Team MI-MO of Hochschule Düsseldorf at Solar Decathlon Europe 21

Minimal Impact - Maximum Output

Düsseldorf, 08/04/2020

An interdisciplinary Team of Hochschule Düsseldorf – University of Applied Sciences (HSD) participates in the student competition 'Solar Decathlon Europe 2021 …goes urban' as one of 18 international teams to introduce their visions, concepts and products to solve an architectural planning task. Thereby, they have to cope with inner-city build-up and a fitting realization of a 1:1 House Demonstration Unit in Wuppertal in 2021. The aim is to put concepts for sustainable, energy-efficient and socially acceptable urban densification into practice.

HSD's 'Team MI-MO' is facing the competition with the new urban profile with the motto 'Minimal Impact - Maximum Output'. It means that implemented techniques and concepts have to add value to the location and create maximum benefit with minimal intervention. Four faculties and the Institute for Sustainable Urban Development (In-LUST) are involved in the interdisciplinary team.

Team MI-MO is taking on a real existing challenge of energetic urban redevelopment and redensification: The addition of residential uses to the cultural centre Café Ada in the urban district Mirke of Wuppertal. Besides architectural, procedural and technical demands, one challenge is to inform, fascinate and enable the people in the district and beyond to become part of an urban energy transformation.

> 'Important as it may be to develop a building that uses the most up-to-date energy-efficient technologies', says Professor Eike Musall, head of team MI-MO, 'it is also as crucial to consider the environment and especially the human factor and the needs of the potential users of the building we construct. According to the principle of 'only build, if we use it to improve the location', our project should offer added value to the immediate surroundings and contribute to the sustainable development of the entire city district.'

Currently about 20 students from the Faculty of Architecture are working on the further development of the design and use concepts for the extension of the Café Ada created last winter semester. The aim is to develop one concept that addresses the ten disciplines of the solar decathlon (e.g. Architecture, Sustainability, House Functioning, Comfort and Energy Performance, Affordability & Viability, Innovation and Urban Mobility) and transports these via integrated design.

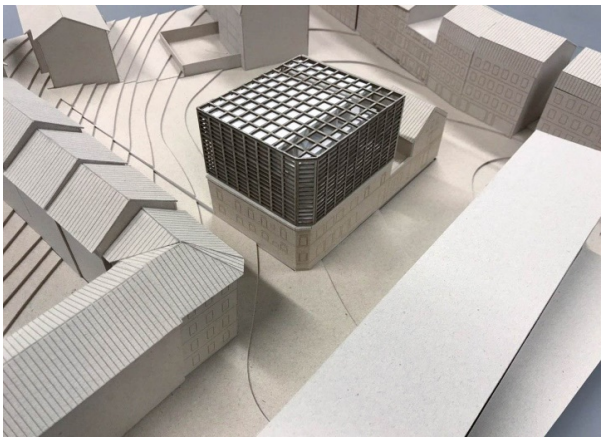

Figure 1 and Figure 2: model and isometry of storey-addition to the cultural centre Café Ada

Students from the Faculty of Social Sciences and Cultural Studies have studied the clientele of the Mirke district and contribute their thoughts to the planning of the apartments. Members of the Faculties of Mechanical and Process Engineering as well as Electrical Engineering and Information Technology develop strategies for energy supply and load management.

Supported by students of the newly added Faculty of Media, the team prepares the concepts and transfers them to public relations, via its website, as well as Facebook and Instagram (see links below). Team MI-MO cooperates in public relations with the press office of the HSD, which serves the local press. The specialist press (e.g. AIT) is involved via the Faculty of Architecture.

In accordance with the tradition of the competition, a section of the extension has to be brought to Wuppertal. In August 2021, a 1:1 House Demonstration Unit in the form of a fully functional, one- to two-storey residential building needs to be built. To ensure this, the team is looking for partners and sponsors.

For HSD, the nomination for participation is both a first big 'stage win' but also a proof of the well-functioning interdisciplinary collaboration of the faculties and between teachers and students.

Figure 3: Team-Photo (shows about half of the team)

Key words: Solar Decathlon Europe 21, HSD, Team MI-MO, MI-MO, Minimal Impact - Maximum Output, Wuppertal, Mirke, Café Ada, House Demonstration Unit, interdisciplinary, storey-addition, modular building, renewable energies, wood construction

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HSD MI-MO

Download Press Kit: https://lust.hs-duesseldorf.de/solardecathlon21/Documents/HSD_PK1_2020_03_25.pdf

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Project Engineer	Mario	Adam	Prof. Dr.	Faculty of Mechanical and Process Engineering
Structural Engineer	Christoph	Ackermann	Prof.	Faculty of Achitecture
Electrical Engineer	Holger	Wrede	Prof. Dr.	Faculty of Electrical Engineering - Electric Power Engineering and Power Electronics
Student Team Leader	Elias	Hoffmann	B.A.	Faculty of Achitecture
Health & Safety Team Coordinator	n/a			
Safety Officers	n/a			
Site Operations Coordinators	n/a			
Contest Captain	n/a			
Instrumentation Contact	n/a			
Communications Coordinator	Sandra	Lohmann	M.Sc.	Institute for Sustainable Urban Development
Sponsorship Manager	n/a			
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Team Member	Jennifer	Binzen	B.A.	Faculty of Achitecture
Team Member	Jil	Bösl	B.A.	Faculty of Achitecture
Team Member	Katrin	Fartaczek		Faculty of Achitecture
Team Member	Moritz	Fleischmann	Prof.	Faculty of Achitecture - Architectural Computer Science
Team Member	Lena	Frank	M.Sc.	Faculty of Mechanical and Process Engineering
Team Member	Marvin	Freund	B.A.	Faculty of Achitecture
Team Member	Lena	Hille	B.A.	Faculty of Achitecture
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Team Member	Schibli	Jaafar	B.A.	Faculty of Achitecture
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Team Member	Alex	Kinzel	B.A.	Faculty of Achitecture
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Team Member	Anabel	Kurz		Faculty of Achitecture
Team Member	Kevin	Kusch	B.A.	Faculty of Achitecture
Team Member	Jörg	Leeser	Prof.	Faculty of Achitecture - Urban Context Design and Urban Design Theory
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Team Member	Levin	Markus	B.A.	Faculty of Achitecture
Team Member	Alexander	Mpaltatzis	B.A.	Faculty of Achitecture
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Team Member	Maximilian	Rödder	M.Sc.	Faculty of Mechanical and Process Engineering
Team Member	Janina	Schleuter	B.A.	Faculty of Achitecture
Team Member	Leonie	Schumann	B.A.	Faculty of Achitecture
Team Member	Matthias	Stemmer	B.A.	Faculty of Achitecture
Team Member	Lisa	van Holt	B.A.	Faculty of Achitecture
Team Member	Anne	van Rießen	Prof. Dr.	Faculty of Social Sciences and Cultural Studies - methods of social work
Team Member	Kevin	Verhoeven	B.A.	Faculty of Achitecture
Team Member	Lea	Willrodt	B.Sc.	Faculty of Media
Team Member	Ansgar	Krajewski	M.A.	Faculty of Achitecture - Architect
Team Member	Judith	Reitz	Prof.	Faculty of Achitecture - Interior Design and Basics of Design
Team Member	Carina	Bhatti	M.A.	Faculty of Social Sciences and Cultural Studies - methods of social work
Team Member	Adina	Branescu		Faculty of Electrical Engineering

Project Description

Minimal Impact - Maximum Output

With the headline “MINIMAL IMPACT – MAXIMUM OUTPUT (MI-MO)“ our contribution is based on the following fundamental ideas:

- Developing a resilient building structure that is exemplary for the topics of densification and affordable and sustainable housing.
- Establishment of shared areas and infrastructure offers (energy and mobility) within the project to increase the quality of life in the neighbourhood.
- Involvement of the entire district in the actual building task and, consequently, the understanding of the new building as part of a holistically conceived urban development.
- Designing a consistently sustainable material and design concept that reduces on-site construction time with a modular approach, pre-fabricated components and the benefits of digital planning and production techniques, minimizing the emissions associated with construction.
- Careful integration of technical building technologies for using renewable energies on-site and their logical interaction with the building structure or the quarter under the constant consideration of the appropriateness in the field of tension of effort, benefit and (energetic) yield respectively stress of the neighbourhood.
- Avoiding energy demands as much as possible including an adequate mix of low-tech strategies and appropriate technical options. The use of technological innovation is always balanced against passive measures in the context of sufficiency and the creation of affordable housing.

According to the principle of ‘only build, when using it to improve the location’, the addition of storeys should offer added value to the immediate surroundings and contribute to the sustainable development of the entire city district. The structural and programmatic solution of Team HSD should involve the importance of the social environment and be based on a corresponding analysis to make the neighbourhood more liveable for the residents. The newly conceived offer of apartments is thought across the district and all generations. In addition to an analysis on the demand for residential space, affordable housing for elder, already living in the neighbourhood will be created through cross-financing models in the sense of a housing allocation.

Around 20 students from the Faculty of Architecture are currently working on the further development of the existing building in the Mirke district, at Wiesenstraße 6 in Wuppertal. The locations are easy to reach both by public transport and by car. The existing building is a corner building with a total of two floors and a shed roof. There is also a large open area north of the existing building, which is also included into the project.

The addition of storey is made by modules that are stacked on top of each other. The offset and rotations of these modules create gaps that are used for access. In addition, these spaces provide common spaces that should be available to all residents of the complex. The modules are individually, as a couple or in a combination of three adapted to the size of the resident and thus offer the optimal living space for different uses. The centre of the modules is a functional core, which includes both bathrooms, kitchens and access roads.

The isometry shows how the new concept of stacking can be implemented statically. The former shed roof of the existing building will be removed. Instead, a new steel carrier grate is placed on the existing structure to guarantee sufficient load-bearing capacity. The modules are statically independent and can be stacked on top of each other. Last but not least, a hanging facade is put over the upper floors (Figure 1). From the outside, the extension appears to be covered with a coat of glass and photovoltaics. The individual modules made of beech wood or spruce can be seen through the facade. The cross-laminated timber walls are mechanically pegged instead of glued.

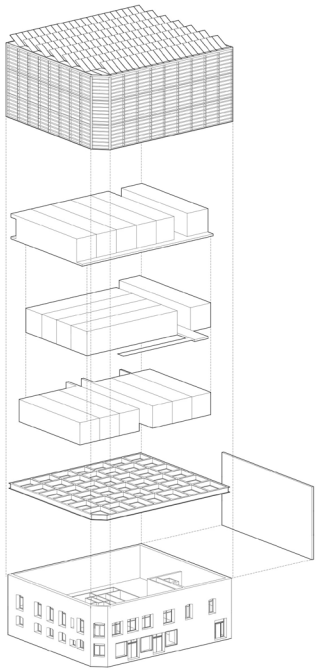

Figure 1: Explosive isometry

In order to achieve high solar profits, the facade is provided with photovoltaic modules in addition to the roof. For this purpose, thin-film modules are designed as movable slats. The slats can be aligned differently depending on the time of day, heat or fresh air requirements.

In summer, with high solar altitude, the slats can be aligned at an optimal angle for maximum profit. The same applies to the roof, according to the natural airflow. At night when the outside temperature cools down, the slats can be closed. The view with the slats closed is provided by the arrangement of the solar cells (Figure 2).

The intermediate zone provides a special kind of ventilation. Cold air can enter the intermediate zone because it is not completely closed. As soon as the residential units are to be ventilated, this is done with pre-heated air. The effect is enhanced by integrated window fans with heat recovery, which also ensure constant ventilation of the modules (Figure 3).

A heat pump using geothermal energy heats it. Outdoor collectors transfer the heat generated in the ground to a heat pump via a heat transfer medium (ethylene-glycol-water mixture). This is located on the ground floor of the building. The individual modules are heated by underfloor heating (Figure 4).

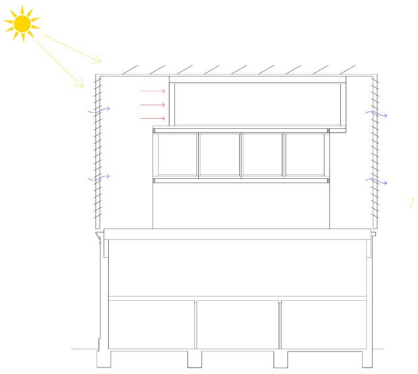

Figure 2: Photovoltaic system

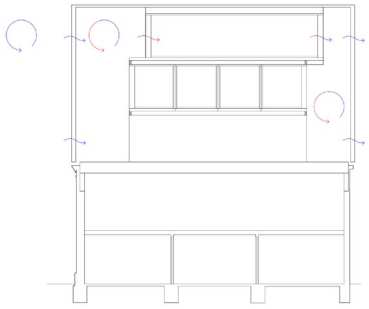

Figure 3: Ventilating system

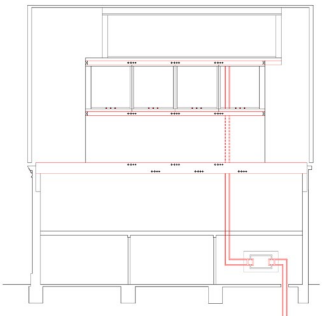

Figure 4: Heating system

The dissemination of scientific information to the (professional) public is a central idea of the competition. For this reason, an official homepage and pages on social media have been set up as a communication and presentation platform. All target groups such as experts, the public, sponsors and companies, as well as family and friends can thus participate in the current events of the team and its project status. Our Team located in Dusseldorf has a direct relation in distance to the venue in Wuppertal. We expect feedback from the general public, especially the people from the Mirke district, and are looking forward to sharing our project with them.

Collaborating Institutions and Sponsoring Companies:

Institution/Company	**Type of business/ branch**	**Type of Sponsorship**
Vaillant	Heating technologies	Products / Know-how / Financial
SMA Solar Technology	Photovoltaic technologies	Products / Know-how
Ingenieurbüro für Bauphysik und Gebäudesimulation alware GmbH	Building simulations	Know-how
Gira Giersiepen	Electrical engineering components	Products / Know-how
Miele	Home appliances	Products / Financial / Know-how
Albrecht Jung	Electrical engineering components	Products
AIT	Communication	Partner network / Publications
Transsolar	Climate engineering	Know-how
Holzius	Wood building components	Products

Caparol	decorative paints	Products
ECBM GmbH	Consultant in artificial intelligence / smart city	Coaching
Dessault Systems	Software engineering	Software systems / Know How
Petershaus – Holzbau	Builder for prefabricated houses and wood components	Production
Energy Endeavour Foundation	SDE 20/21	Financial
Hochschule Düsseldorf - University of Applied Sciences Düsseldorf		Financial
Faculty of Architecture	Hochschule Düsseldorf - University of Applied Sciences Düsseldorf	Financial
Faculty of Mechanical and Process Engineering	Hochschule Düsseldorf - University of Applied Sciences Düsseldorf	Financial
Faculty of Electrical Engineering & Information Technology	Hochschule Düsseldorf - University of Applied Sciences Düsseldorf	Financial
Faculty of Social Sciences and Cultural Studies	Hochschule Düsseldorf - University of Applied Sciences Düsseldorf	Financial

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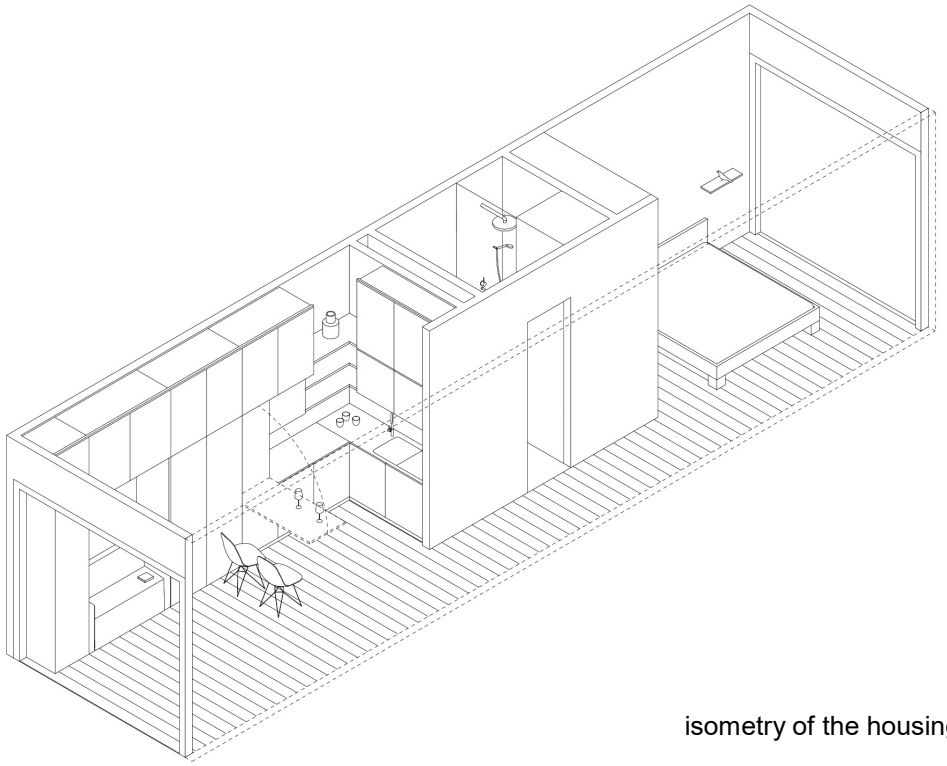
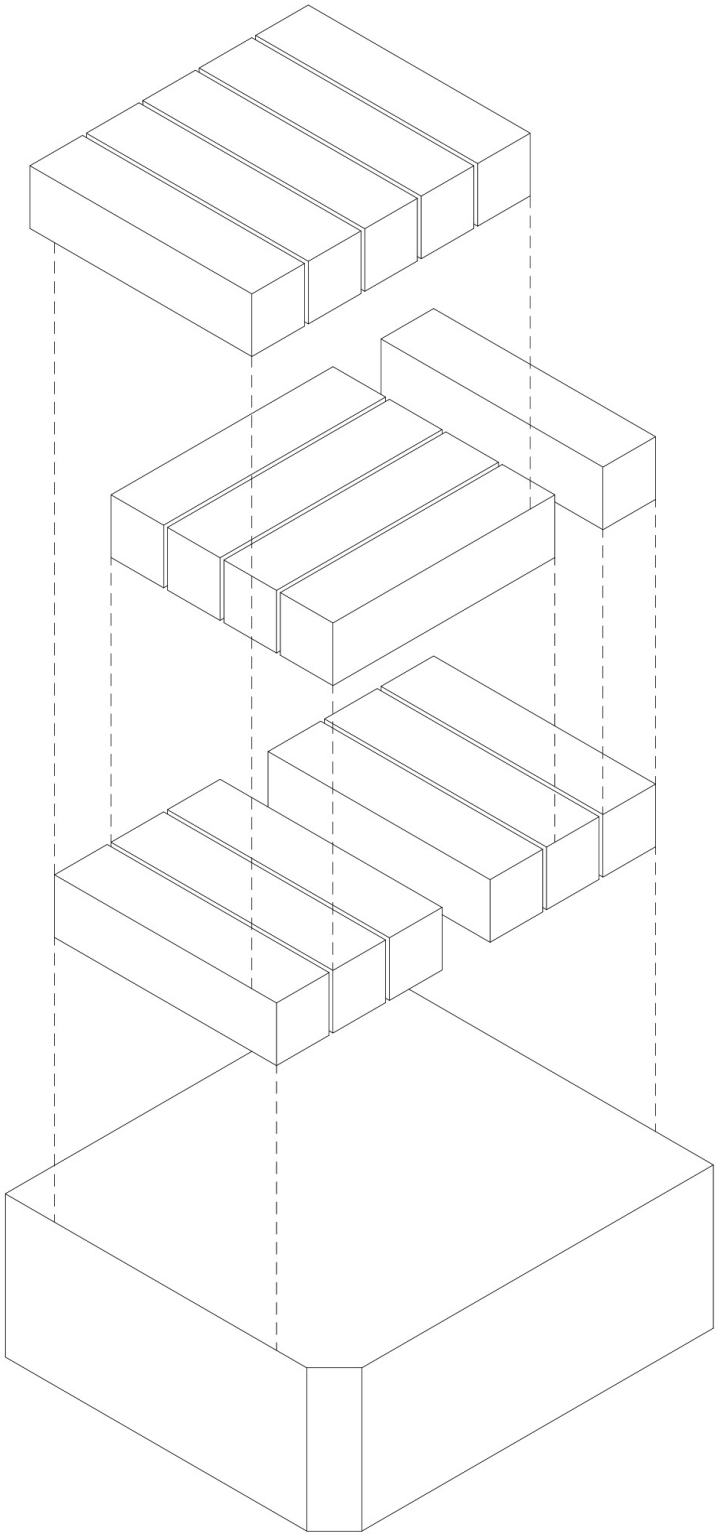
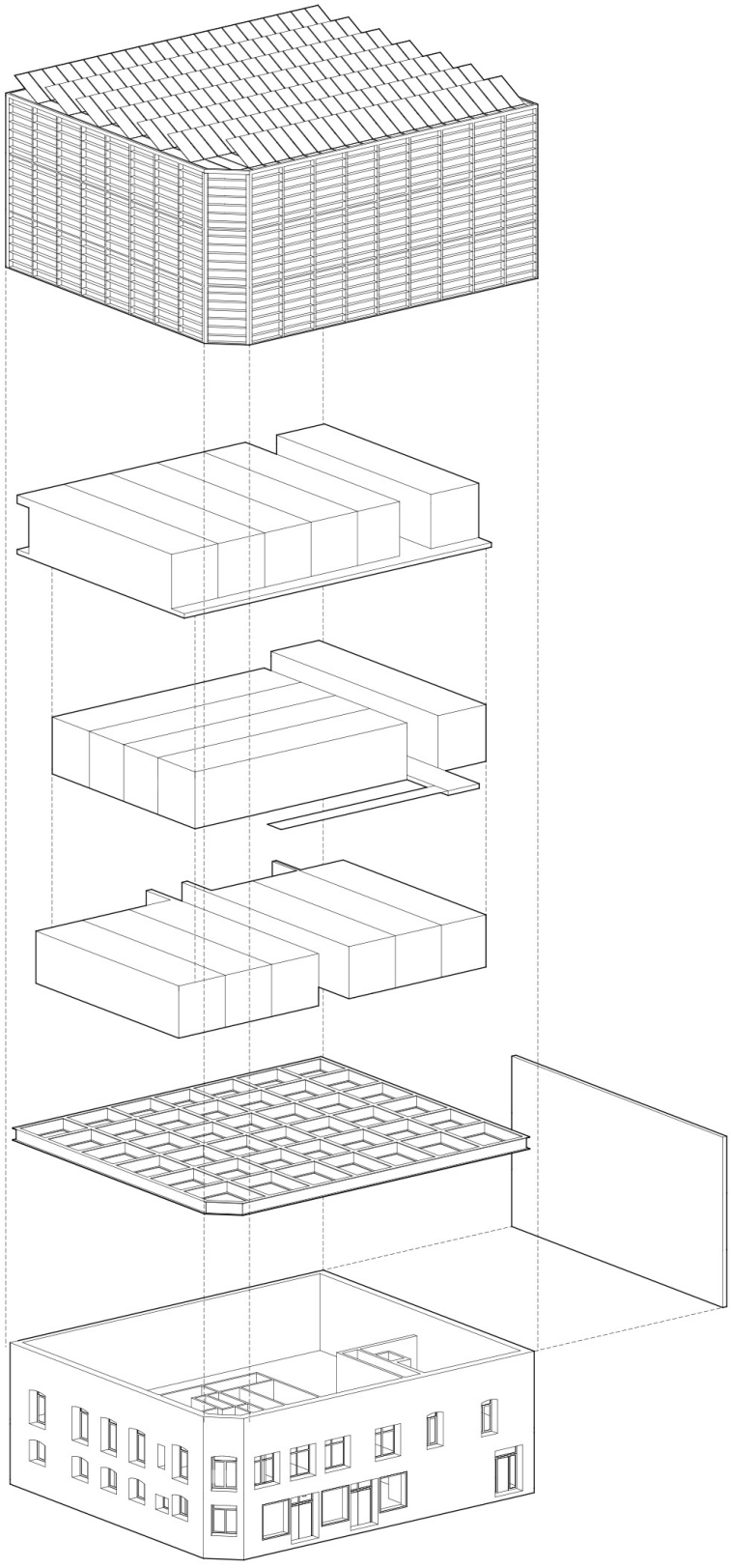
isometry of the 3D-model



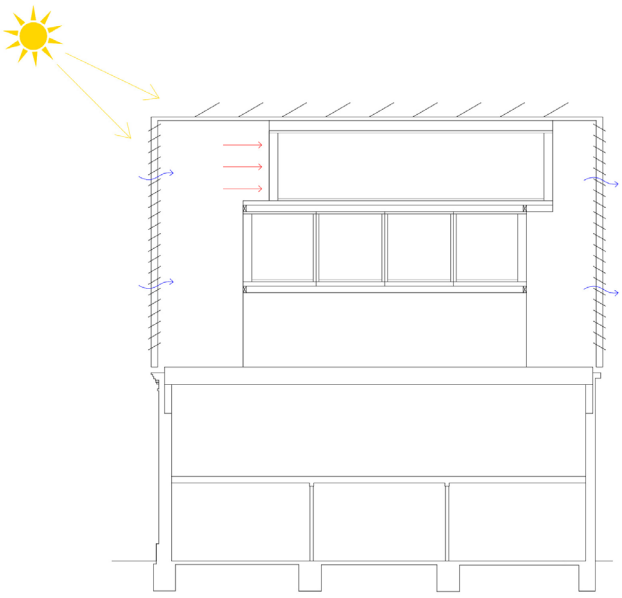
isometry of the housing-module



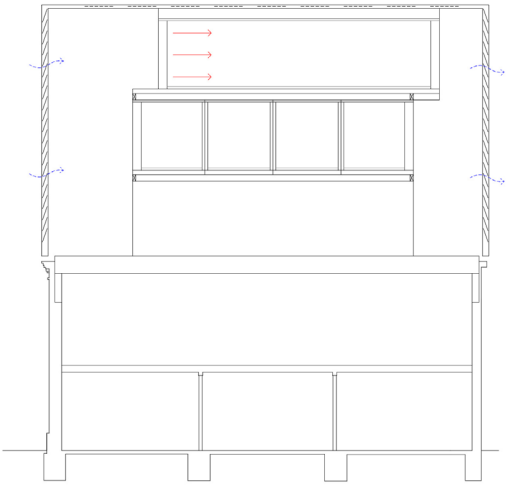
concept of storeys



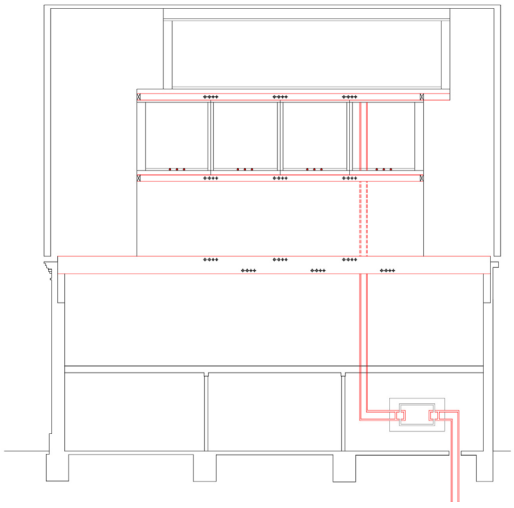
conceptual isometry



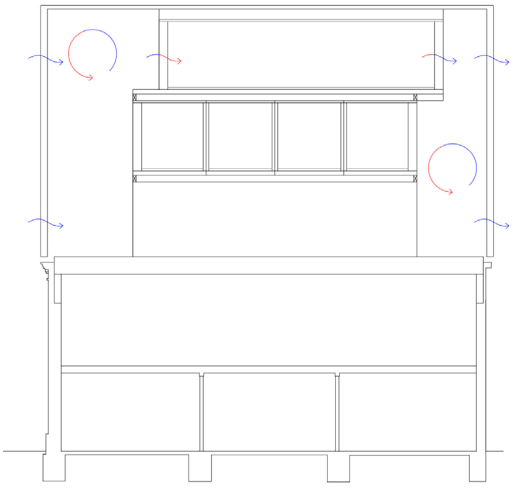
photovoltaic system (day)



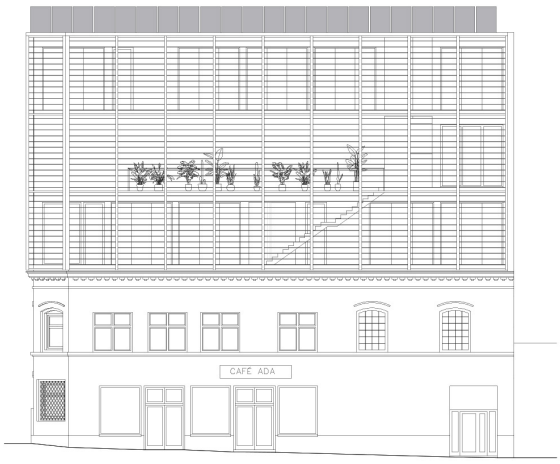
photovoltaic system (night)



heating system



ventilating system

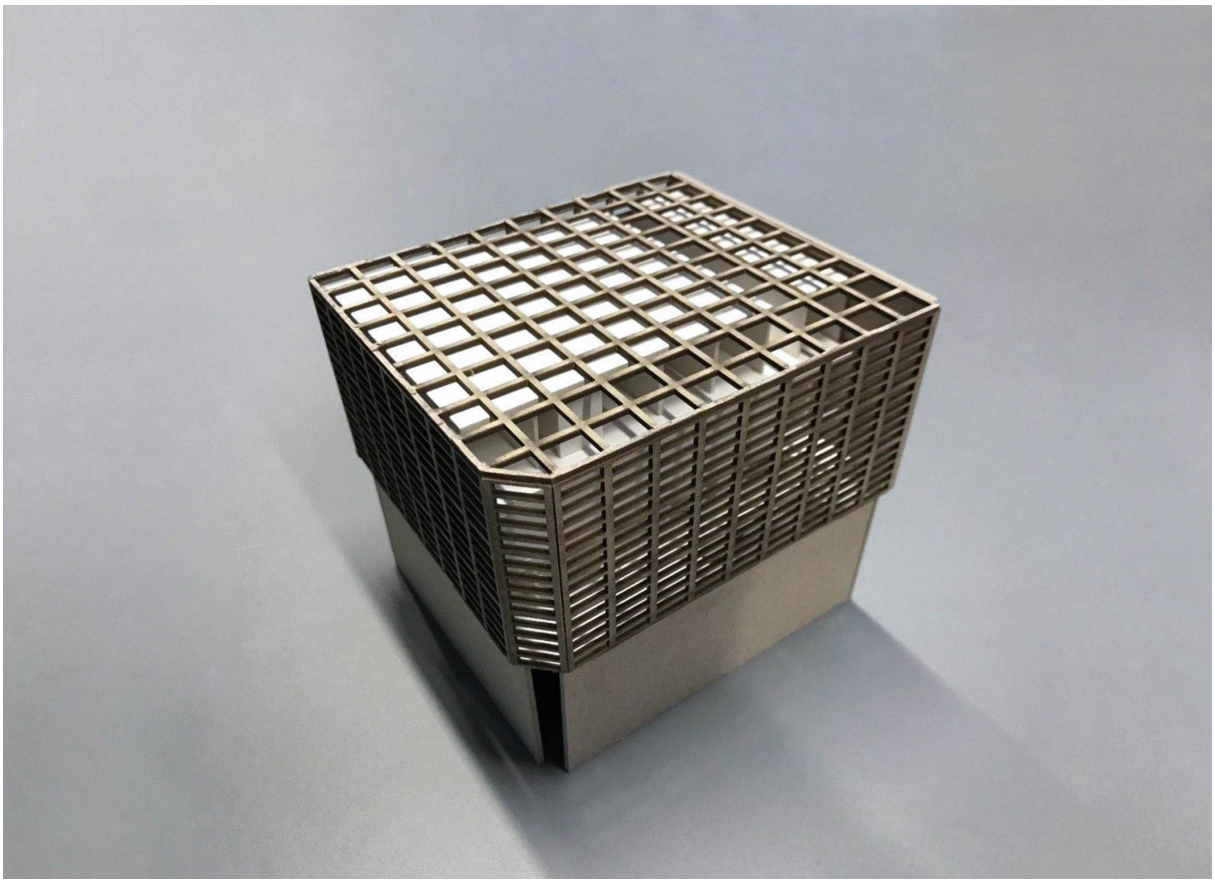


building elevation south, lamella facade closed

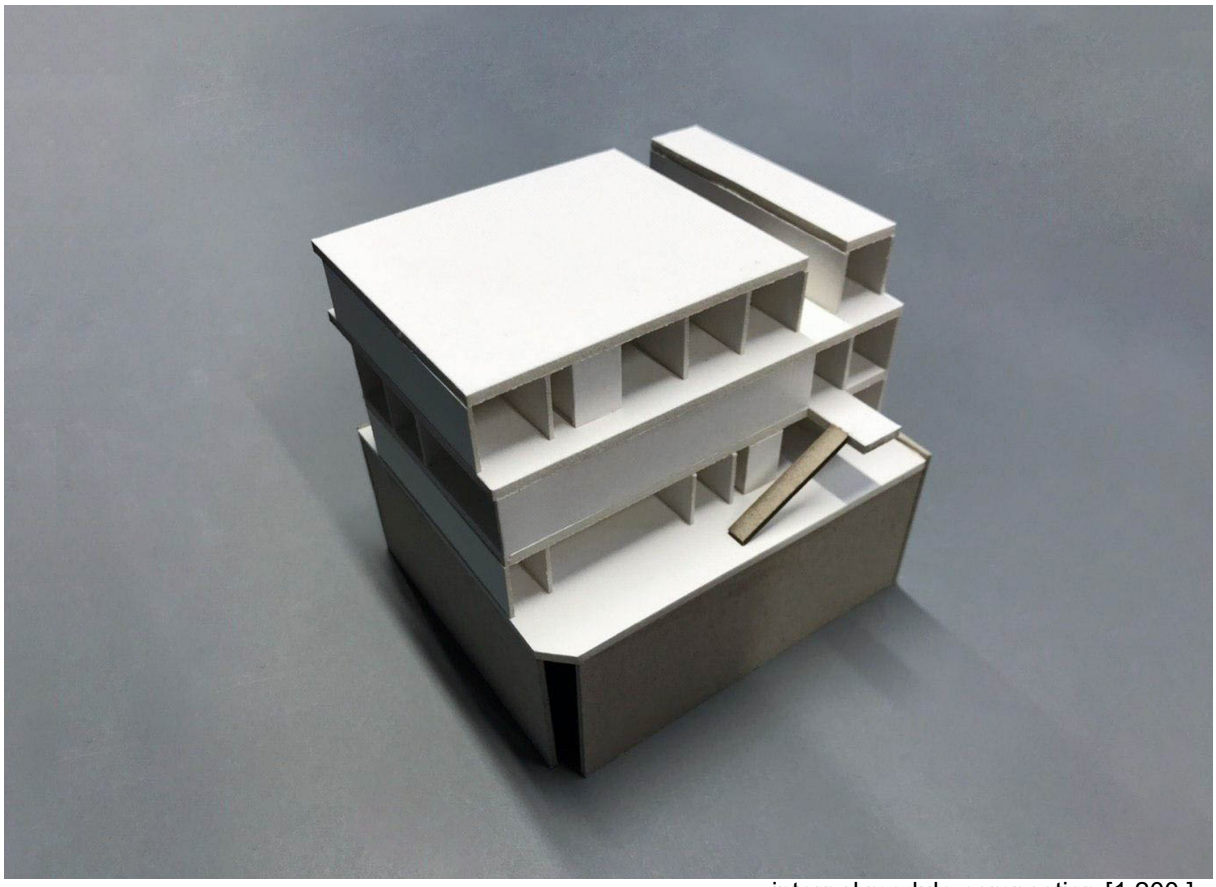
building elevation south, lamella facade opened

building elevation west, lamella facade opened

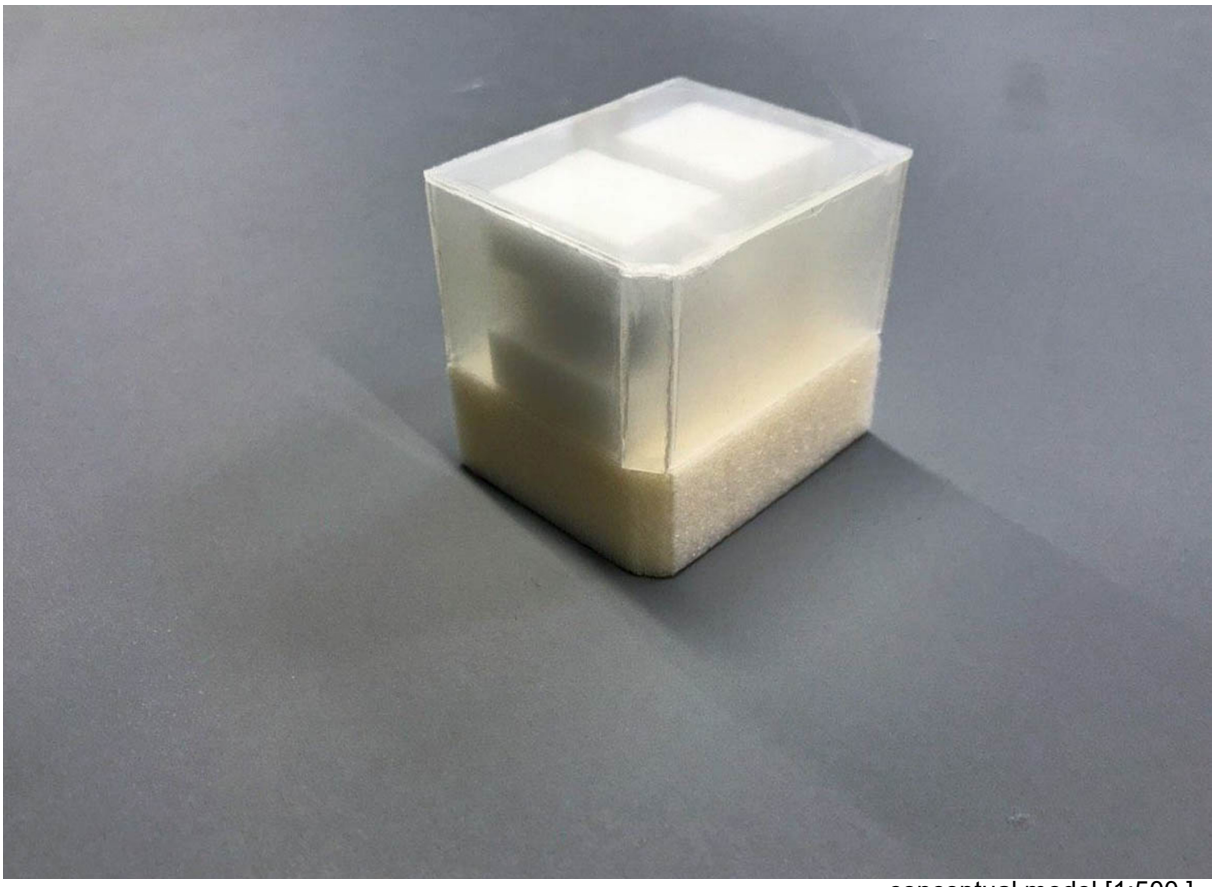
building elevation west, lamella facade closed



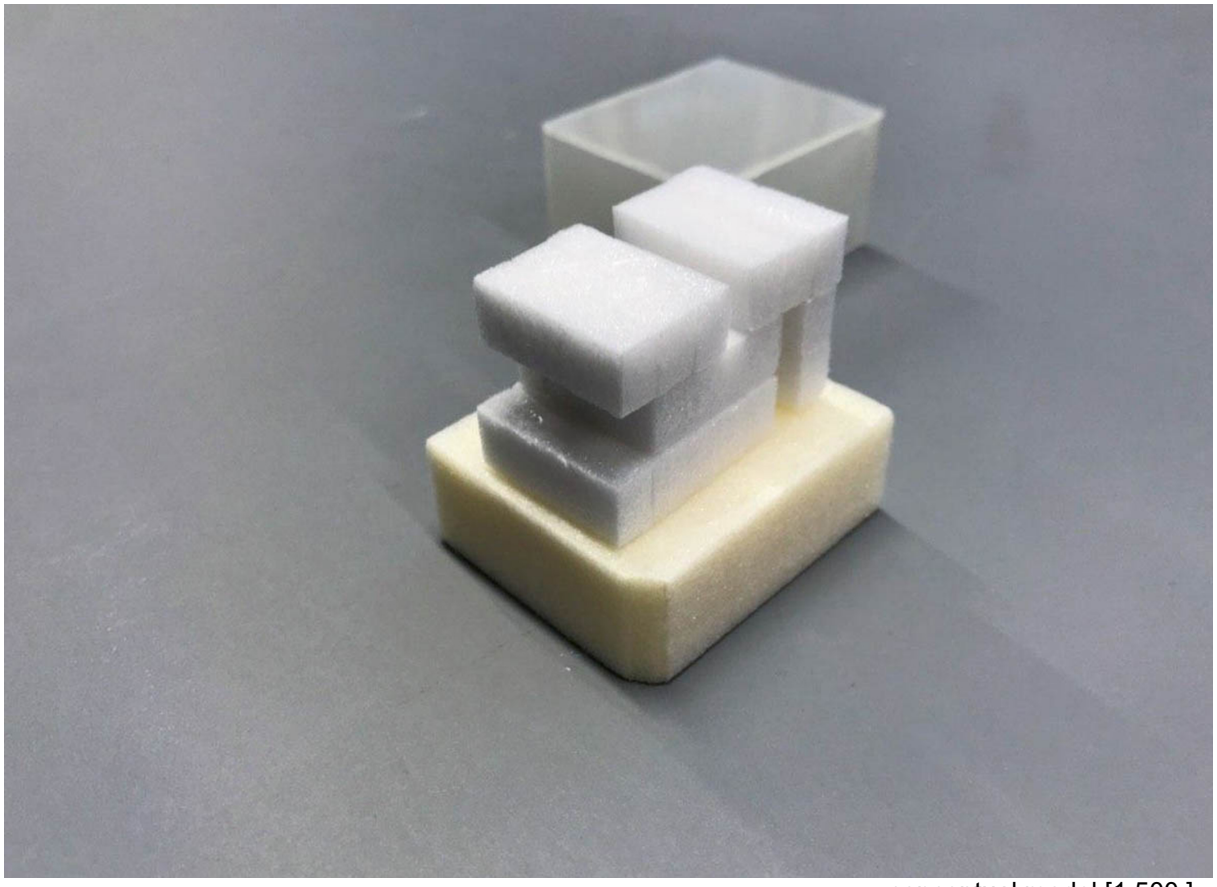
external facade structure [1:200]



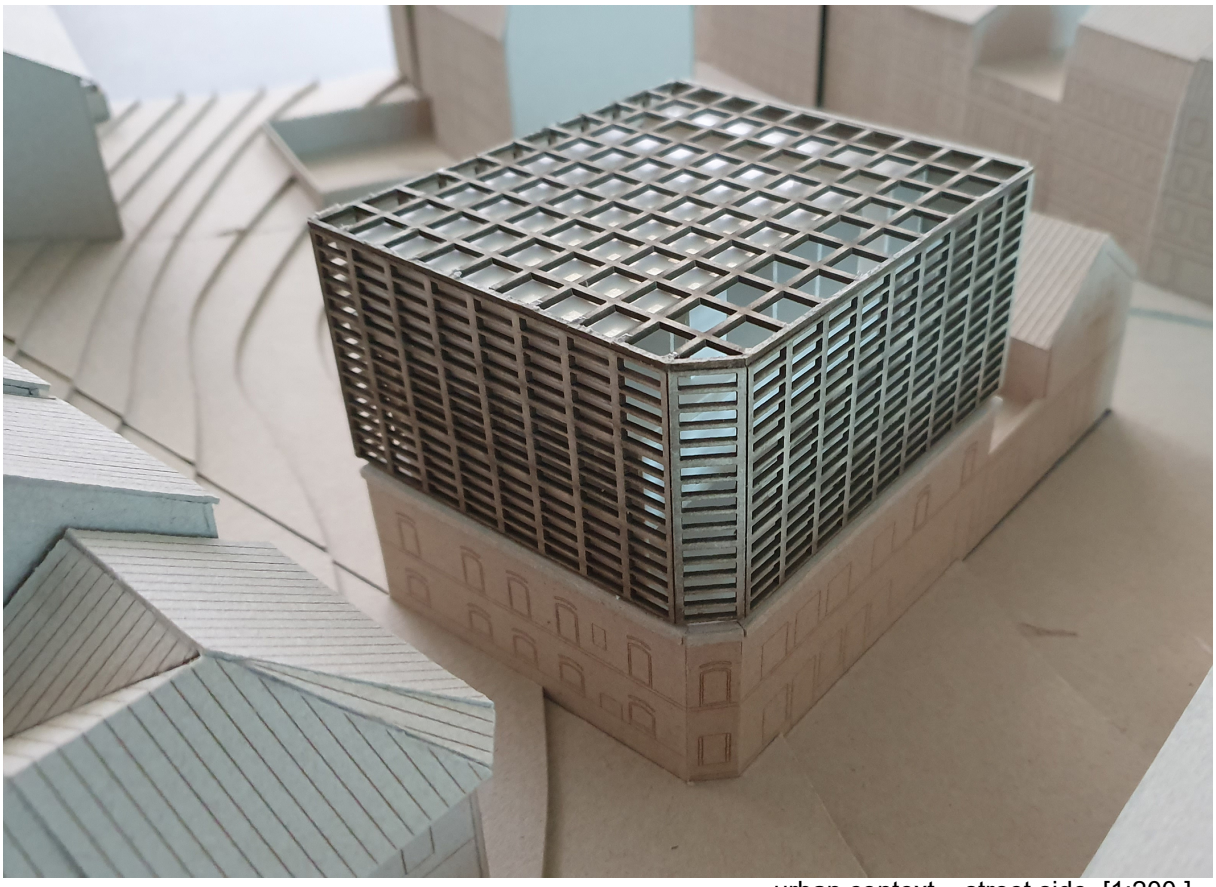
internal module compostion [1:200]



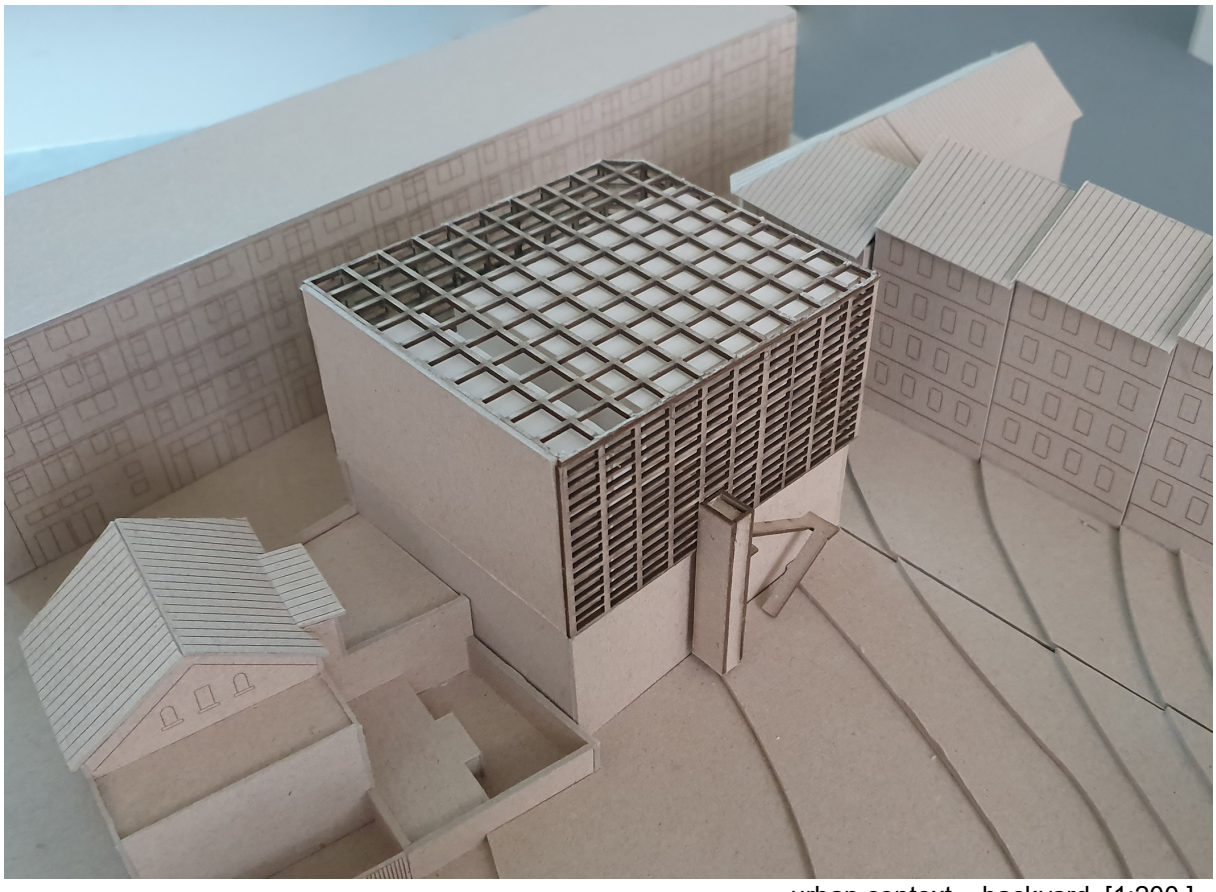
conceptual model [1:500]



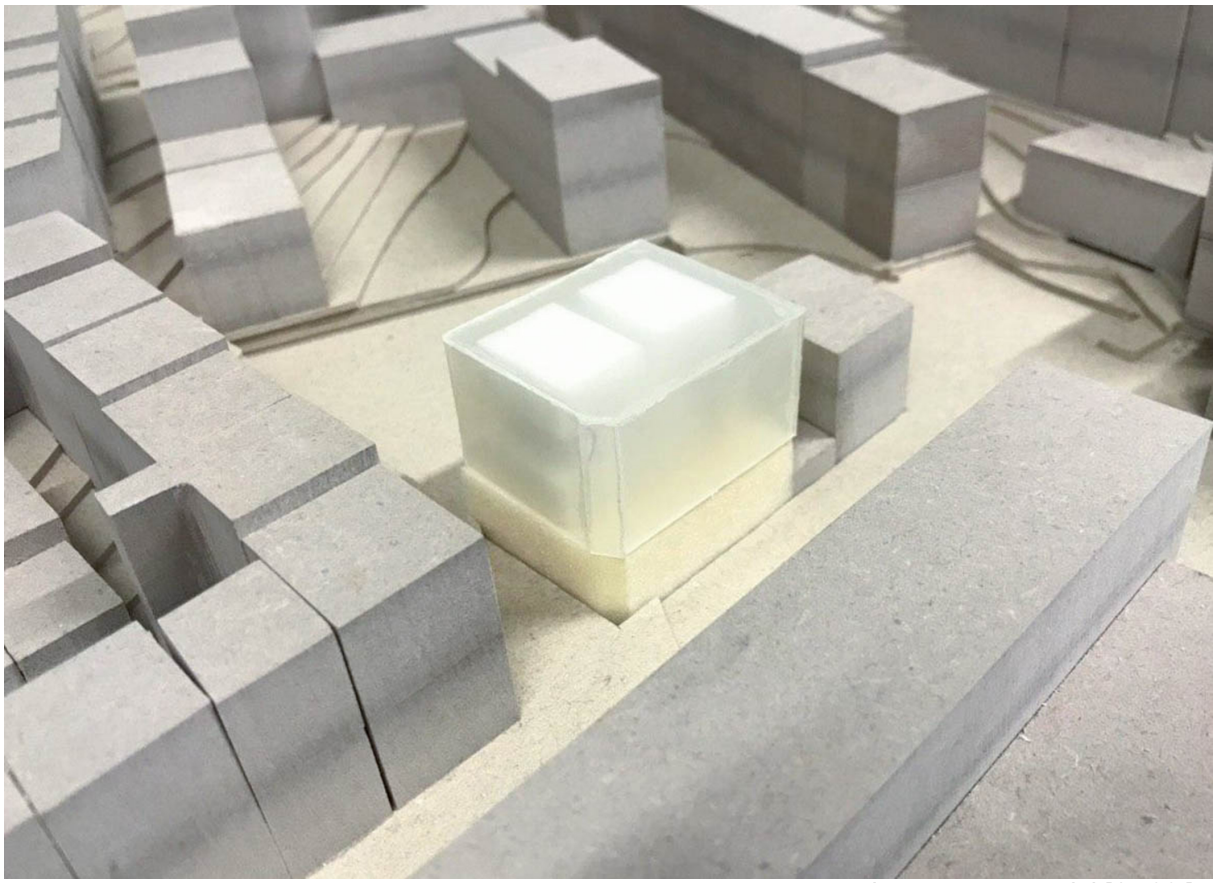
conceptual model [1:500]



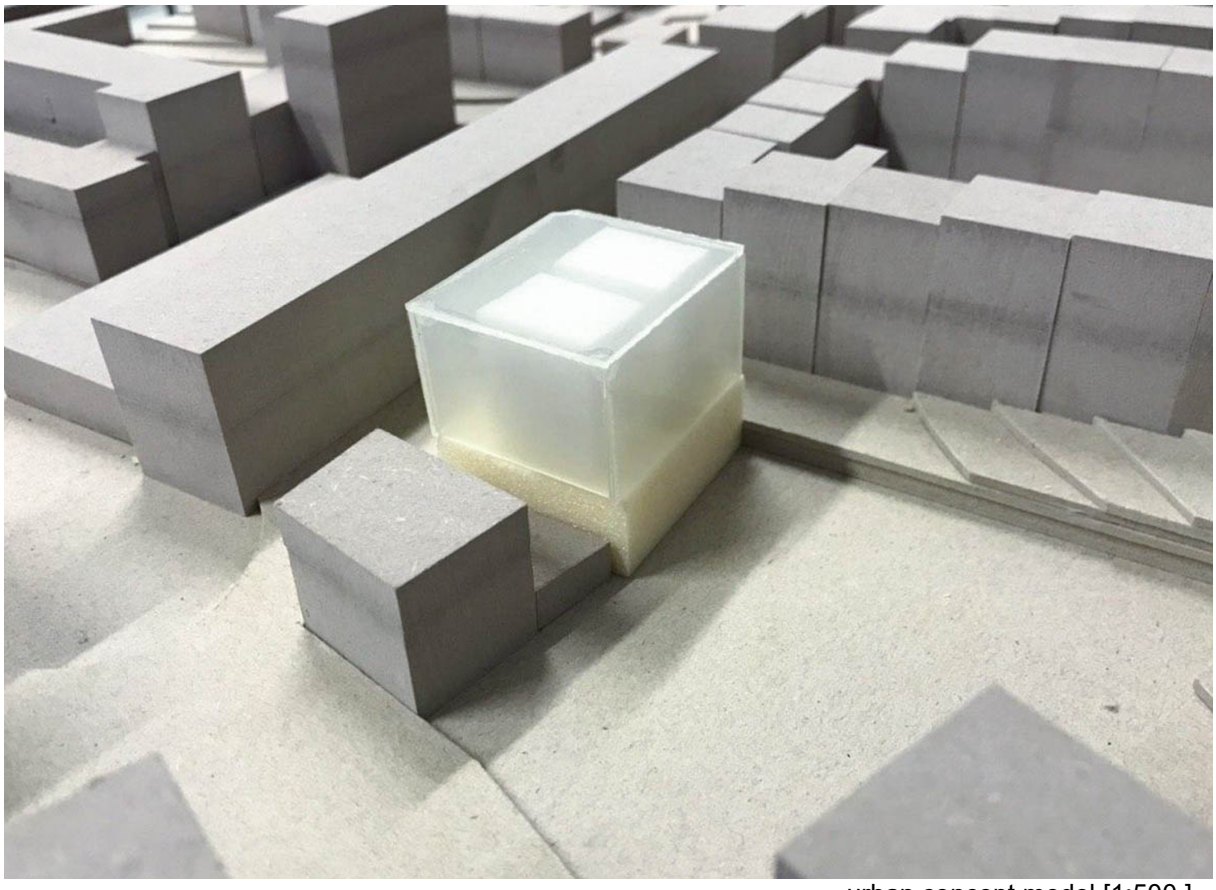
urban context – street side [1:200]



urban context – backyard [1:200]



urban concept model [1:500]



urban concept model [1:500]