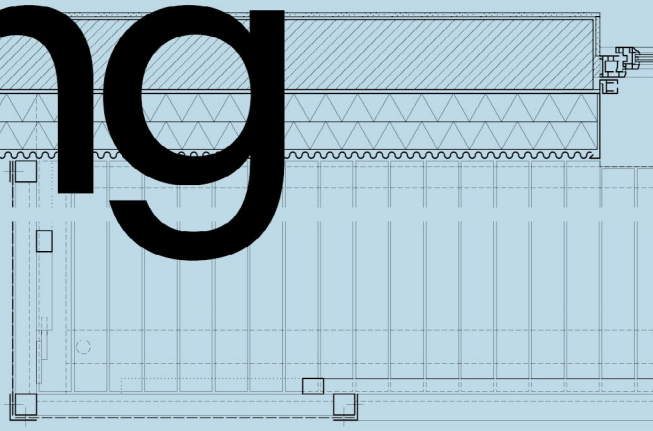
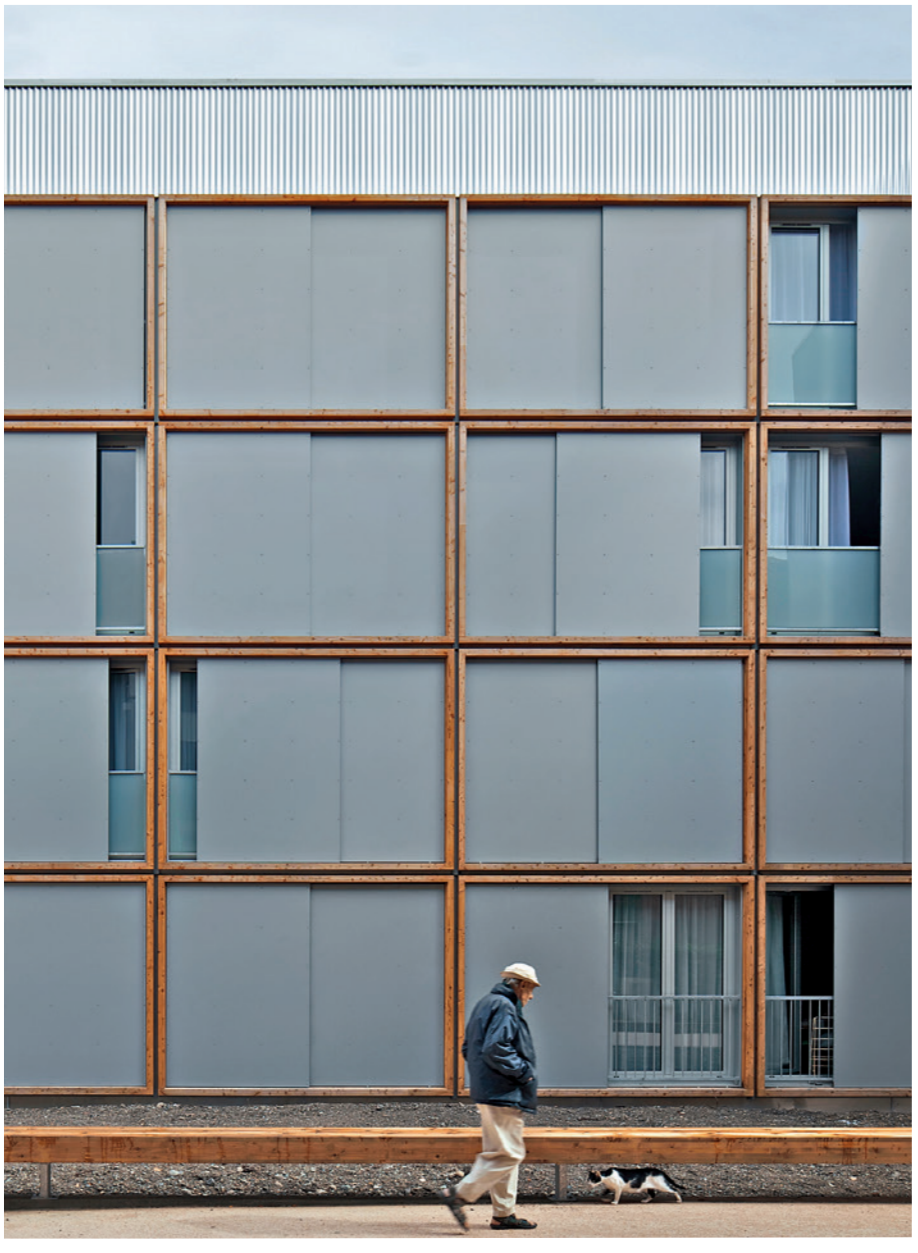
Affordable Housing



Cost-effective Models for the Future

Edition **DETAIL**

Modular Housing, Toulouse, FR



A residential building with a modular timber construction completed in 2015 has created a lively, heterogeneous residential area in northern Toulouse. The 50 simple flats for young working people and elders provide cost-efficient housing in the city, and are intended to contribute to the integration of lower income groups. The trapezoidal site, which had hitherto been used as a car park for the adjoining high-density housing development in the south and west, posed challenges to the architects. The inconvenient shape and orientation of the site, the height restriction, as well as the desire for fast implementation required fundamental reconsideration in order to find viable solutions.

A modular construction system comprising timber modules was selected, a system which the architects were already familiar with from a previous project. Using their knowledge on the advantages and limits of the system, it was possible to rethink the principle of modular timber construction and to adapt it to the specific requirements of the location. The high degree of prefabrication permitted a short construction phase of only about two months—from the delivery of the first modules to the completion of the outer skin. The architects used a repetitive construction system to be able to flexibly respond to the specific site and to create well-proportioned urban spaces. In spite of the maximum utilisation of the building volume, the relationship between built space and open space is appropriate, creating high-quality habitable spaces, while simultaneously keeping within a tight budget.

Instead of a classic linear arrangement, the housing units are offset with respect to each other in groups, resulting in a compact, staggered building structure, which achieves the best possible balance between privacy and sunlight exposure. As in many hotel buildings, the modules are grouped around a concrete circulation core, thus minimising the access areas for the individual units. Multiple bends in the corridor loosen up the strictness of the system, enabling natural lighting along the outer walls.

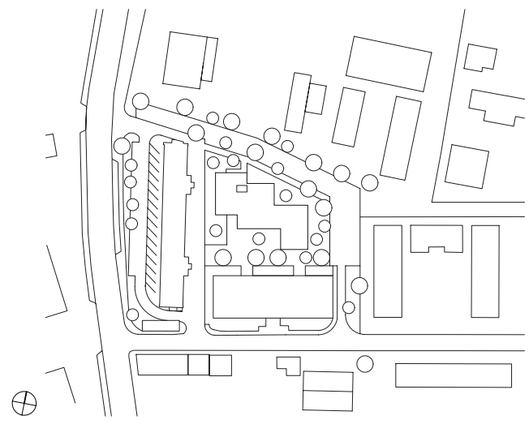
The modular concept is based on three basic types of 20, 24, and 32 m², all with a standard width of 3.65 metres. Depending on their position and orientation, the length of the modules varies. In response to the loss of area adjacent to the lift, a special solution with a second room was developed. While the bathroom and the kitchenette are oriented towards the corridor, the living / sleeping area opens up towards the outdoor space. The modular facades are divided into two on the front: one half is glazed, while the other, closed section provides space for a sliding shutter. A total of 14 modules are located on each of the three standard floors. A gap of four modules on the ground floor creates a covered entrance area, as well as space for bicycle stands, and an administrative unit.

With the exception of the stairwell, all built components consist of screwed, cross-laminated timber. Steel plates with welded connecting pins hold the stacked cubes in place. Wood frame walls and projecting floor slabs support the floors of the corridor, which were added later. Above the third floor, the floor slabs of the modules are laid to falls, to avoid a complicated shaping of the roof insulation on the building site. Two modules share a single shaft for building services, which are routed outside of the units. To lend homogeneity to the volume, the construction of the outer skin was executed on site. For this purpose, simple corrugated aluminium sheeting was employed, which reflects its surroundings and recedes into the background, depending on the incidence of sunlight. Larch wood frames make the units legible and lend the facade a kind of simplicity reminiscent of Japanese architecture.

Year of completion:	2015
Plot area:	5,080 m²
Floor area:	1,700 m²
Uses:	50 flats (20 to 32 m²), administration, bicycle room, heating and service space
Clear ceiling height:	2.50 m in the flats; 2.25 m in the corridor
Costs (total):	€ 2.4 million (construction costs)
Construction costs per square metre:	1,412 €/m²
Construction period:	9 months
Affordability:	rent, funded by government funding for housing
Residents:	young working persons or older persons with low incomes

Site plan
Scale 1:2,000
Section, floor plans
Scale 1:400

1 Entrance
2 Administration
3 Bike room
4 Boiler room
5 Services room
6 Flat 20 m²
7 Flat 24 m²
8 Flat 32 m²



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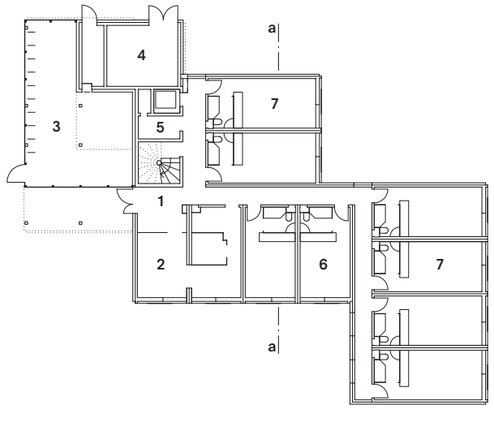
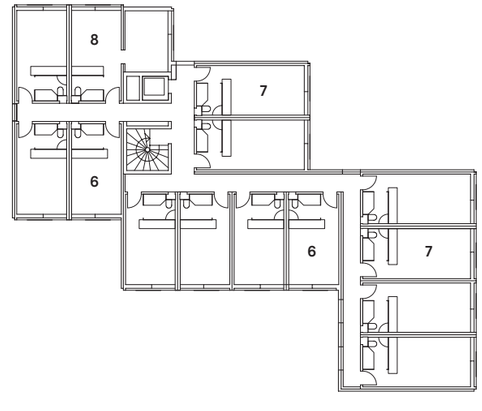


Ground floor



Typical floor

Spatial modules of wood

Floor plans of modules
Scale 1:200

A Residential module 20 m²

B Residential module 24 m²

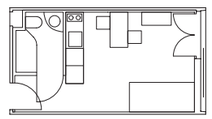
C Residential module 32 m²
(one-off, at lift)

Axonometrics of modular concept:

A Space that can be built on

B Shifting and swivelling the modules

C Stacking modules, omitting modules for entrance



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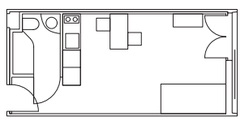

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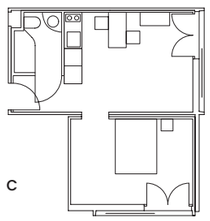

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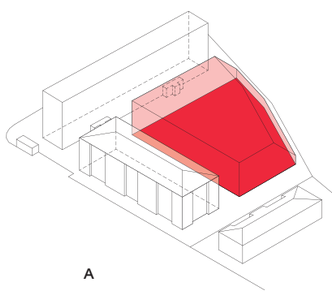

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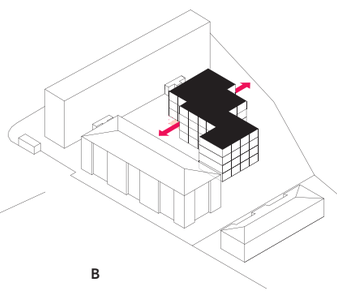

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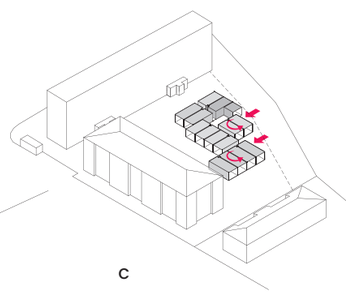
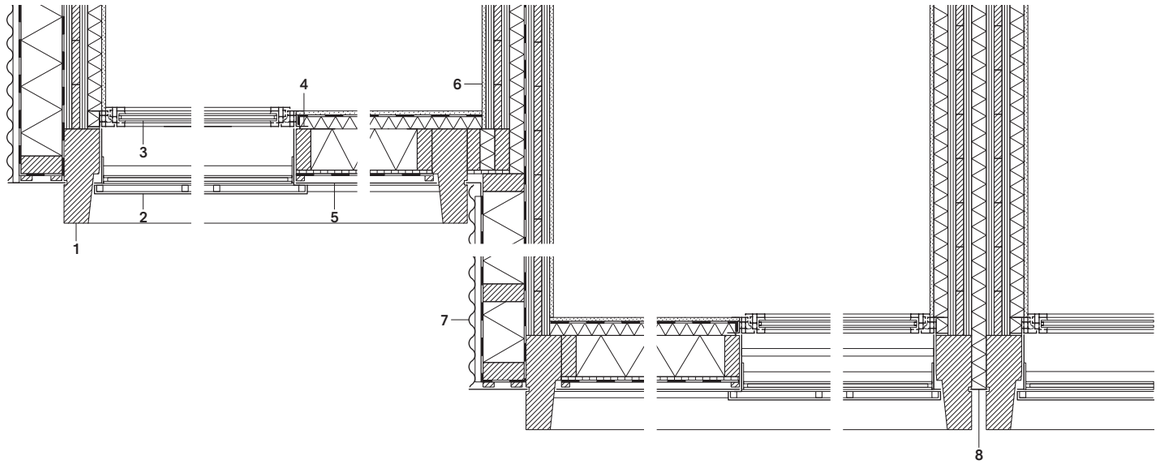


C

Horizontal section
Scale 1:20

1 120/320 mm timber sections as frame
2 Sliding shutter 1.5 mm grey-coated sheet aluminium screwed to 20/20 mm hollow steel tube substructure
3 French window thermal glazing in aluminium frame
4 Aluminium angle L 40/50/5
5 1.5 mm sheet aluminium cladding screwed to 25/38 vertical battens
breather membrane,
19 mm OSB panel
140 mm mineral wool thermal insulation
38/38 mm horizontal battens with mineral wool between them
vapour barrier,12.5 mm plasterboard panel, painted
6 12.5 mm plasterboard panel, painted
80 mm three-ply-cross laminated timber
50 mm mineral wool thermal insulation
separating layer, 80 mm three-ply cross-laminated timber
12.5 mm plasterboard panel, painted
7 0.8 mm corrugated aluminium sheet
25/38 mm horizontal battens,
breather membrane
140 mm mineral wool thermal insulation
vapour barrier, 80 mm three-ply cross-laminated timber, 12.5 mm plasterboard panel, painted
8 5 mm composite aluminium panel



Spatial modules of wood

Vertical section
Scale 1:20

1 0.8 mm corrugated aluminium sheet
25/38 mm horizontal battens
breather membrane
140 mm mineral wool thermal insulation
vapour barrier, 80 mm three-ply cross-lam. timber
12.5 mm plasterboard panel, painted

2 Two ply bitumen sealing membrane
260 mm mineral wool thermal insulation
vapour barrier, 60 mm three-ply cross-laminated timber, partly to falls, varnished

3 6 mm PVC tiling, glued,
40 mm concrete screed
120 mm five-ply cross-laminated timber
30 mm mineral wool thermal insulation
60 mm three-ply cross-laminated timber varnished

4 Connecting element 10 mm flat steel with welded Ø 30 mm steel pins

5 HEA 180 steel section support

6 6 mm PVC tiling, glued
80 mm three-ply cross-laminated timber

7 Suspended ceiling, acoustically insulated perforated aluminium elements

8 □ 80/60 mm RHS steel tube with welded 8 mm flat steel fin

9 0.8 mm corrugated aluminium sheet

10 French window thermal glazing in aluminium frame

11 Sliding shutter 1.5 mm grey coated aluminium sheet screwed to substrucuture of □ 20/20 mm SHS steel tube

12 8 mm coloured PMMA parapet in steel frame

13 120/320 mm timber section as frame

14 5 mm composite aluminium panel