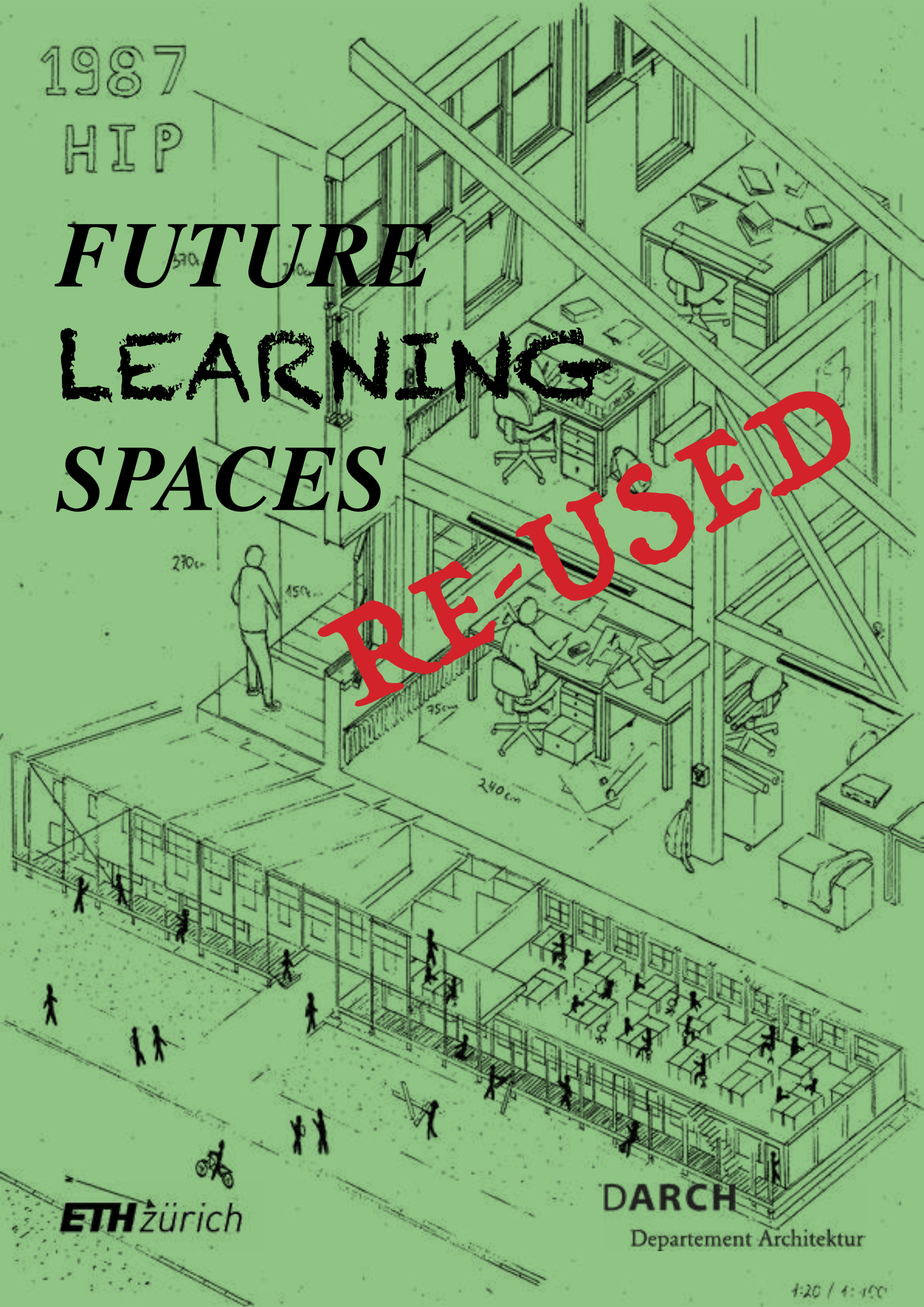
1987
HIP

FUTURE LEARNING SPACES

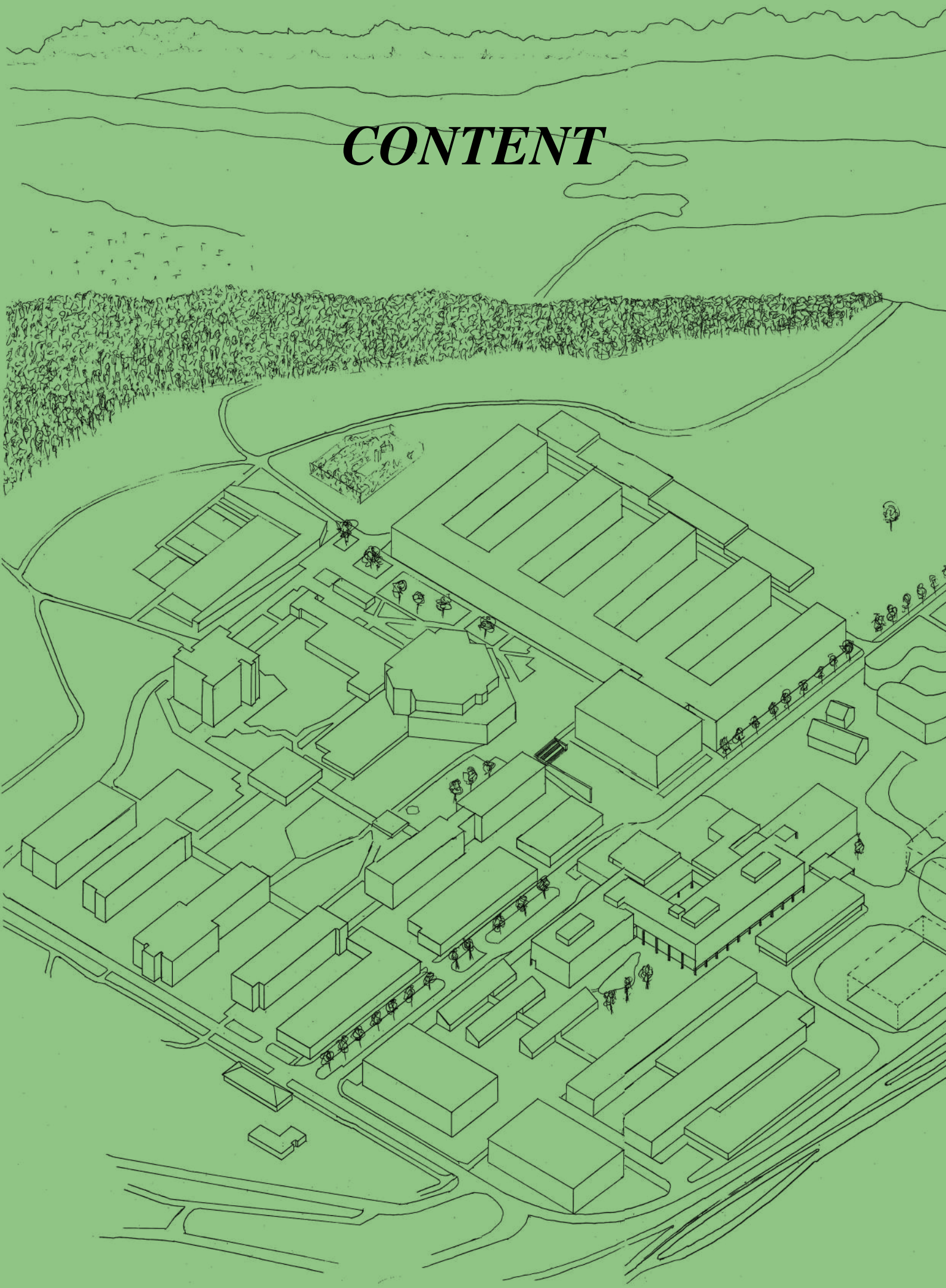
RE-USED



ETH zürich

DARCH
Departement Architektur

CONTENT



Höngger-Berg 1:1000

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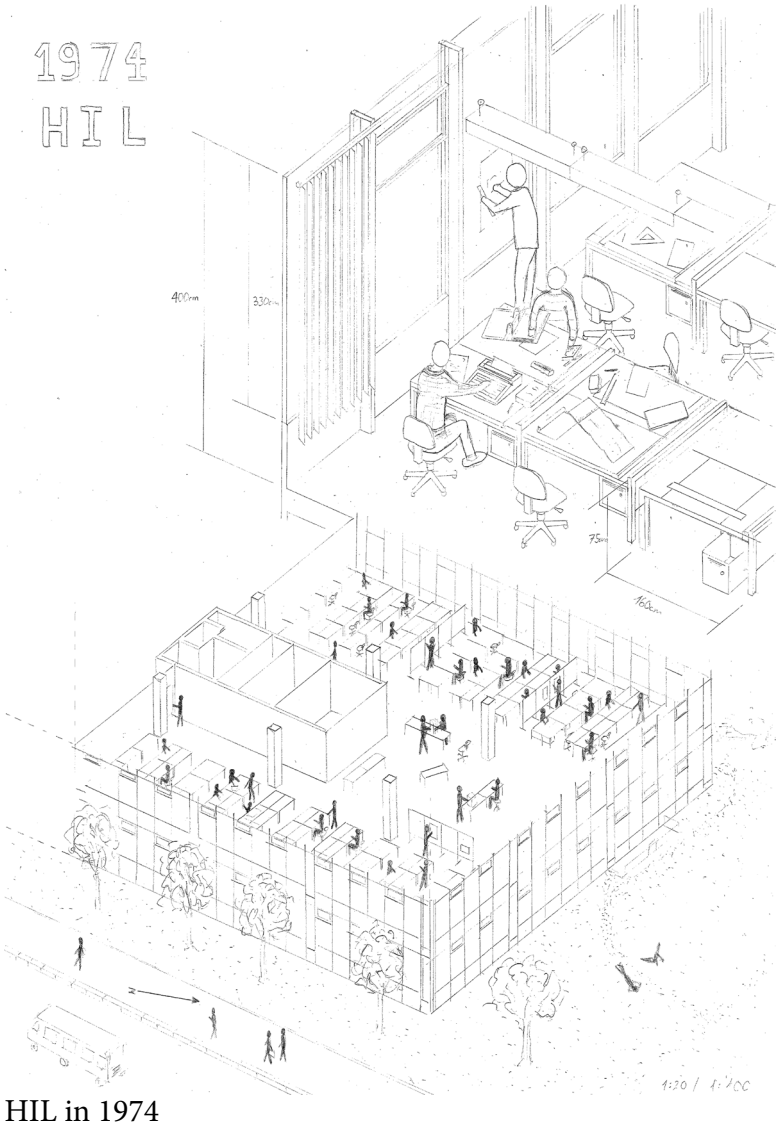
INTRODUCTION

BACKGROUND

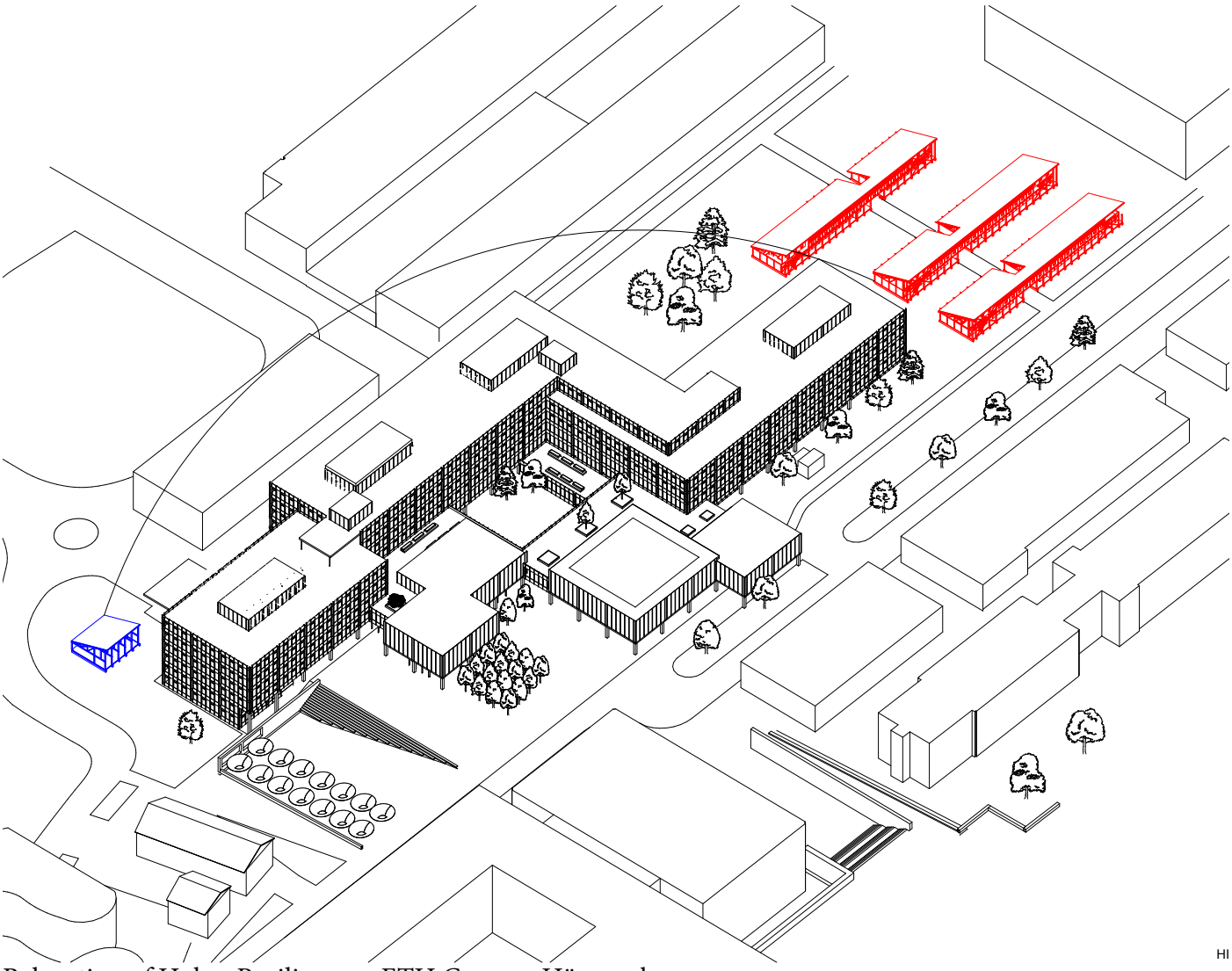
The **HIL building** was constructed in 1974 for the study of **engineering and architecture** at ETH. It is expected to enter into a **second life cycle** in the coming decade. The number of students has been growing in recently, resulting in an **overload** of **learning spaces** and a lack thereof to occupy.

As a consequence of a lack of learning spaces, D-ARCH diploma students are being moved to **HIL F 15**, which was primarily used by students of D-BAUG. As part of a case study, a **forum ad interim** has been introduced, which will serve as model for the modular **expansion of HIL.** In particular, the construction of the case study was executed with **reused materials** from ETH.



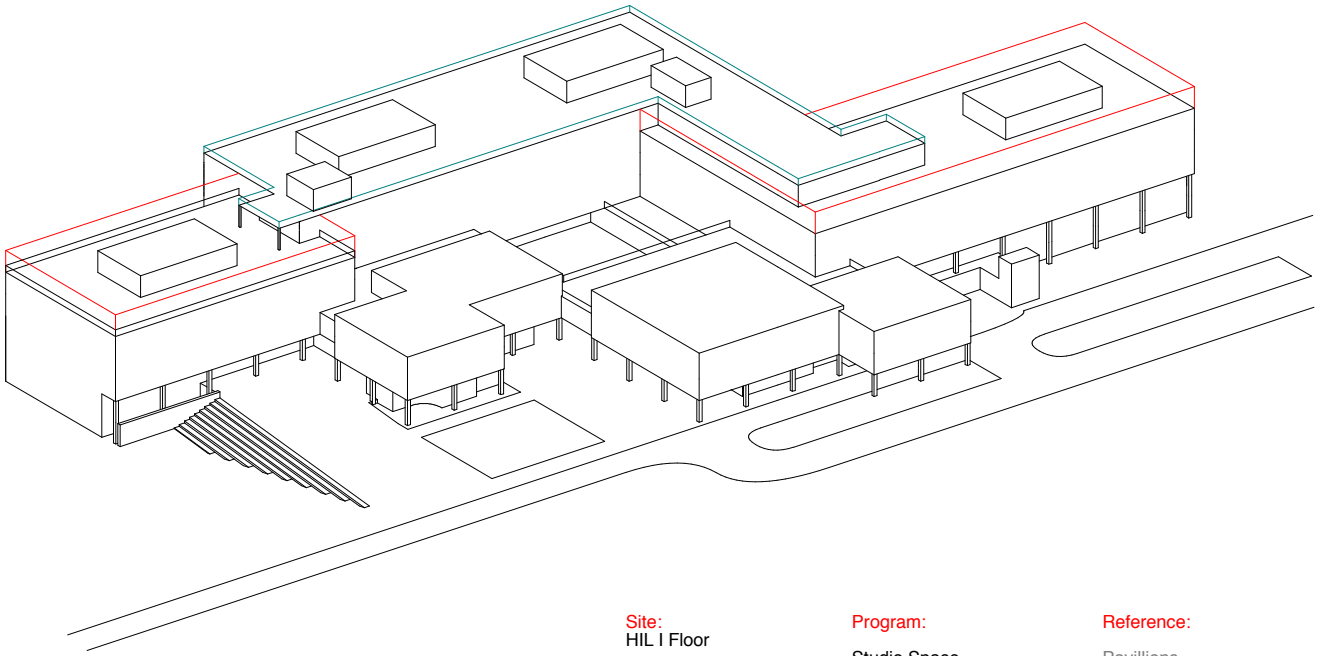
HIL in 1974

The three **Huber pavilions** next to HIL were built in 1989 with the purpose of accommodating architectural design studios. The pavilions were conceived as a **temporary**, light weight **wood construction** with simple connections. It's simple structure offers the option of deconstruction and **reuse** in another location. The pavilions will be deconstructed in 2022, further contributing to the **scarcity** of built resources in the learning environment of D-BAUG and D-ARCH**.**



Relocation of Huber Pavilions on ETH Campus Hönggerberg

Healthy students are good students. In 2022 ETH has started to equip learning spaces with two **height-adjustable tables** per 20 students.
Standing tables have three main benefits: They are barrier free, foster a **healthy learning space** and allow students to interact with each other in **common learning** activities. Thus, group learning methods may mitigate the need for personal work stations and deepen the acquired knowledge through collective engagement and sharing of positive experiences.



Site:
HIL I Floor

6'700 m2
530 Students
26 Studios

Program:

Studio Space
Informal Space
Resting Space
Kitchen Space

Reference:

Pavillions
1'500 m2
120 Students
6 Studios

axonometric view 1:500

Potential future roof top extension of HIL,

Future Learning Spaces

table behaviorology

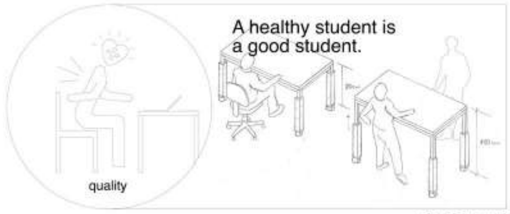
What are **Future Learning Spaces?**

Since the construction of the original ETH Main Campus by **Gottfried Semper** in 1860, not much of the learning environment has changed, except for the technical tools, which are being used. **Knowledge** is commonly conveyed during **study actions in sedentary position**, whether in a group lecture hall or at individual workspaces.
The only physical (standing and moving) activities are connected to excursions, model building or other, non-study related activities and "**informal learning**" on campus, such as drinking coffee with peers or having lunch. Building friendships and social connections along the way is regarded more of a side product, than a deliberate goal of the education itself.

Different **learning methods**, such as real building processes, disassembly, preparation of material, hands-on design and execution of a project are yet to be integrated formally into the curriculum. Rather than to criticise an existing system of teaching, the common sense thing to do, is to propose new models for learning. **Institutional change** is successfully achieved by engaging less in politics but more in practical solutions.

Study and learning methods are evolving digitally. A majority of learning occurs in places, which are not intended as **learning space**. (Thomas, 2010). We question how, where and when does learning take place in higher education?
Knowledge is commonly conveyed in **standardised spaces**, which are characterised by the industrialisation of society. Lecture halls have been conceived as an efficient **production line of knowledge**, thus being designed for one-way and the **delivery of content** from faculty to student (Biggs, J. B., 2003).
The spatial articulation of designated learning spaces plays a crucial role in study **behaviours** and the overall **performance** of students.

We know that **mental health** is closely connected **physical well-being**. Physical movement improves the **cognitive capabilities** of students and encourages peak performances (Ratey, 2013).
Contemporary study methods, such as sitting in front of computer screens for many consecutive hours, do not support the notion of physical movement.
We underline the impact of furniture on **pedagogical** and behavioral patterns in the learning environment and furthermore the importance of physical movement during learning processes. (Dr. John Ratey, 2013).

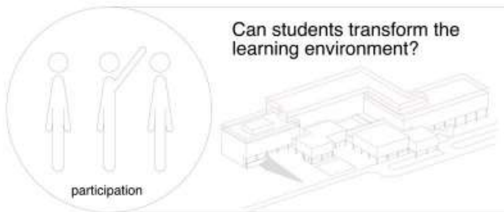


What makes healthy learning spaces?

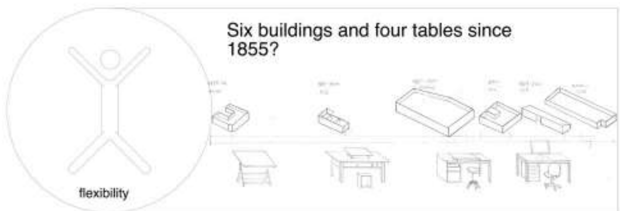
a conversation between teachers and students

Physical space at the department is limited.

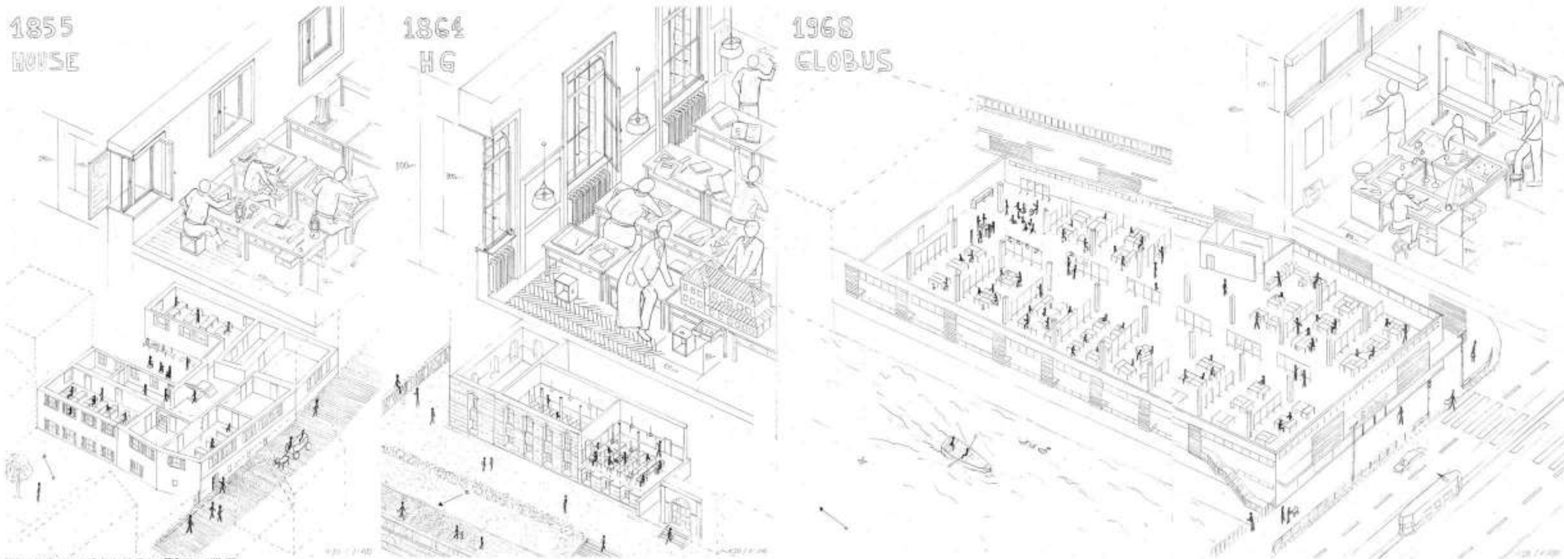
perspective of HIL and Hubei pavilions



What is the role of students at university?



What is the role of the university for future architects?



Formal learning

Case Study HIL F 15

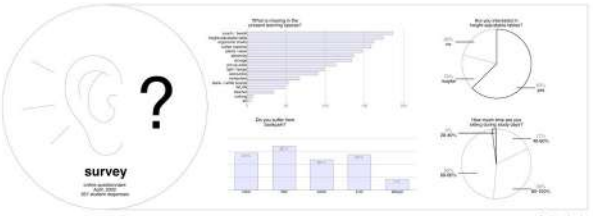
learning behaviorolgy

A high occupancy site within the D-ARCH faculty building HIL has led to an overload of the learning environment.
The HIL building was constructed in 1974 for engineering and architecture students at ETH. It is expected to enter into a second life cycle in the coming decade. The number of students has been growing in recently, resulting in a lack of flexible study- and work spaces in/ around it. The Stress Hubs (colloquy next to HIL entry built in 1968) with the purpose of accommodating architectural design studios. The pavilions are connected as a temporary, light weight wood construction with simple connections. No primary structure is made of solid wood and inserts with the option of deconstruction and re-use in another location. The pavilions were deconstructed in 2022. Further contributing to the scarcity of build resources.
In the context of the Master course Architecture and Urban Design (MAUD), HIL, which was primarily used by students of D-ARCH, as part of a case study, a frozen pit volume has been introduced, which will serve as model for the extension of HIL. In particular, the construction of the case study was executed with in-use materials from ETH.
The case study, introduced as a pilot phase, constitutes a proposal for the change of furniture and thus extension of common workspaces of students. The design may serve as future strategy for the repurposes of the HIL building. The evaluation of the outcome and satisfaction of stakeholders further reinforces future learning spaces and thus the design of the HIL building.
The main goal, to create a healthier space for learning activities succeeded. A proposal for an in-between space was introduced, accepted and refined in meetings with all stakeholders. The case study not only looks new learning spaces, but also safeguards as many working stations as available before the intervention.

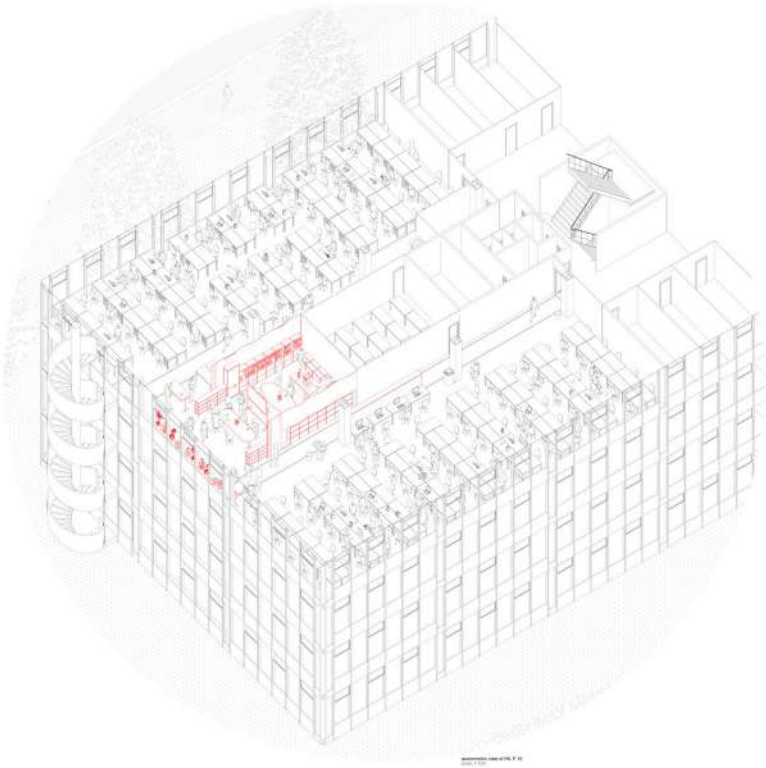
Informal learning spaces have been implemented successfully at D-ARCH on several occasions. In the case of HIL F 15, the introduction of a buffer zone between the different student groups has proven worthwhile, it invites students to spend time deliberately exchanging and interrelating while in shared space.
The empowerment of student's appropriate of space hereby meets the idea of democratic activism and expands the participative process with individual choice. Weight-adjustable tables are limitedly available at ETH. For the execution of the case study, these such tables were made available by "ETH Remetten", serving approximately 1000 students.
Hereby, we develop a DIY solution to retrofit existing furniture Fig. 09) with non-intrusive and reversible table seat fastening. The method consists of an encasing for the table top, which is fixed to the table with an additional underplate. This additional, outer top is equipped with wheels for increased mobility. The mechanism for adjusting the height of the table relies on a simple bolting system. A metal screw or bar is inserted into cross-reinforcing openings of the encasing, thus interlocking the inner table leg on a certain height.

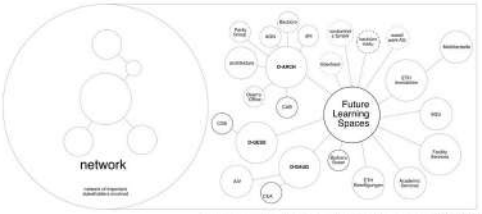
The resulting prototype of DIY bolting seat rider produced professionally both in wood and in metal by a local carpentry (kunststoff GmbH) as well as a metal workshop (metall razor AG) in the neighborhood. Both solutions consult making use of the same bolting system.

Anatomy of Learning
In order to build better learning spaces, first, study activities must be identified and quantified. Behavioral observations allow for a deeper understanding of preferred spacial typologies and correlating performance efficiency of students.

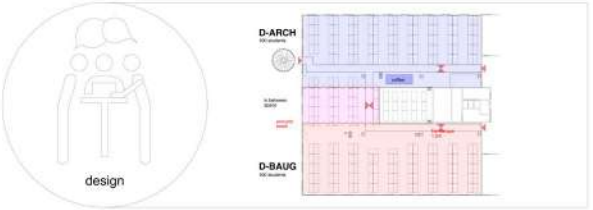


Teaching vs Learning
Roughly 33 percent of all pertaining students claim to have excess or constant back pain. Likely, as a result from their study activities, which occur mostly in sedentary position. Teachers, on the other hand, often stand during lectures and utilize more comfortable furniture in their office. In particular, we find, that height-adjustable tables are very popular with students, not only for individual work, but mainly for group discussion in a standing position.

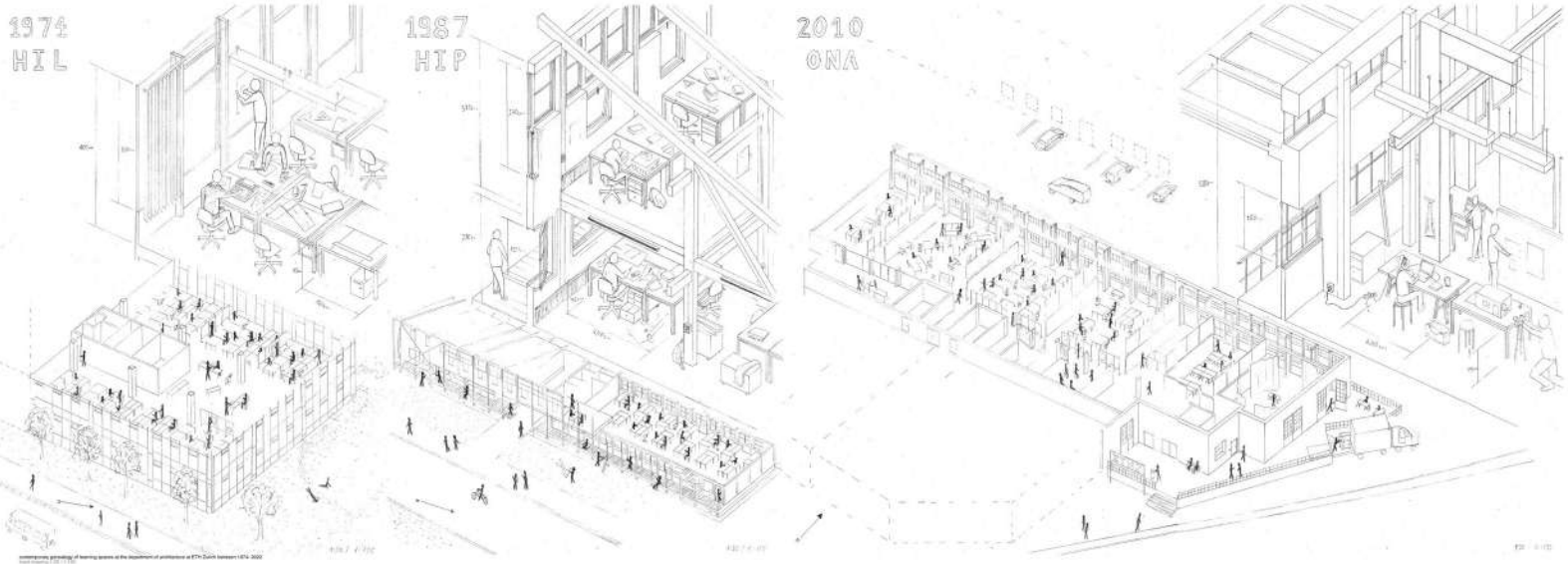




Design in Dialogue
In order to realise any proposal for transformation in the learning scope of ETH, many stakeholders are automatically involved in the permission- and decision making process. In order to enjoy their support, it requires a clear understanding of safety and behavioural rules.



Which requirements need to be fulfilled?
Democratic options require a multiplicity of voices to be heard and considered.
The case study was designed in coordination with the Academic Services of ETH. Join from B.Sc.BU and architecture from S.ARCH.
The case study holds further student initiatives such as a coffee station and PET bottle collection.



contemporary genealogy of learning spaces at the department of architecture at ETH Zurich between 1974- 2022

Informal (deep) learning

The thesis presents a problem, which is responded to with means of scientific research and architectural design:

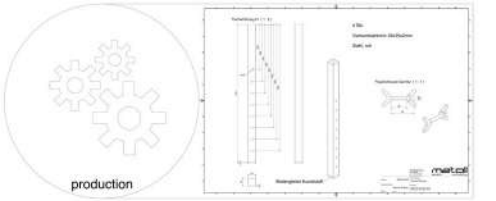
"A high occupancy rate within the D-ARCH faculty building HIL has led to an overload of the learning environment. Conflicts arise with the dual utilization of spaces for pinnacles (test) and stimulus and technical (learning) events. The availability of learning spaces varies between the hours of the day, the day of the week and the month of the year. As a result, students face an increasing exposure to environmental factors such as noise, light, air, temperature and social activities. Furthermore, learning spaces are insufficiently fitted in terms of furniture. These issues whistle the demand for action and the necessity of upgrading and up keeping the learning landscape at HIL."

— Bettart Lorna Hegetschweiler, Akademische Gärtnerin (AHS, ETH Hönggerberg), WS/ETH, 2022

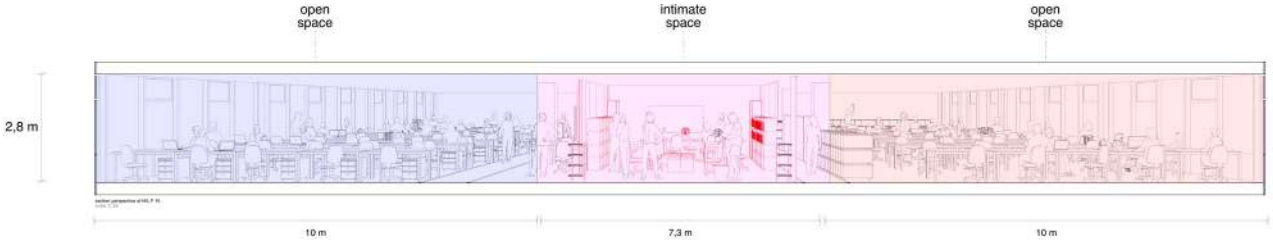
In the context of this thesis, we use the following two references to describe the **terminology of a learning environment**:

"We define a learning environment as designed space – physical as well as digital – which stimes and fosters learning. This incorporates infrastructure, techniques, materials, media and associated teaching- and learning methods. The learning landscape includes various areas for a diverse range of activities on Campus."

— Definition of Learning Environment, Akademischer Ehrrats (AHS) and ETH Library, 2020



Who builds learning spaces?
In order to successfully transform learning spaces, it requires expert craftspeople. Safety is a top priority, which requires professional execution on site. As we plan always for the most unlikely, in case of traces of accidents, the learning space always requires to offer an opportunity of fresh air storage.



section perspective of HIL F 15

INTENTION

In the design proposal, we question how best to re-use the building material from the **demolition site of the Huber Pavilions**. The project attempts to articulate a **circular learning space typology** next to the HIL building. An actor network of teaching staff, experienced craftsmanship and architectural expertise has been set up to back a re-use solution for students by students. To sustain the **built character**, and preserve the perks of the Huber pavilion, a selection of materials are re-utilized to build a physical connection between old and new learning space enclosed by the three pavilions.

Circular engineering in architecture activates deep learning processes through physical activities connected to the learning progress.
In an ever changing exhibition of building elements, the Huber Pavilions will be preserved for future re-use projects as **common learning property** of the environment of ETH Zurich. An **second life-cycle** of the pavilions will enable future students to experience a second phase of disassembly. The role of the architect and builder hereby creates awareness about the life cycle of building systems and measures takes for circular durability.

What are ***Future Learning Spaces?***

Since the construction of the original ETH Main Campus by Gottfried Semper in 1865, not much of the learning environment has changed spatially. Knowledge is commonly conveyed acquired through **study actions** in a group lecture halls or at individual workspaces in **sedentary** position.
The only physical (standing and moving) activities are connected to excursions, model building or other, non-study related activities and "informal learning" on campus, such as drinking coffee with peers or having lunch. Building friendships and social connections along the way is regarded more a side product, than a deliberate goal of the education.

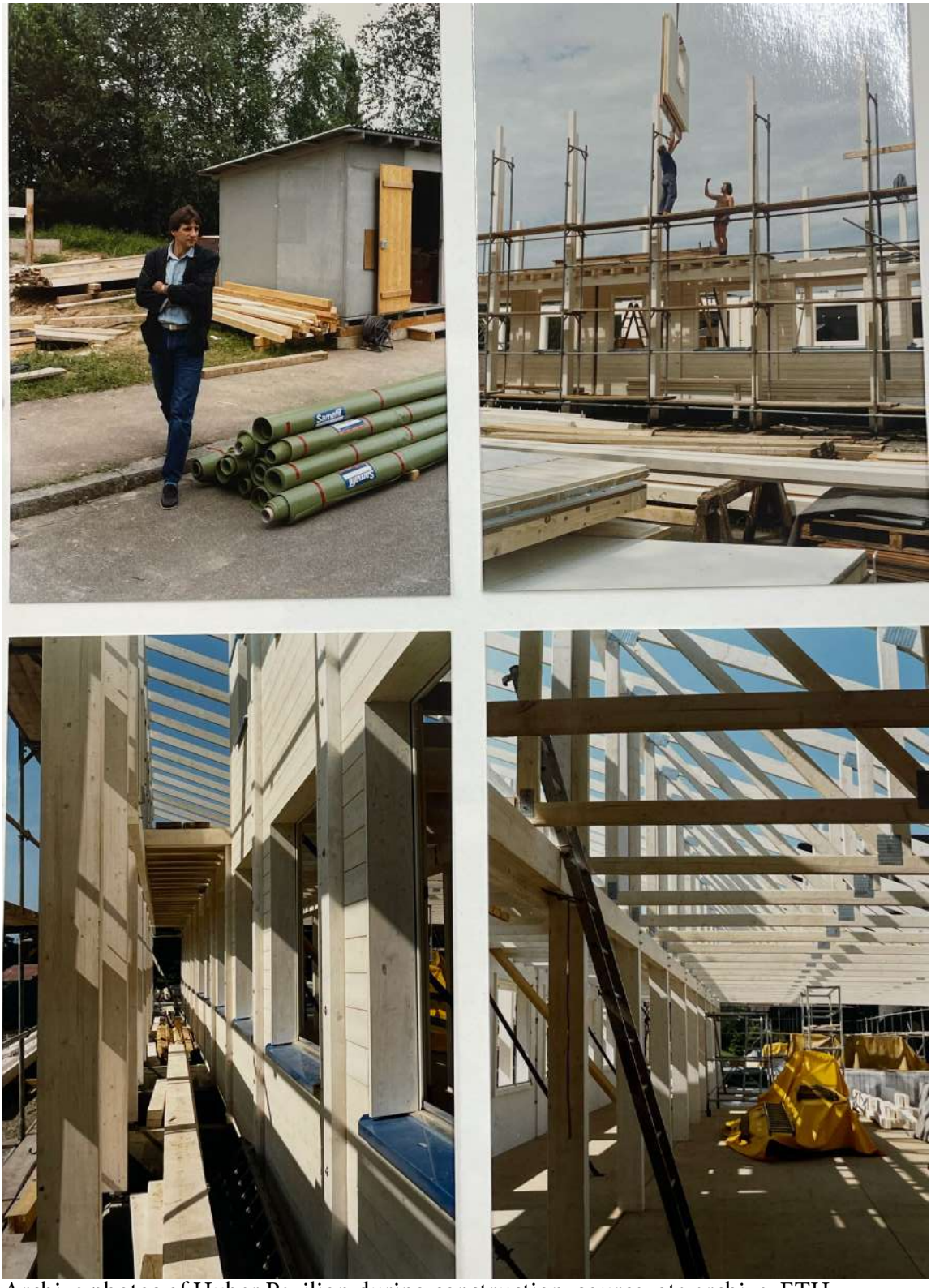
Different **learning methods**, such as real building processes, disassembly, preparation of material, hands-on design and execution of a project are yet to be integrated formally into the curriculum. Rather than to criticize an existing system of teaching, the common sense thing to do, is to propose new models for learning. Institutional change is successfully achieved by engaging less in politics but more in practical solutions.

Why is **re-use** so important?

Annual waste emissions from construction are being reduced by the **down cycling** of miscellaneous building elements. Yet, common building elements become unique, when vernacular architecture, local craftsmanship and design of the ordinary are set as learning goals.
Architectural creation and intellect is considered the key factor to nourish with the design of learning spaces, in regards to the appearance of teaching spaces.

Learning spaces must foster learning activities, not teaching methods.

The program of the re-use ETH pavilion therefore consists of interior working spaces for individuals and groups, as well as a roofed outdoor space, offering a double height room for **1:1 model building**. Learning from the preliminary **behavioral observations** and feedback, we intend to advance the learning environment of HIL with a new model for **informal learning spaces.**



Archive photos of Huber Pavilion during construction, source: gta archive, ETH

BUILDING MATERIAL

The Huber Pavilions were an elementary part of the ETH learning environment. They have offered a alternative spaces for a range of study actions for over 30 years continuously.

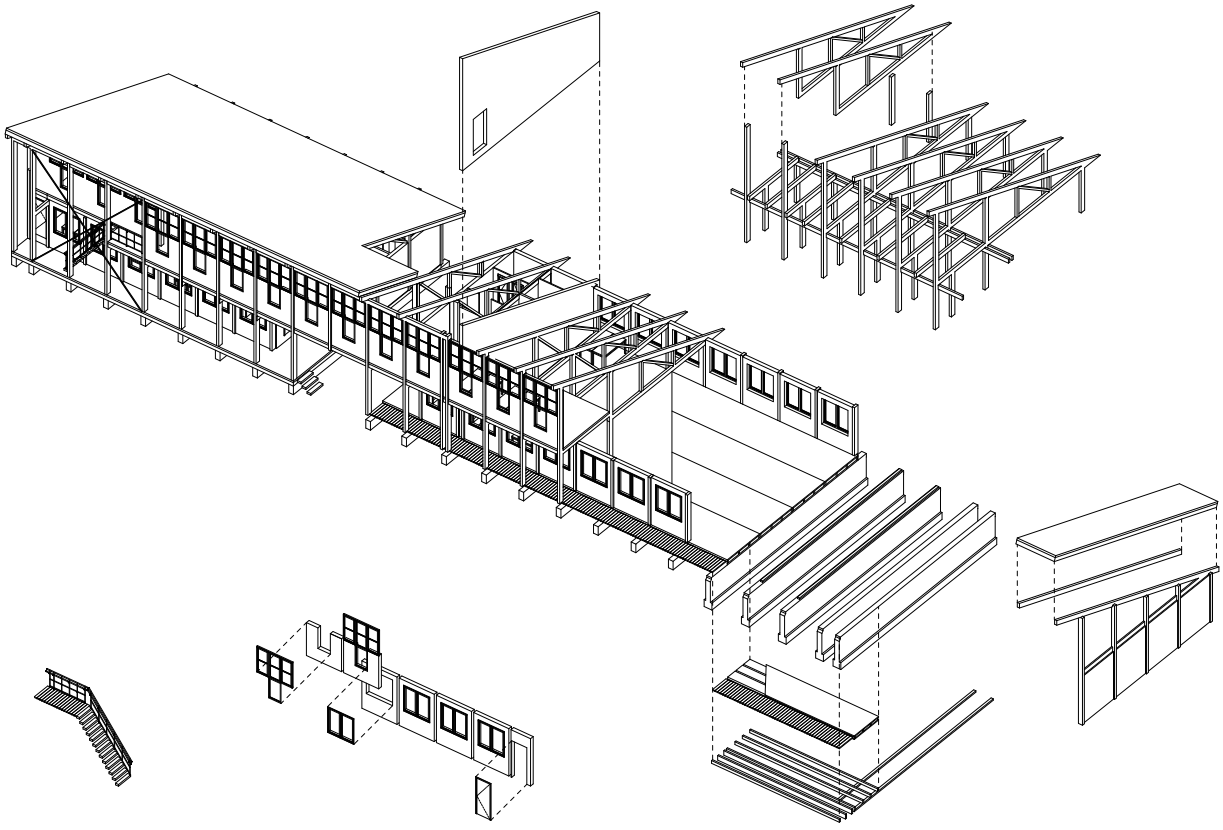
In an environment of generic learning spaces, the **triangular shape** of the Huber Pavilions were far more than just iconic and worthy of preservation.
The pavilions were celebrated by students, because the form incorporates multiple learning methods.

Intimate personal spaces were offered in a second floor gallery, an open, the **double height room** allowed for large model building and group presentations. Further, low-ceiling niches served well as individual workspace. The outdoor spaces of the pavilion were used for ad-hoc public interaction as well as 1:1 model building and larger informal gatherings.

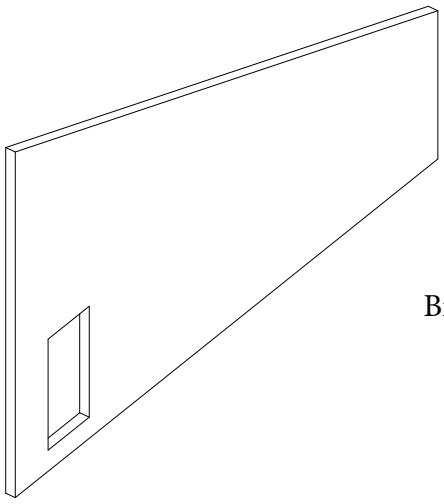
The expected outcome of this diploma thesis is to test the adaptability of materials to new use in contrast to the adaptability of spatial program in the existing learning scape.

We focus on the following objectives concerning the re-use of the materials from the Huber-Pavilions:

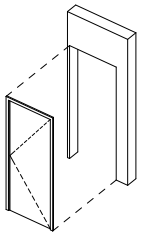
Disassembly and identification
Transport and distribution
Preparation and storage
Design and testing



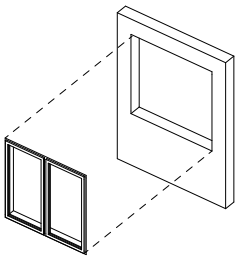
Axonometric explosion of Huber Pavilion



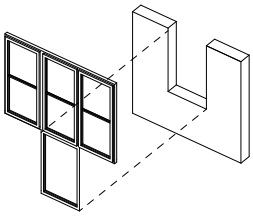
Brick wall: 67 m^2

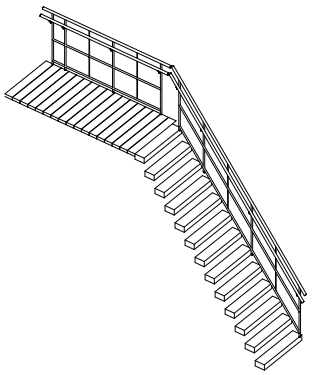


Doors: 16



Windows: 49





Stairs: 4

Building components of Huber Pavilions

EXPECTED OUTCOME

The diploma thesis proposes a design for the **extension of HIL** building by **re-using** building materials from the **Huber Pavilion.**
The design project tackles the lack of available learning space at HIL and addresses the quality and fittings thereof. This project raises the question how to deal with material waste in the construction industry in the broader future of the campus and in general.
Future students of HIL will be directly confronted with, and benefiting from a sustainable, circular construction by being exposed directly to the physicality of learning spaces.

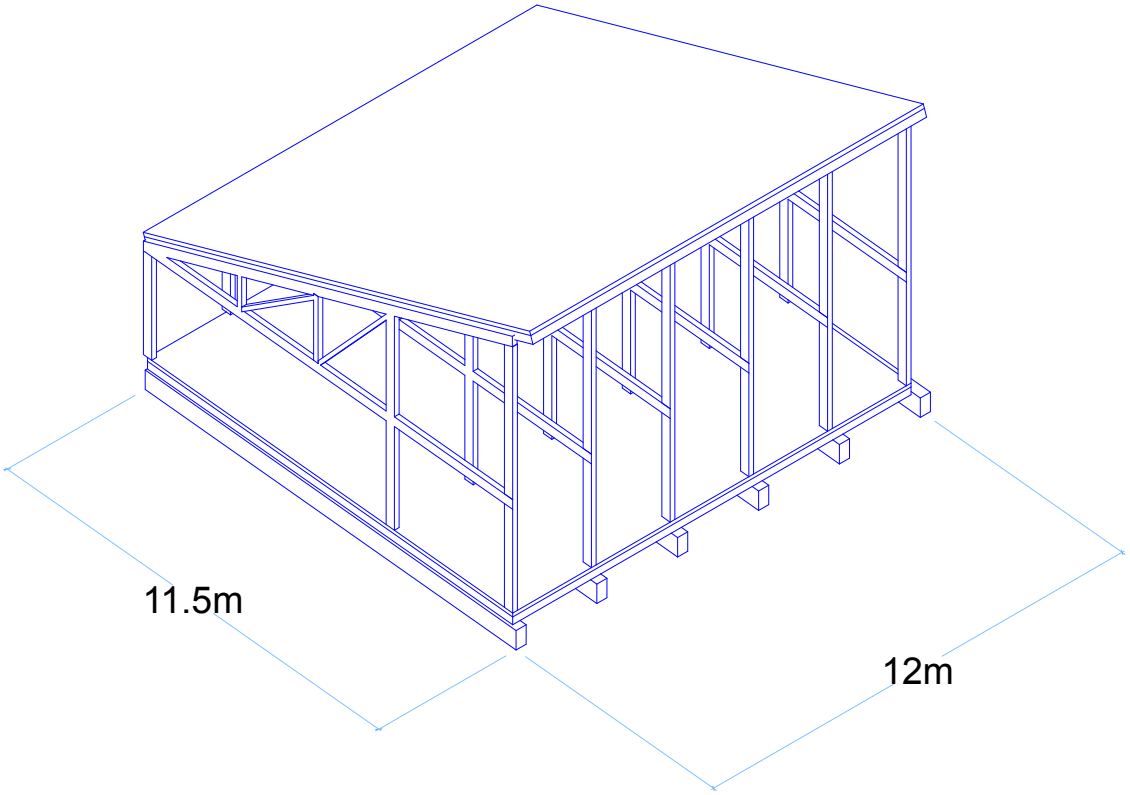
A culture of sustainability in construction can only be achieved through positive learning experiences during education in regards to circular building systems. When initiatives for sustainable construction are successful repeatedly, they become ordinary habits.

Student leadership furthers the democratization of learning spaces by giving agency to future users. Negotiation and maintenance of space hereby impacts the flexibility of space and of users.
The empowerment of student to appropriate of space hereby seeds the idea of democratic activism and expands the participative process with individual voices.

The expected outcome of re-using the Huber pavilion is multi-layered:

- The ETH pavilions are preserved as ETH pavilion.
- Expand generic and similar spaces (HIL) with alternative spatial qualities.
- Reduce the required sedentary workload during learning activities.
- Integrate diverse learning actions into the architecture of learning spaces.
- Activate deep learning / deep teaching methods in the architecture curriculum.
- Densify, apply and search for transformation within the learning environment.
- Nurture student participation in democratic processes.
- Generate awareness in regards to circular building systems and sustainable construction methods.
- Test the new construction and layering of different, unmodified materials from the Huber Pavilion

Huber Pavilions during construction, gta archive, ETH



Dimensions of the future re-use pavilion

HUBER - PAVILION: NUMBERS

CONSTRUCTION TIME	*6 months*
COST (1989)	*1'416'200 CHF*
VOLUME	*2'920 m^3*
AREA	
ground floor:	*477 m^2*
gallery:	*160 m^2*
PRIMARY WOOD STRUCTURE	
solid wood:	*58 m^3*
laminated wood:	*34 m^2*
FACADE:	
external shuttering (groove and comb):	*532 m^2*
FLOOR, exterior:	
larch	*78 m^2*
CEILING:	
paneling	*704 m^2*
WALLS AND FLOOR, interior:	
particle boards	*1'482 m^2*
WORKING SPACES:	*115 students*
	12 staff

top: Data on Huber pavilions, gta Archiv ETH

REUSE - PAVILION: NUMBERS

CONSTRUCTION TIME	*2 weeks*
COST (2022)	*30'0000 CHF*
VOLUME	*1'111 m^3*
AREA	
ground floor:	*100 m^2*
stage:	*60m^2*
PRIMARY WOOD STRUCTURE	
solid wood:	
FACADE:	
external shuttering (groove and comb):	
FLOOR, exterior:	
larch	
CEILING:	
paneling	
WALLS AND FLOOR, interior:	
particle boards	
WORKING SPACES:	*30 students*
	4 staff

DEMOLITION

photographic documentation

Approximately 30 % of the Huber Pavilion were estimated to be suitable for reuse, whereas 70% was either recycled or disposed. These number takes into account the inability to disassemble certain building components due to time constraints and the level of difficulty to dismantle. Components can only be disassembled if there is specific demand for it and if uncomplicated. Nailed and glued elements particularly aren't reusable, as they cannot be dismantled without damaging the material.

During deconstruction, valuable materials of interest have been identified, registered and quantified utilizing excel sheets while subject to extreme time pressure.
Visiting the construction site is an elementary part of assessing the potential for re-use.
What is the condition of the construction site as found?
How many tons of material are being thrown away?
How much carbon and energy is embodied by the materials?
Which selection of resources do we save, perhaps, or definitely not?

Which materials can be dismantled, which materials are unaccessible?
Must components be dismantled by hand?
Who will dismantle, volunteers?
Which materials are resilient to mechanic demolition?
Can we calculate the cost of labor in the different methods and approaches of demolition?
How do we evaluate the embodied craft and material value in re-use?
Demolition is an opportunity to preserve and transform an original house.

Removed window of the Huber Pavilion

500 Boards, Timber
240 x 15cm

38 Beams
800 x 7 x 7cm

29 Truss
270 x 780cm

10 Beam
15 / 18 x 6cm

3 Corrugated roof, large
495 x 110 cm

15 Timber > 3m
24 x 14 cm

40 Timber < 3m
11,5 x 11,5 cm

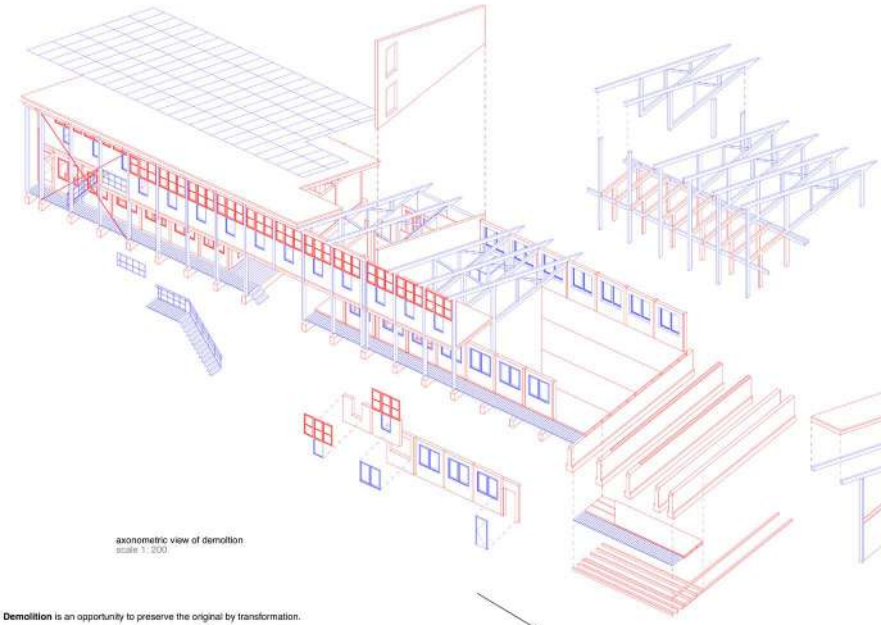
15 Grid balustrade
90 x 200 cm

18 Grid bracing
60 x 200 cm

200 Eternit panels
90 x 250 / 170 cm

50 Boards, Larch
120 x 12 cm

2 Glass, VSG
100 x 200 cm



axonometric view of demolition
scale 1: 200

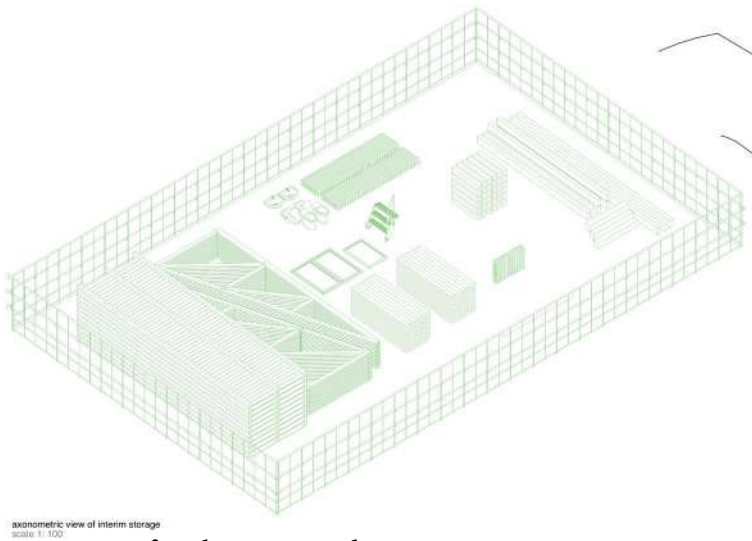
Demolition is an opportunity to preserve the original by transformation.

Approximately **30 %** of the Huber Pavilion were estimated to be suitable for reuse, whereas **70%** was either recycled or disposed. These number assumes the inability to **disassemble** certain building components due to **time constraints** and the level of difficulty to dismantle. The **selection** of resources to be saved, perhaps, or definitely not, must be taken in the very moment. Components are only removed if there is specific demand for it and if uncomplicated to acquire. **Nailed and glued** elements particularly aren't reusable, as they cannot be dismantled without causing **damage to the material**. Furthermore, some components are only to be dismantled by hand or by machine, further complicating the **process of demolition** and negotiation between **workers and volunteers**. During demolition, valuable materials of interest have been identified, registered and quantified utilising **excel sheets** while subject to extreme time pressure.
The **condition of the construction site** plays an elementary part in assessing the potential for re-use.

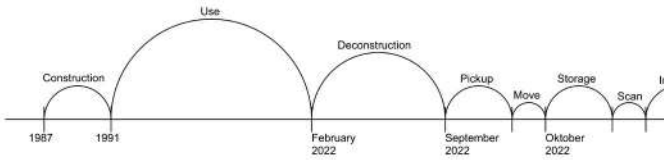
The amount of disposed materials directly depends on the success and the efficiency of marketing and re-**allocating building components**. If materials are made **available for free**, they become much more popular, accessible to low-budget initiatives and thus easier to save from disposal.

The re-use of building materials also preserves the **embodied energy** and carbon within the resource.
How do we evaluate the **embodied craft** and material value in re-use? If the cost of labor exceeds the material value, the different methods and approaches of demolition must be evaluated.

The **storage of materials** must be planned carefully, to guarantee the success of preservation and future use. Materials must be stored in a way, so they remain accessible for testing and building and yet safe from weathering. In this case, an outdoor, interim storage space of 8x20m was offered next to the future building site, filled with materials and fenced thereafter. A simple **plastic tarp** is provided to keep the materials protected from **wind, rain and snow**. The danger of decay is imminent, as **constant wetness** will seriously **damage** any structures.



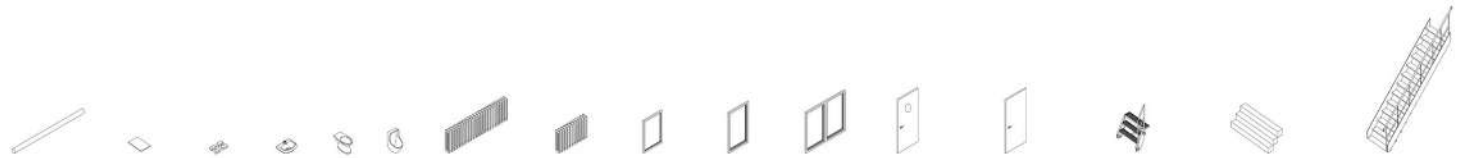
axonometric view of interim storage
scale 1: 100

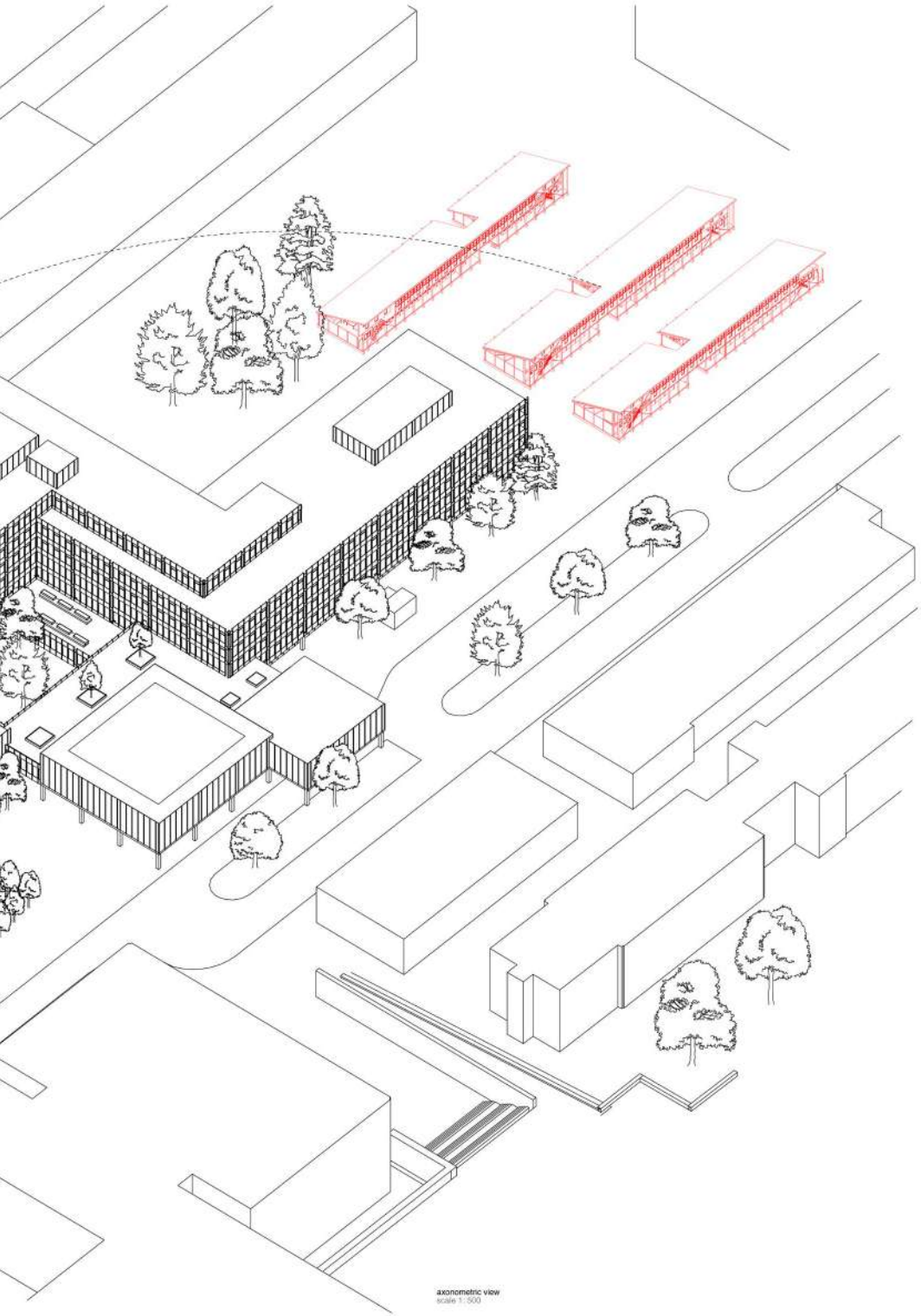


Life cycles of the Huber Pavilions

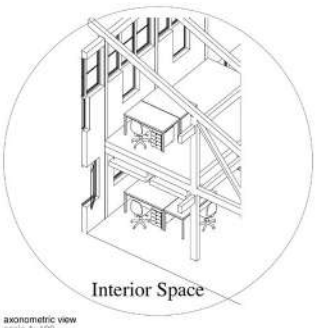
Re-Use of Huber Materials

Pipe	Cement plates	Paving stone	Water basin	Toilet	Urinal	Radiators	Window sash, small	Window sash, large	Window with frame	Door, exterior	Door, interior	Stairs, small	Step	Stairs, large
12 x 200 cm	40 40 x 60 cm	450 12 x 24 cm	1	2	2	20 350 x 50 x 7 cm	21 80 x 100 cm	14 80 x 155cm	1 170 x 176 cm	5 108 x 205 cm	8 84 x 198 cm	1 90 x 140 x 70 cm	3 40 x 60 cm	1 500 x 105 cm

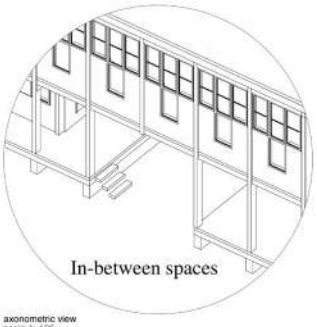




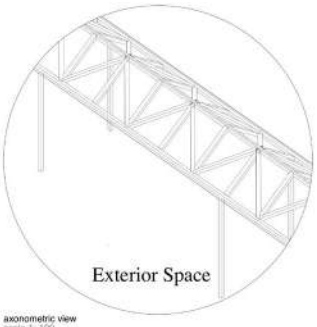
axonometric view
scale 1: 500



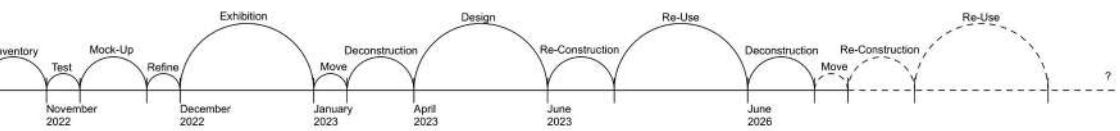
axonometric view
scale 1: 100



axonometric view
scale 1: 100

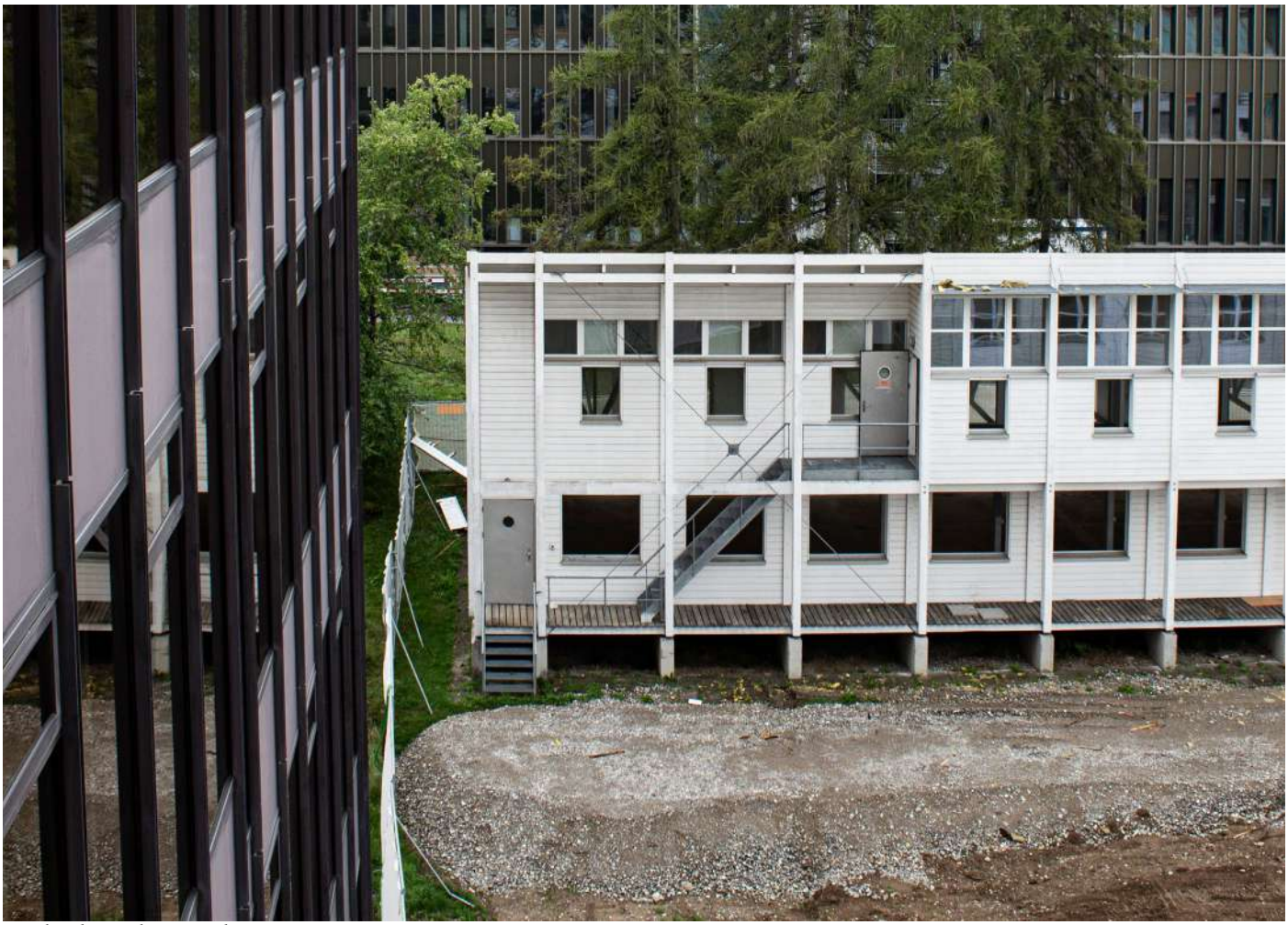


axonometric view
scale 1: 100



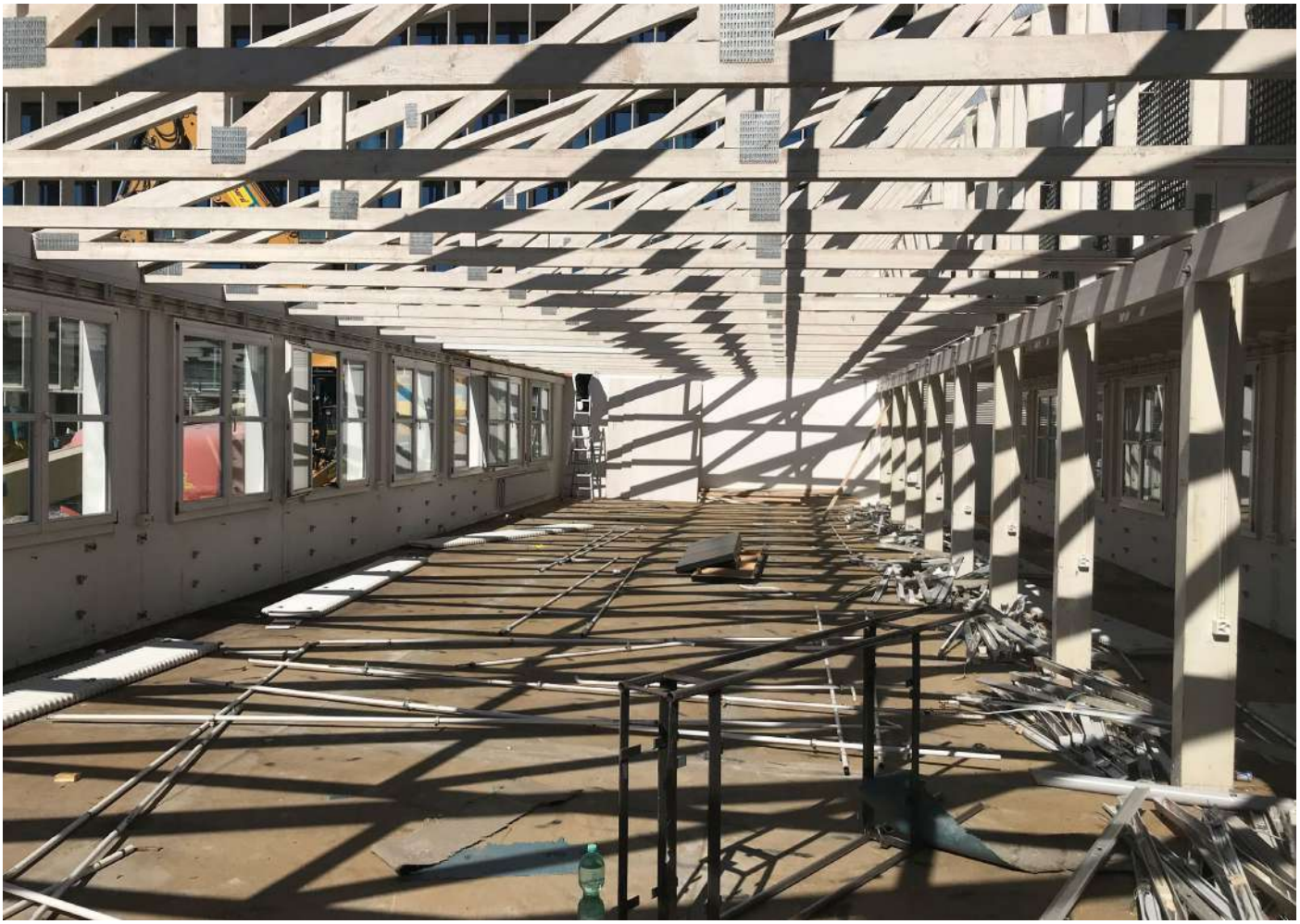
Huber Pavilion and HIL building, gta archive

Site visits before deconstruction



Early demolition phase

Site visit and dismantled materials

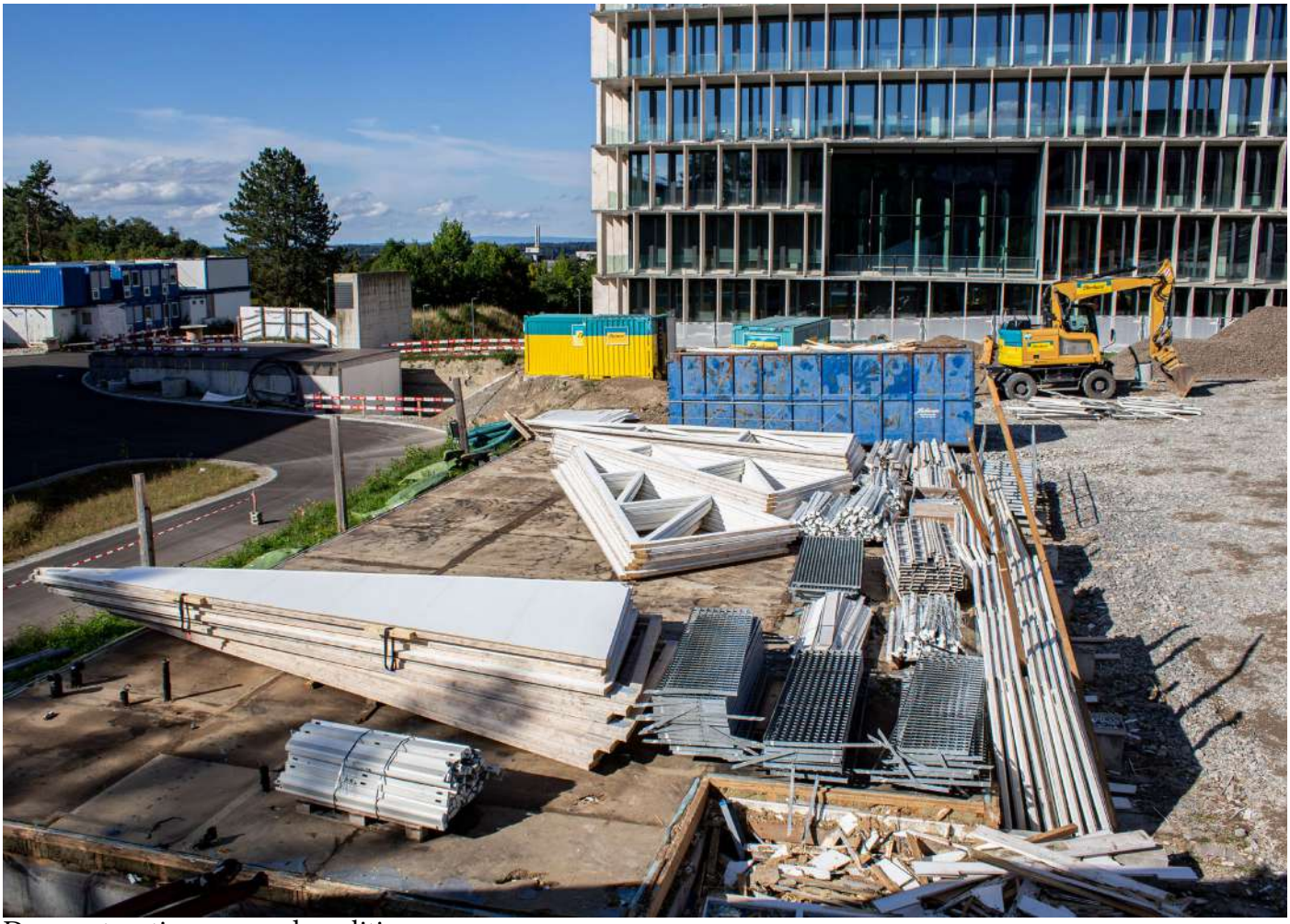


Deconstruction of the roof

Removing windows from the Huber Pavilion

Before and after demolition

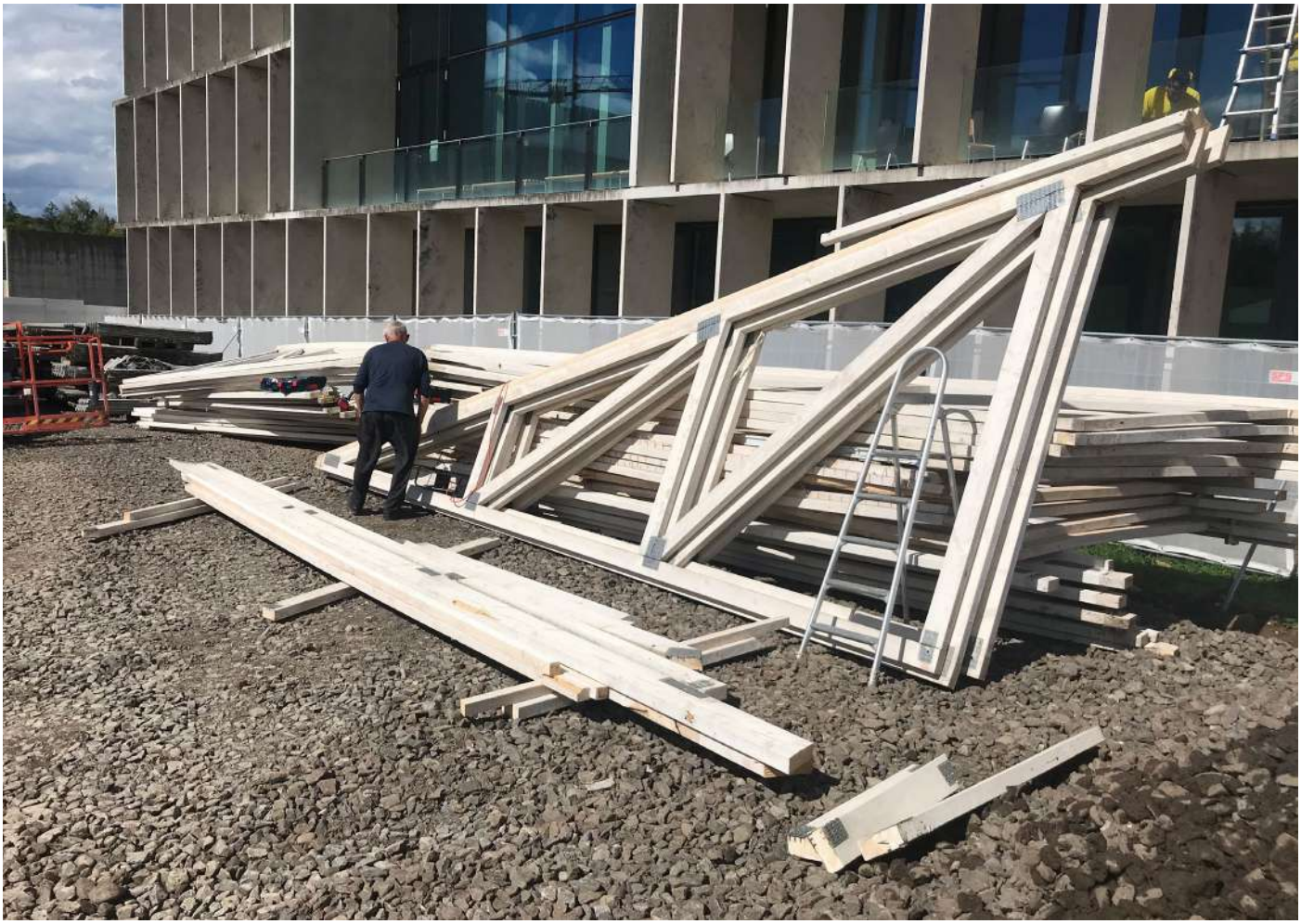
De-construction versus demolition



De-construction versus demolition

Demolition of Huber Pavilion

Salvaging building materials

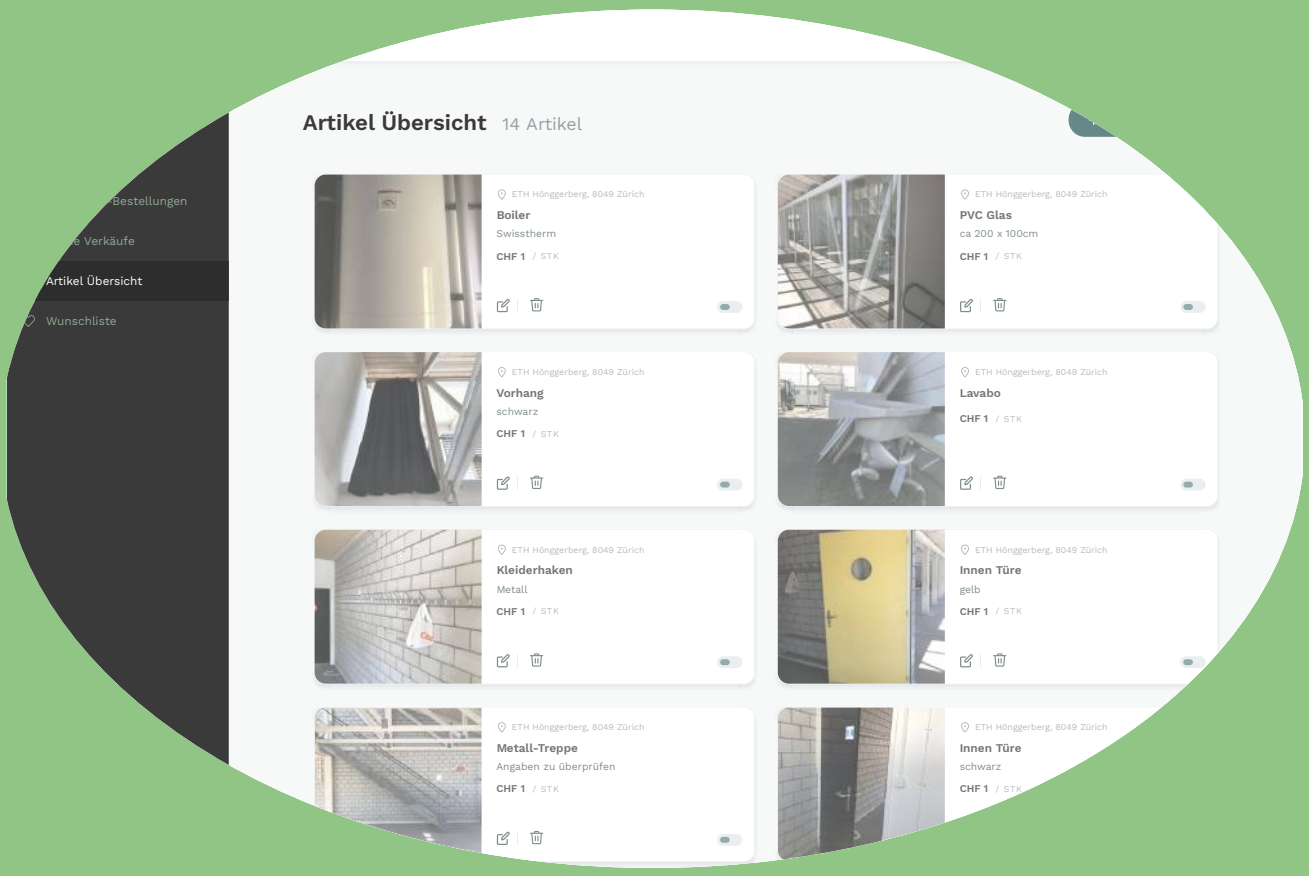


Assessment and preparation of building materials

Door-window in the Huber Pavilion

RELOCATION

photographic documentation



The design of a re-use project always starts with the choice of building materials.
In order to hunt for, collect and distribute materials of the Huber pavilions, a catalogue is produced, displaying a library of available re-use materials.
This includes measurements, material, weight, condition etc.

In order to distribute as many building materials as possible, recipients were identified on the **market-driven** online platform useagain.ch. Utilizing this tool, all components were picked up by approximately thirty recipients within two weeks. With the help of a simple excel sheet, interested users could reserve desired quantities of the different materials.

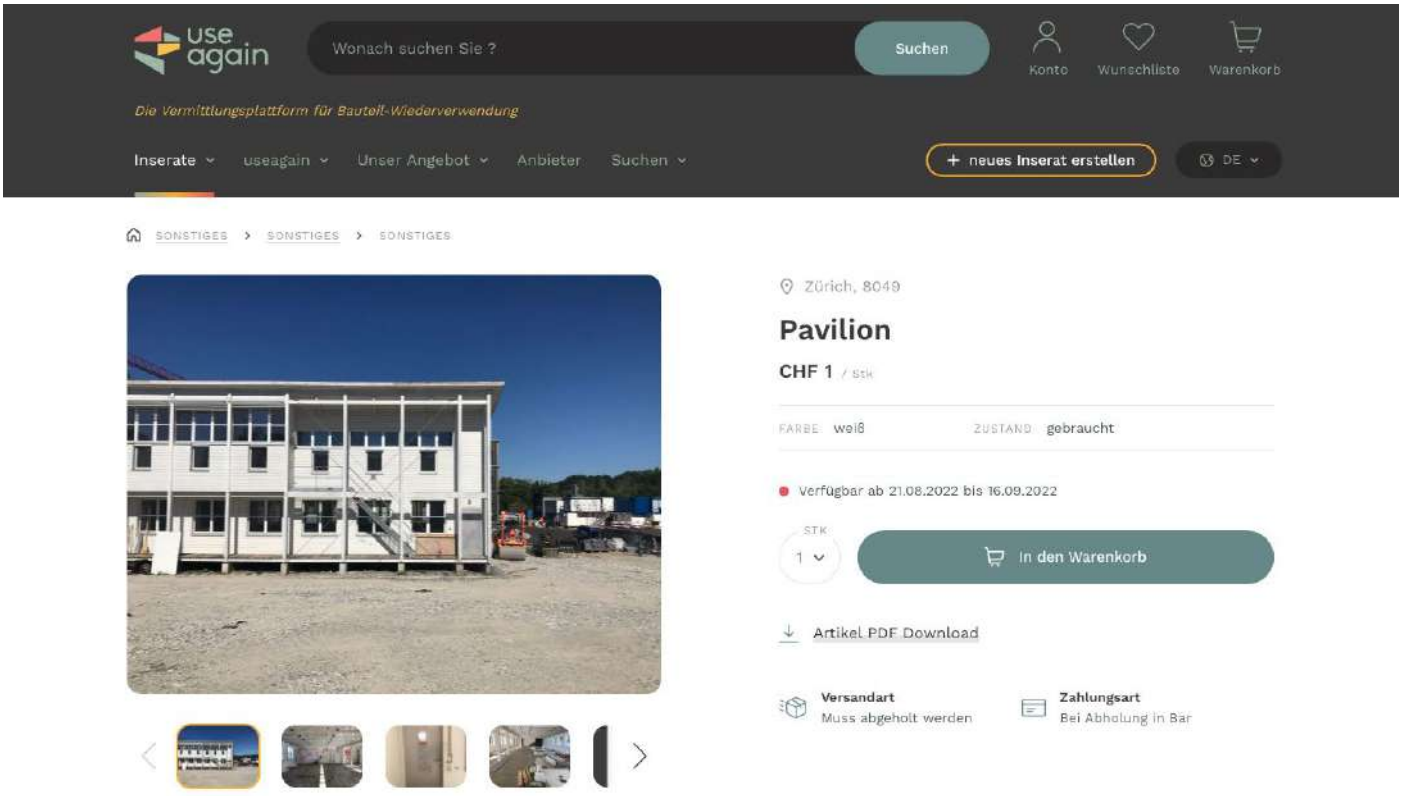
The cost and distance of transportation impacts the ecological footprint of re-use and the relation between the building parts and future users.

In regards to the economy of materials, the condition and availability of building materials defines their value on the market. A single window costs about 50-100 CHF to remove from a wall.
Correct treatment of extracted materials can extrapolate the value of the original material considering the factor of heritage.

While spreading the material, question arise in regards to the logistics of reuse.

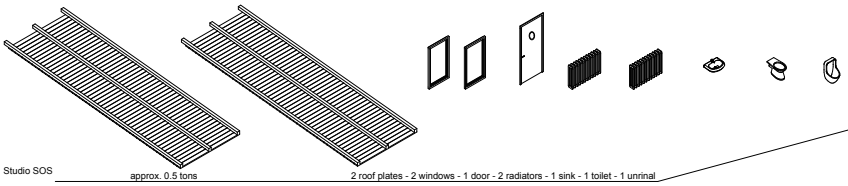
What is the total amount of materials? Who else is sharing? How many material units fit on a transportation lorry? How many lorryloads fit in a storage unit? Are building materials contaminated with asbestos?

How are materials to be stored, so they remain accessible for testing and safe from weathering? An outdoor, interim storage space of 8x20m was selected next to the future building site, filled with a selection of materials and fenced thereafter. A simple plastic tarp would keep it wind and rain proof.

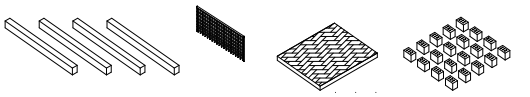


Huber Materials offered online on useagain.ch

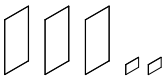
ETH



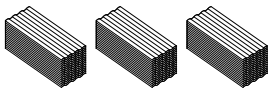
Studio SOS — approx. 0.5 tons — 2 roof plates - 2 windows - 1 door - 2 radiators - 1 sink - 1 toilet - 1 unrinal



Studio Kaijima (Studio FS23) — approx. 0.2 tons — 4 pcs wood - 1 metal balustrade - 20 brick stones - 20 cement stones



Atelier Altstetten (Matt Phillips) — approx. 0.2 tons — 3 pcs PSF glass - 2 mirrors



Studio De Vylder (Furka) — approx. 1 ton — 3 units eternit plates

Summer School (Structural Behaviorology) — approx. 0.1 tons — 1 window - 2 radiators -1 sink - 1 toilet

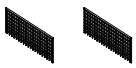
The design of a re-use project always starts with the **choice of building materials**.
In order to hunt for, collect and distribute materials of the Huber pavilions, a catalogue is produced, displaying a **library of re-use** with available materials. This includes details, measurements, material, weight, condition etc.

In order to distribute as many building materials as possible, recipients were identified on the online platform **useagain.ch**. Utilising this tool, all approximately **thirty recipients** picked up **all available components** within **two weeks**. With the help of a simple **excel sheet**, interested users could reserve desired quantities of the different materials.
The cost and distance of transportation impacts the ecological footprint of re-use and depends on the **relation between the building parts and future users**. While distributing the material, question arise regarding the logistics of reuse. What is the total amount of materials? Who else is sharing? How many material units fit on a transportation lorry? How many lorryloads fit in a storage unit? Are building materials contaminated with asbestos?

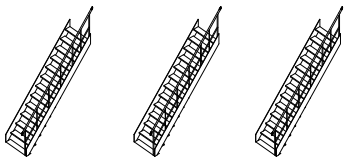
The condition and availability of building materials defines their market-driven economic value. A single window **costs** about 50-100 CHF to **remove** from a wall. Correct treatment of extracted materials can extrapolate the original value by honour their heritage.

In total, **20 different projects** received building materials of the Huber Pavilions. Approximately **8 tons** of materials have been distributed groups of ETH. Approximately **25 tons** of materials have been distributed to private recipients.

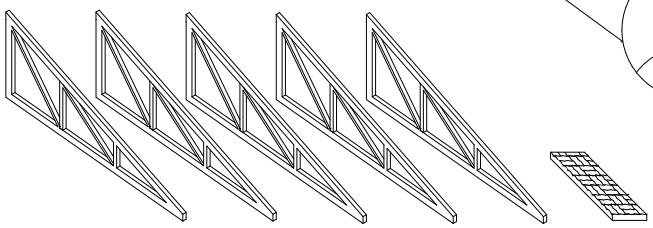
Digital Fabrication Lab (Experiment Set-Up) — approx. 0.05 tons — 4 cement stones



Diplomaproject (Romain Iff) — approx. 0.1 tons — 2 metal balustrades



Verein Zitrone (Joshua Andres) — approx. 3 tons — 3 metal stairs

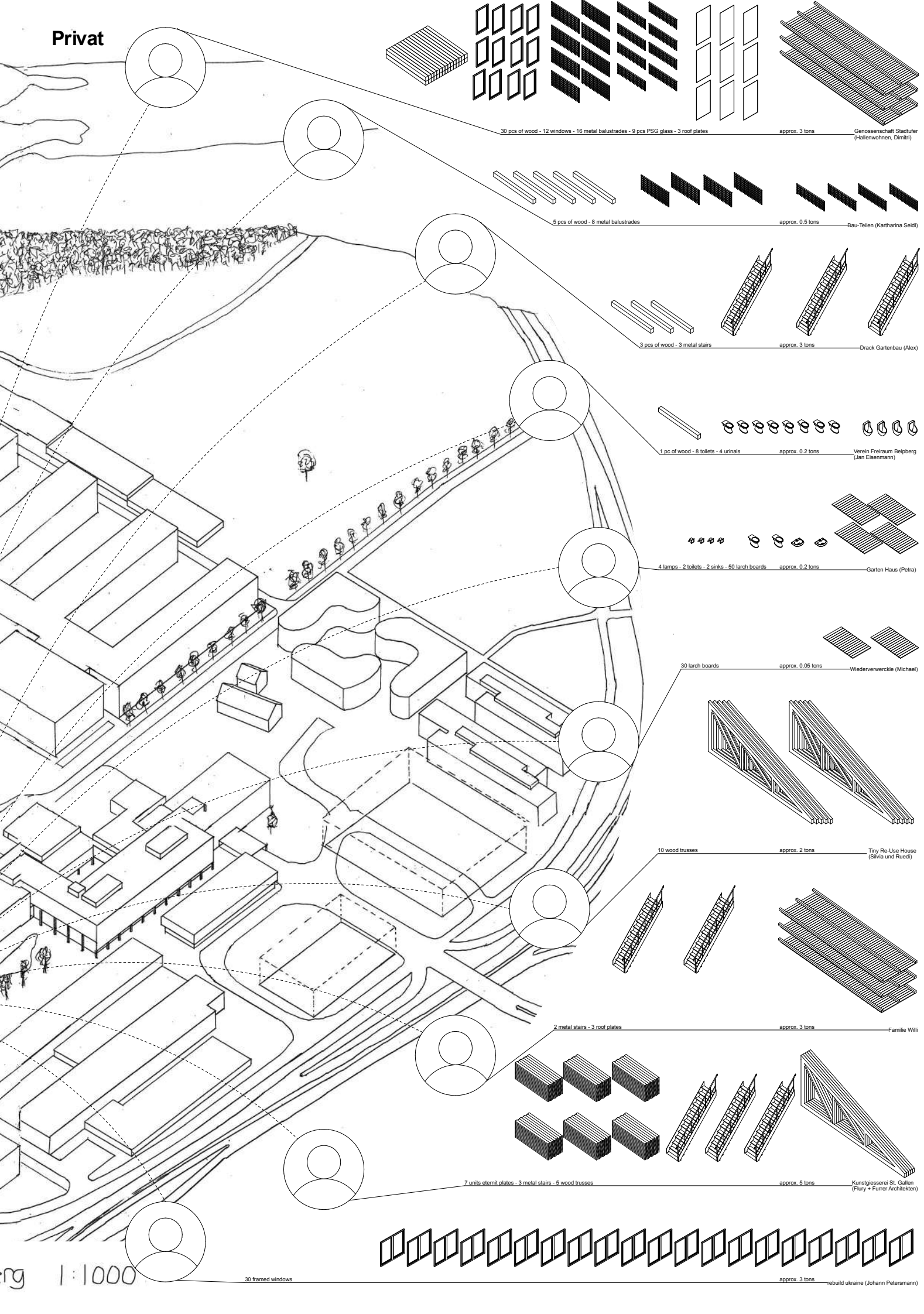


Studio Emerson (Garden Project) — approx. 1 ton — 5 wood trusses - 10 brick stones

Studio Thériot (Biennale Ticino) — approx. 2 tons — 32 metal balustrades

Höngger-Be

Privat


30 pcs of wood - 12 windows - 16 metal balustrades - 9 pcs PSG glass - 3 roof plates
approx. 3 tons
Genossenschaft Stadtufer (Hallenwohnen, Dimitri)
5 pcs of wood - 8 metal balustrades
approx. 0.5 tons
Bau-Teilen (Kartharina Seidl)
3 pcs of wood - 3 metal stairs
approx. 3 tons
Drack Gartenbau (Alex)
1 pc of wood - 8 toilets - 4 urinals
approx. 0.2 tons
Verein Freiraum Belpberg (Jan Eisenmann)
4 lamps - 2 toilets - 2 sinks - 50 larch boards
approx. 0.2 tons
Garten Haus (Petra)
30 larch boards
approx. 0.05 tons
Wiederverwerckle (Michael)
10 wood trusses
approx. 2 tons
Tiny Re-Use House (Silvia und Ruedi)
2 metal stairs - 3 roof plates
approx. 3 tons
Familie Willi
7 units eternit plates - 3 metal stairs - 5 wood trusses
approx. 5 tons
Kunstgiesserei St. Gallen (Flury + Furrer Architekten)
30 framed windows
approx. 3 tons
rebuild ukraine (Johann Petersmann)
1:1000









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Der Umwelt zuliebe.
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Eberhard


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Re-used wood and balustrade at Genossenschaft Stadtufer, photo by Tobias Häusermann

Re-used stairs at Kunst Giesserei St. Gallen, photo by Lukas Furrer

Pavilion Bauteile	Anzahl total (Stk.)	Verfügbar (Stk.)	Reserved (total)	Learning Lab	SOS at ETH	CEA (Catherine de Wolf)	Structural Behaviorology	CAB (Momoyo Kaijima)	Studio Emerson (Michelle)	Studio Jan de Vylder (Roth)	Diploma Thériot (Romain)	Ticino Biennale (Ch
Pick-Up between 5.-16. Sept. on site												
Elias Knecht; 078 907 65 64												
Primär Struktur:												
Fachwerk	73	3	70	15		15			15			
Konstruktionsholz, ab 2m	70	-19	89	20		20		4				
Bretter, Lärche	220	-20	240	50	10	50						
Schalungsbretter	1000	900	100									
Raumabschluss:												
Fenster, Doppelflügel	100	37	63	10	2	1	1					
Türe, innen	10	6	4	2		1						
Türe, aussen	12	5	7	2		1						
PVC Glas	24	11	13	1								
Gitterrost, metall (Dach)	62	32	30	1								
Geländer, metall	47	19	28	1				1			2	
Dachplatten, Eternit	600	300	300	50						50		
Dachplatten, verläfert	50	14	36	20								
Wellplatten, plastik				1						1		
Ausbau:												
Treppe, gross	10	-4	14	1								
Treppe, klein	1	0	1	1								
Heizkörper	40	35	8	5	1		2					
Waschbecken	20	14	6	1	1	1	1					
Kleiderhaken	2	-2	4	1	1		1				1	
Vorhang	3	1	2	1	1							
Boiler	3		0									
Toilette	10	4	6	2	1		1					
Urinal	10	7	3	2	1							
Kabelabdeckung, plastik	200			10								
Leuchstofflampe, -Halter	100											
Scheinwerfer					2							
Kabelkanal, plastik	100	90	10									
Bewegungsmelder	10	-1	11		1							
Metalleisten	10	-1	11		1			10				
Rohre	5	-6	11									
Türschliesser / Griff	20	15	5									
Spiegel	3			2								
Aussenbereich:												
Pflastersteine	236	-10	246	50	10			36				
Zementplatten	220	10	210	20								
Zementblöcke	500	476	24					20				

Re-used balustrades at Zentral Wäscherei Zürich, photo by Pascal Beutler

air of Ther	DFAB(Vasilei	Matthew Phillips	Joshua Andres	Familie Willi	Wiederverwerkl	Carlos	Bau-Teilen (Kat	Zirkular	kosmos	rebuild-ua (Johann)	Genossenschaft Stadtufer (	Minihaus (Silvia Zimmer)	Drack Gartenbau	Flury + Furrer	GartenPavilion (Pe	Jaden	Jan Eisenmann
						5						20		10			
							5				30	10	3	6			1
					30							50			50		
											100						
						6				29	14						
						1											
						2					2			1			
		3									9						
18							4				7						
12							4				8						
														200			
				6							10	15					
			3	2		5							3	2			
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														36			
8															4		
											10						
											10						
			2												1		
											5						
		2															
														150			
													10	180			
	4																

Excel sheet with distributed materials

Re-used timber for Tiny House, photo by Silvia Zimmer

Interim storage space on ETH Campus Hönggerberg with materials of the Huber Pavilion

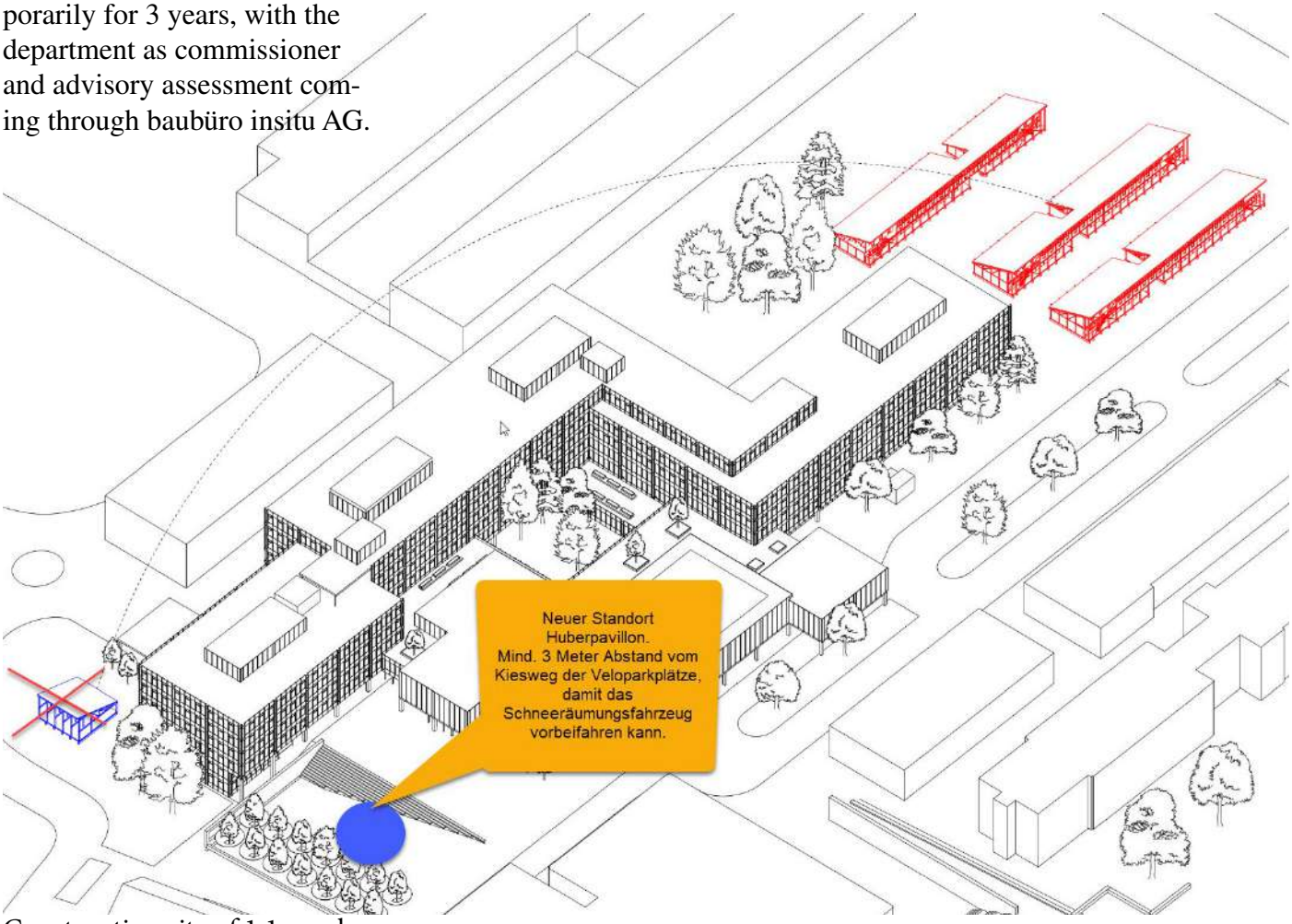
RE-USE

photographic documentation

In order to reuse the Huber Pavilions on campus, first, a building site was needed. Within the campus, there are several pieces of vacant land. However, at ETH, a network of stakeholders is involved when negotiating real estate and building projects, namely ETH Real Estate (ETH Immobilien). 140m2 were made available next to the garage entrance of the HIL building. After all, certain proposals, such as building on the HIL rooftop, were non-negotiable.

Testing the re-use of building components requires the construction of an exploratory object (“Forschungsobjekt”). A permission is only valid temporarily for 3 years, with the department as commissioner and advisory assessment coming through baubüro insitu AG.

The vision for designing future learning spaces derives from real, observed learning activities. The character of the re-use pavilion hereby reflects the experimental use and hands-on experience of an endless laboratory of learning space. Learning spaces are required to provide specific functions and services, such as space for individual and/or group study, spaces for presentation and exchange, as well as model making labs and informal spaces. Combined, these spaces make an accessible learning pavilion respecting all normative standards of construction.



Construction site of 1:1 mock up

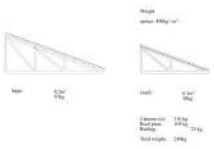
Mock-Up Learning Spaces

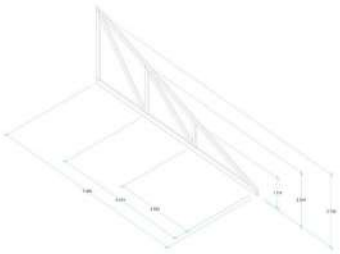
construction behaviorolgy

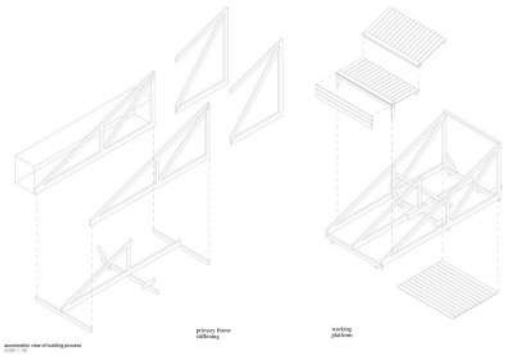
In order to test the different **construction methods** and joints, a further temporary building site was acquired on campus to build a **1:1 mock-up**. By building a mock up with **real components**, specific connections can be tested. It allows to make **many mistakes** and to learn from them as well as teaching others about them.
Materials are layered and joined together in an **ad-hoc manner** of construction. Designing and testing go in parallel **loops**, where many options only become visible when starting the 1:1 situation.
The **open character** of the mock pavilion hereby reflects the **experimental use** and **boredom experience** of an endless **laboratory** of learning space.
A **culture of sustainability** in construction can only be achieved through **positive learning experiences** during education concerning **circular building systems**. Where initiatives for sustainable and durable construction are successful repeatedly, they become ordinary habits.
Therefore, it becomes important to support student leadership within the democracy of learning spaces by giving agency to the future students.

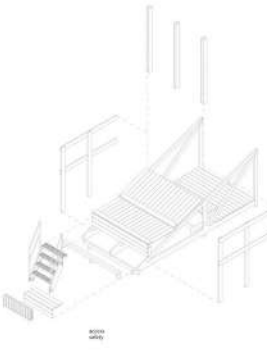
Methods

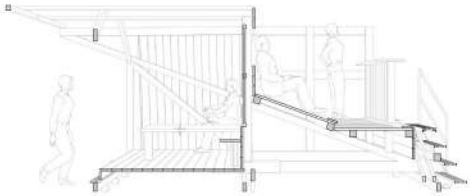
First and foremost, during construction, the protection of **health and safety** of all protagonists is of most importance, as well as future users. Aside from reasoning of **building norms** (SIA/SN) and rules for the **protection of workers** (SUVA), a safety concept is required when working with students, who have no previous training or experience on construction sites. This includes an **introduction** to **safety measures** and **risk assessment** for each working step, as well as **supervision** and **safety checks** during the active planning. Furthermore **emergency protocols** and evacuation need to be clearly prepared, including psychological experts, such as as stated during construction.
A healthy **culture of safety** is fostered with leadership by example, and the company and audit of experts and responsible safety officers. Although there always remains a certain risk of exceptional dangers, it in the duty of the organisers to mitigate unsafe **practices and behaviour**, as accidents can (almost) happen.

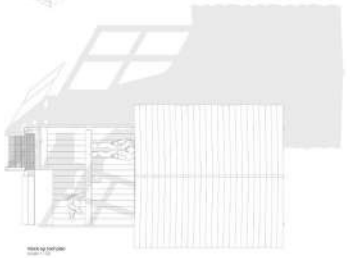


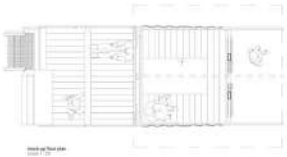


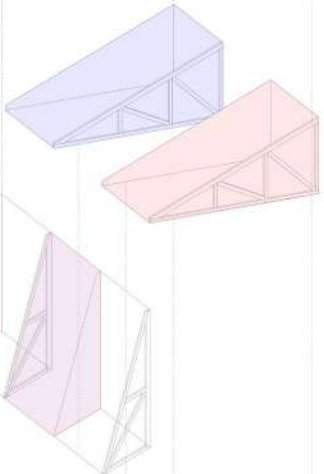


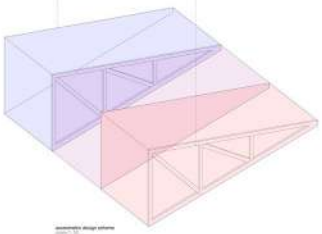












Design vision for learning spaces
Our design vision for learning spaces is inspired by the architecture of spaces. By reusing building components of the Huber Pavilion, a connection is made between **old and new learning spaces** at ETH. The texture of the temporary re-use pavilion is **rough and unfinished**, which **invites students to engage** with the space. The design of the pavilion is not that of a learning space, rather than a formal learning space. Spaces for learning must hereby be distinguished from spaces for learning. The spaces are designed on purpose to support **different educational activities**, which have been observed and identified as common learning actions.

All in all, there will be **149 m²** of additional learning spaces made available to the students in D-BAUG as well as D-ARCH. 40m² are covered by the roof, whereas 40m² are open.

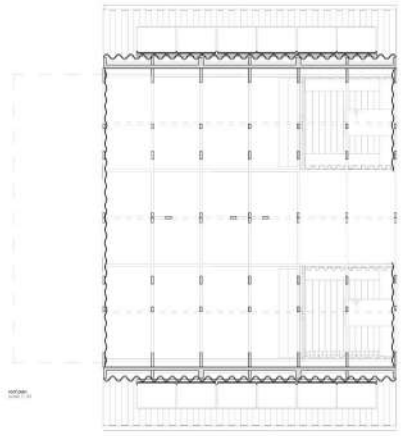
Most importantly, the re-use pavilion offers shelter and protection from natural elements as rain, wind and heat. As the proposal includes of **building systems** (water, electricity, ventilation), the integration of different spatial typologies becomes even more important.

Interesting "streets" through the design create **metaphorical spaces** of enclosure and encounter inhabited with social gatherings and circulations. A transition of space is completed, as we enter the roofed spaces, which offer calm niches and a window scape for **study**.
Student satisfaction relies on the ability to fulfill educational activities, which are prohibited in certain learning spaces. This includes building larger 1:1 models, spraying, concrete pouring and other invasive practices. It´s a double height space with public character, the translation and communication of **architecture skills** can be tested and **experimented** on by students.

A stepping bronze invites students to use the **exterior as extension** of learning spaces, when the weather is right.
The corridor spaces attempt to extend as much as possible the character of the **Arabesken spaces**, which made the surroundings of the Huber Pavilion less dense.

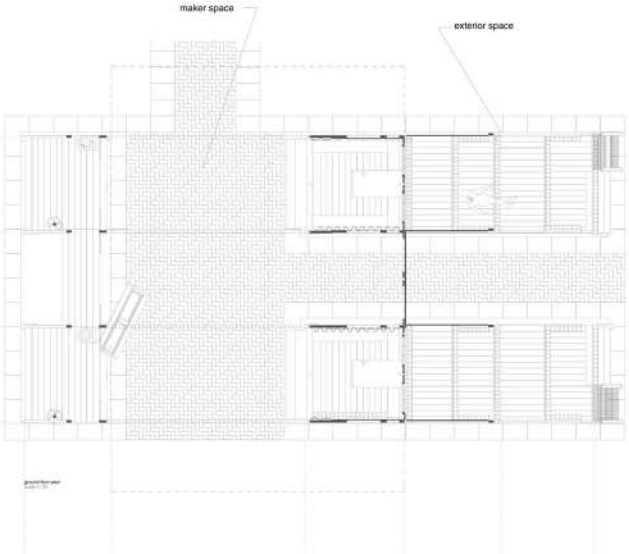
Preservation of the original structural system and form was impossible to achieve due to missing parts. Known points in the wood construction are particularly critical, as they most have vertical and horizontal forces.
A transformation and acceleration of the original **wooden triangle forms** was at the core of the design effort and to highlight its qualities.

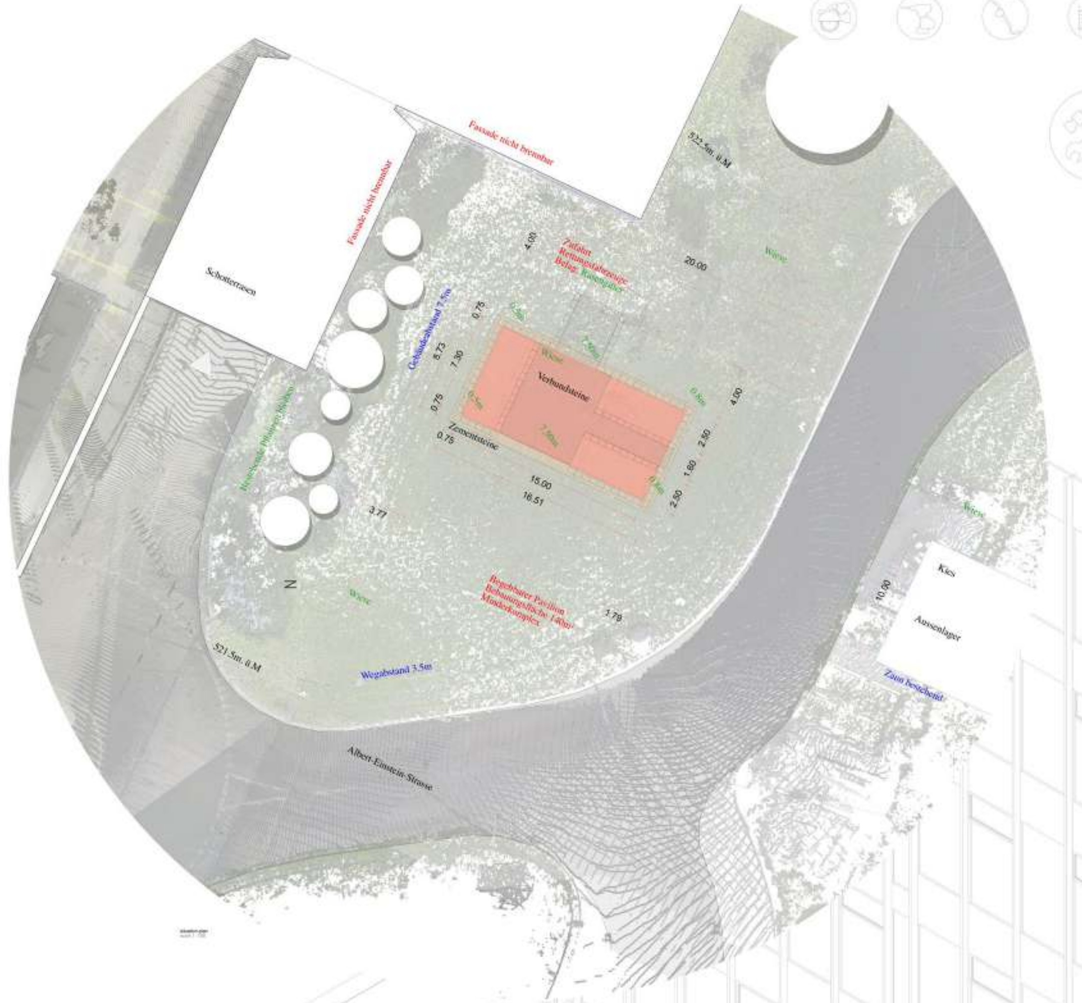
An open construction is convenient concerning **wind loads**, as each square meter of closed surface area accounts for approximately **1 kN of force**.
In general, the wind force cleavable is equivalent to the dead load of the tool construction, and the **weight of the pavilion** itself. The heavier the pavilion, the more stronger is posed by wind.
At the same time, a **proper foundation** is required to keep the pavilion from sinking. As the design utilizes wood elements, a **light weight** is given. Therefore, the foundation is designed with **concrete blocks** (1.5 x 1.5 x 0.5 m) and **steel plates**.
Aside from the wind- and dead load, **fire loads** need to be taken into account to safeguard the **accessibility** and use of the pavilion. Furthermore, easy access is granted also for people with disabilities.



10 rules of design:

1. plan for future dismantle
2. respect celebrate original material
3. accelerate original qualities
4. enjoy
5. build as much as necessary
6. build little as possible
7. collaborate with others
8. stay safe while constructing
9. test everything
10. re-use 100 % of the available Huber materials





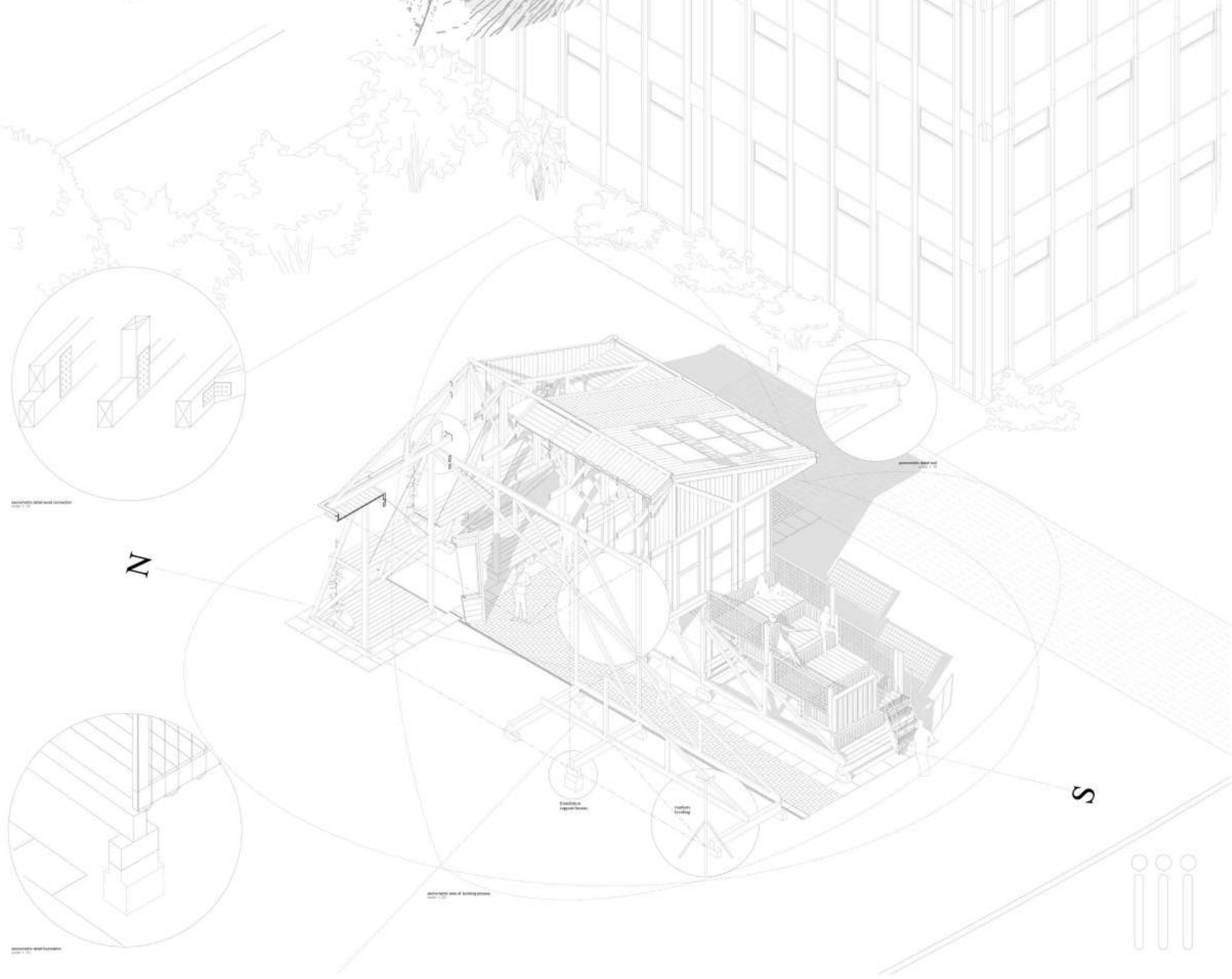
Working with re-used materials is challenging.

The process of construction starts with the cataloguing of materials while in storage. The designated function of each building may be deliberately misused or rethought. Each building element fulfils its own purpose within the context of a new re-use project.

Building a mock-up is regarded a learning process. The principle for design lies in the testing of construction rather than having a predefined result in mind. The re-use pavilion project will advance the competences of students concerning manual craftsmanship and create awareness to the topic of circular building systems.
Further, students will deal with the original material, their designated use in the original building, and its preparation for use in the re-use pavilion. Part of the re-use project are the different preparation-, design- and construction phases, which include disassembly of the previously built mock-up and further refinement of the diploma design proposal.

The process of building will be completed with 24 students, two supervising Chairs and two external firms, Baubüro insitu and Wiederverwendbar GmbH during the course of a spring semester with Prof. Catherine De Wolf and a focus work with Prof. Momoyo Kaijima. Likewise, budget applications were granted to both of the two Chairs of Architectural Behaviorology and Circular Engineering in Architecture.

A step-by-step timetable will clarify the task, schedule and methods of the different students involved in the re-construction. Smaller teams are organised concerning individual tasks, such as the foundation, structural elements, or roof construction. Also, heavy machinery, like cranes, if necessary, must be reserved, as well as scaffolding for working in heights. Also, the documentation of the entire process allows future students to learn from the project and be inspired to participate in further initiatives.



Testing the re-use of materials

Pavilion Re-Use

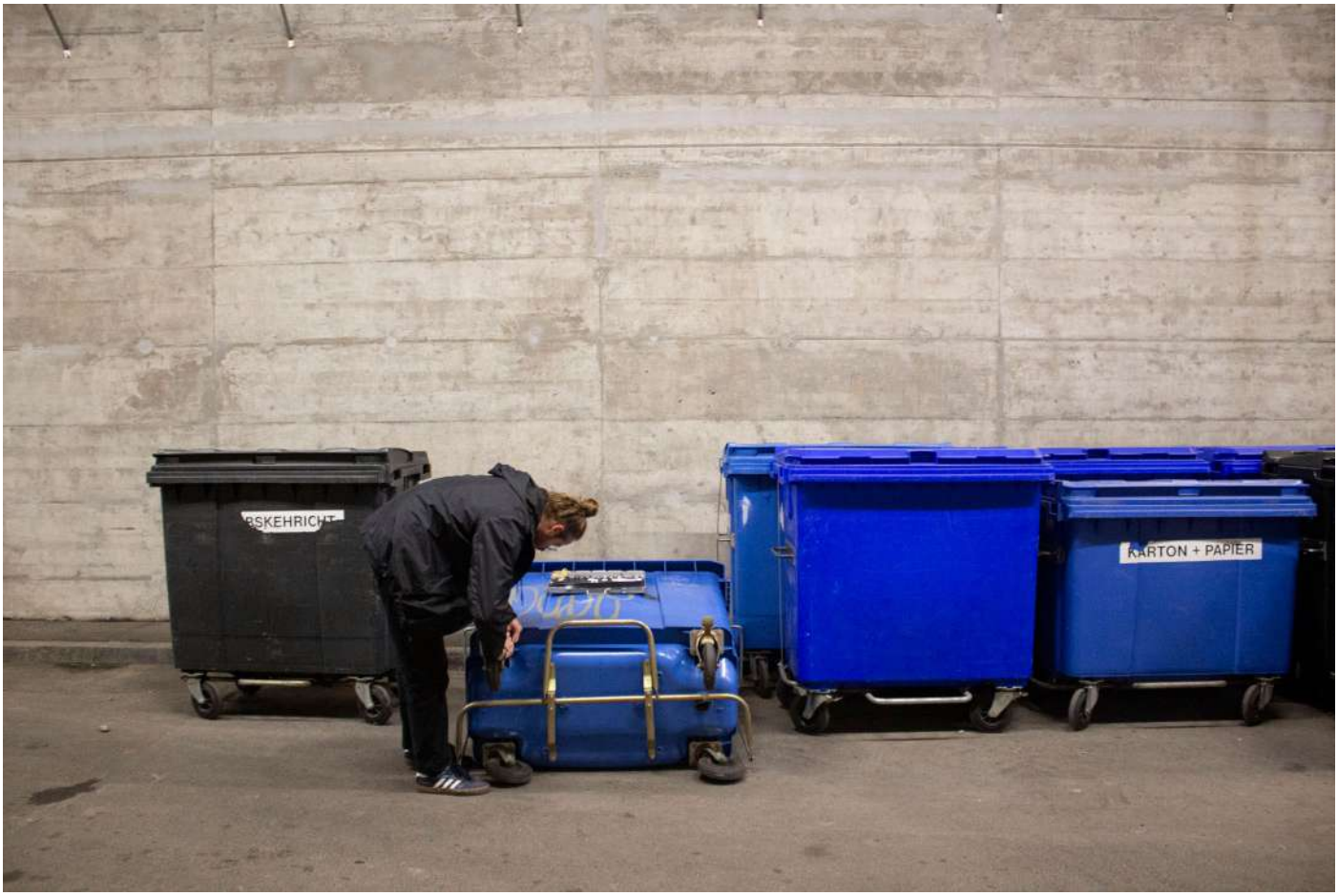
	Material	Origin	Amount	Dimensions
Primary Structure:				
Truss	Timber	Roof structure	15	270 x 780cm
Truss-Beam	Timber	Roof structure		15 / 18 x 5,5cm
Timber < 3m	Timber	Collonade between pavilions	40	11,5 x 11,5 cm
Timber > 3m	Timber	Beams, Coloumns	15	24 x 14 cm
Boards, Larch	Timber	Exterior veranda	50	120 x 12 cm
Boards, Timber	Timber	Roofplates	500	240 cm
Beams	Timber	Roofplates	30	800 x 7 x 7cm
Secondary Structure:				
Window sash, large	Wood, Glass		14	80 x 155cm
Window sash, small	Wood, Glass		21	80 x 100 cm
Window with frame	Wood, Glass			170 x 176 cm
Door, interior	Wood, Aluminum		6	84 x 198 cm
Door, exterior	Wood, Aluminum		5	108 x 205 cm
Glass, VSG	Glass	Interioir balustrades	2	100 x 200 cm
Grid bracing	Metal	Roof bracing	1	60 x 200 cm
Grid balustrade	Metal	Interior balustrades	1	90 x 200 cm
Eternit panels	Eternit	Roof cladding	200	90 x 250 / 170 cm
Corrugated roof, small	Plastic		4	495 x 50 cm
Corrugated roof, large	Plastic		3	495 x 110 cm
Tertiary Structure:				
Stairs, large	Metal		1	500 x 105 cm
Stairs, small	Metal		1	90 x 140 x 70 cm
Radiators	Metal		20	350 x 50 x 7 cm
Water basin	Porcelain		1	
Clothes hook	Metal		1	
Curtains	Textile		1	
Boiler				
Toilet	Porcelain		2	
Urinal	Porcelain		2	
Fluerescent lamp	Glass			
Spotlight	Glass, metal			
Cable tunnel	Plastic		30	
Motion detector	Plastic			
Pipe	PVC, plastic		3	12 x 200 cm
Door handle, locker	Metal		1	
Mirror	Glass		2	40 x 50cm
Exterior:				
Paving stone	Bakestone		450	12 x 24 cm
Cement plates	Cement		40	40 x 60 cm
Step	Cement		3	40 x 60 cm
Rock	Stone		1	120 x100 x50 cm

Working with re-used materials is challenging.
The process of construction starts with the care taking of materials while in storage. The designated function of each building may be deliberately misused or rethought. Each building element fulfills its own purpose within the context of a new re-use project.

Building a mock-up is regarded a learning process. The principle for design lies in the testing of construction rather than having a predefined result in mind.

Top: Exhibition of materials, below: Excel Sheet with material inventory

Re-locating wood truss to construction site

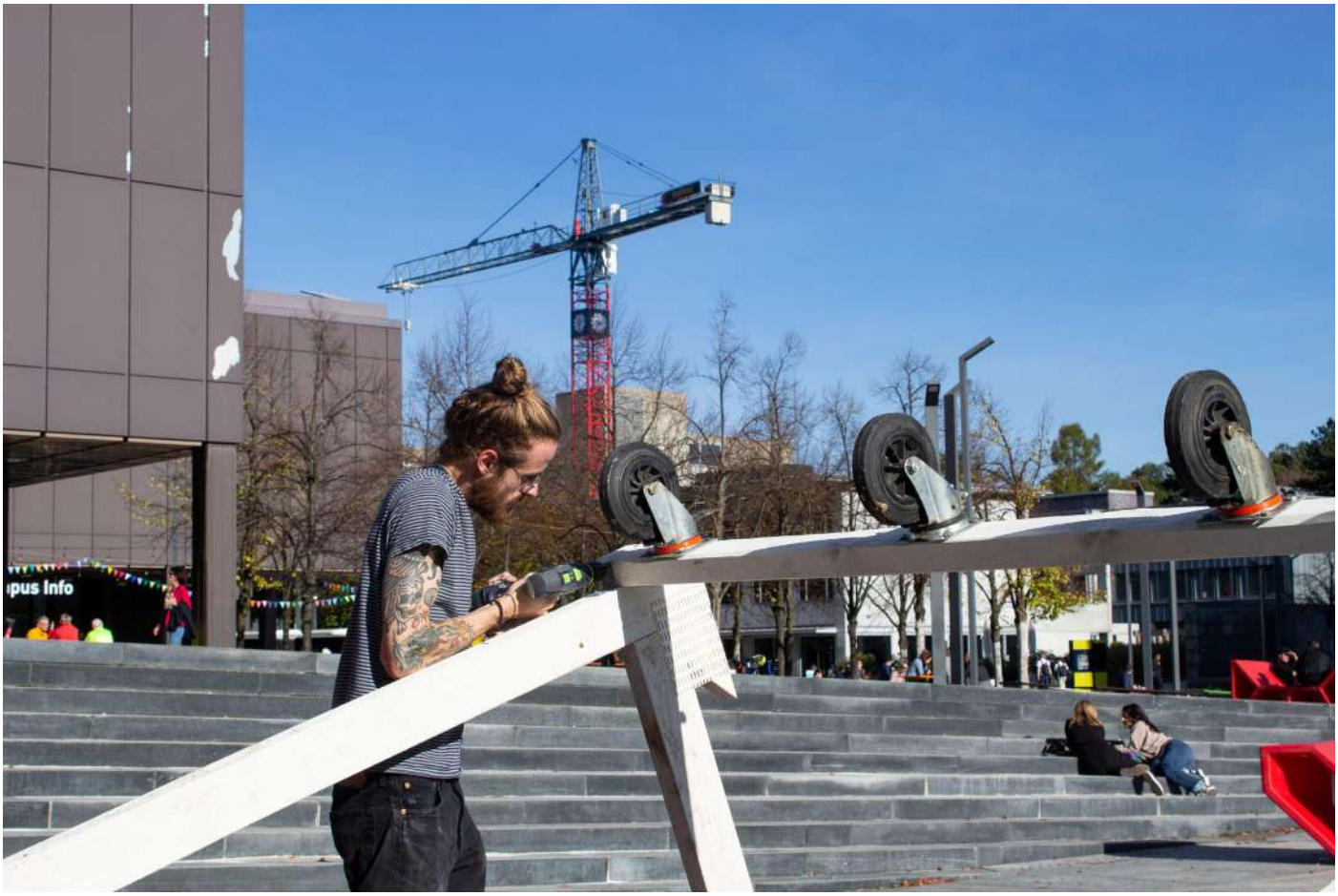


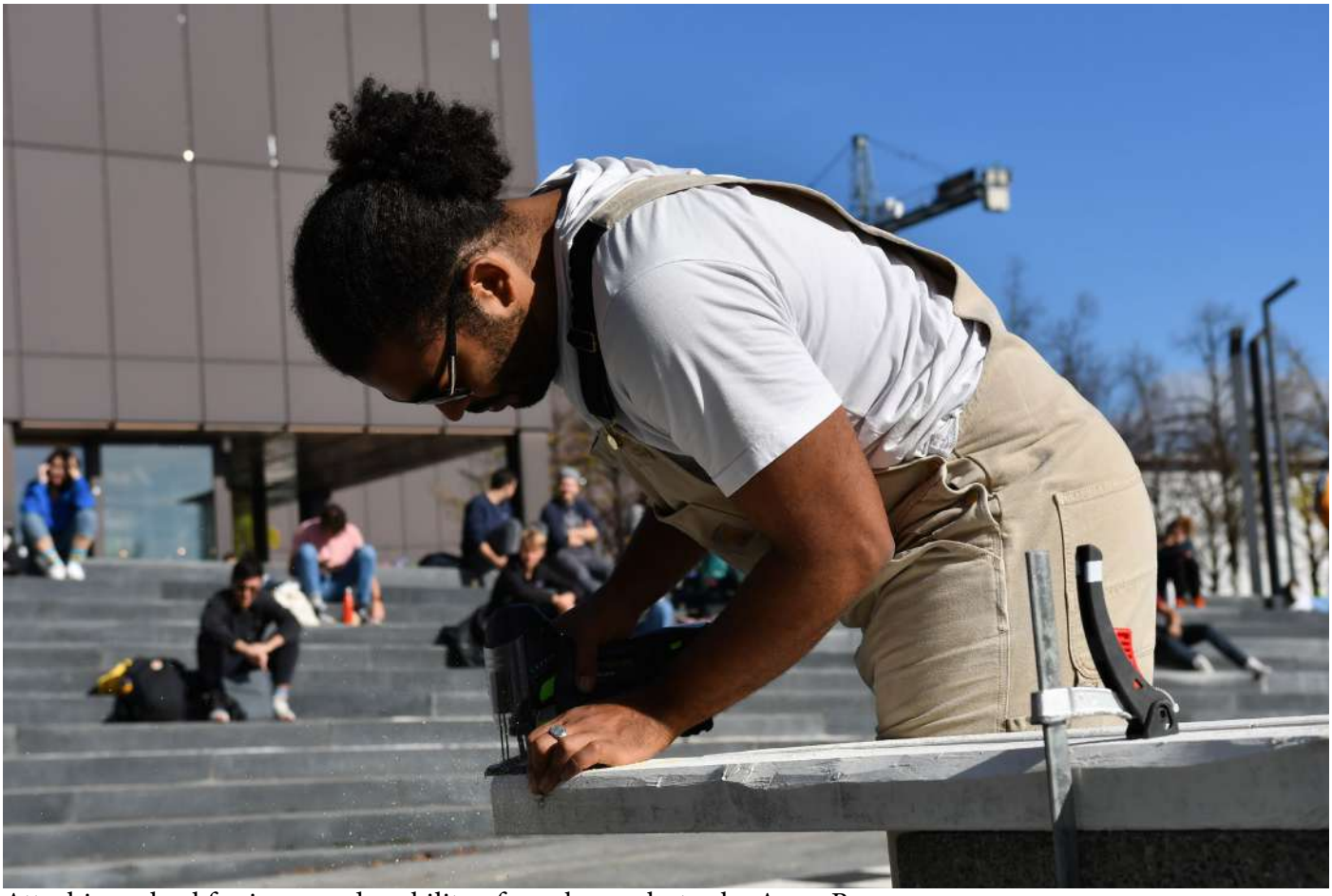
In order to test the different construction methods and joints, a further site was acquired to build a 1:1 model on campus. By building a mock up with real components, specific connections can be tested. It allows to make many mistakes and to learn from them as well as teaching others about them. Specifically, the ad-hoc manner of construction results in quick results, but the quality and attention to detail suffers.

Materials are layered and come together in an ad-hoc manner of construction. Designing and testing go in parallel loops, where many options only become visible when testing with a 1:1 situation.

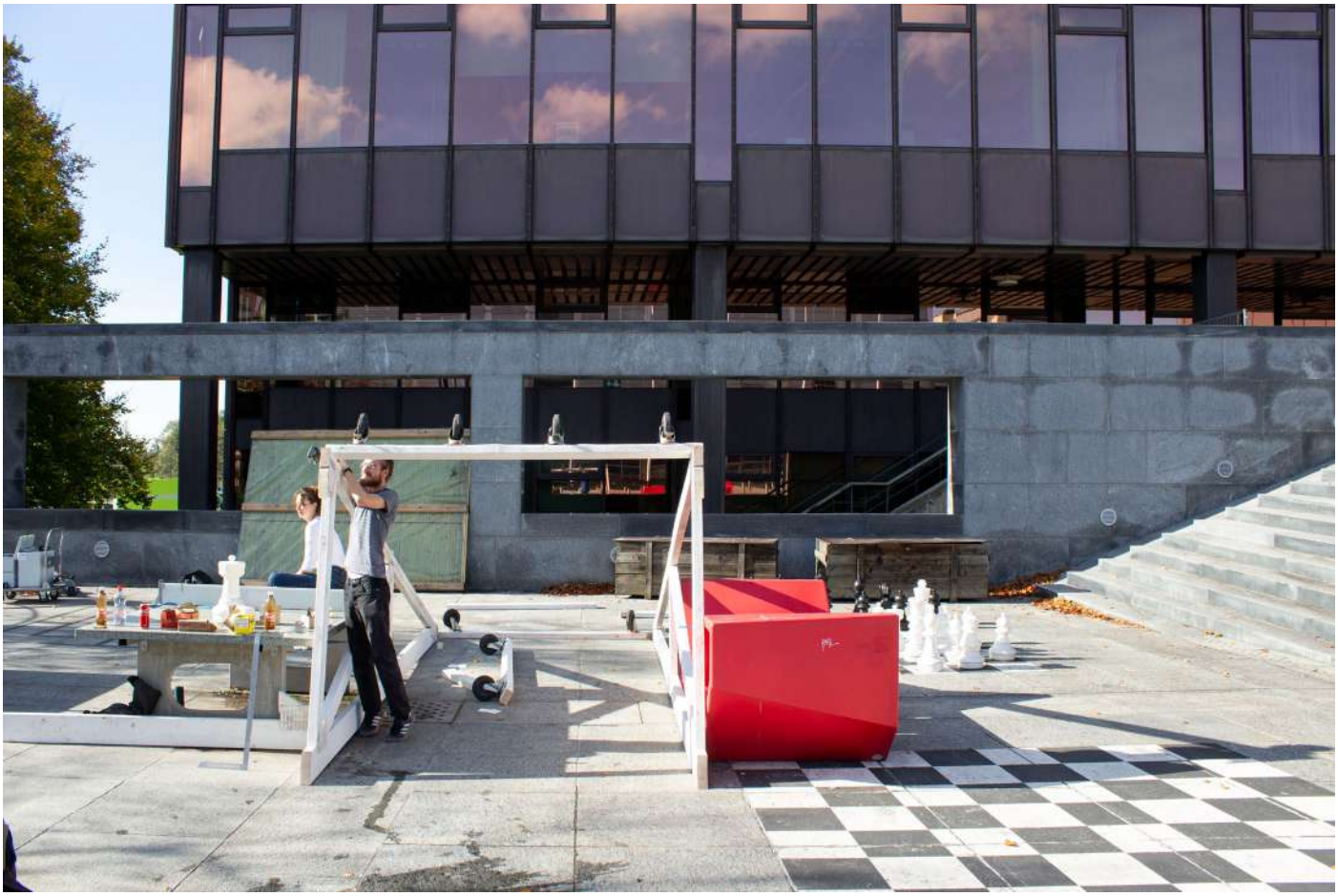
Interim use of wheels from garbage container

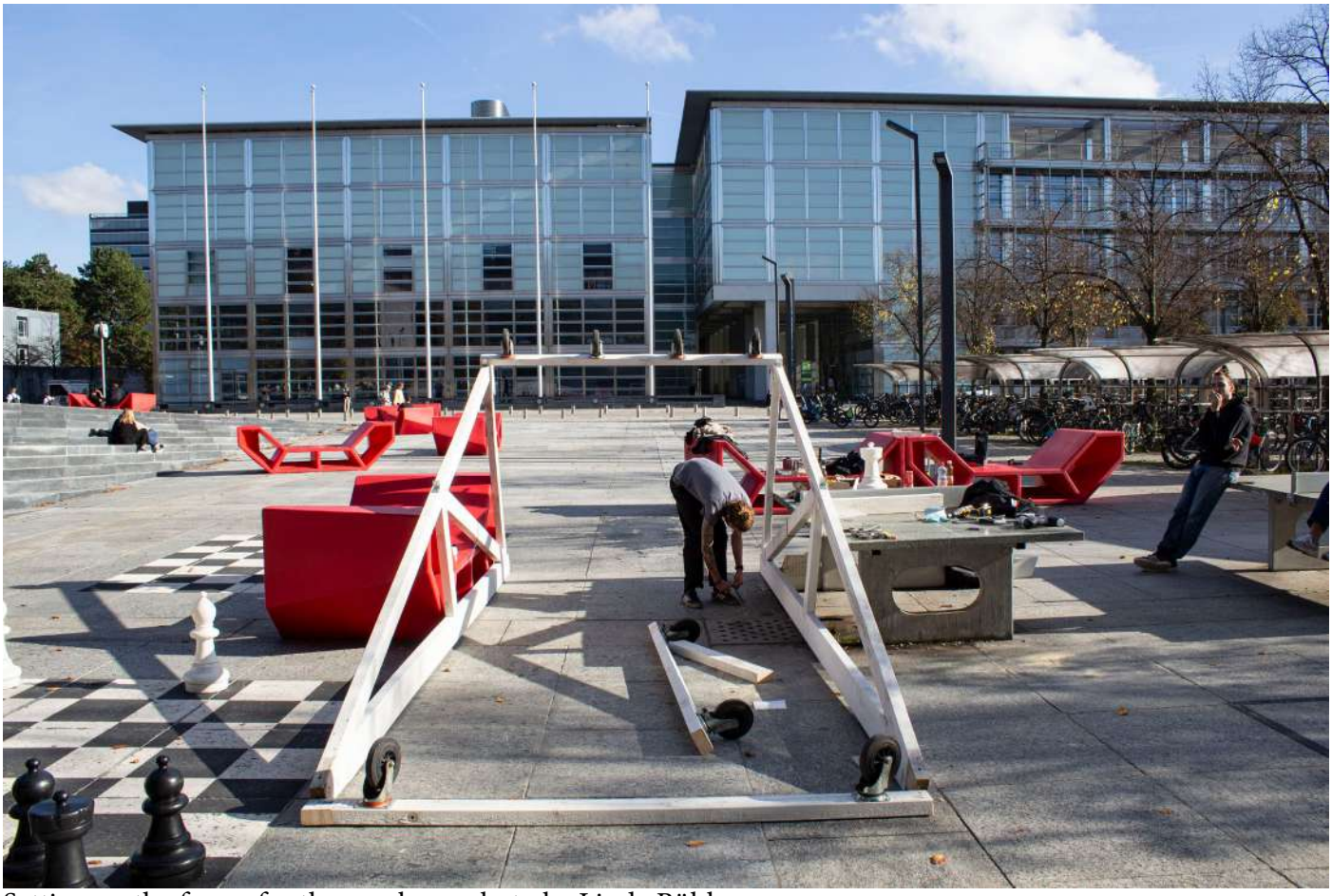
Stiffening the primary structural frame, photos by Anna Buser



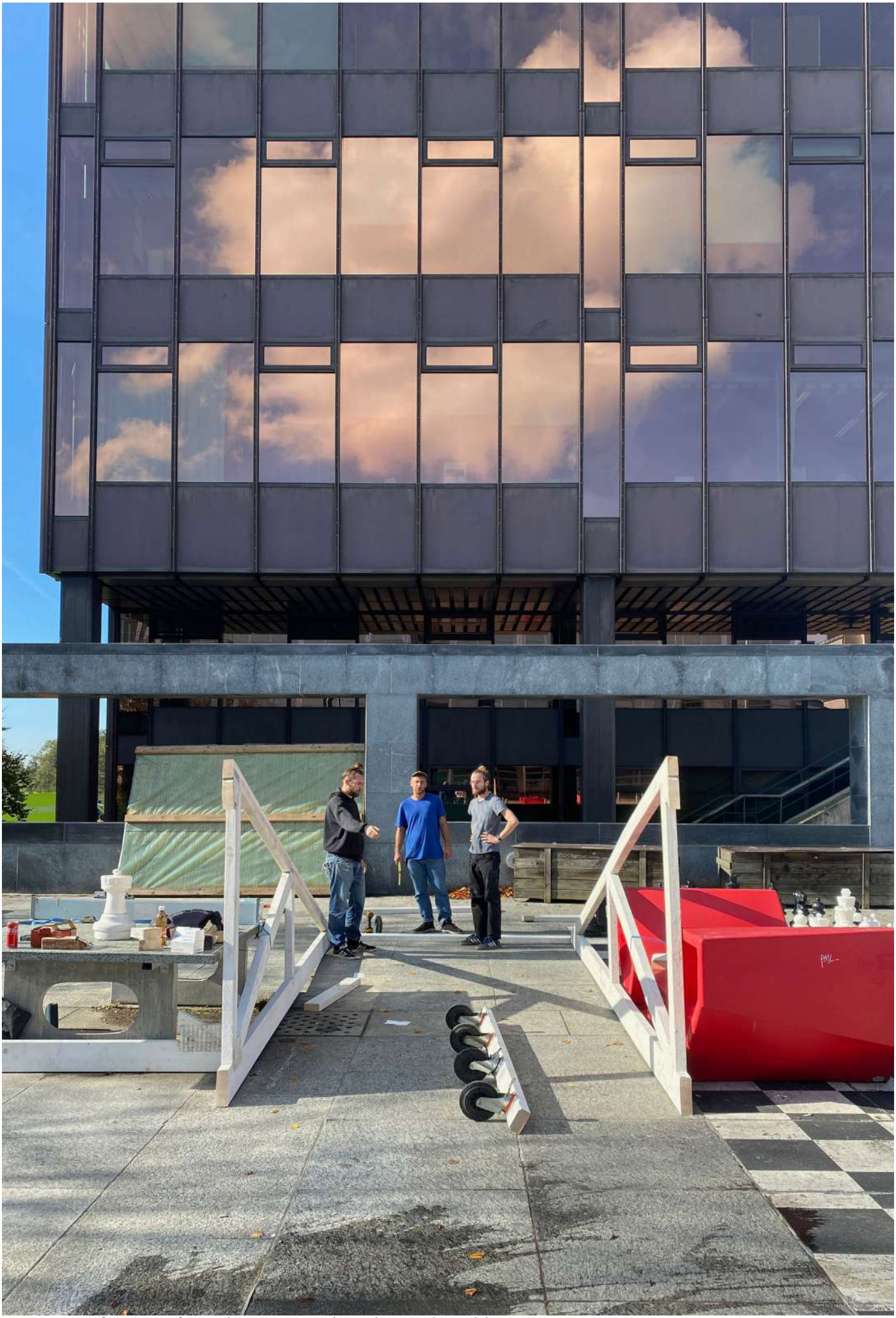


Attaching wheel for increased mobility of mock up, photos by Anna Buser



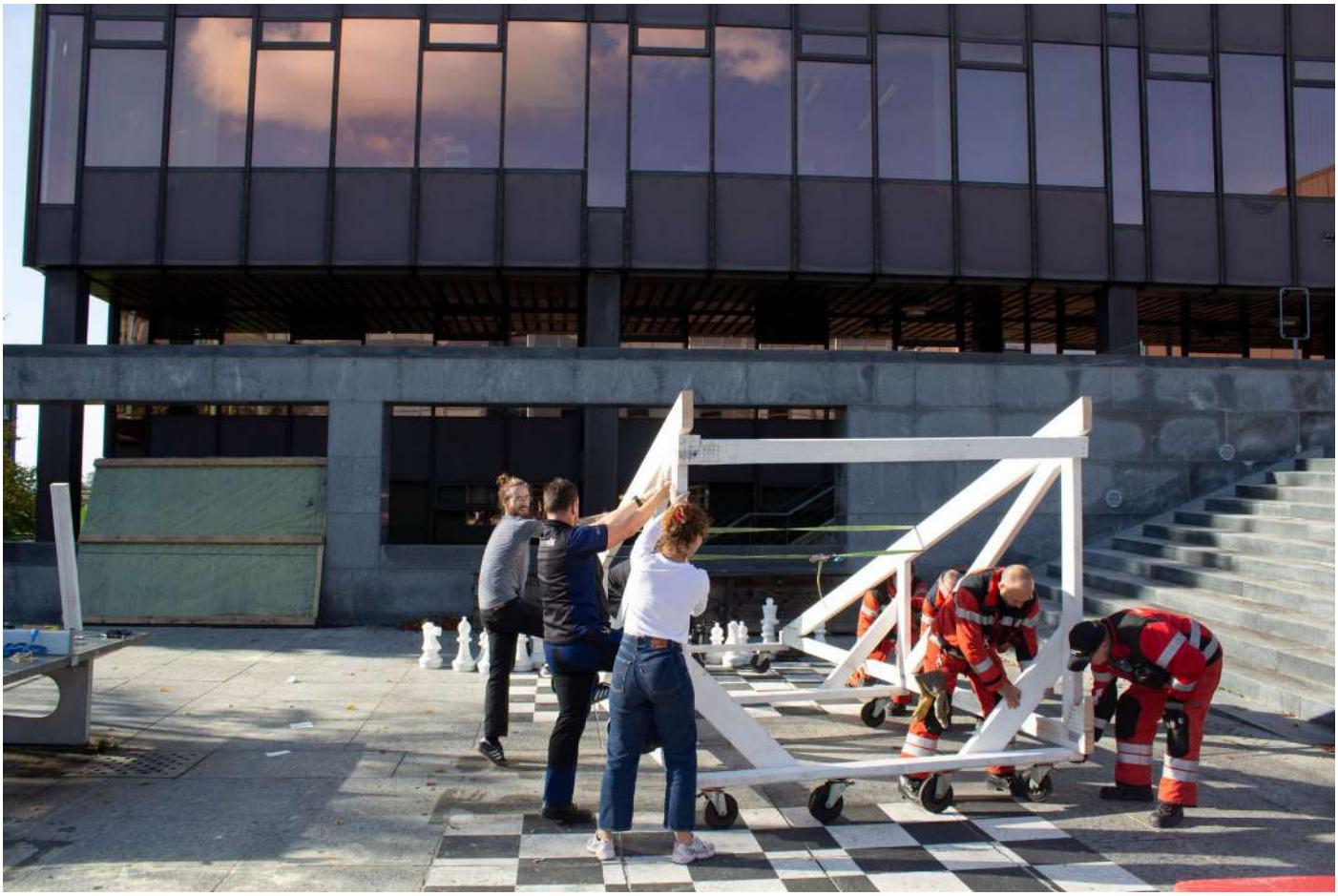


Setting up the frame for the mock up, photo by Linda Bühler

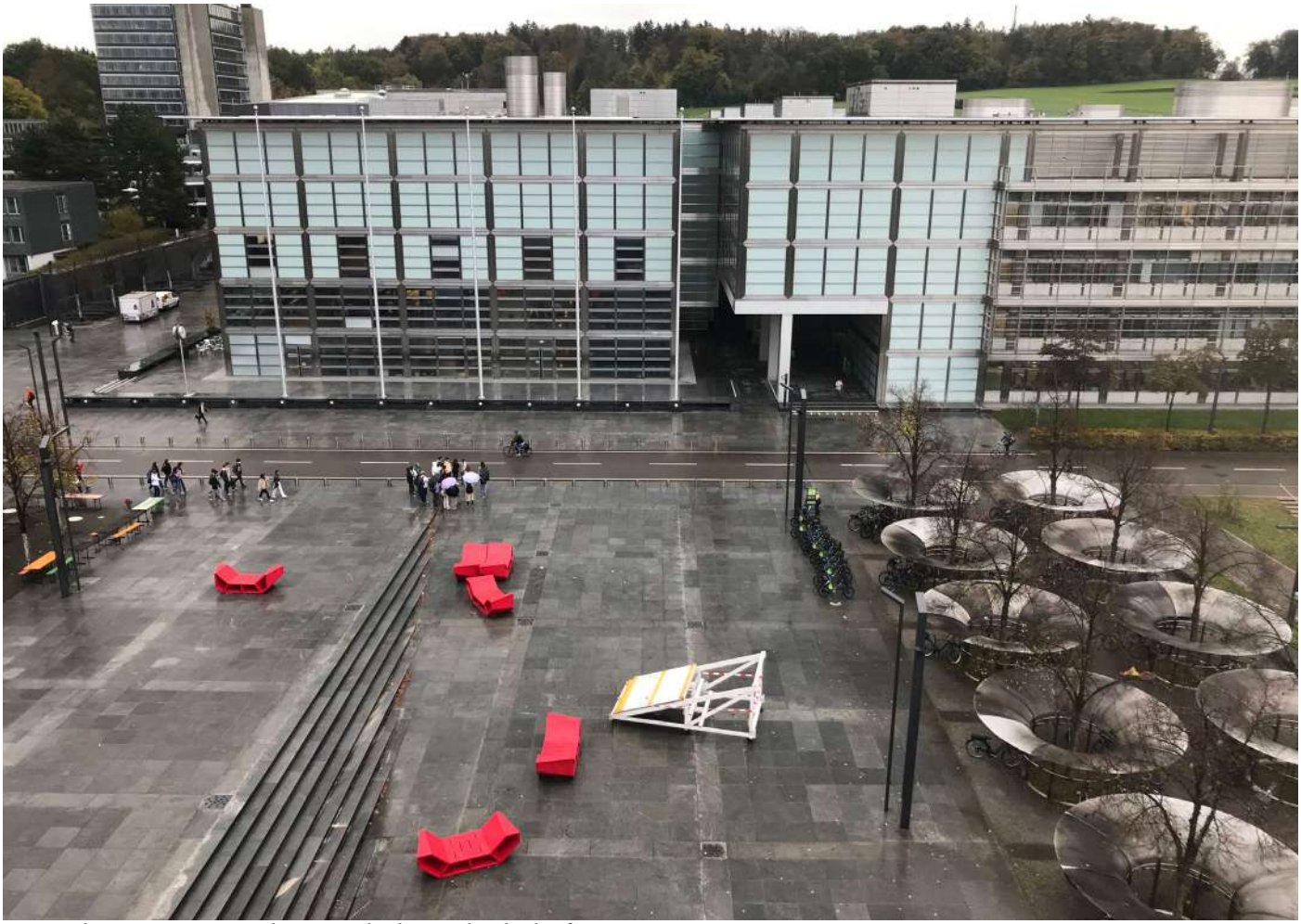


Temporary fixation of wooden trusses, photo by Linda Bühler

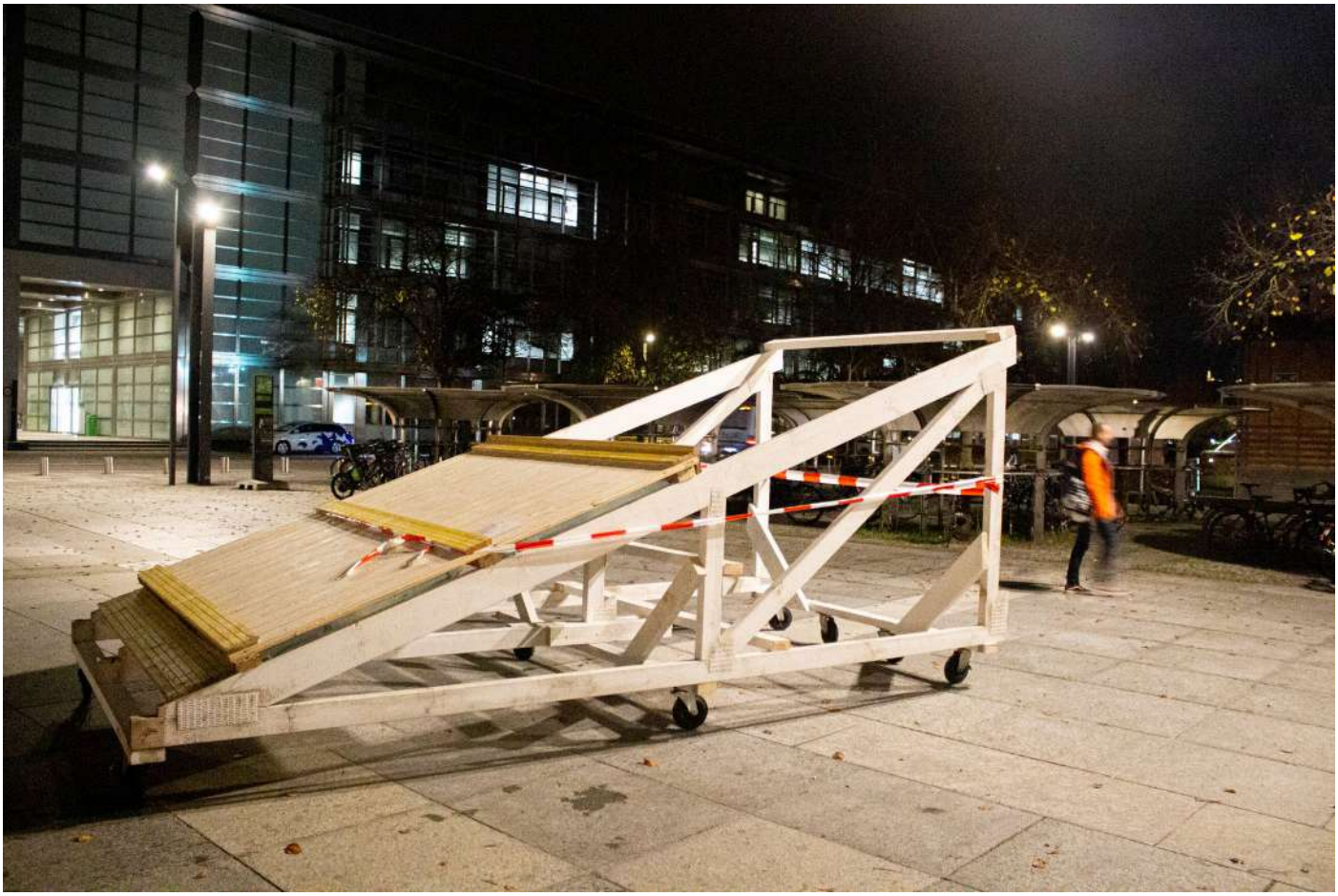
Flipping the mock up with the help of volunteering firemen

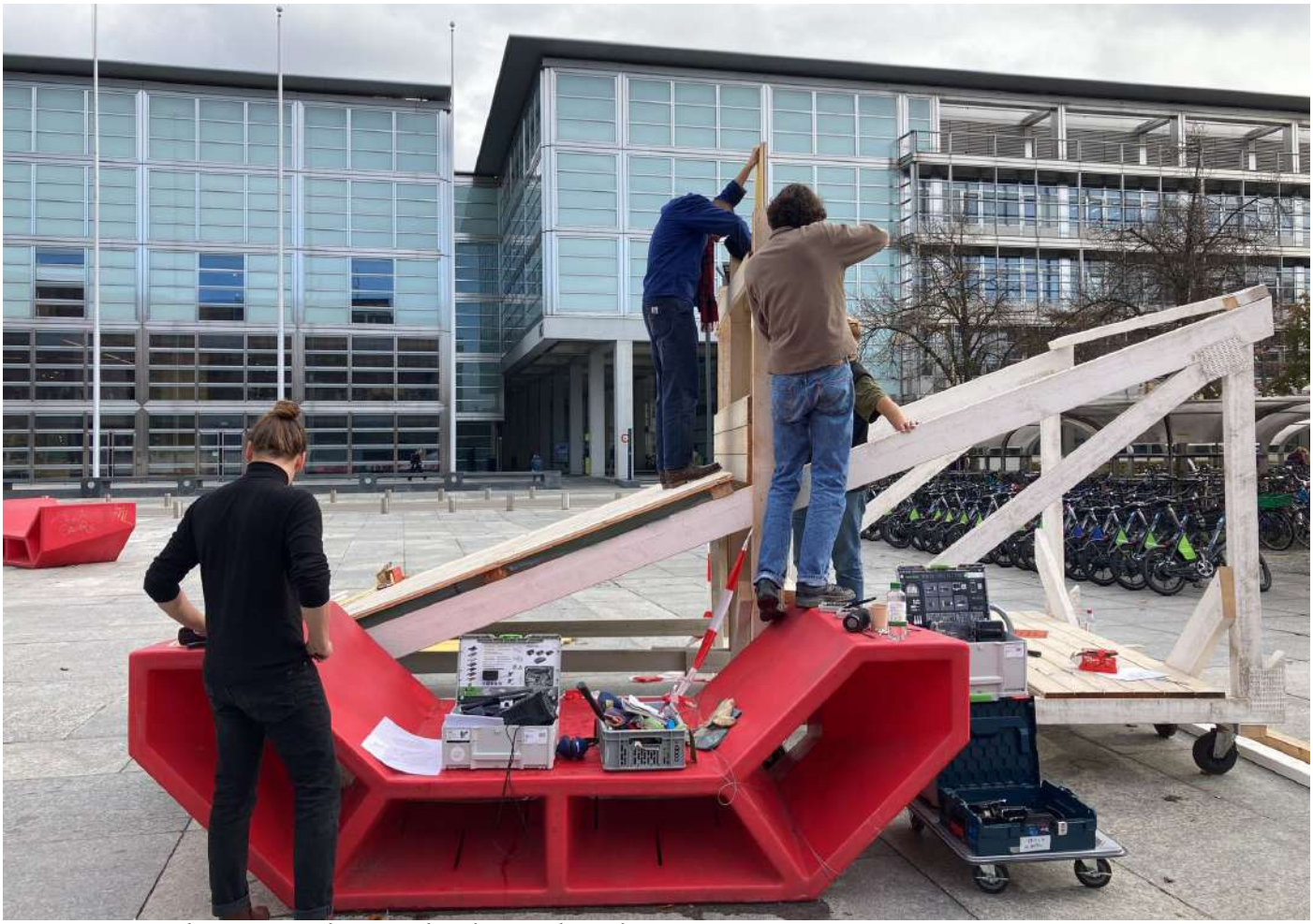


End of first construction day



Second construction phase including tilted platform





Construction phase 3: windows and railings, photo by Lucas Tanner

Fencing around the mock up by Eberhard

Completed interior of the mock up

Completed mock up during snow fall

DESIGN

The design of the temporary re-use pavilion is considered a celebration and acceleration of the original Huber Pavilions, their rhythm and heritage.
By reusing building components, a connection is made between old and new learning spaces at ETH.

The spaces are designed as such, to support different educational activities.
The proposal is to be considered a result of recently observed and identified learning actions.
Spaces for teaching must hereby be distinguished from spaces for learning.

Most importantly, the re-use pavilion offers shelter and protection from natural elements as rain, wind and heat. As the proposal excludes all building systems (water, electricity, ventilation), the integration of different spatial typologies becomes even more important.

The outdoor spaces attempt to preserve as much as possible the character of the in-between spaces, which made the surroundings of the Huber Pavilions less dense.

A stepping terrace invites students to use the exterior as extension of learning spaces, when the weather is right.

In regards to construction methods, the preservation of the original structural for was impossible. Corner points in the wood construction are particularly critical, as they must bear vertical and horizontal forces.
An open construction is convenient in regards to wind loads, as each square meter of closed surface area accounts for approximately 1 kN of force.
In general, the wind force bearable is equivalent to the dead load of the roof construction, and the weight of the pavilion itself. The heavier the pavilion, the less danger from wind.
At the same time, a proper foundation is required to keep the pavilion from sinking. As the design utilizes wood elements, a safe distance is required from moisture and wetness in order to protect the material.

Aside from the wind and dead load, live loads need to be taken into account to safeguard the use of the pavilion.

Intersecting “streets” through the design create metaphorical spaces of exchange and encounter inhabited with social activity and co-presence.
A transition of space is completed, as we enter the roofed spaces, which offer calm niches and a window scape for the student study perspective.
Student satisfaction relies on the ability to fulfill educational activities, which are prohibited in certain learning spaces. This includes building larger 1:1 models, spraying, concrete pouring and other invasive practices.
In a double height space with public character, the translation and communication of architecture skills can be tested and experimented on by students.
Social group behavior is impacted by the architecture of spaces, such as plazas and boulevards with services located alongside.

Circular Learning Spaces

Re-Using the Huber Pavilions

The diploma thesis proposes a design solution for the **extension of HIL** by **re-using building materials** from the former **Huber Pavilions**.
The new, circular ETH Pavilion addresses qualities and the form of learning spaces in relation to **learning behaviorology** and the lack thereof in the existing environment of the HIL building. By re-using construction components of the historic learning scape, the built **character**, as well as the in-between spaces enclosed by the three pavilions, is sustained for **future student** generations in a new design solution.

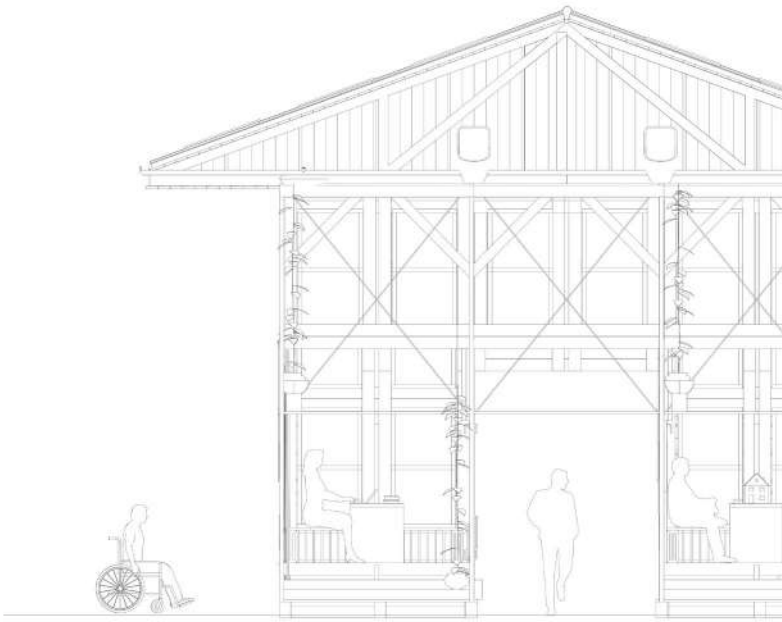
The **vision** for designing future learning spaces derives from real occurring **learning actions**, and also takes into account theoretical curriculum standards shaped by the historic culture of university architecture. The **form** of the re-use pavilion can be derived directly from its **use**. Learning spaces are required to provide specific **functions and services**, such as space for individual and/or group **study**, spaces for presentation and **exchange**, as well as **model building** labs and informal spaces.

An **outdoor stage** is constructed utilising the typology of amphitheatres for **collective moments** and encounter. A large **overhanging roof** provides **sheltered outdoor spaces** with additionally **tall room heights**, ideal for model building and **informal moments**. Further, they offer a safe and quiet **indoor space** with furniture for sitting or standing, as well as a table for **work** and pin-up walls for smaller presentations.

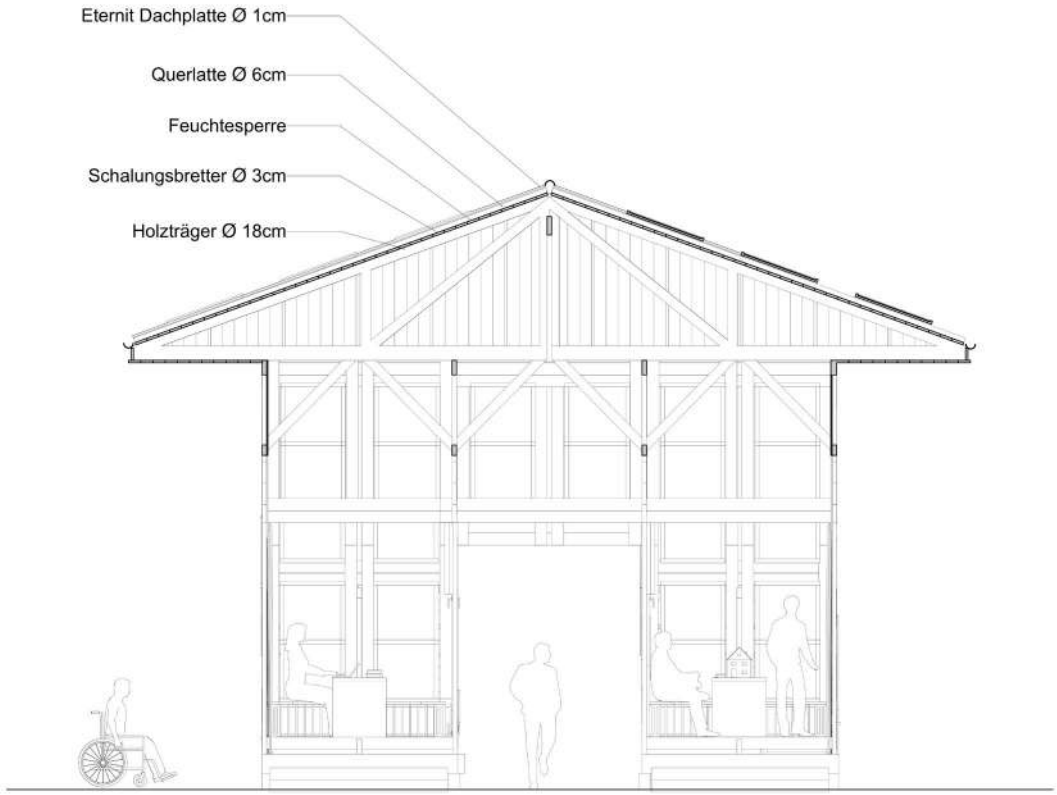
The design proposal is labled an **exploratory o**
a **building permit** issued by the cit of Zurich,
will function as **commissioner**, whereas technis

Learning from the preliminary **behavioral obse**
new model for **informalised learning spaces.**

First, a building site was needed. a **network o**
ETH Real Estate (**ETH Immobilien**).
A **140 m²** piece of land was made available o
rooftop of the HIL building, were non-negotiab



south elevation
scale 1:33



cross section
scale 1:33

cross section perspective
scale 1:33

oject ("Forschungsobjekt"). The permission therefor can be valid temporarily for **3 years**, requiring
acquired with the advisory support of **baubüro insitu**. For the project, the department of D-BAUG
al and expertise is provided by Wiederverwerckle GmbH.

rvations and feedback in surveys, we intend to **advance the learning environment** of HIL with a

f stakeholders is involved when negotiating real estate and building projects on campus, namely

st to the garage entrance of the HIL building. After all, certain proposals, such as building on the
e.

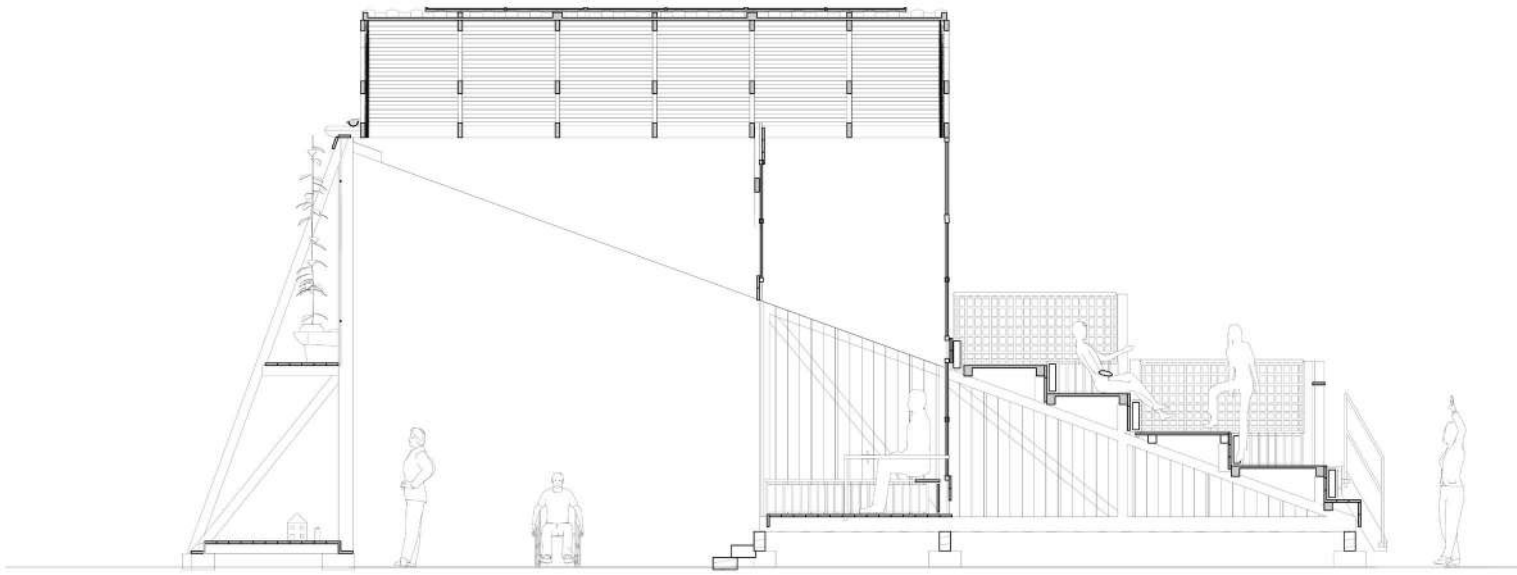
north elevation
scale 1: 33

We propose an urban infill at ETH Hönggerberg and test the boundaries of the masterplan Hönggerberg 2040. Additional learning spaces addresses the lack thereof within the HIL building. The re-use pavilion is shared by the two departments of engineering and architecture as a common expansion of the learning scape.

Not only will the design project tackle the immediate problem of a lack of available space at HIL for the two departments of D-ARCH and D-BAUG, but also, the project will serve as an exemplary solution, how to deal with material waste in the construction industry. Future students in HIL will be directly confronted with, and benefitting from a sustainable, circular construction economy.

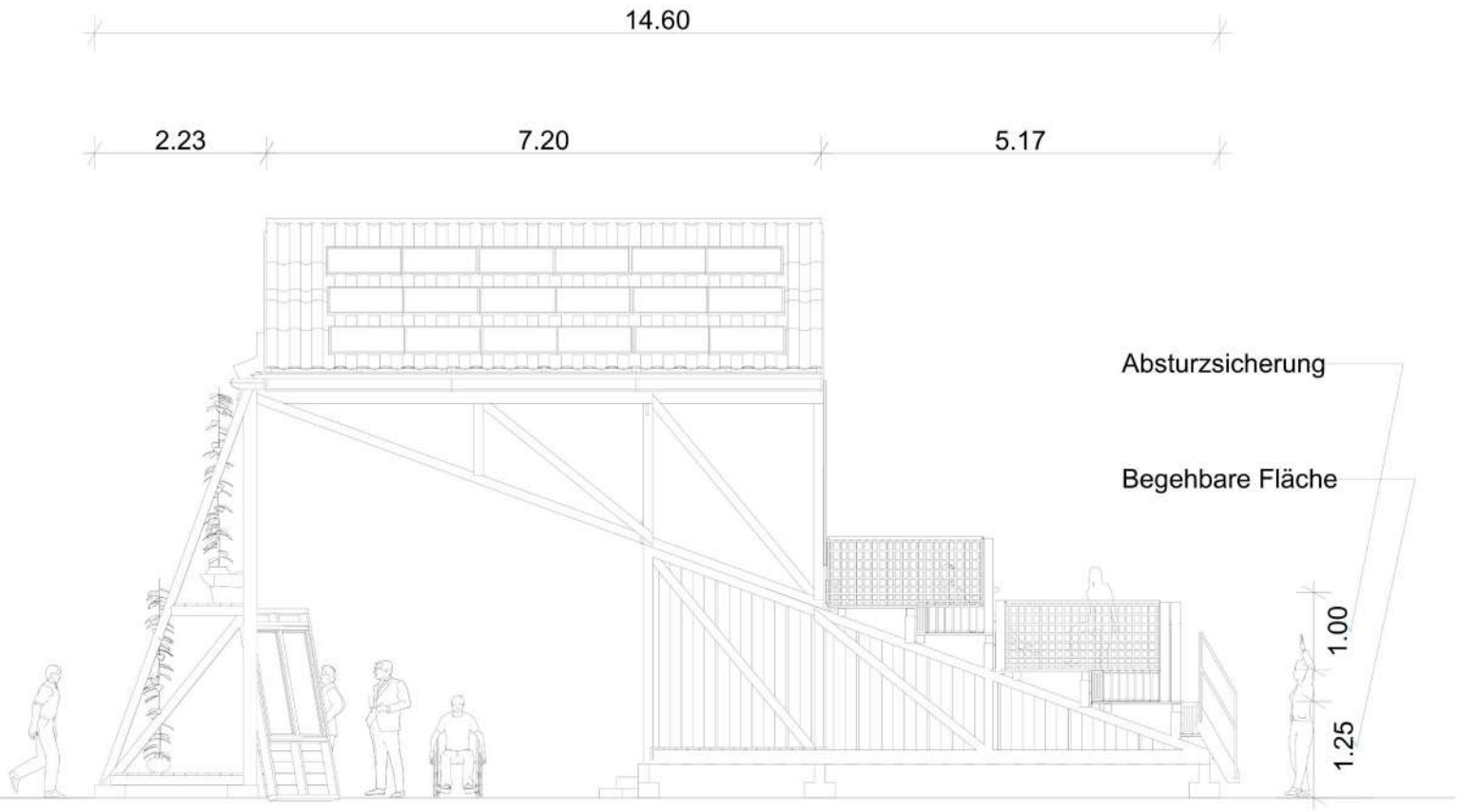
We advocate the **preservation** of the ETH pavilion learning spaces. This includes physical material retrieved from the construction site, as well as the **3 typologies** of space, which made the Pavilions:

The **interior** serves learning and presenting.
The **exterior** serves informal breaks and model building.
In-between spaces serve encounter and exchange.

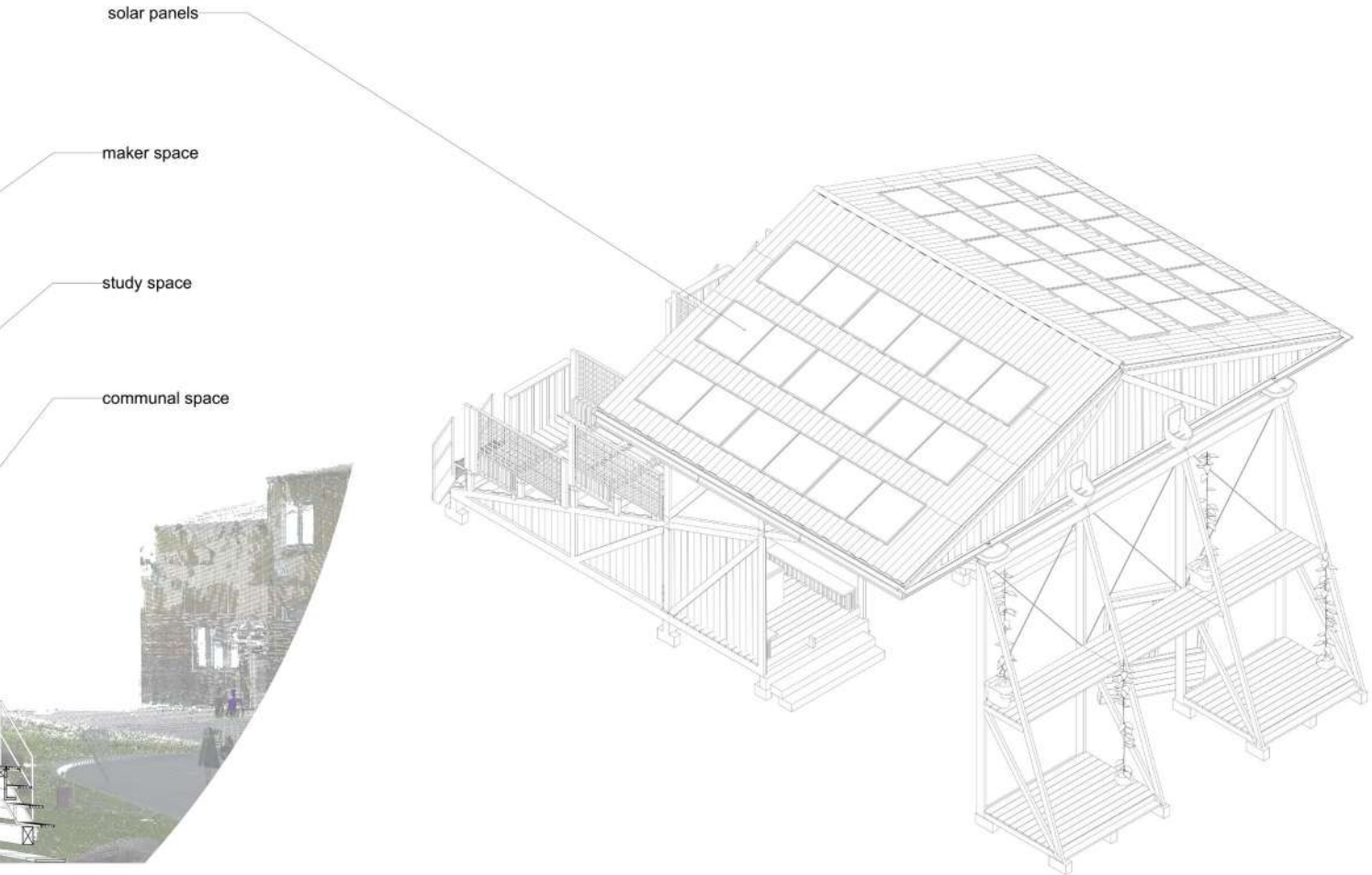


longtudinal section
scale 1:33

longtudinal section perspective
scale 1:33



west elevation
scale 1: 33



axonometric view
scale 1: 33

1:33 Model of the re-used Huber Pavilion

CONCLUSION
&
OUTLOOK

The re-use of the Huber Pavilions was long desired and fought for by many different actors. The fact, that many materials have been shared and are being re-used is a huge success in itself. Additionally, the design of the re-use pavilion suggests further dismantling after the completion of the temporary, three-year contract with ETH. Again, materials may be offered to recipients of the private market, or further ETH internal projects might benefit from the third-generation material of the Huber Pavilions.

Learning from the construction of a mock-up, the collective design and construction of the re-use pavilion is set as a next goal.
The process of building will be completed with 24 students, two supervising Chairs and two external firms, baubüro insitu and Wiederverwerckle GmbH during the course of a spring semester with Prof. Catherine De Wolf and a focus work with Prof. Momoyo Kaijima. Likewise, budget applications were granted to both of the two Chairs of Architectural Behaviorology and Circular Engineering in Architecture.

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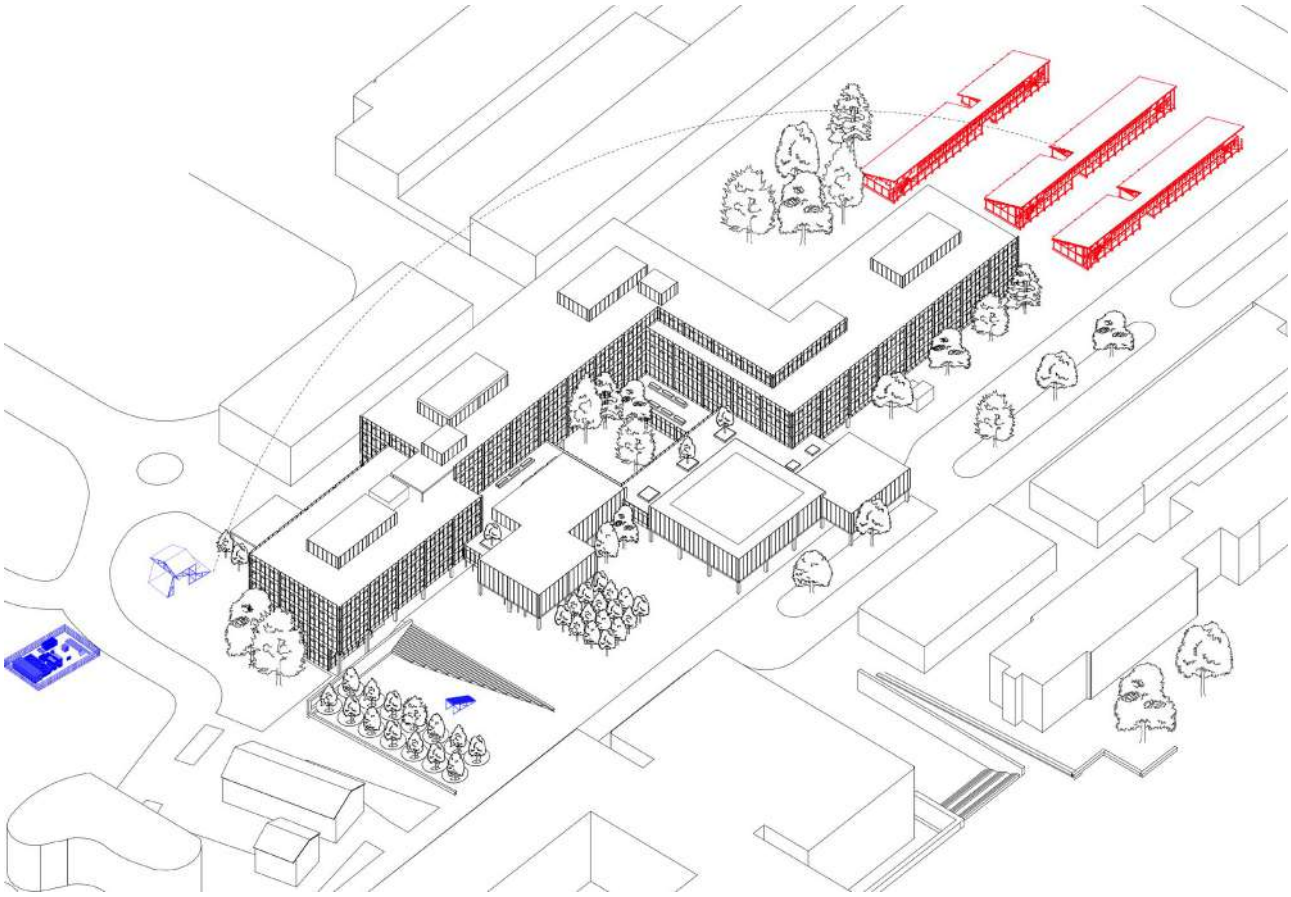
Further, students will deal with the original material, their designated use in the original building, and its preparation for use in the re-use pavilion.
Part of the re-use project are preparation-, design- and construction phases, which include disassembly of the previously built mock-up and further refinement of the diploma design proposal.

A step-by-step timetable will clarify the task, schedule and methods of the different students involved in the re-construction. Smaller teams are organized concerning individual tasks, such as the foundation, structural elements, or roof construction. Also, heavy machinery, like cranes, if necessary, must be reserved, as well as scaffolding for working in heights.
Also, the documentation of the entire process allows future students to learn from the project and be inspired to participate in further initiatives.

First and foremost, during construction, the protection of health and safety of all protagonists is of most importance, as well as future users. Aside from respecting all building norms (SUVA) and rules for the protection of workers (EKAS), a safety concept is required when working with students, who have no previous training or experience on construction sites.
This includes an assessment of dangers and risks on the construction site, rules of conduct, principles and organization of safety instructions and action planning. Furthermore emergency protocols and co-operation need to be clearly prepared, including psychological aspects, as stress.
A healthy culture of safety is fostered with leadership by example, and the company and audit of experts and responsible safety officers. Although there always remains a certain risk of exceptional dangers, it is the duty of the organizers to mitigate unsafe practices and behavior, as accidents can happen, even if only almost.

Reuse Huber Pavilions' Materials

Spring Course D-BAUG & Focus Work D-ARCH



Drawing
by Elias Knecht (2022)

The Spring Course of D-BAUG and the Focus Work of D-ARCH plan the reuse of the Huber Pavilions' components on the Hönggerberg Campus in a design and construction next to HIL. It is organised as a joint venture by the Chair of Circular Engeneering in Architecture from D-BAUG and the Chair of Architectural Behaviorology from D-ARCH and open to students from all departments. (max. 25 places)

Spring Course
(FS23) by CEA

Focus Work
(FS23) by CAB

Organizer:	Chair of Circular Engineering in Architecture (CEA) Prof. Catherine De Wolf, D-BAUG Chair of Architectural Behaviorology (CAB) Prof. Momoyo Kaijima, D-ARCH
Collaboration:	Baubüro in situ ag Wiederverwerkle - Wick Upcycling GmbH
Instructors:	Catherine De Wolf, D-BAUG Momoyo Kaijima, D-ARCH
Date:	February 2023 - June 2023
Construction period:	April 11–15 & June 18-26
Location:	ETH Hönggerberg
Students:	Up to 25 Spring Course students, 12 of them can also register for the Focus Work.
Program:	Spring Course (FS23) by CEA Focus Work (FS23) by CAB

Assignment:	The Spring Course by CEA deals with digital transformation tools to support the design and construction of a new structure with reused materials from the Huber Pavilions organized as a Focus Work by CAB.
Credits:	8 ECTS (CAE) + 6 ECTS (CAB) = 14 ECTS for D-ARCH students and 8 ECTS (CAE) for other students.
Application:	By 09.02.2023: 1. Everyone must enroll for Spring Course by CEA 2. Everyone must send a 300-words letter of motivation and a 1-page CV. 3. D-ARCH students must also register for the Focus Work by CAB and send their portfolio.
Contact/Submit to:	Nina Limbach, limbach@ibi.baug.ethz.ch

baubüro in situ ag Zürich · Wiederverwerkle Upcycling & Restholzbörse · D BAUG · DARCH Department of Architecture · ETH zürich

Re-Use Huber Pavilion: Poster for spring course and focus work