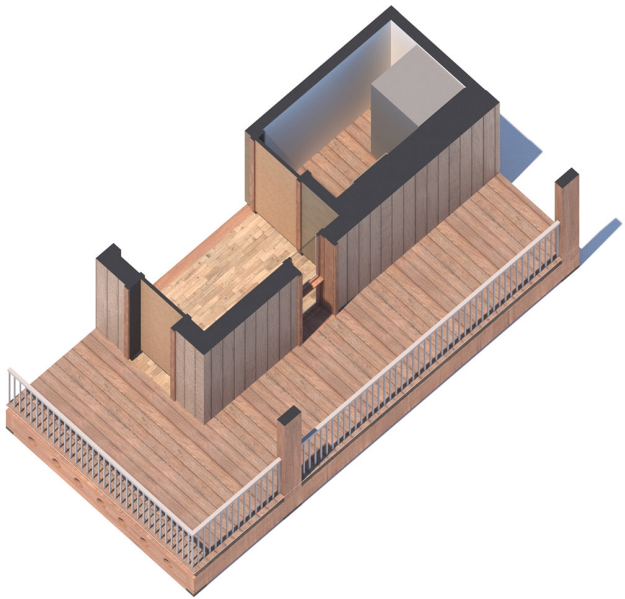
Kitechen



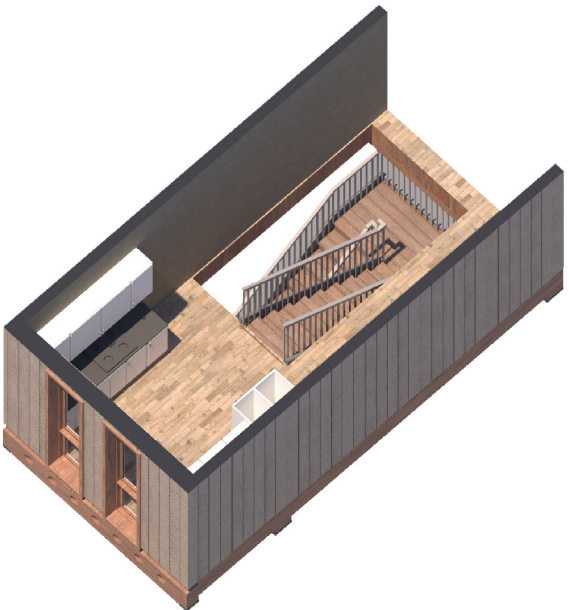
Next to the gallery



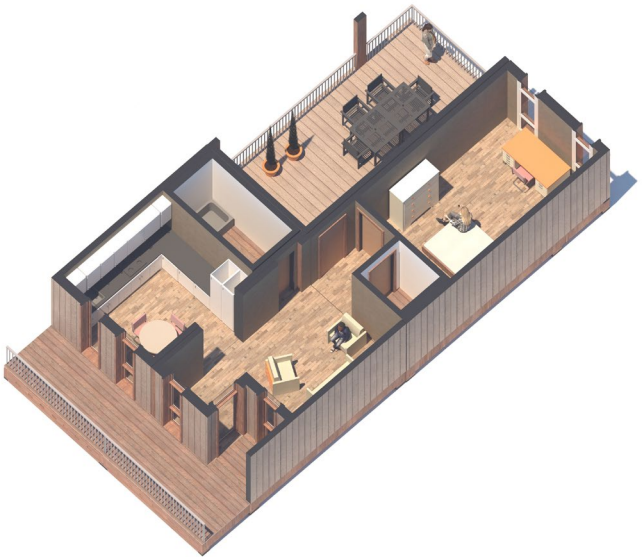
Side balcony



Stairs for duplexes



Combinations



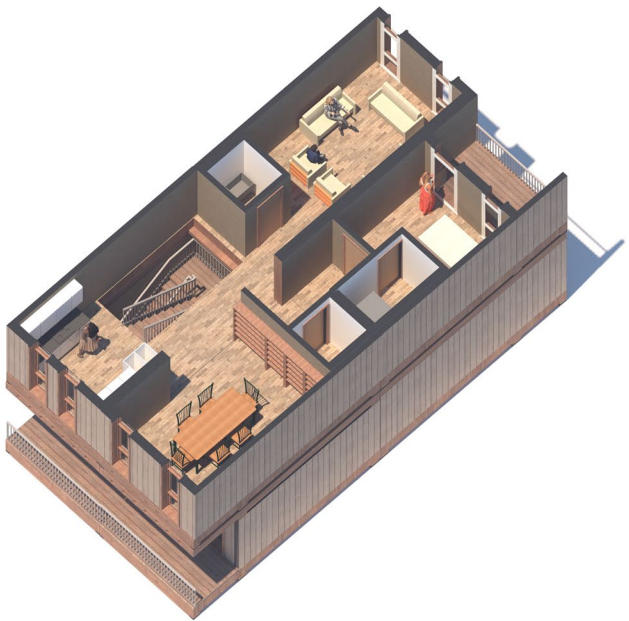
Combinations

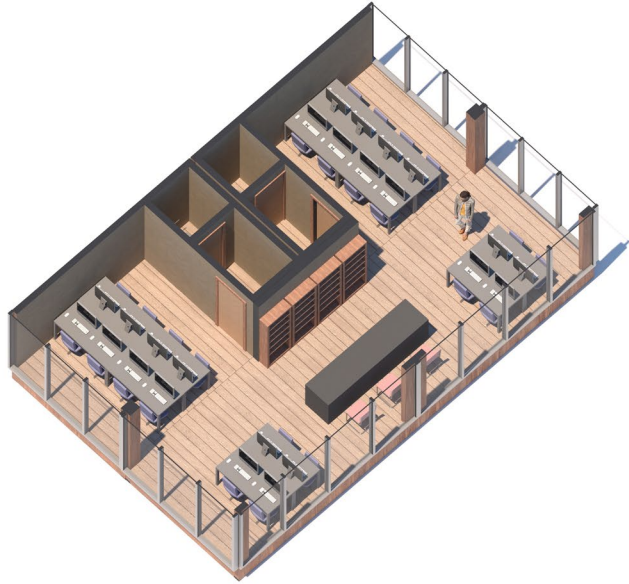


Combinations



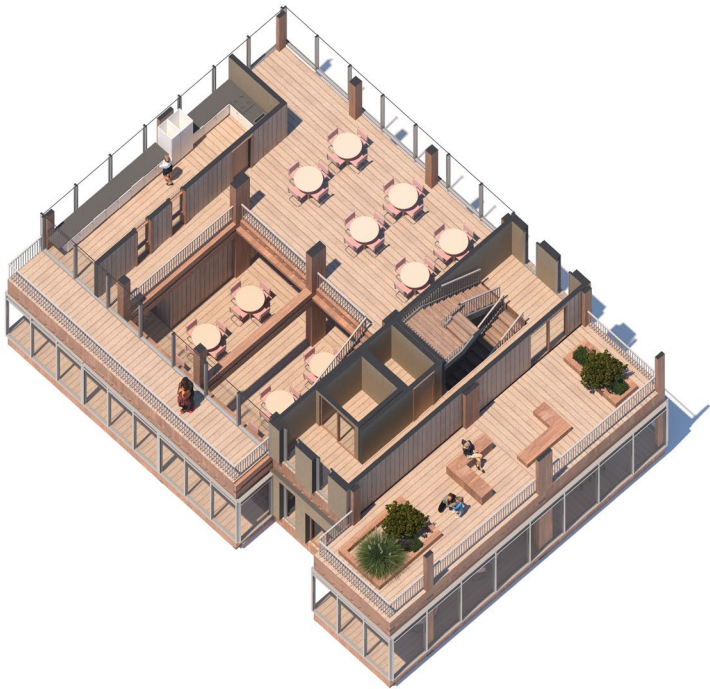
Combinations



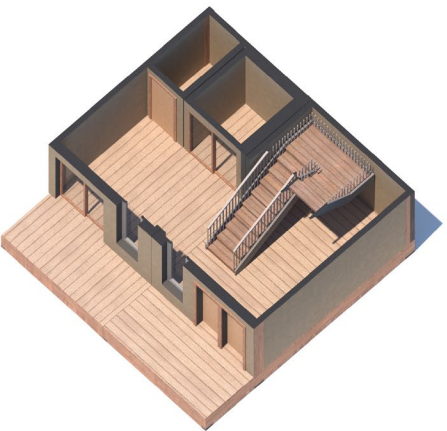


Public

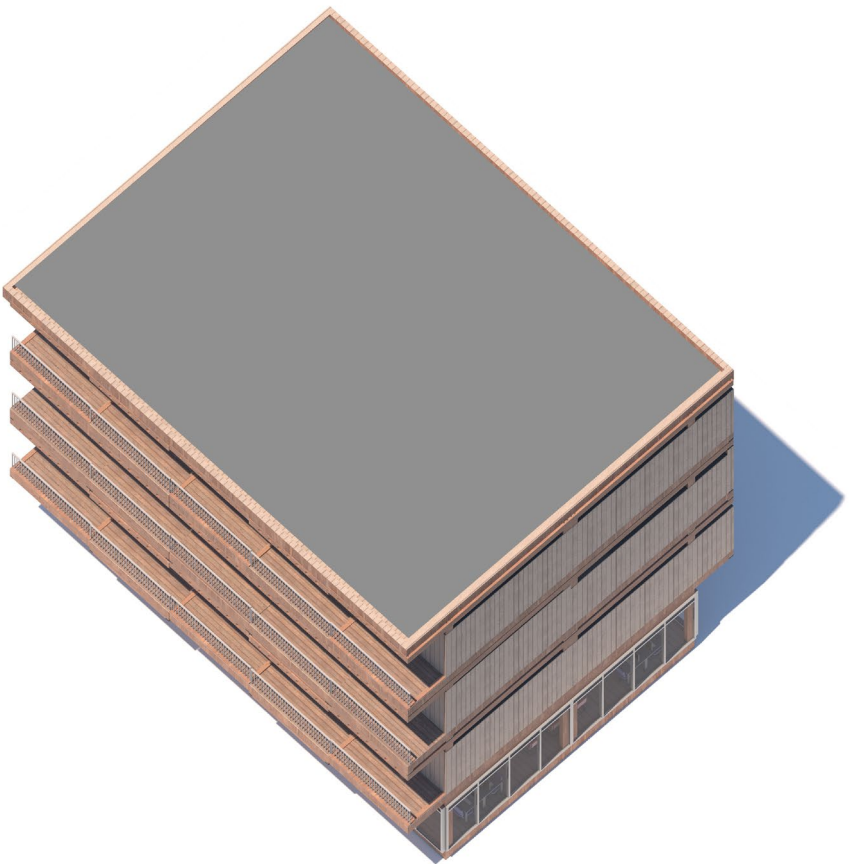
Combinations



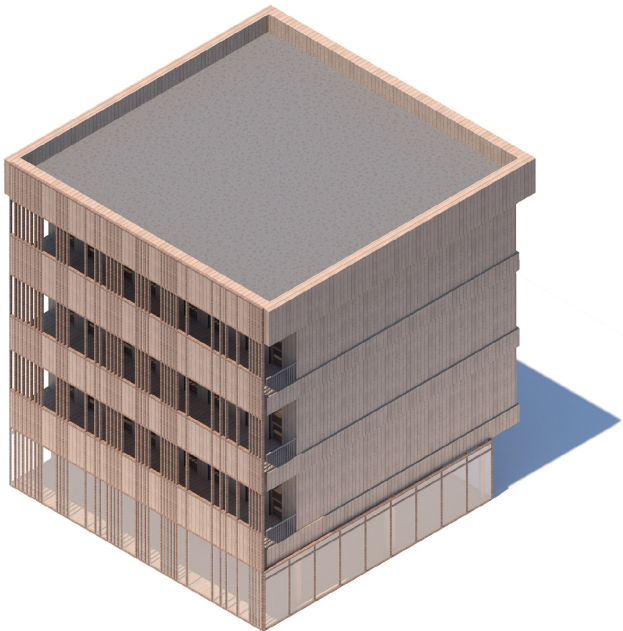
Staircases

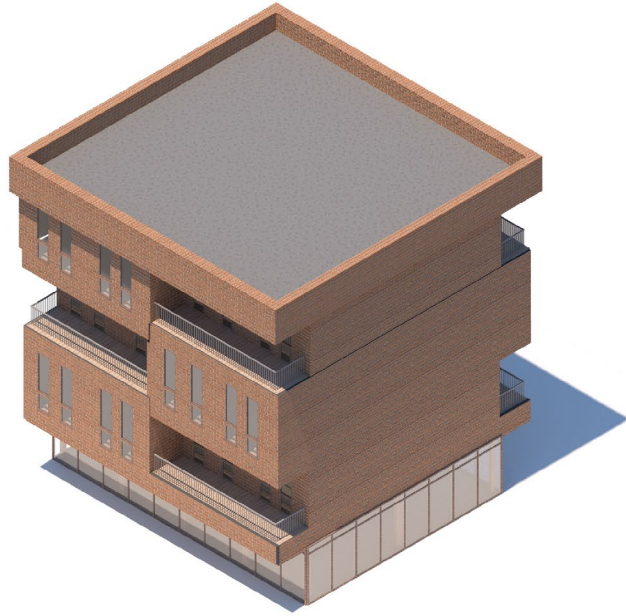


Combination

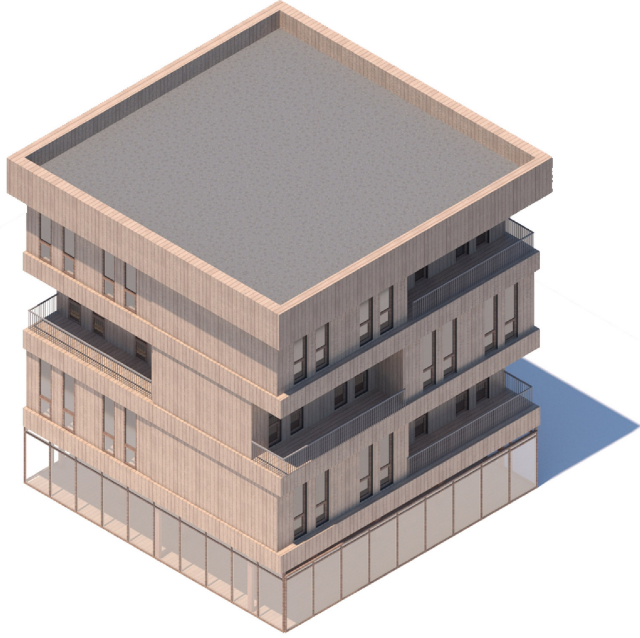


Galleries





Other Side



Sides

Combinations



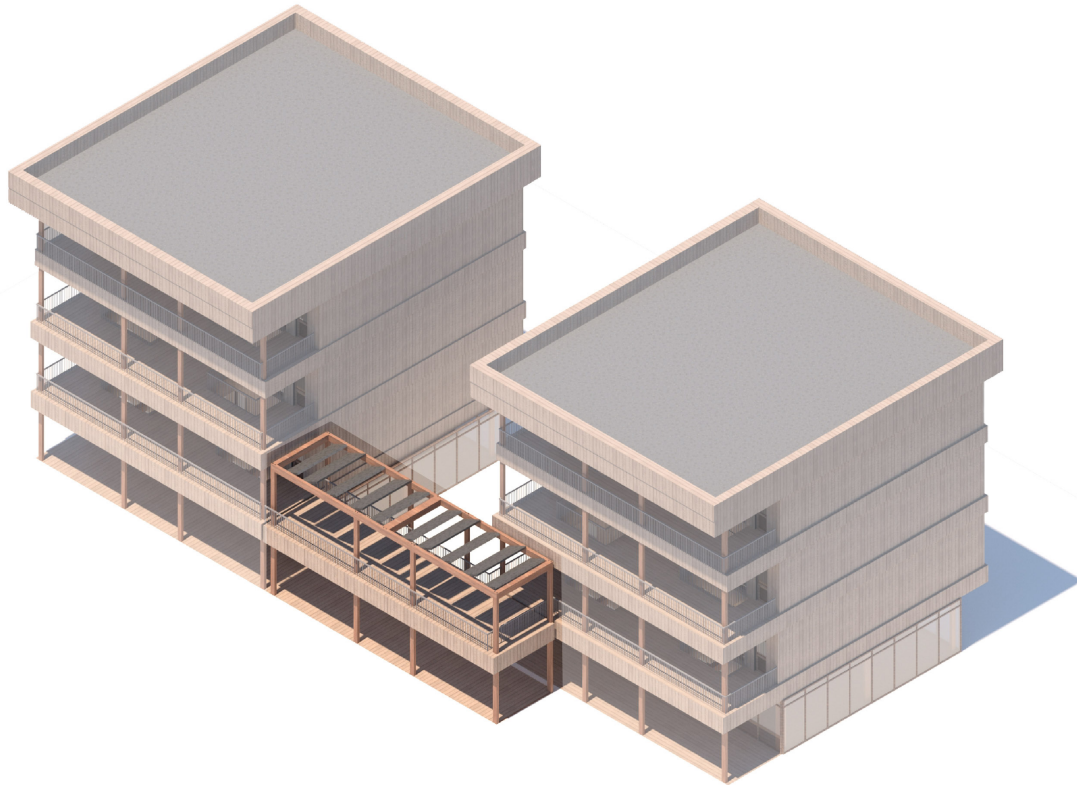
Combinations





Facades

Bridges





Using the space

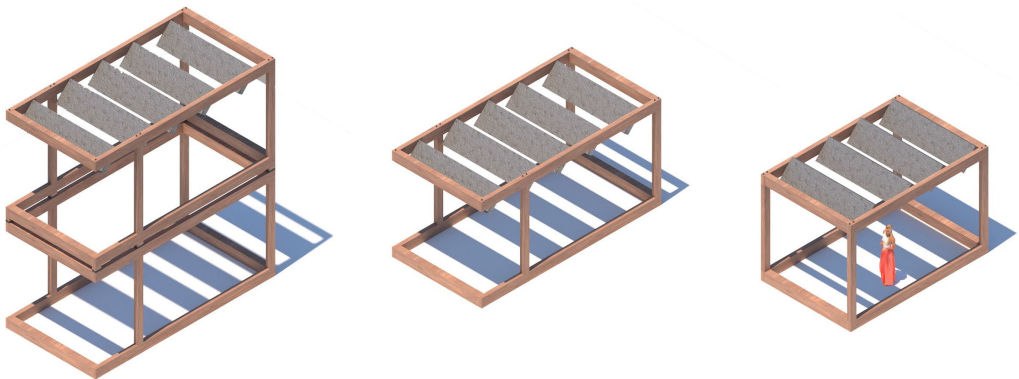


Bridges

Using the space



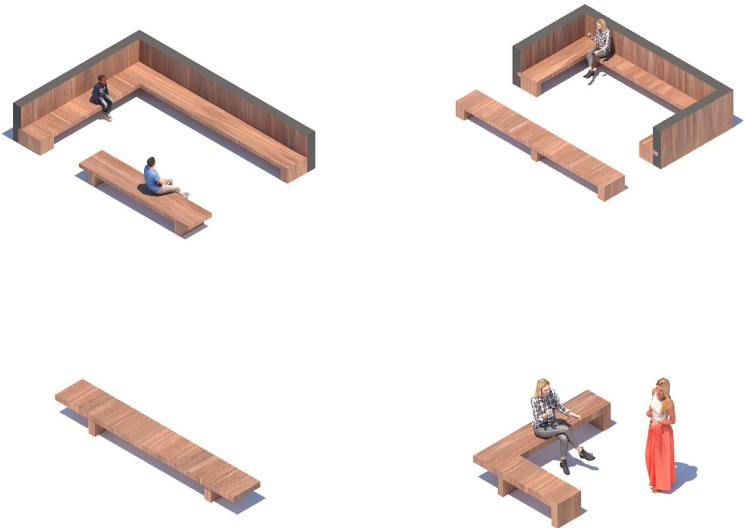
Canopies



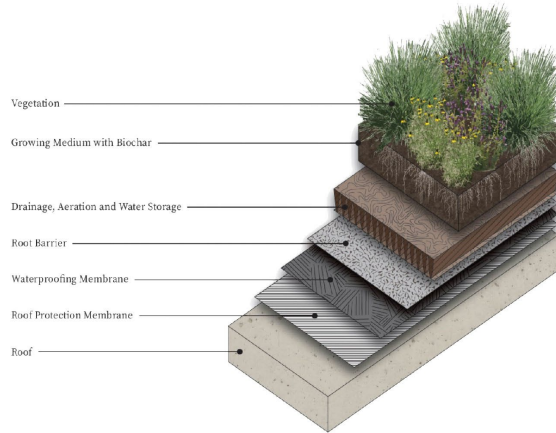
Using the space



Meeting points



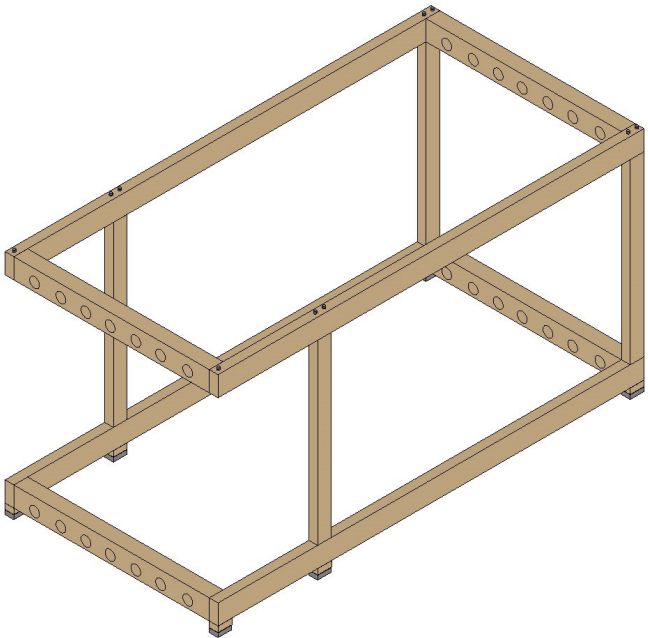
Meeting points



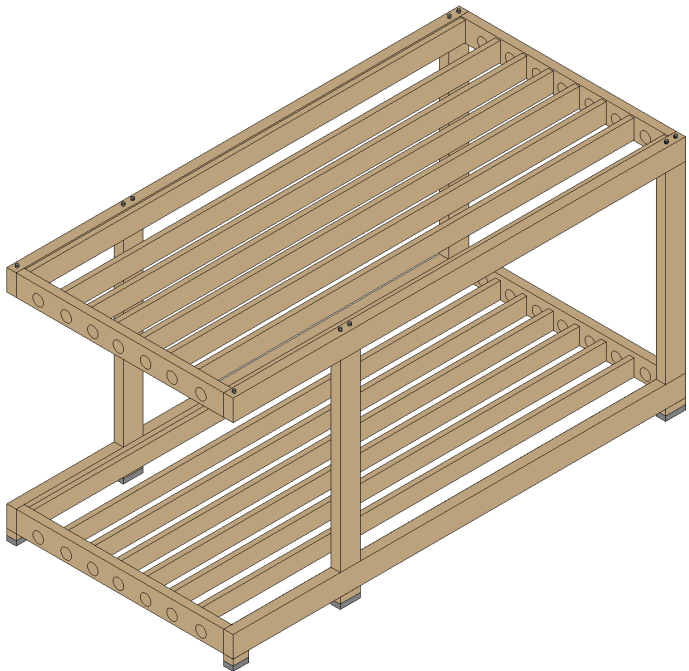
Using the space

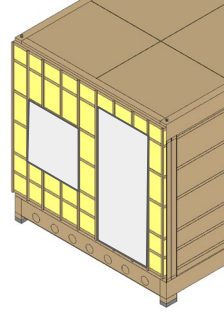
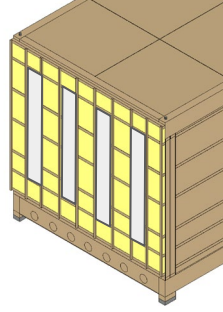
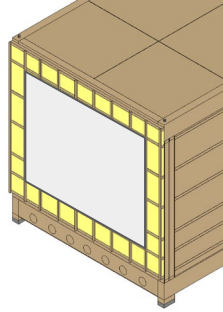
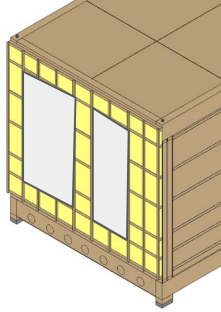
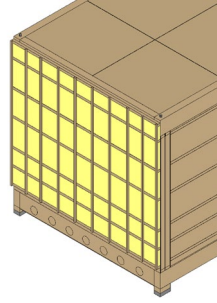


Details



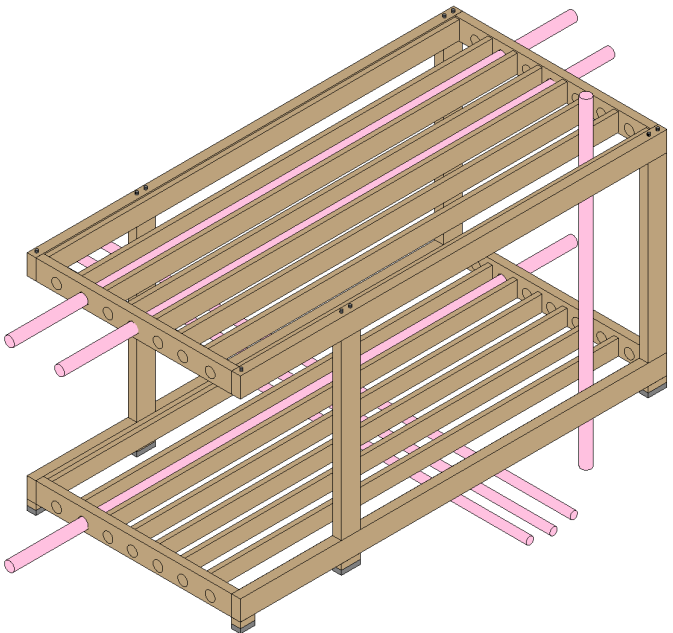
Details



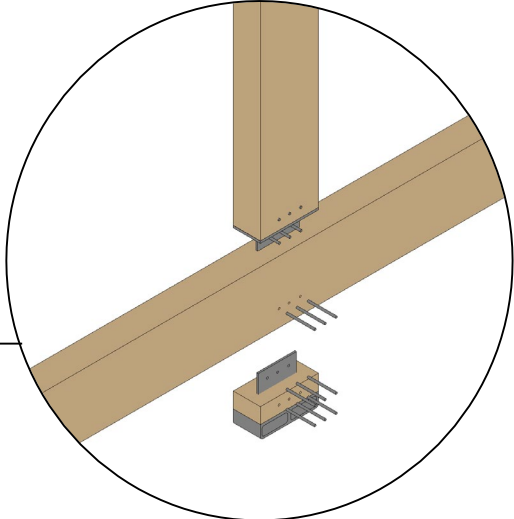
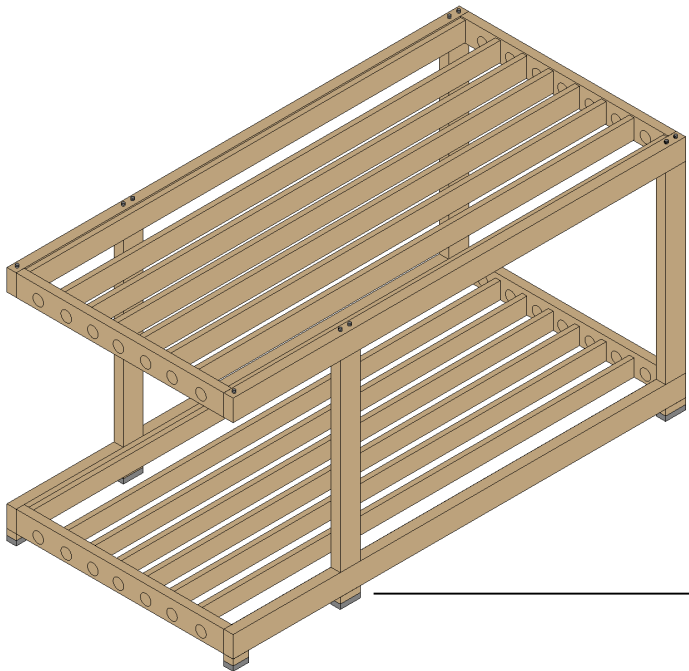


Walls

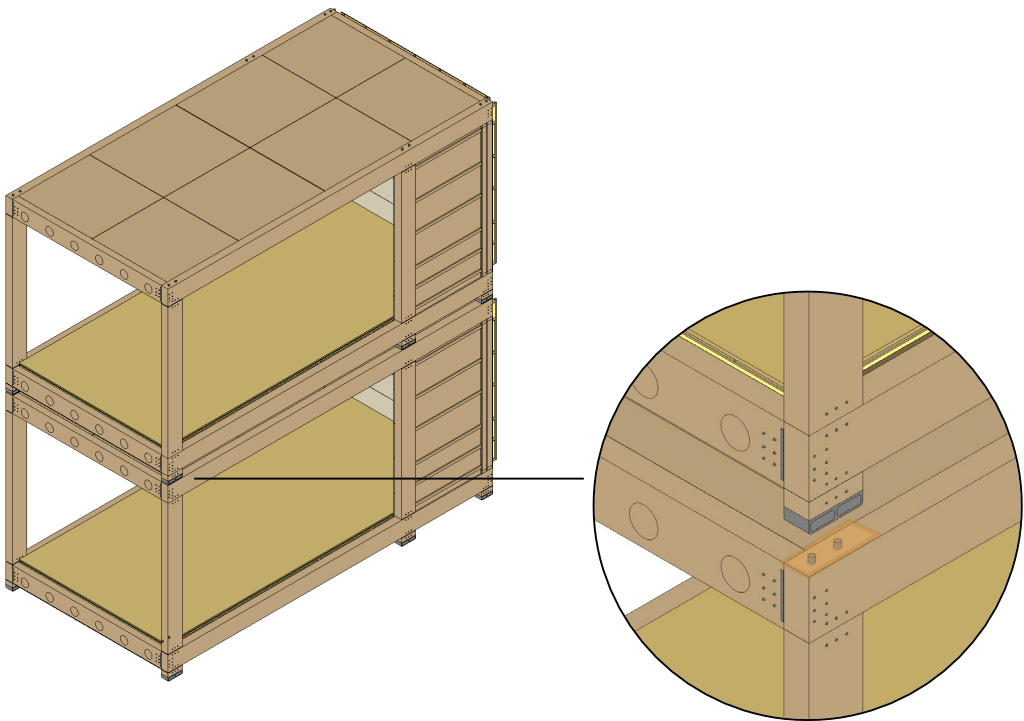
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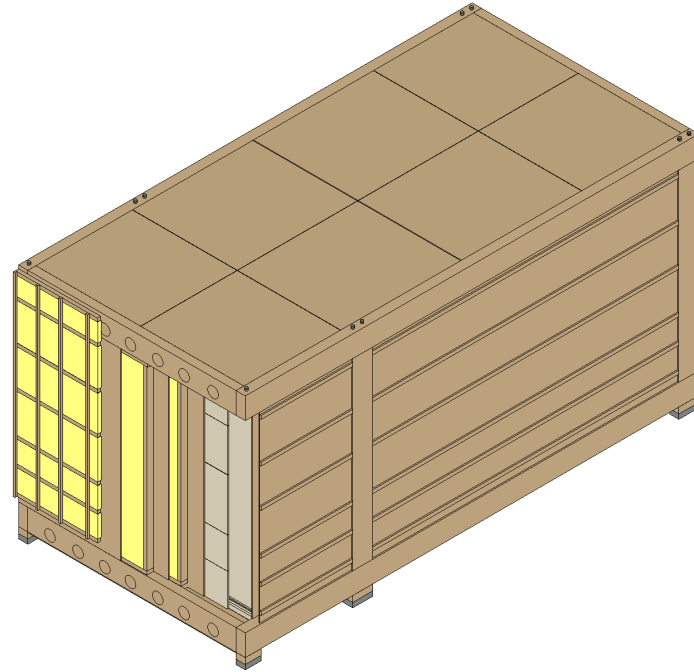


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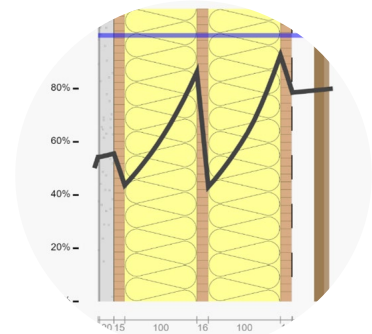


Connection





Details





Insulation For 0.1m thickness

Flax 2.6 R
1100x600mm



North of France including Normandy

Hemp panel 2.5 R
1100x600mm



France, Netherlands, Romania

Straw 1.6 R



Reed 1.4 R



Grass 2.6 R



Wood fibre 2.5 R
1325mm X 600mm



East Europe, paraffin wax
80% wood fibres

Cork 2.6 R
1000 x 500mm



Recycled cotton 2.5 R

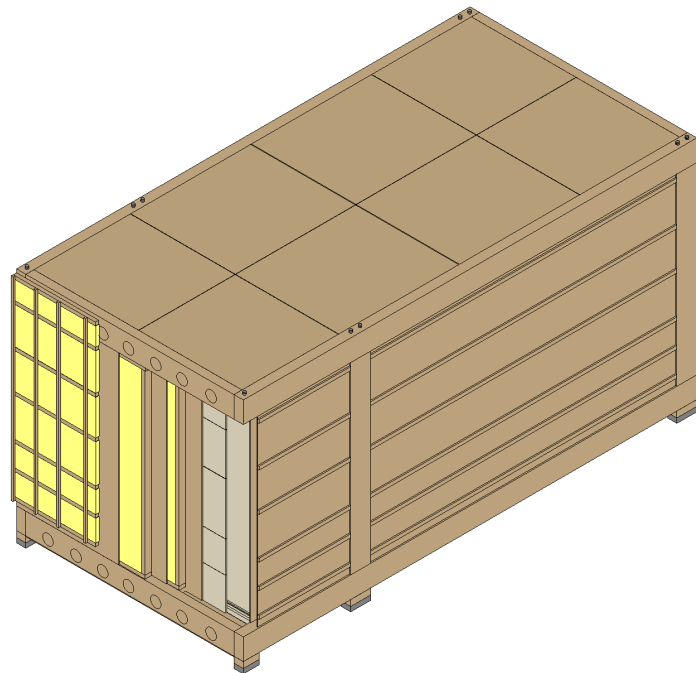


Mycelium 4 R



Peat 2.1 R



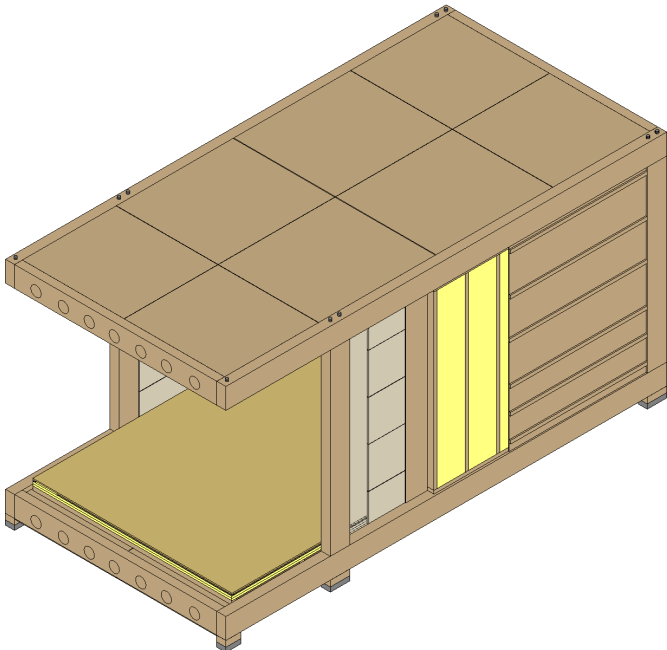


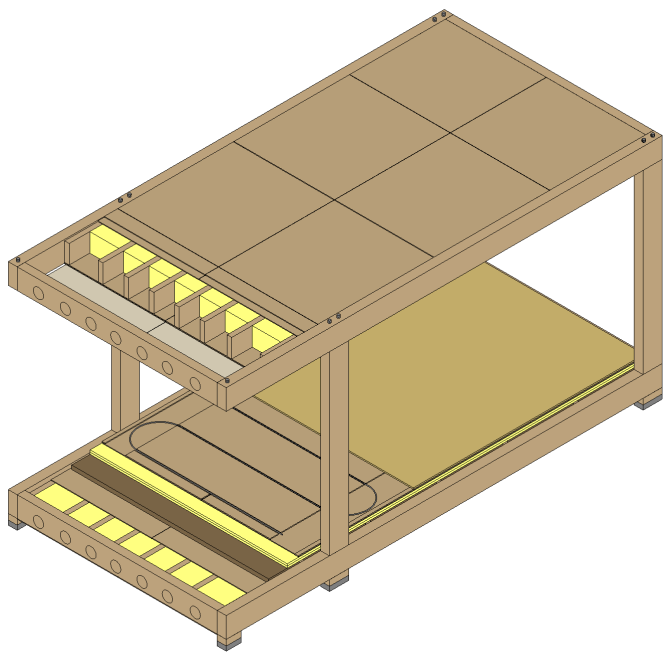
Details

Clay Boards
Clay plaster



Details





Floor heating within
timber sheets

Chipping for Mass

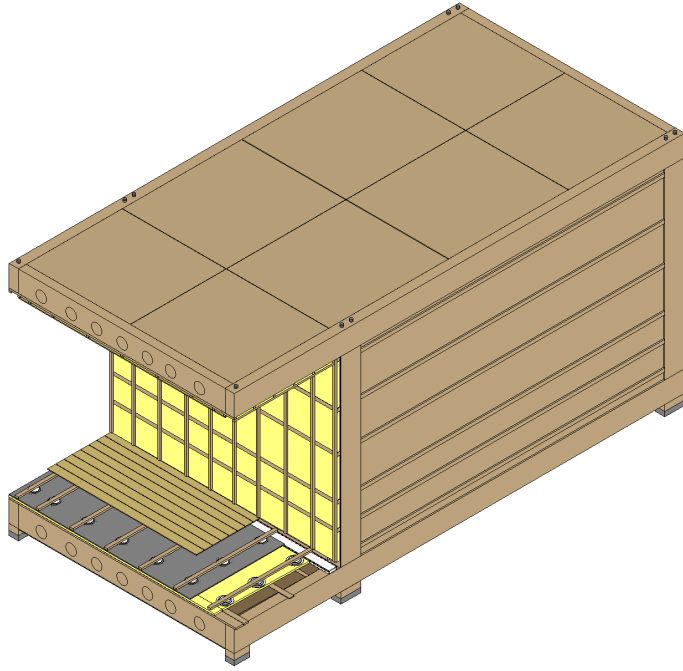


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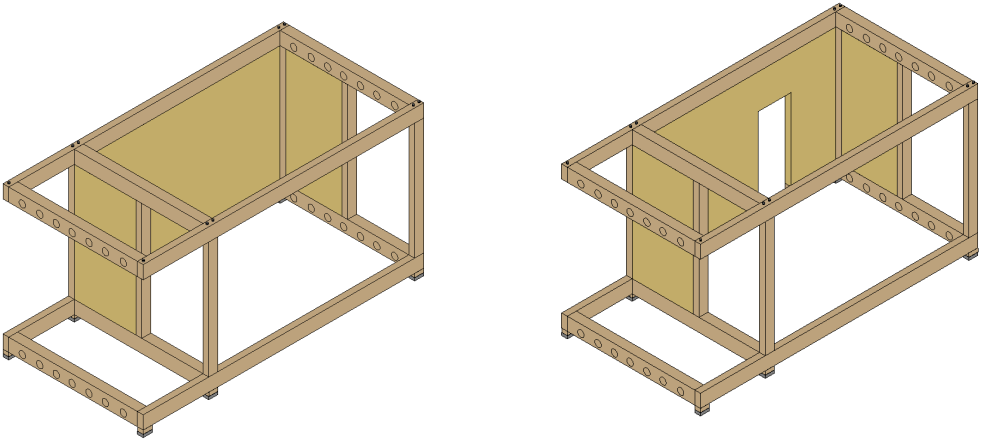


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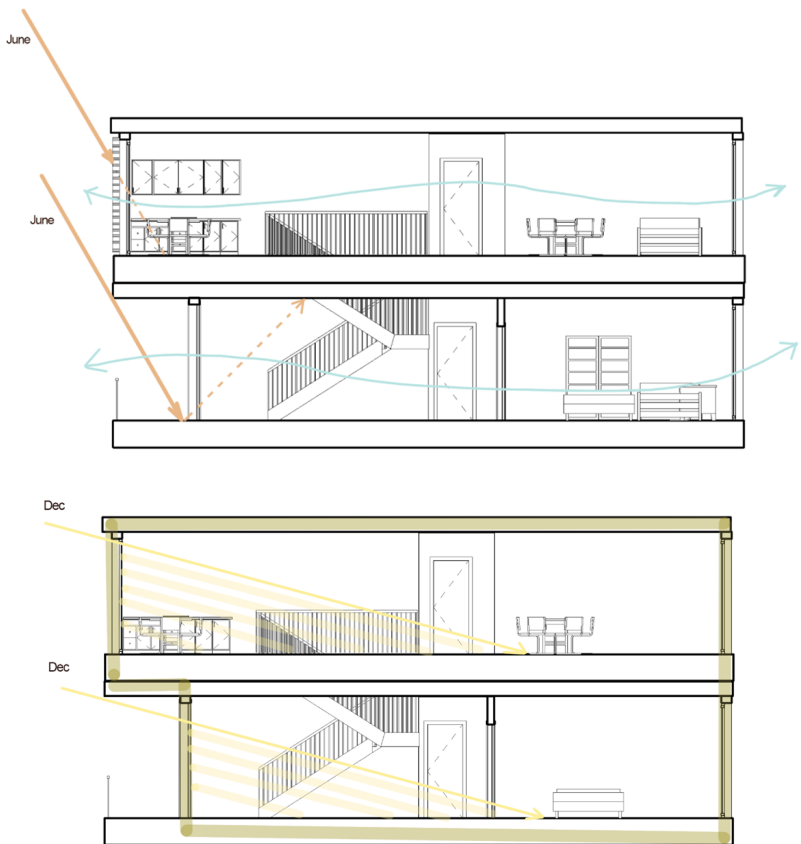
Recycle plastic
Pedestals



Stability: CLT



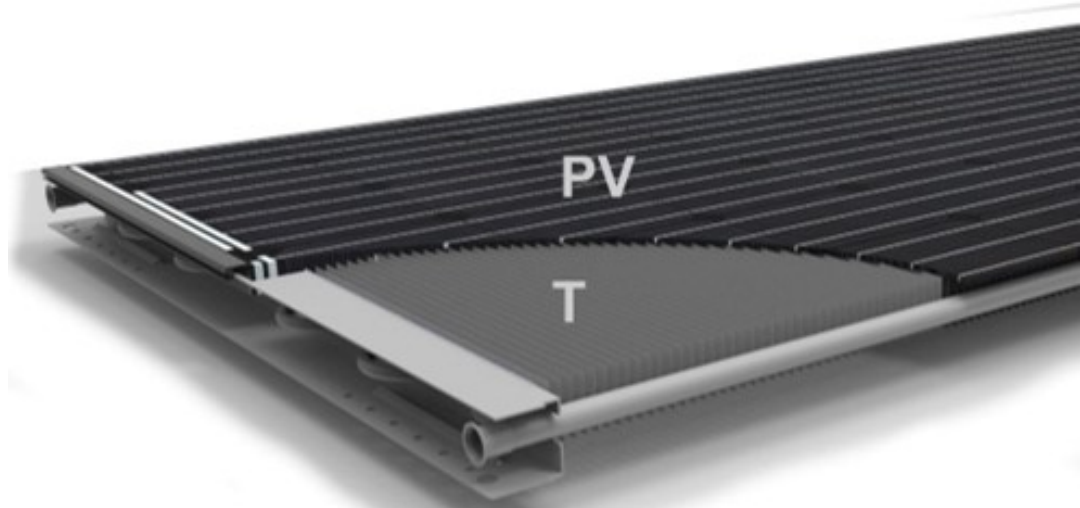
Climate diagram

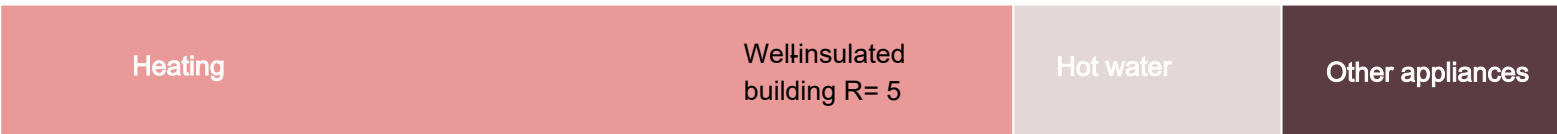




PVT

PVT





2600 kWh

Wellinsulated building R= 5

Hot water

Other appliances

577 kWh

900 kWh

Energy



Using heat pumps (Water from tap, river or heat cold storage)

Heating

Hot water

Other appliances

866 kWh

192 kWh

900 kWh



hybrid Photovoltaic-Thermal (PVT)



Electricity

Hot water

2430 kWh

4500 Kwh

Up to three floors zero energy + Excess hot water for one floor

Installation



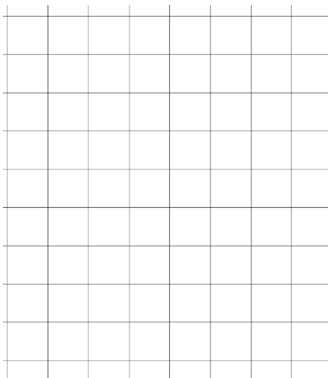
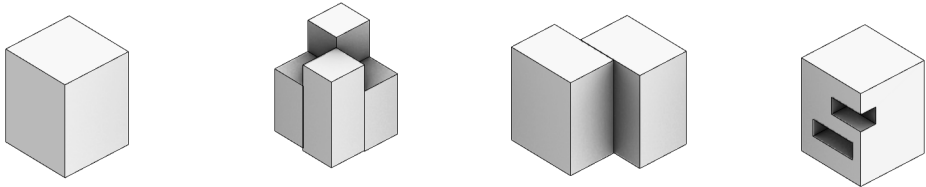
- Rain water collected
- Air handling units
- Heat pumps and Boiler



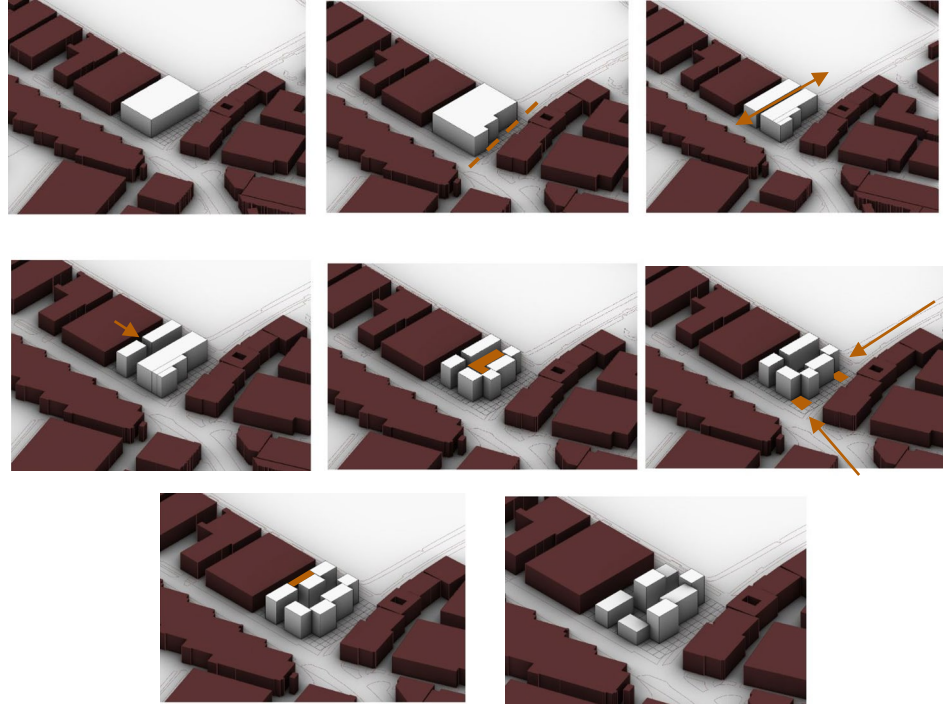
Dividing waste



Using the modules



3.4 x 3.4



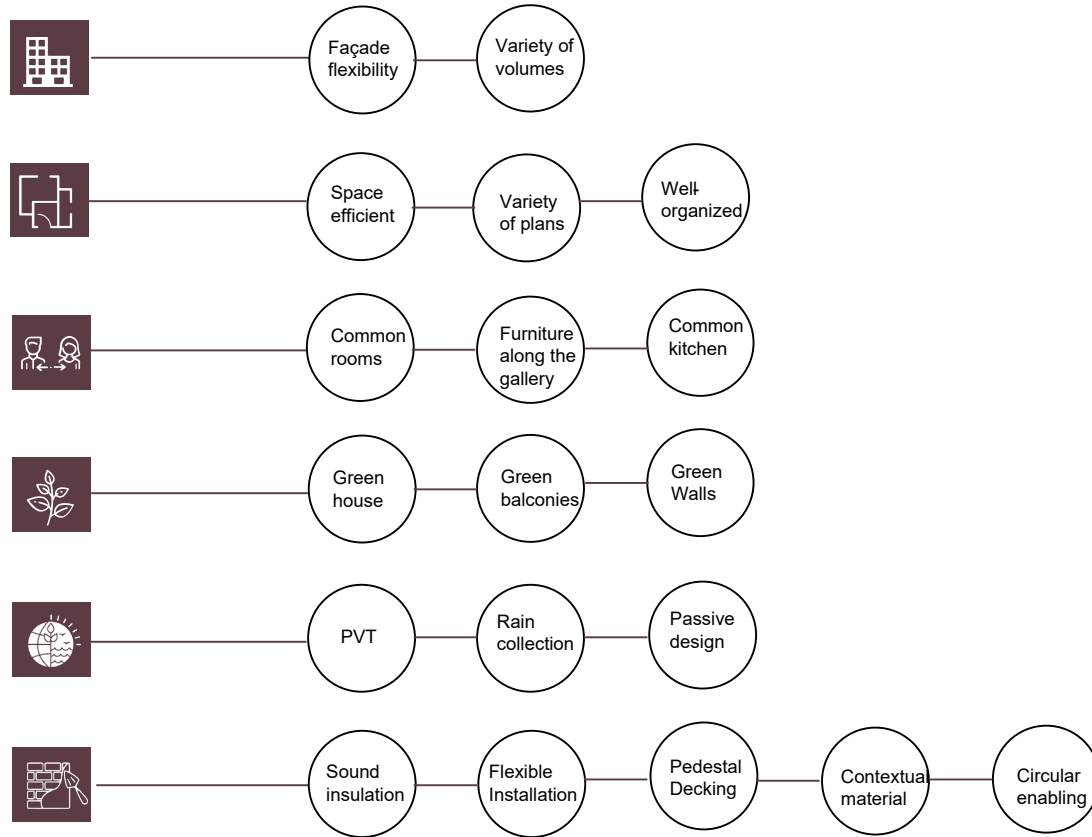
Concept

Second floor

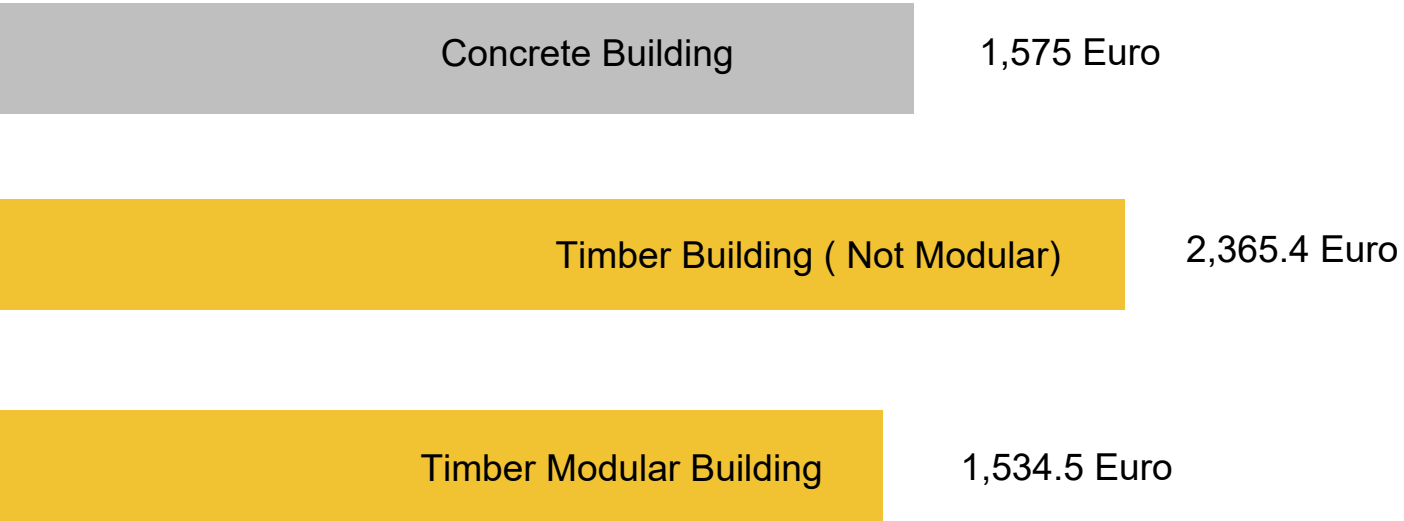


Fourth floor



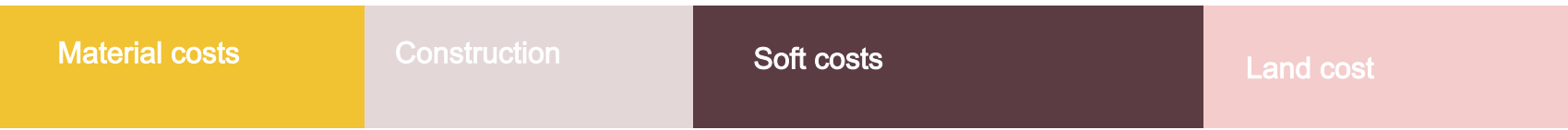


Price per m²

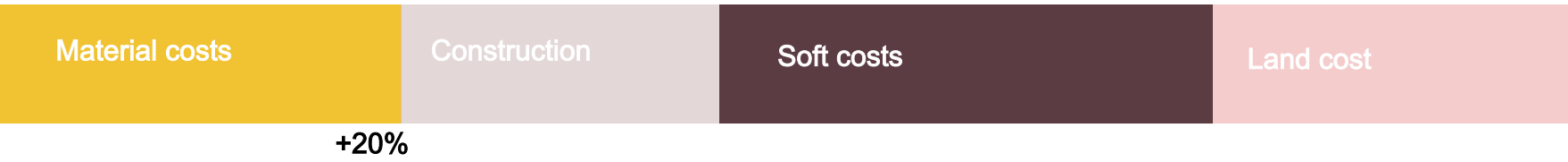




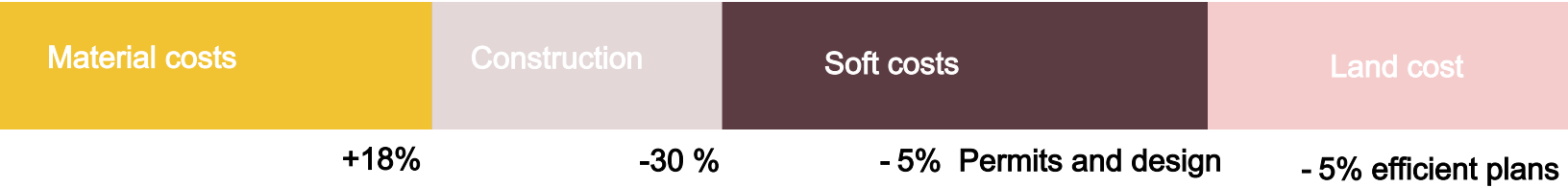
Concrete Building



Mass timber Building



Modular Habitat



Less unexpected costs



Using the space



