ReUseCases

Year completed: 2025

ReUseCases aims creating a new architectural guidance tools regarding the design with reused concrete slabs. The parts of a selective demontage process in an eastern german ,,Plattenbausiedlung“ are supplying the substance to design with. Through different-scale optimization algorithms I aim at giving a clear performance Profile and seek to emphasize consequences on the building process as a whole. That way a designer can directly see how e.g. the window grid will influence cutting efforts, grey energy preservation and construction time but also physical properties of the finished building like light autonomy and anualized heating costs. This integral information transfering is then scaled to influence large-scale decisions like cubature or position, aswell as midsized and smaller decisions like the window grid, constructive details and interior choices.

ReUseCase

Rafael Helm

Digital Workflow

Counting Tonnage and parts

The donor building and the dimensions of its components are known. Using a counting function, a design can quickly be tested for material utilization. The construction method defines a degree of utilization. If assembled according to their original use, wall elements could be reused one-to-one. A nesting function can optimize wall thicknesses in the new design in relation to the available donor components.

Counting Emissions

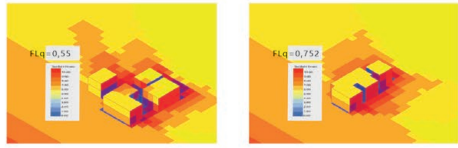
The construction decisions allow an estimation of the required upgrading effort from the dismantled component to its implementation in the new building. Together with the transport distances, this makes it possible to quickly evaluate the total emissions as well as the additional effort resulting from individual design decisions

Selective demontage in Halle(Saale)

Physical validation

Makrolevel - LADYBUG

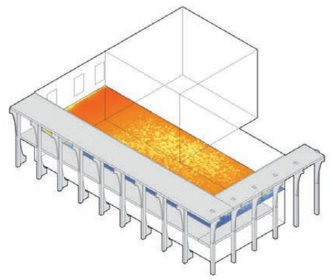
With real weather data from open-source meteorologic stations we can simulate large scale mass behaviour in annualized or specific cases. Digital sensors in our environment measure fictional sensor grids and evaluate vector behaviour of a



Two comparative sunlight analyses, with a quotient from wall-size to room footage

Mikrolevel - HONEYBEE /ENERGYPLUS

In Micro scale the weather data from the outside is connected into interior room decision-making. Shadow scenarious for example can deliver ideas about room behaviour in heat peaks, should the window measurments be changed. SO the opening portions of walls can be calculated back into room behaviour and thermal gains and vice versa.



Room-Simulation of annualized sunlight autonomy

Demontage Steps

Live Weather Data

Surrounding Cubature

Space demands

Material Usage /m²

Emissions/m²

Annualised Values

Possible Goal functions

Example parameters to optimize for: can be combined, valued against each other etc.

Fromt Material Counting
Minimal required wall size to fullfill footage demand
Wall measurments that use cutting from the old plates with minimal waste

From Emission Counting
Minimal Use of the selected energy Carrier (e.g. Diesel Usage)
Calculating grey emission counting versus refitting emission occurance

Volumetric Layer
Optimizing the cubature for material usage versus sunlight parameters
Constraints for design limits (e.g. maximum floor number)

Physical layer
Maximum daily sunlight
Maximum overheating hours
Good daylight autonomy
Thermal mass calculation

With fixed construction Module
Maximum stresses
Wind force optimizing

Per-Room-Analysis

Volumetric Exploration

Additive and subtractive volumina generators can be plugged into the optimizer.
Parametrical mass modeling can be put in place to fixed parameters such as walldimensions, square-per-wall-ton etc.

Volumina generation Evomass

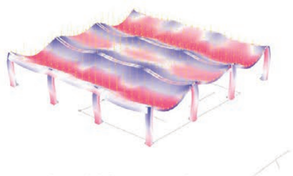
Cubatures

Feedback

Architektonic Solutions

Structural validation

Finite Element Analysis enables real-near physics simulations. For live optimization the chosen grasshopper Platform is suboptimal, but designed constructions can be evaluated

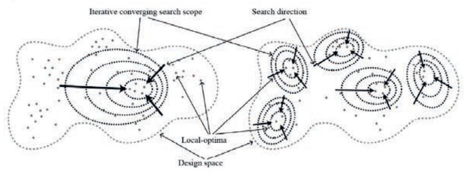


statical model from Karamba 3D

Validations

Evolutionary optimization

Two-Island-Optimization gives a powerful tool to optimize for certain parameters. we can also cross-combine singular parameters into powerful mixed goal-functions that allow for complex mathematical manipulation



Two-Island optimization

Generated Volumina

Optimized Decision Making

Quick Feedback

Evaluations

Refinement Iteration

I am not advocating for the automatic house here. The Design doesnt profit from start-to-finish-automatisation. Saved time can be lost on useless automatization attempts. The proposed usage of optimization solutions orients on a individual deployment with a clearly defined goal. The decision for a set of detail sections, a design location, Room program etc. can be seen as a data basis upon which a design choice can be optimized and the tool locked onto a specific design implementation goal.

Example in emergency exit:
included second emergy in a veranda or adding an external construction?

REUSE CASE 0

Get to know ReUseCases!

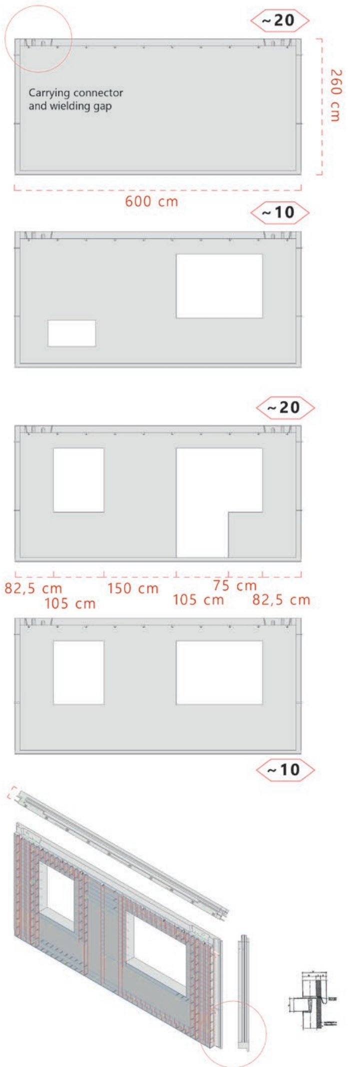
Project Video: https//vimeo.com

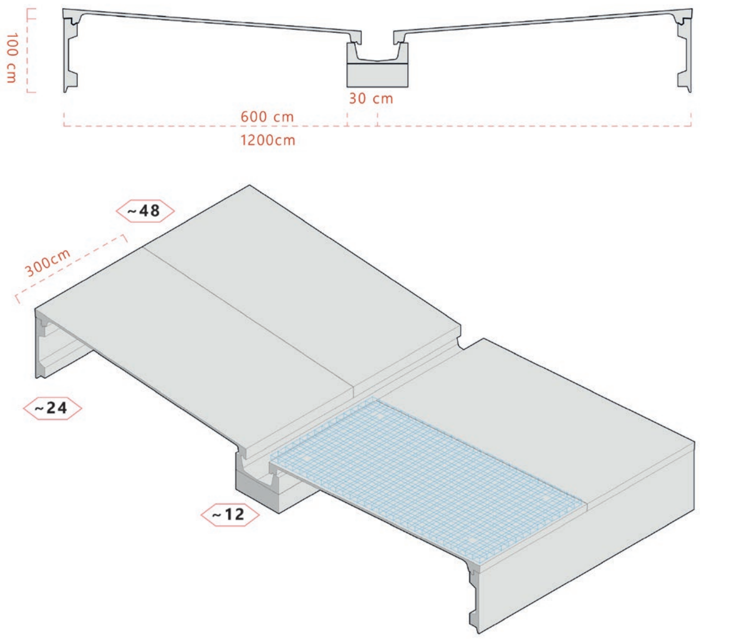
Use	Library
Adress	Gellertstr. 54
Planning:	post-demontage
Special use:	Yes
Footage demand:	ca. 500m²

The applied design project for the developed techniques is a WBS70-type housing block that was partially dismantled in 2011 to improve living quality amid declining occupancy. At the time, data processing did not allow realistic reuse, so the building was demolished and disposed of. Based on the theoretical material recovered through careful disassembly, a selective deconstruction was simulated, the resulting elements assessed, upgraded, and tested for possible joining methods. A library building then served to test their transfer into a permanently demountable system. Local reuse of materials and optimization strategies minimize transport costs and enable promising emission values while maintaining full usability and high aesthetic standards.
For full assessment and documentation see: rafaelhelm.com/ReUseCase-Bilancing

Original structure 1971-2011

After selective demontage 2011





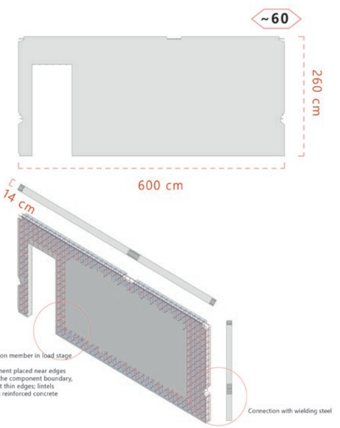
Often corroded and therefore unfit for regular loadbearing use. Will be utilized for other building parts.

Roof Story

Trifold Precast Facade Slab

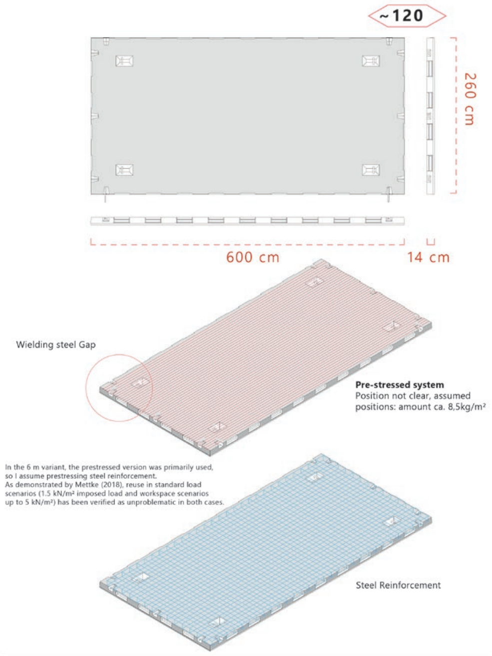
Same compression capacity as the interior loadbearing parts but with extra insulation.

Katalogue

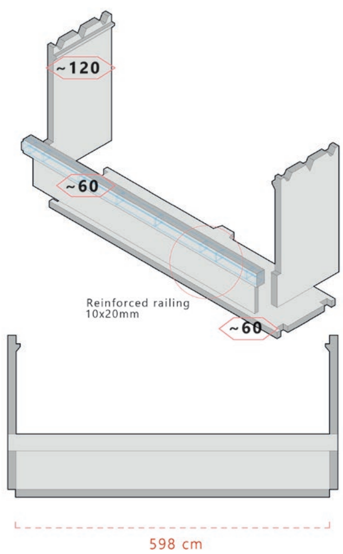


According to Mettke (18) according to displayed load bearing (N=155kN/m) unproblematic.

Loadbearing Interior Wall



Ceiling Slab



Loggiaparts

Applied Workflow

Requirments

City-Planning constraints

Block structure demands a yard closing to the street side

Small location with opening to the inner, invitation to spend time

Aesthetical Priorities

Strong monumental value, important to give residents a feel of selected remontage advantages IV VI

No Use of full plate dimensions to break the areas uniformity VIII

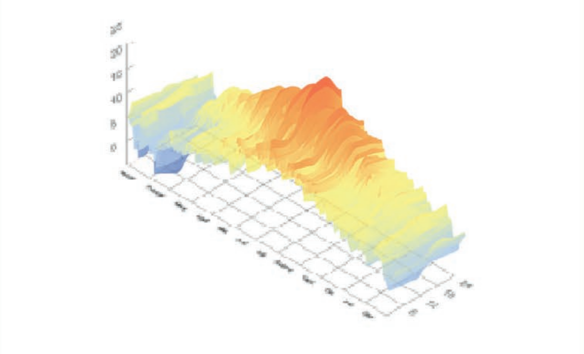
Use Scenario

Ground access barrier free, all core functions useable in ground level VIII

Second constructed emergency exit in public library II

300-400m² Usable space

Makroanalysis



Temperature profile Halle-Neustadt

Optimization

Orientation in the yard
vs.
Space requirments
vs.
BGF/Facade Area
vs.
Sunlight in the proposed reading

Design Decision:

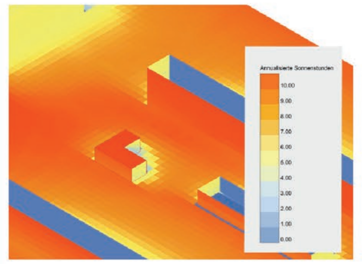
BGF: 498m²

Space 235m² x 2 = 270m²

Space quotient with ground area:
0,96 m² ground floor per m² Facade

Sun: Biggest possible reading area with 8.83 daily sun hours per annum

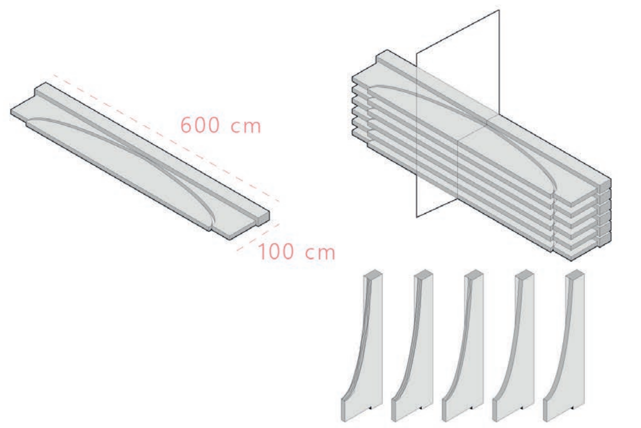
II III V

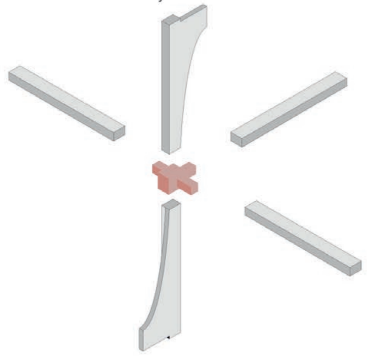


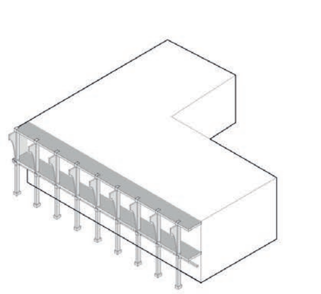
Decided Cubature

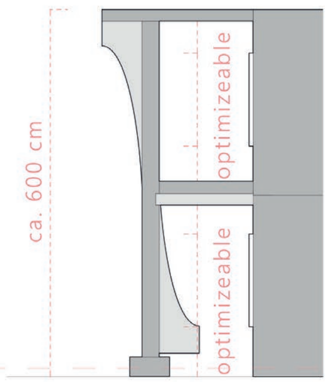
reUSE CASES

A - Access balcony walk



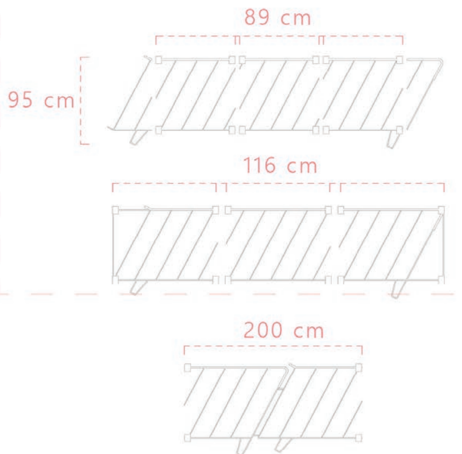






II IV V VI VIII

B - Access Balcony railings from old stair railings

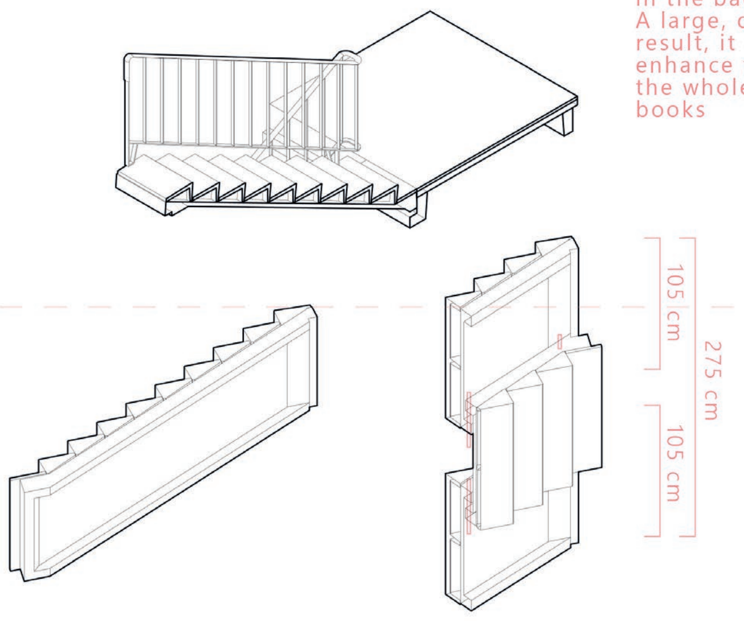


The finished railings can later be demounted and used again in future buildings. Succesful transfer into rebuildable System.

IV VI

C - Book shelves from old stair modules

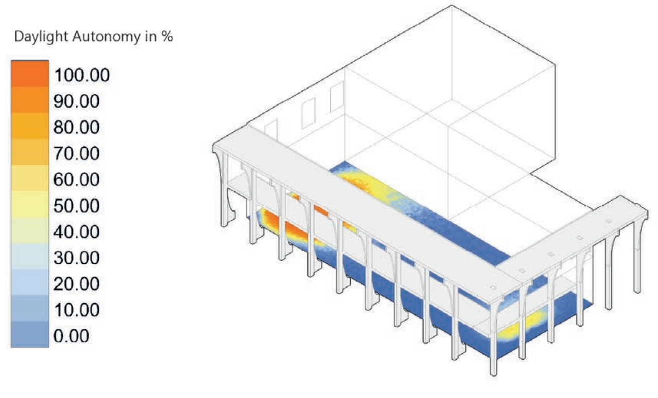
The Stairs are rebar sleds on the bottom side, covered with light, hollow triangular stairs. Through separating from the platforms the full stair modules can be refit through jamming large screw profiles in the back and fixing them. A large, durable shelf is the result, it can be polished to enhance the reuse flair of the whole building and hold books

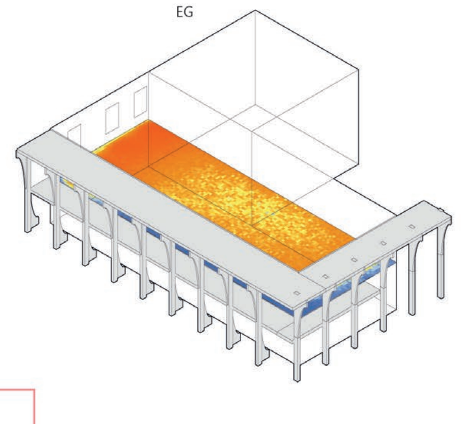


IV

Mikroanalysis

From my ReUse-Cases a new optimization scale is derived. The Access Balcony is seated on the columns, providing shadow and also influencing the window grid. A new Goal Function forms, derived from the option to optimize column distance against room lighting and cutting the wall parts subsequentially.





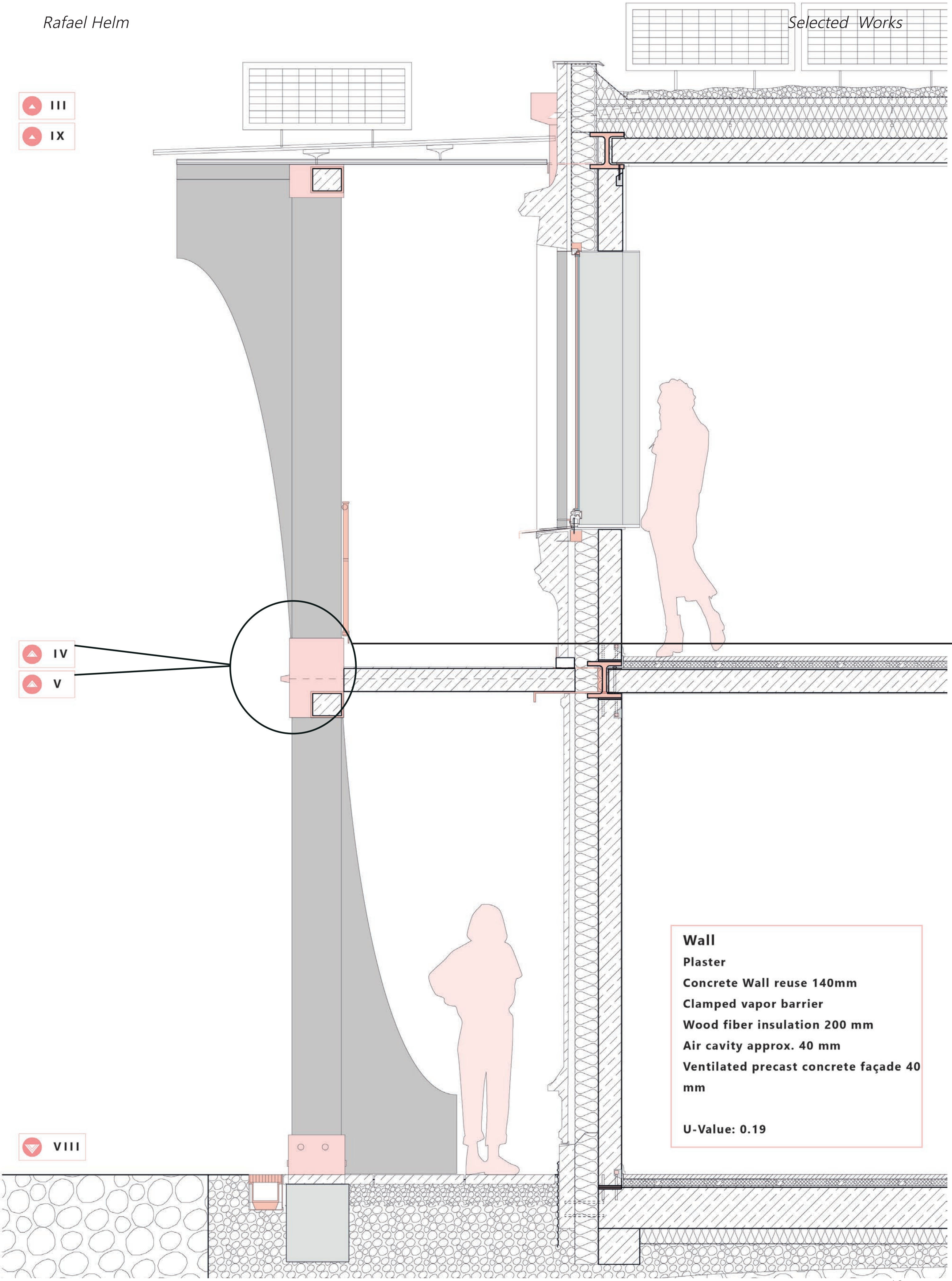
Optimization

Functionality (1,2 m emergency exit requirement)
vs
Column Grid
vs.
Window Grid
vs.
Daylight Autonomy
vs.
Overheating hours

Design

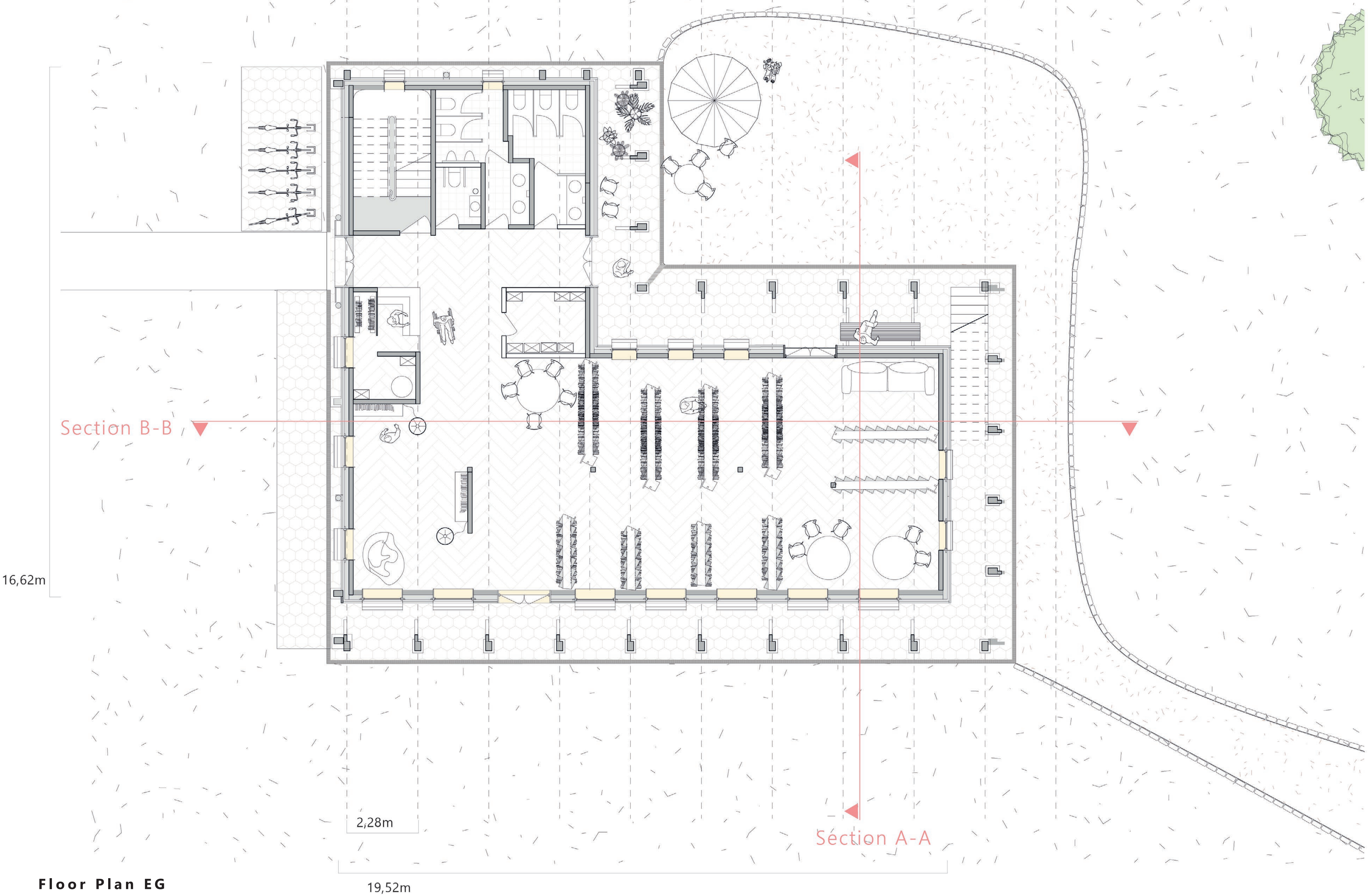
Stair position East side
South side
Window Grid: 180 x 140cm
Column Grid: 228cm
Opening South: 26%
Shadowed access balcony
Daylight autonomy
FH Area EG: 52%
OG: 75%
AVr: 63,5%
Overheating hours per ASE 1000/250
FH Area EG: 8,01%
OG: 10%
AVr: 9%

I II III IV VI VIII


III
IX
IV
V
VIII
Wall
Plaster
Concrete Wall reuse 140mm
Clamped vapor barrier
Wood fiber insulation 200 mm
Air cavity approx. 40 mm
Ventilated precast concrete façade 40 mm
U-Value: 0.19

Detail M1:

Modellfoto



Floor Plan EG