MINERVAHAVEN
WATER RESILIENT

A LIVEABLE AND AFFORDABLE
PLACE FOR STARTERS

P5 - BOOKLET
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AR4AD110 DWELLING GRADUATION STUDIO - DUTCH HOUSING

CONTENT

1. PROJECT BRIEF

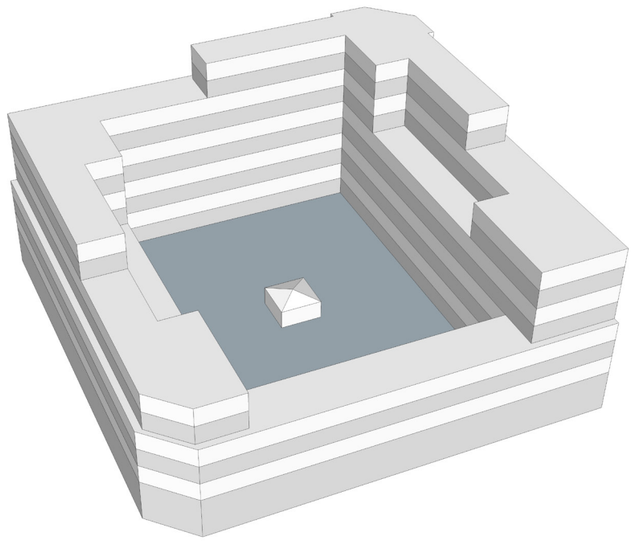
BUILDING INFORMATION:
- Plot: 80x80m with two chamfered corners
- Site: 6.220m^2 (52,8% built)
- Total floor area: 32.055m^2 (FSI/GSI: 9,8 & 5,2)
- Height: 18,5-39,5m
- Dwellings: 315 (density: 227 dwellings/ha)
- Courtyard as garden for the residents including a pavilion
- Underneath courtyard: 2.935m^2 basement for 32 shared car parking spots, 310 bicycle storage spots and 96 private storage units
- Two grid systems to create rhythm: a 7,2mx7,2m grid for the building and a 5,4x5,4m grid that is adapted to the 7,2x7,2m grid for the basement

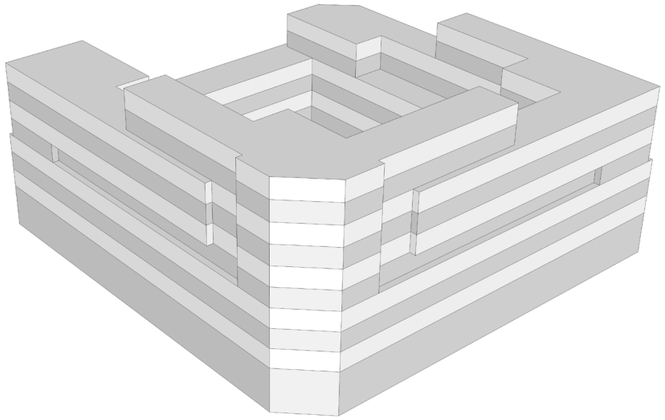
PLINTH:
- 8 meters high. Divided in a 4,5/3,5m split level.
- Multifunctional
- Mix of commercial functions, offices and dwellings (on the first floor)
- South chamfered corner will become a café to use the qualities of the square that is part of the urban master plan

RESIDENTIAL FLOORS:
- Compact dwellings to make it affordable
- 3,5m high floors used to add quality in the compact dwellings
- 2 typologies: apartment & maisonette
- Mix between private and collective spaces

COLLECTIVENESS AS QUALITY:
- On different floor levels outdoor spaces where people can come together
- Shared functions such as kitchens, laundry rooms and work space
- Collective and private storage

SUSTAINABILITY:
- Water retaining. No rainwater going directly to sewage system to contribute in preventing floods.
- Sustainable architecture: integration of different subjects into one design proposal.
- Structural grid is the starting point for aspects such as repetition, aligning and flexibility.
- Meeting today's energy requirements by devices such as balanced ventilation with heat recovery and sun screens





Function	Surface	
Built	3285 m2	52,8%
Courtyard	2935 m2	47,2% +
Site	**6220 m2**	**100%**

Floor area	32055
FSI	9,8
GSI	5,2

Total floor area		
Ground Floor	6220 m2	19,4%
Courtyard	6220 m2	19,4%
1st Floor	3285 m2	10,2%
2nd Floor	3285 m2	10,2%
3rd Floor	3285 m2	10,2%
4th Floor	2255 m2	7,0%
5th Floor	2445 m2	7,6%
6th Floor	1825 m2	5,7%
7th Floor	1825 m2	5,7%
8th Floor	705 m2	2,2%
9th Floor	705 m2	2,2% +
	32055 m2	**100,0%**

Dwelling typologies	Number of types
Apartment	6
Maisonette	1 +
	7

Density	
Minervahaven	30,5 ha
Building blocks	22 avg.
Surface per block	1,4 ha/block
Municpality wants	200 dwellings/ha
My proposal	315 dwellings/block
	227 dwellings/ha

Functions		
Office & Stores	5220 m2	16,8%
Circulation	6600 m2	21,3%
Apartments	9480 m2	30,6%
Collective space	3850 m2	12,4%
Basement	2935 m2	9%
Courtyard	2935 m2	9% +
	31020 m2	**100,0%**

Dwellings per floor	
Ground Floor	0
Courtyard	0
1st Floor	59
2nd Floor	59
3rd Floor	59
4th Floor	32
5th Floor	38
6th Floor	25
7th Floor	25
8th Floor	9
9th Floor	9 +
	315 Total Apartments

Apartment	Surface (GBO)	Amount	Percentage	Percentage of total	Total surface	
Type A	43,2 m2	80	26,8%	25,4%	3456 m2	38,9%
Type B	21,3 m2	154	51,5%	48,9%	3280,2 m2	36,9%
Type C	34,9 m2	48	16,1%	15,2%	1675,2 m2	18,8%
Type D	31,2 m2	8	2,7%	2,5%	249,6 m2	2,8%
Type E	25,6 m2	9	3,0%	2,9%	230,4 m2	2,6% .
		299	**100,0%**	**94,9% Total Apartment**	**8891,4 m2**	**100,0% Total Apartment**

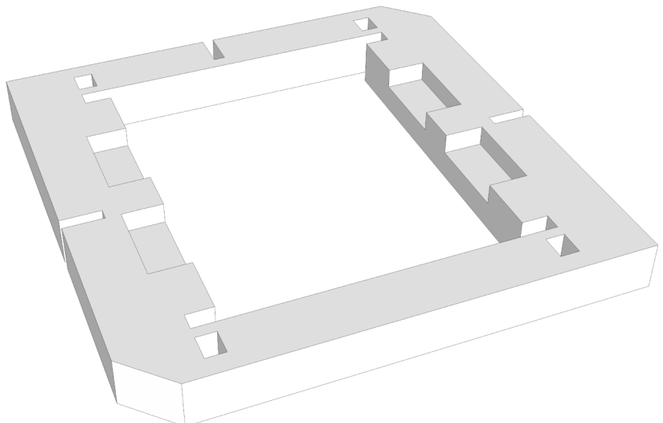
Maisonette	Surface (GBO)	Amount	Percentage of 1 floor	Percentage of total	Total surface	
Type A	36,7 m2	16	100,0%	5,1%	587,2 m2	100,0%
						+
		16	**100,0%**	**5,1% Total Maisonette**	**587,2 m2**	**100,0% Total Maisonette**

315	**Apartments**	**100,0%**	**Total amount**	**9478,6 m2**	**Total surface**

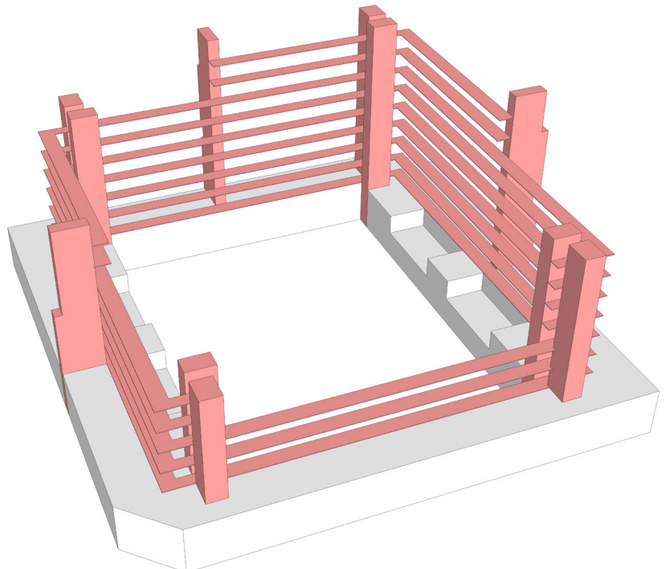
Remark: Difference between “Total floor area” and “Functions” is caused by the GBO instead of BVO usage of the dwellings for “Functions”.

OVERVIEW BUILDING

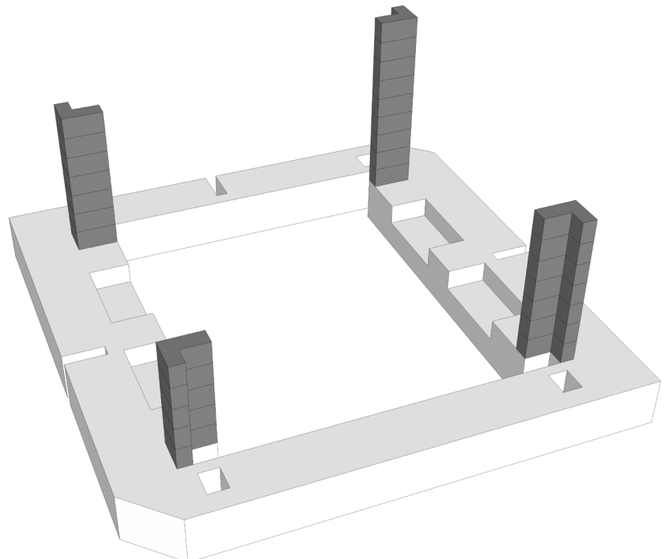
COMMERCIAL PLINTH



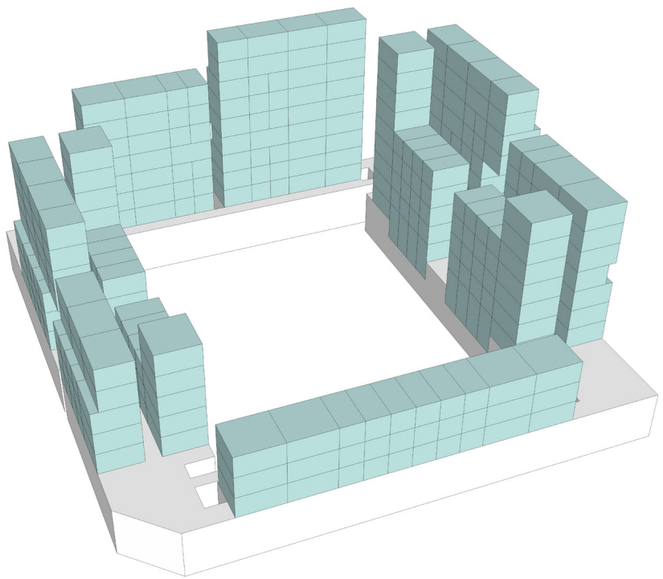
CIRCULATION



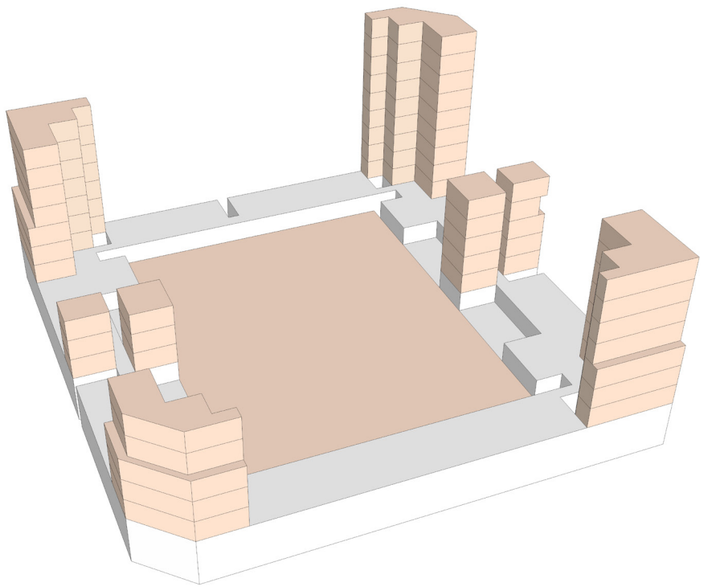
TECHNICAL ROOMS



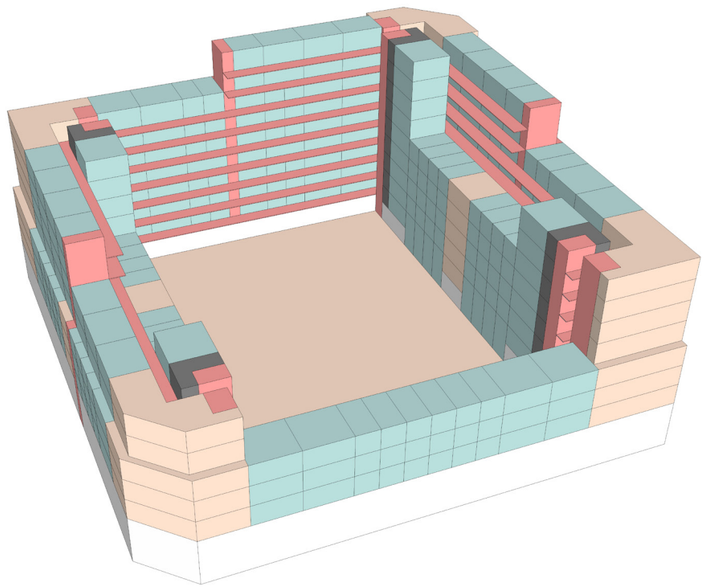
DWELLINGS



COLLECTIVE SPACES



TOTAL OVERVIEW



2. OVERVIEW TARGET GROUP

SUMMARY OF RESEARCH

INCREASE IN ECONOMICAL VALUE OF HOUSES AND STAGNATION OF THE HOUSING MARKET	STARTERS ARE HAVING DIFFICULTIES ON THE CURRENT HOUSING MARKET	THESE PROBLEMS ARE EVEN BIGGER IN POPULAR CITIES SUCH AS AMSTERDAM	THE CURRENT HOUSING MARKET CAN'T FULFIL THE STARTERS' DEMANDS
STARTERS HAVE NO OTHER OPTION THEN TO LEAVE AMSTERDAM	THE MUNICIPALITY OF AMSTERDAM SHOWS THEIR CONCERNS BY THE DOCUMENTS THEY HAVE PUBLISHED	STARTERS BETWEEN 18 AND 25 YEARS OLD WILL FACE THE MOST DIFFICULTIES	CHALLENGE IS TO CREATE AN AFFORDABLE HOUSING MARKET THAT FULFILS THE STARTERS' DEMANDS.

PERSONAL RESEARCH

ECONOMICAL RESEARCH TO DETERMINE WHETHER IT IS FEASIBLE FOR STARTERS TO LIVE IN AMSTERDAM	LOOKED AT HOUSING PRICES AROUND THE SITE AND THE MORTGAGES STARTERS CAN HAVE BASED ON THEIR INCOME	STARTERS BETWEEN 18 AND 25 YEARS OLD CAN LIVE IN 1- OR 2-HOUSHOLD DWELLINGS WHEN IT HAS COMPACT DIMENSIONS	HOW CAN COMPACT DWELLINGS BE ORGANISED WHILE MAINTAINING THE QUALITY OF LIVING?

STARTERS

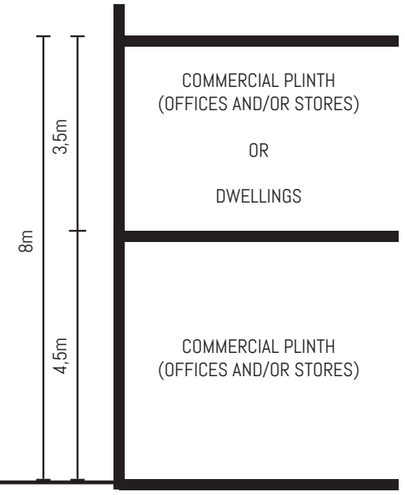
KEYWORDS: AFFORDABLE, COMPACT AND MAINTAINING QUALITY

AGE:	18 - 25 YEARS OLD	PERSONS IN HOUSEHOLDS:	1 OR 2 (SINGLE, FRIENDS AND COUPLES)
EDUCATION:	MBO, HBO OR WO	DWELLING SIZES:	BETWEEN 20 - 45m^2
ANNUAL INCOME:	€19.800 AND €30.600	HOUSING PRICES:	BETWEEN €102.600 AND €230.900
MORTGAGE BETWEEN:	€49.300 AND €249.300	HOUSEHOULD POSSIBILITIES:	1x HBO 1x WO 2x MBO 1x MBO AND 1x HBO 1x MBO AND 1x WO 2x HBO 1x HBO AND 1x WO 2x WO

THE DESIGN IN AN OVERVIEW OF WORDS

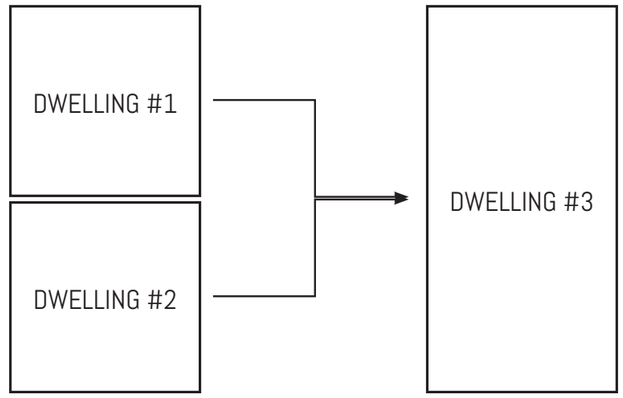
SUSTAINABLE BY DIFFERENT APPROACHES

PLINTH



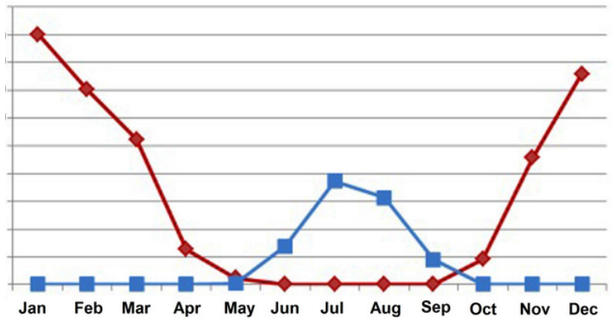
By having a plinth of 8m high it represents the wishes of the municipality of Amsterdam as described in the development strategy of Haven-stad. In the 8m a flexibility is realised where the second floor can partly be removed to change functions through time.

FLEXIBILITY



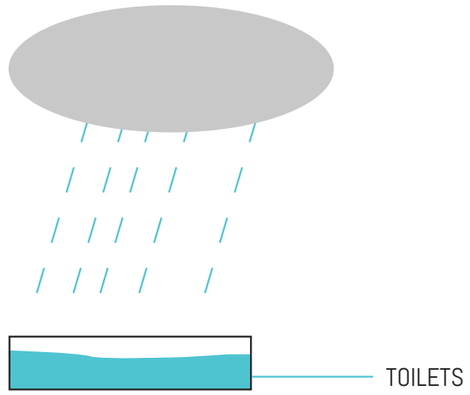
The current economy and housing market values causes that starters are forced to live in compact dwellings when they want to live in Amsterdam. A certain flexibility is needed to make the building/structure future proof to create different dwelling types in case the economy will change drastically.

REDUCE EXTREME ENERGY NEEDS



A lot of energy for heating and cooling will be saved when having a proper climate concept that reduces the extreme values in the winter and summer. It is key to integrate it well in architectural point of view.

ABSORBING RAIN WATER



Absorbing rainwater is needed to prevent extreme floods, which will become more problematic through the years. This measurement will have a positive fact in sustainable point of view because it can be used to flush toilets.

REFERENCES AS STARTING POINT FOR FACADE DESIGN

DIFFERENTIATION

PLINTH, SETBACKS AND HIGHER PART ARE DISTINGUISHABLE BUT COHERENT

COMMERCIAL PLINTH

TRANSPARENT FROM CHARACTER TO SHOW THAT IT IS ACCESSIBLE FOR PUBLIC

GRID

REPETITION WITH EXCEPTIONS TO CREATE A DYNAMIC FACADE

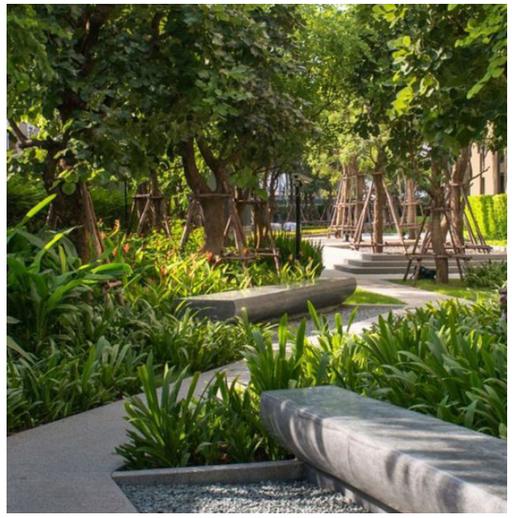
CORNER & SETBACK

CONTINUATION OF GRID AND MATERIALS AT THE CORNERS. REDUCED OPPRESSIVENESS BY APPLYING SETBACKS

REFERENCES AS STARTING POINT FOR COURTYARD DESIGN

MAIN WALKWAYS

WILL BE APPLIED TO GO TO THE VERTICAL CIRCULATION SPACE AND THE PAVILION. IT WILL BE THE STARTING POINT FOR THE COURTYARD DESIGN.



HIGH DENSITY VEGETATION

THE FOCUS IS ABOUT TURNING THE COURTYARD IN A PARK CHARACTER TO ABSORB AS MUCH RAINWATER AS POSSIBLE

WATER SQUARE WITH SITTING AREA

TO MAKE IT A PLACE WHERE RESIDENTS CAN INTERACT. AT THE SAME TIME, THE WATER ISSUE WE FACE BECOMES VISIBLE BY FUNCTIONING AS A WATER STORAGE PLACE.

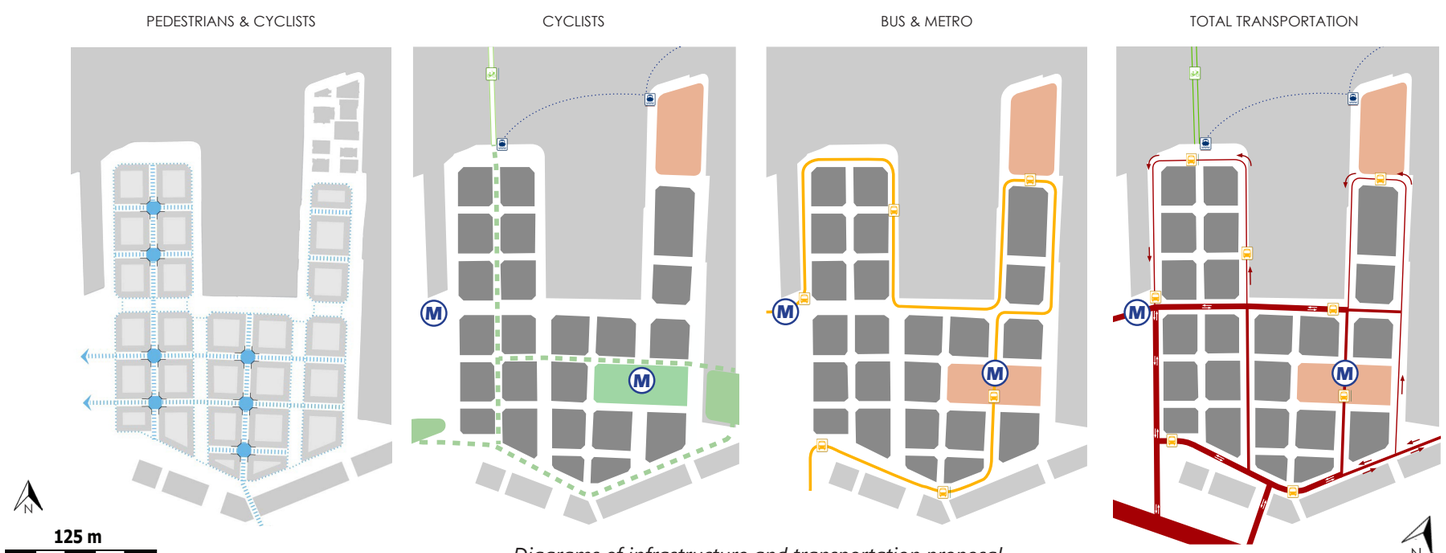
WALKING FREEDOM

EVEN THOUGH THE FOCUS IS ABOUT CREATING A HIGH DENSITY PARK CHARACTER, THE RESIDENTS WILL HAVE THE FREEDOM TO WALK WHEREVER THEY WANT

4. URBAN DESIGN

OVERVIEW URBAN MASTER PLAN

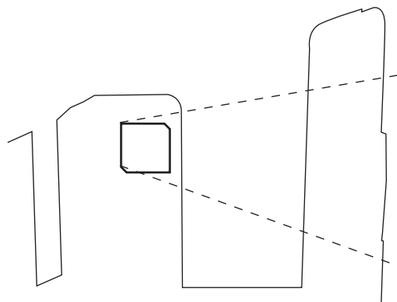
Three types of street profiles, scale 1:1000.



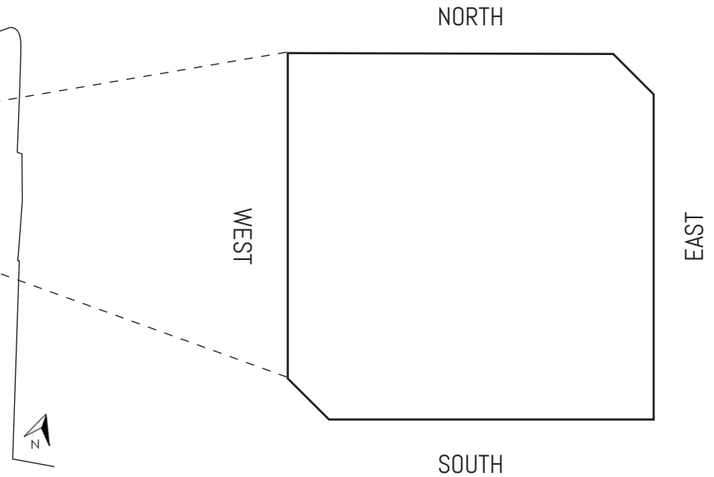
Diagrams of infrastructure and transportation proposal.

DESIGN SITE ANALYSIS

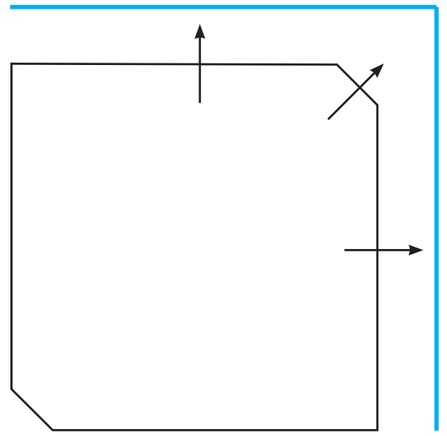
LOCATION



ORIENTATION

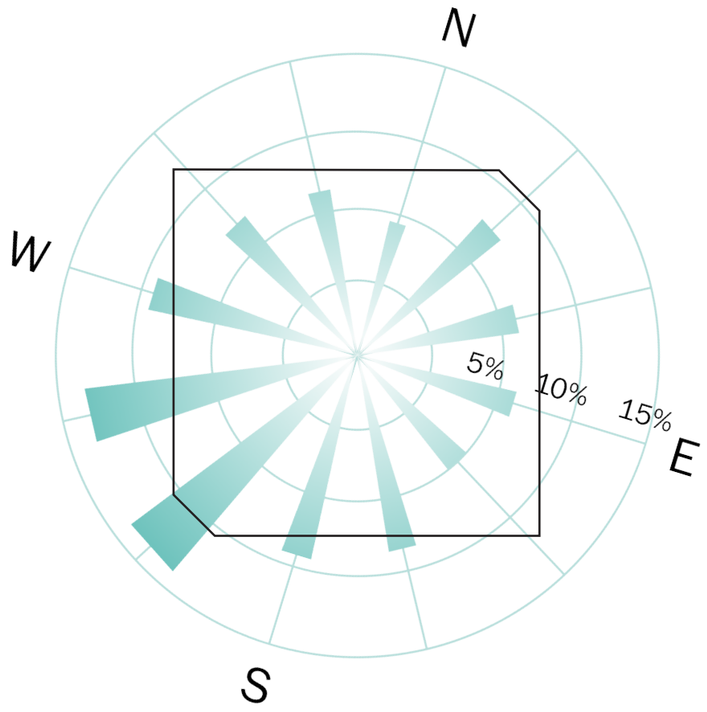


WATERFRONT



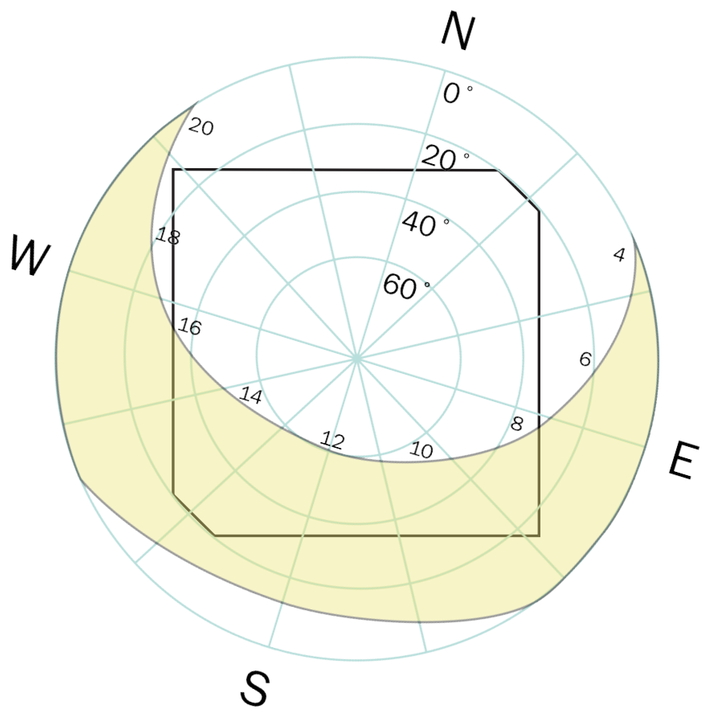
With the views orientated north and east from the design site, the question that will arise is in what way these sides are qualitative in relation to the sun path.

WIND DIRECTIONS



The wind in is mainly coming from southwest direction. This is perpendicular on the chamfered corner of the design site. Building blocks in the environment will protect the building from the wind most of the time. However, wind can also come more from north and east direction because the site is located at the waterfront and is open from character.

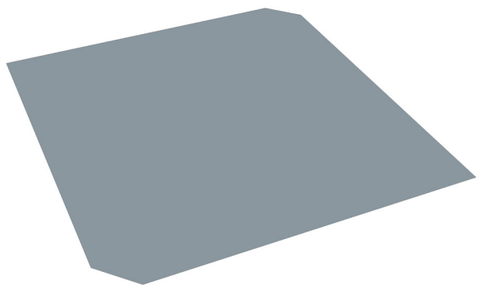
SUN PATH



With the sunrise coming from the east and the sunset west, the design site will have a decent orientation. The north facade will be a challenge. The dwellings located at that facade should somehow have incoming sunlight.

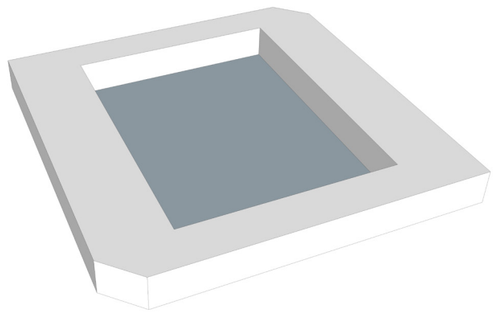
DEFINING MASSING

BUILDING AREA



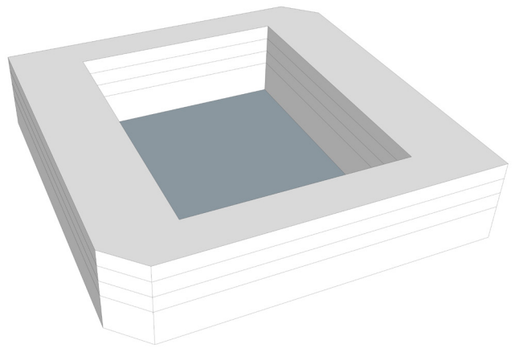
The building area is a square shape of 80x80 meters. Two chamfered corners are present in order to integrate the building well with the other building blocks to form a superblock as mentioned in the urban master plan.

PLINTH



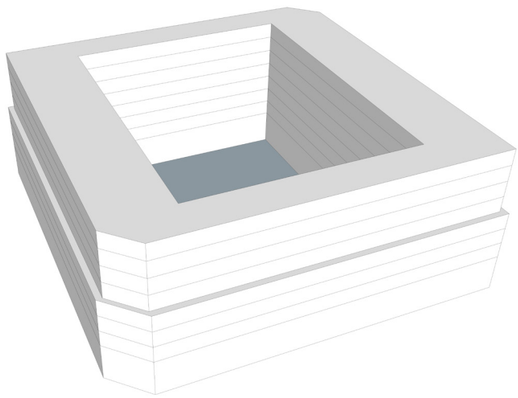
The plinth will be all around the building line in order to both meet the building regulations that are defined in the urban master plan and to have a continuous facade.

DWELLINGS



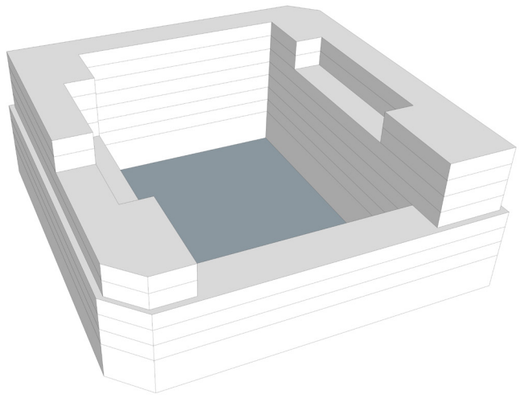
The shape of the plinth will be extended with minimal three floors, which will be used for dwellings.

SETBACKS



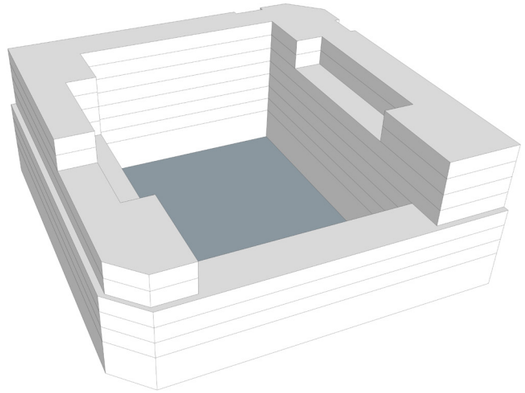
Setbacks are used to reduce the oppressiveness of the building while walking in the streets and at the same time the plinth is more emphasised.

ADAPTING TO SUN PATH



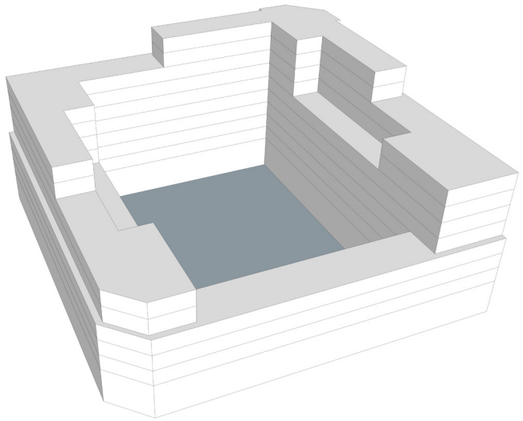
Voids have been applied in combination with lowering the south facade in order to reduce the amount of shadow in the courtyard. The voids will be used as collective outdoor spaces.

DYNAMIC CHARACTER



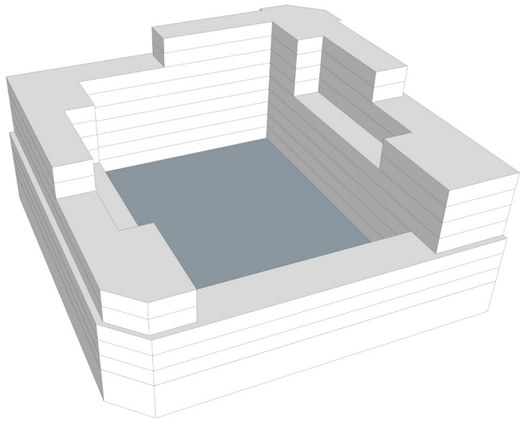
Aligned and setback facades will come together at the corners which creates a dynamic character. At the south chamfered corner only a setback is used to create a more comfortable street impression at the square.

INCREASING DENSITY



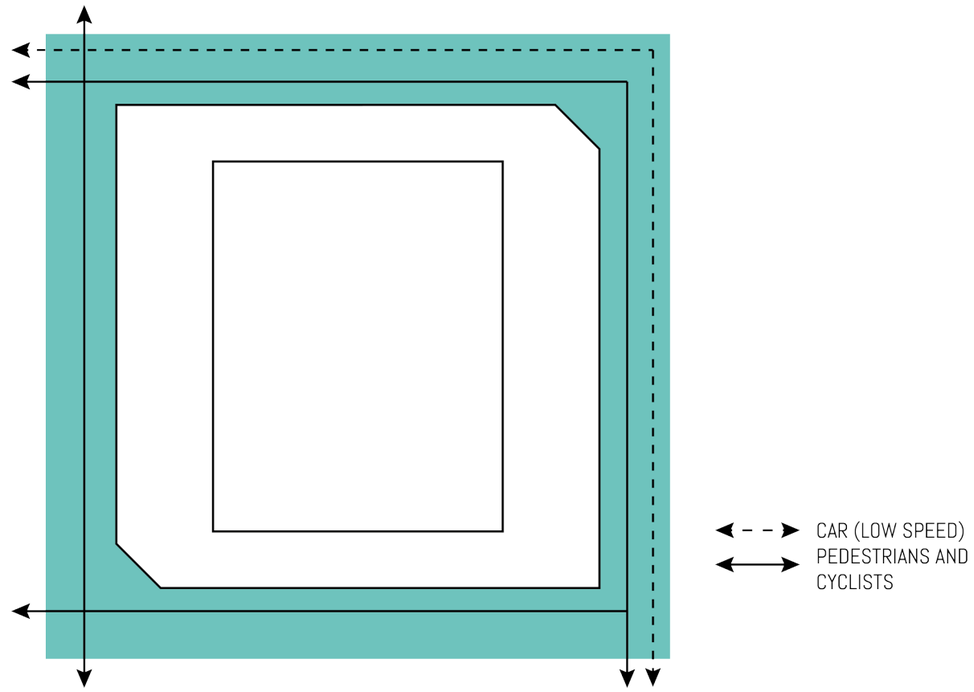
Extra floor levels have been added to both increase the density and to have a smoother transition between the lowest and highest chamfered corner.

RAISING COURTYARD



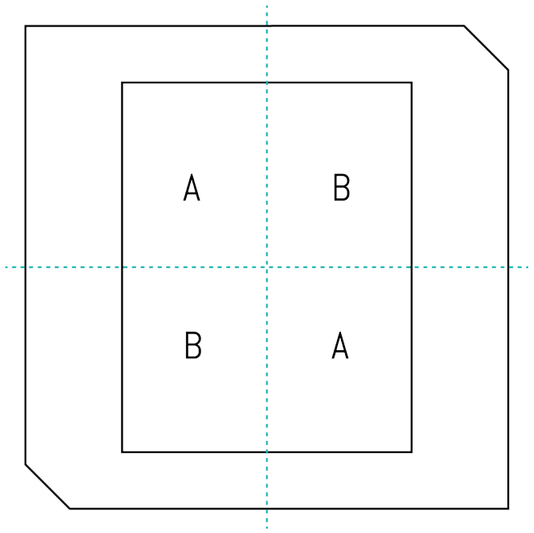
The final step is raising the courtyard. A better interaction between the first floor of the dwellings can be realised and less shadow will occur. Oppressiveness will be reduced as well when being in the courtyard.

TRAFFIC



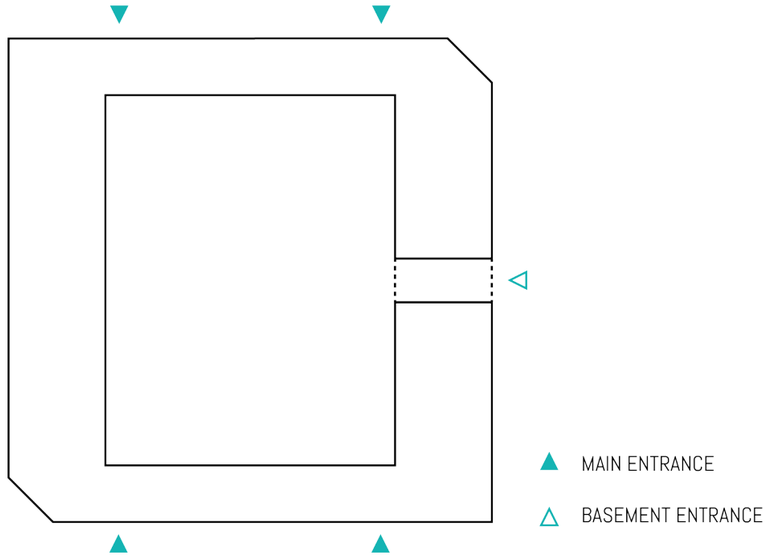
Pedestrians and cyclists will have the priority as described in the urban masterplan. Cars have to go around the building block where the pedestrians and cyclists still have the priority. The streets where no cars are allowed will become quieter and more qualitative to stay.

SEGMENTATION



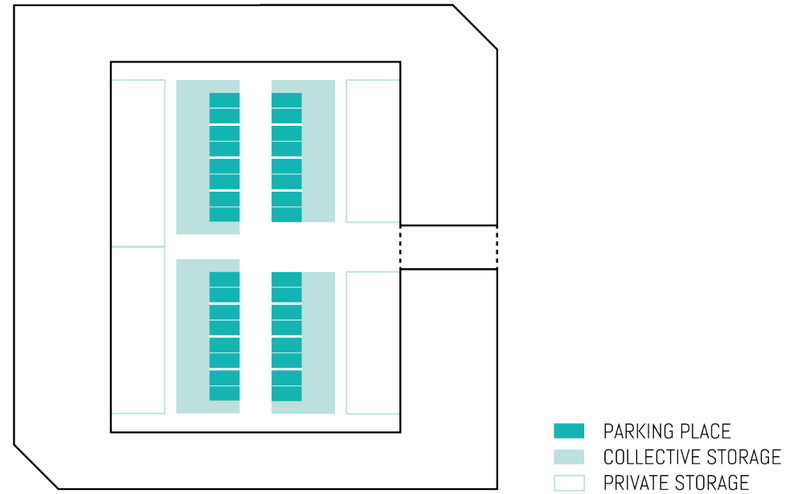
The building block is divided in two times two parts. This creates rhythm in all the floor plans and will have a lot of benefits during construction.

ENTRANCES



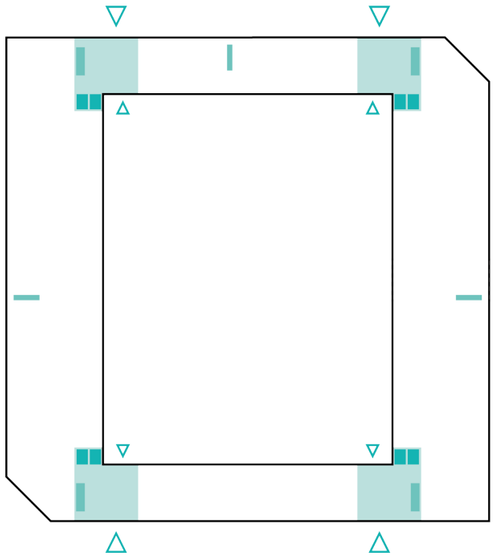
Four main entrances are located close to the corners. The entrances direct you to the vertical circulation points. The basement entrance is located a side where cars are allowed to come.

BASEMENT - PARKING & STORAGE



The segmentation is good visible by the four zones that have been realised. A shared electrical car principle will be used. Research showed that 32 parking spots will be sufficient. Private storage space will add value to the dwellings starters can buy.

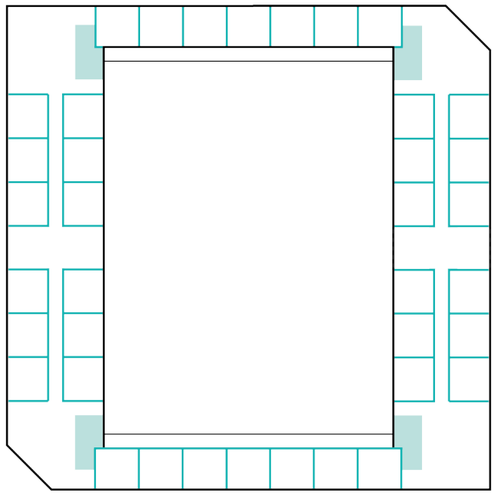
VERTICAL CIRCULATION



MAIN ENTRANCE
BASEMENT ENTRANCE
MAIN HALL
ELEVATOR
(EMERGENCY) STAIR

The vertical circulation can be entered from both the outside and the basement to make the walking distance for the residents shorter. Emergency stairs are needed to reduce the walking distance and because of the shape of the building on the top floors.

DWELLING ORIENTATION

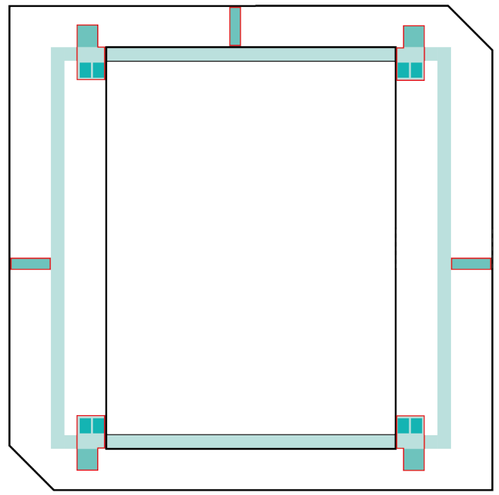


N

VERTICAL CIRCULATION
DWELLING

Based on the sun path a distinction is realised in north and south and east and west. This is done to prevent that some dwellings won't have any incoming sunlight over the entire day.

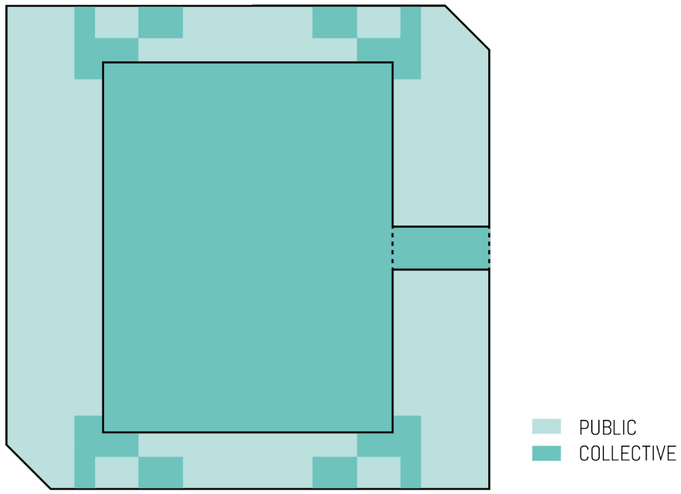
HORIZONTAL CIRCULATION



CIRCULATION
ELEVATOR
(EMERGENCY) STAIR
FIRE SAFETY COMPARTMENT

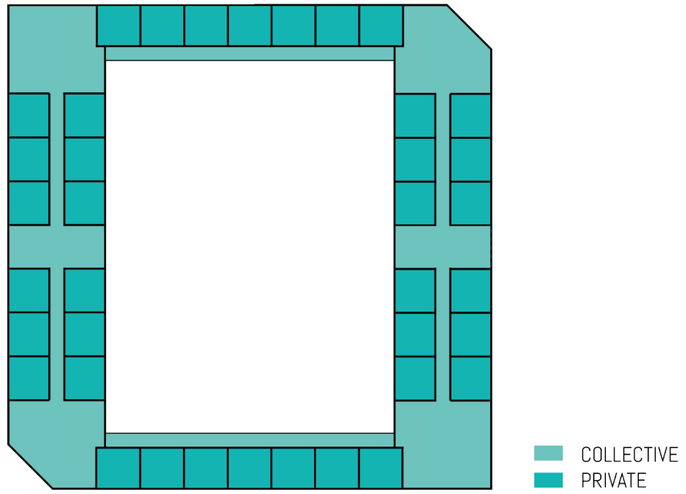
The dwelling orientation is key in the horizontal circulation. The shift from a corridor to a gallery typology becomes visible in this diagram where the gallery will be outside.

PUBLIC, COLLECTIVE & PRIVATE SPACES - GROUND FLOOR



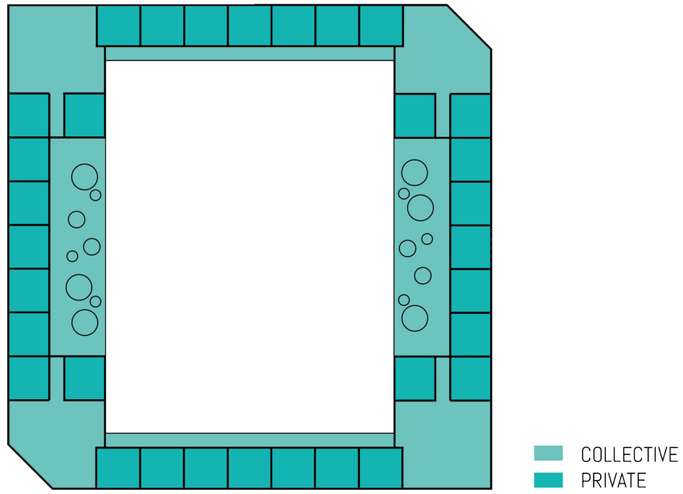
The ground floor is characterised by the commercial plinth. This is good visible in the amount of public space in this diagram. The collective spaces are the hallways, vertical circulation, basement and a room for the waste bins.

PUBLIC, COLLECTIVE & PRIVATE SPACES - DWELLING FLOOR



On this typical dwelling floor a coherent diagram is realised. The galleries and corridors are connected to the collective spaces where residents eventually can come together with a nice view over the neighbourhood and/or courtyard.

PUBLIC, COLLECTIVE & PRIVATE SPACES - DWELLING FLOOR WITH ROOF GARDENS



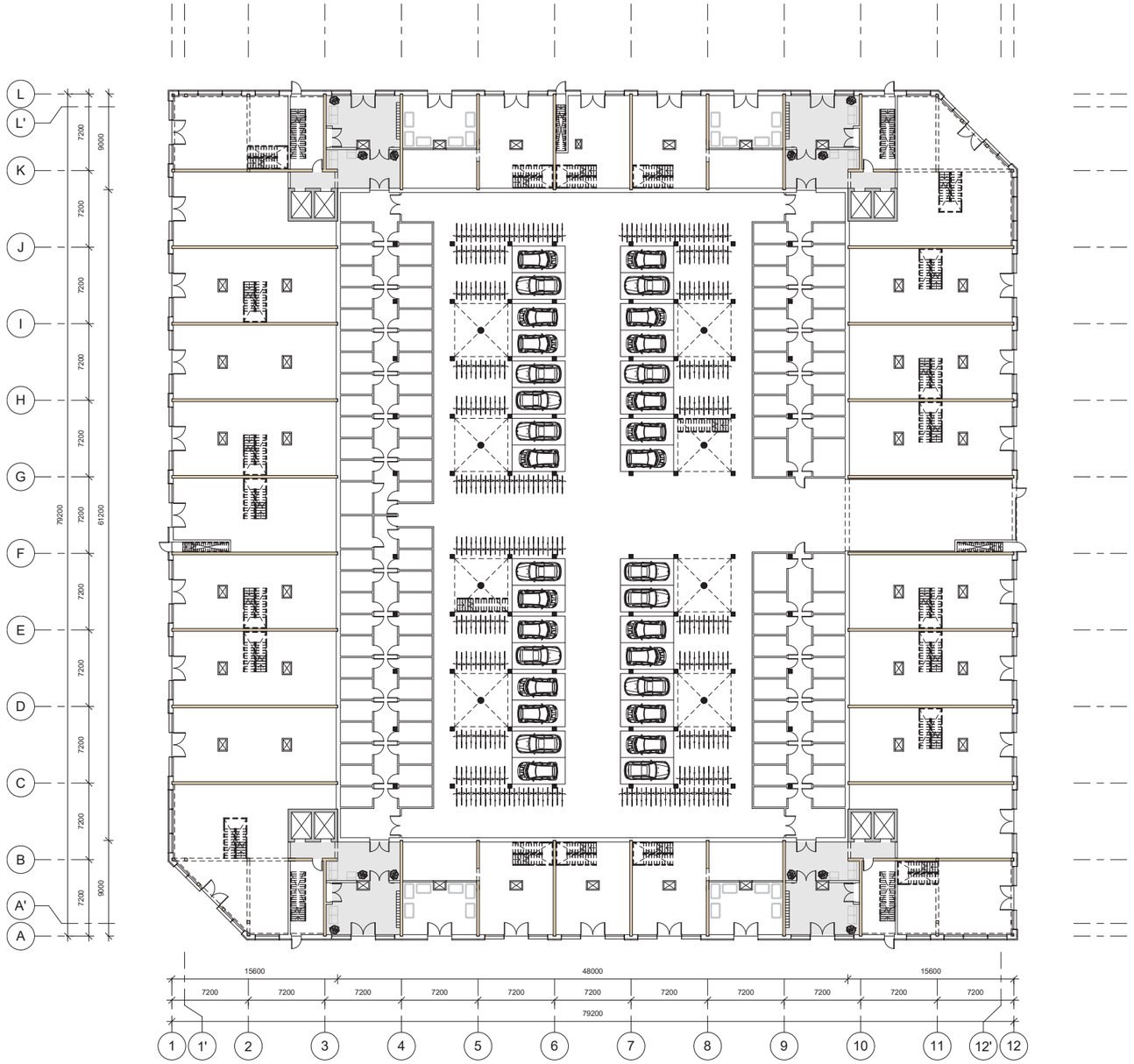
Key in my design proposal is the collective spaces on different floor levels. It will stimulate residents to use these spaces to eventually create a community where everybody recognises each other. This makes it easier to be willing to share functions with others.

5. ARCHITECTURAL DRAWINGS

FLOOR PLANS

GROUND FLOOR P = 0

- Characterised by the basement, entrances to the circulation and a commercial plinth by having stores, offices and a café on the chamfered south corner.
- Two stairs in the basement reduce the walking distance to the courtyard.
- A room for waste bins is located next to the main entrances.



Ground Floor P = 0

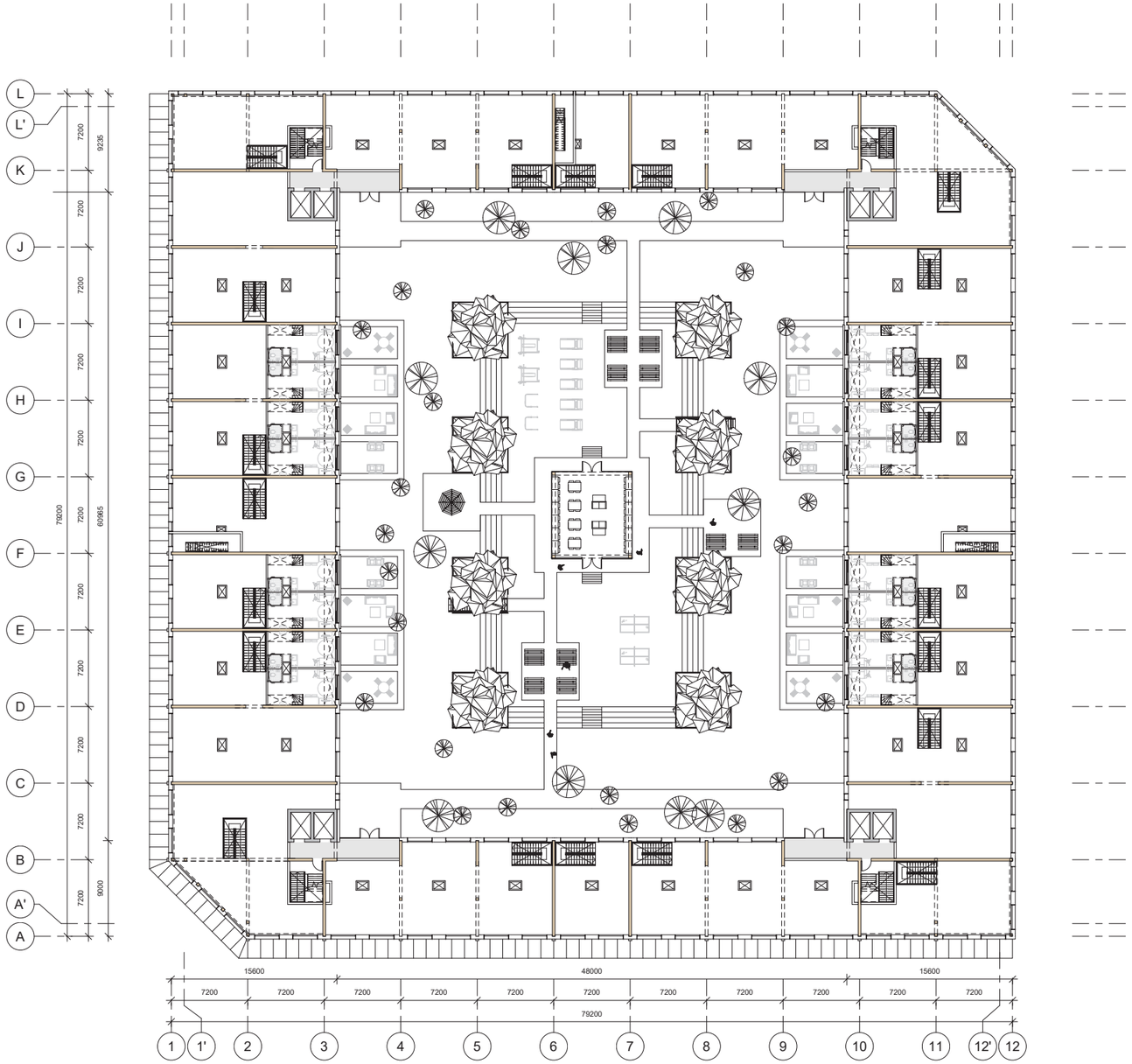
N

12.5 m

1 : 500

COURTYARD P = +4.500

- Main entrances are connected to the raised courtyard.
- Commercial plinth will be partly used for the lowest floor of the maisonette dwellings.
- A pavilion in the centre of the courtyard will be collective place where people can work and relax.
- The focus of the courtyard will be to absorb water. That will be realised by high dense vegetation and a water square that can be used when it is not raining. The rainwater problems we face become visible by having introduced the water square.



Courtyard P = +4.500

N

12.5 m

1 : 500

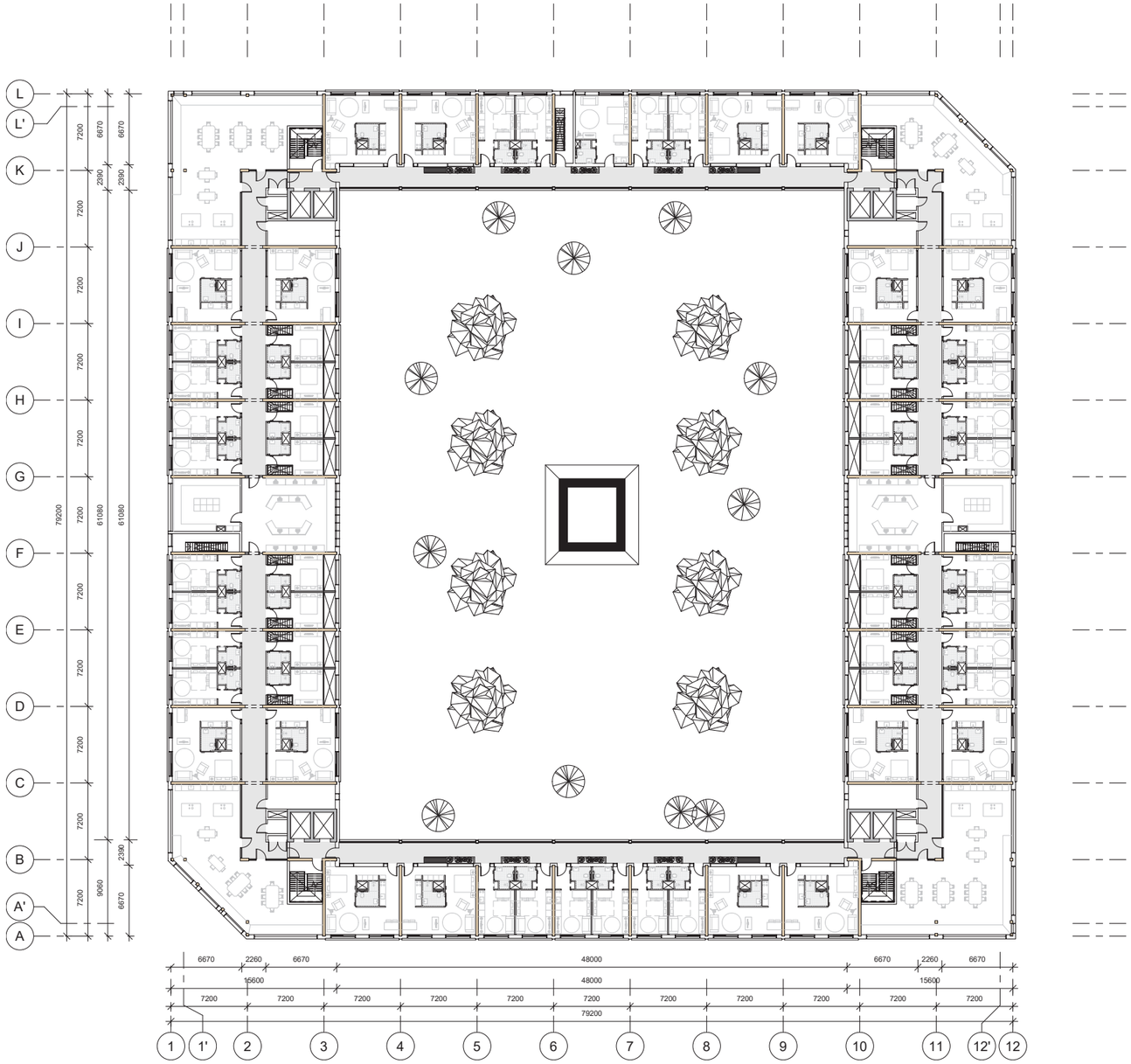
1st FLOOR P = +8.000

- The difference in dwelling orientation by using different circulation systems becomes visible.
- Collective spaces are located at central places and will enhance the quality of the corridor. Kitchen will be placed at the corners. Laundry rooms and working space in the middle of the corridor.

DWELLINGS:

- Apartment Type A: 16
- Apartment Type B: 26
- Apartment Type C: 0
- Apartment Type D: 1
- Apartment Type E: 0
- Maisonette Type A: 16

Total dwellings: 59



1st Floor P = +8.000

N

12.5 m

1 : 500

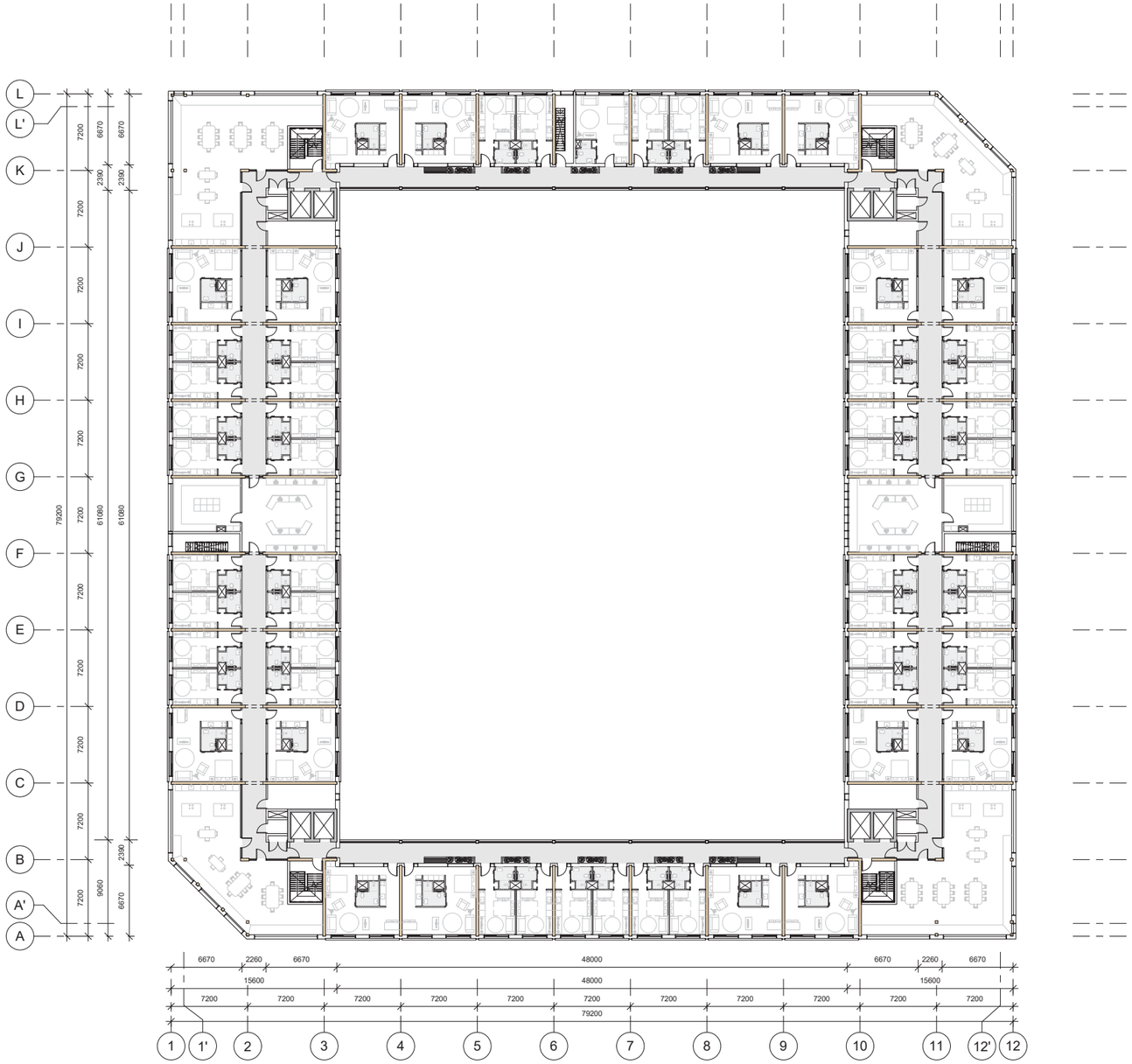
2nd FLOOR P = +11.500

- This floor has the same organisation as the first floor.

DWELLINGS:

- Apartment Type A: 16
- Apartment Type B: 26
- Apartment Type C: 0
- Apartment Type D: 1
- Apartment Type E: 0
- Maisonette Type A: 16

  Total dwellings: 59



N

2nd Floor P = +11.500

12.5 m

1 : 500

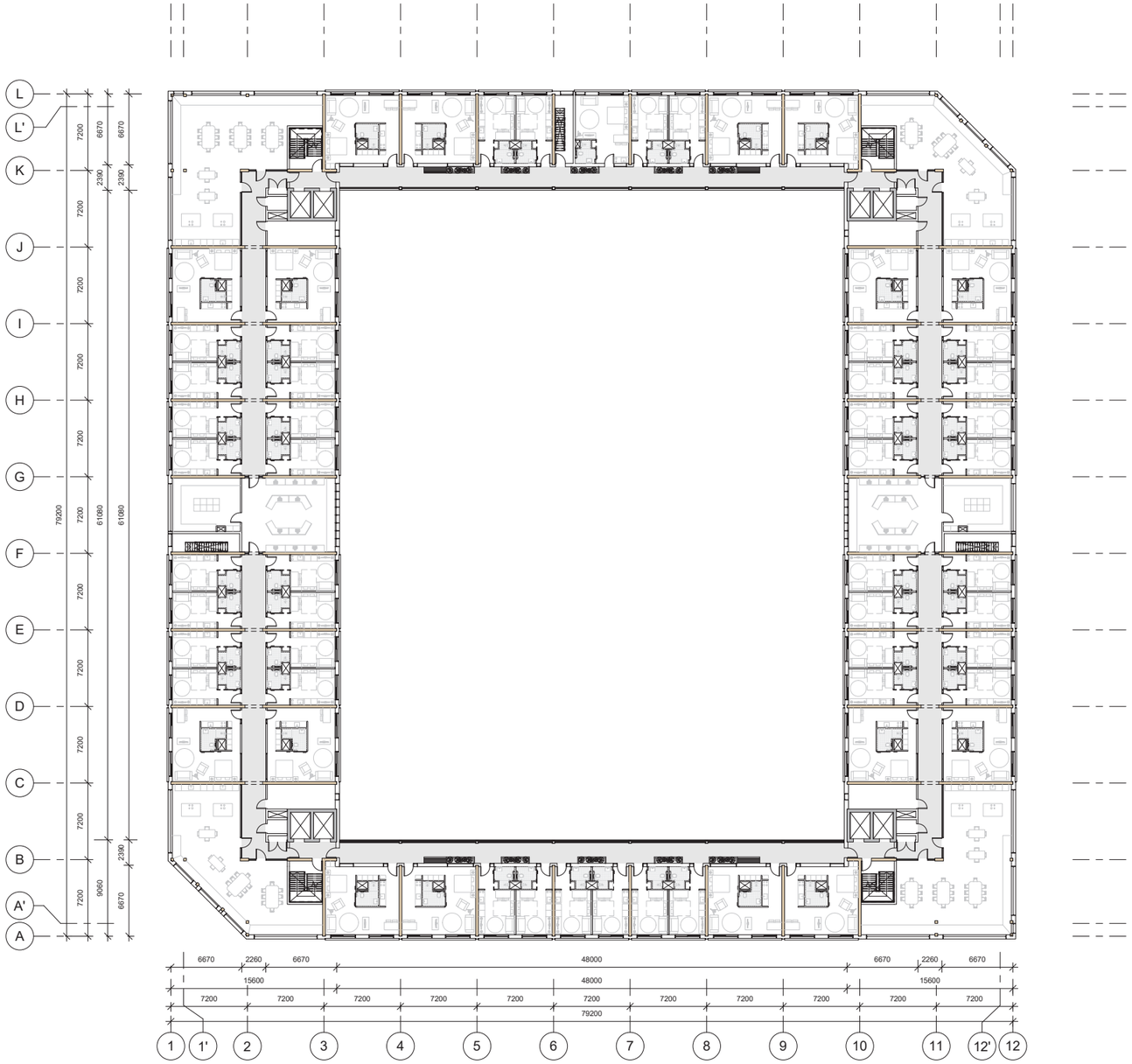
3rd FLOOR P = +15.000

- This floor has the same organisation as the first and second floor.

DWELLINGS:

- Apartment Type A: 16
- Apartment Type B: 26
- Apartment Type C: 0
- Apartment Type D: 1
- Apartment Type E: 0
- Maisonette Type A: 16

  Total dwellings: 59



N

3rd Floor P = +15.000

12.5 m

1 : 500

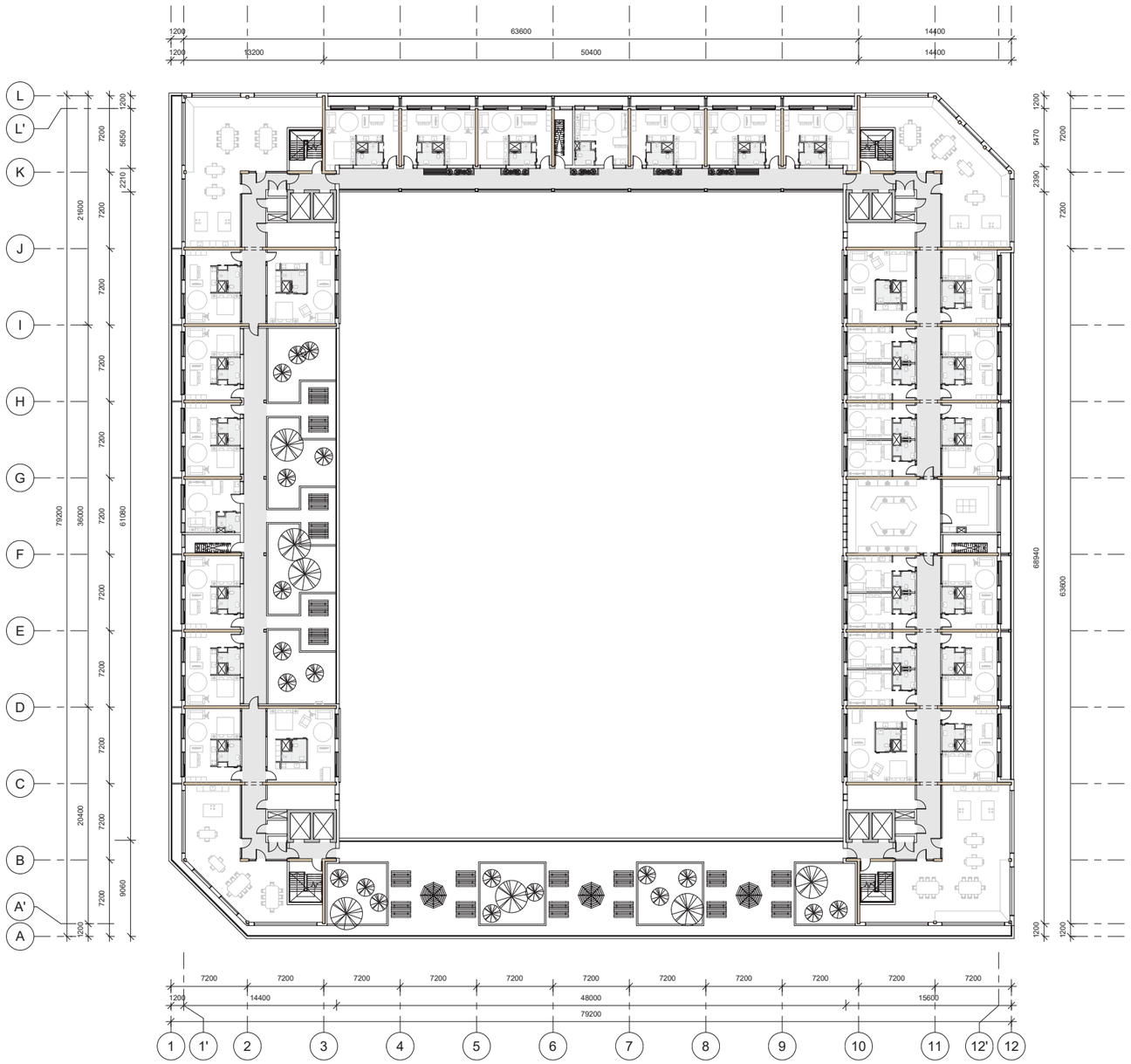
4th FLOOR P = +18.500

- The fourth floor is characterised by the setback everywhere except the north chamfered corner. This makes a distinction with the plinth (the lower floors) and the floors on the higher levels.
- Massing south and west are removed to create outdoor collective spaces which also improves the amount of sunlight at courtyard level.

DWELLINGS:

- Apartment Type A: 4
- Apartment Type B: 8
- Apartment Type C: 18
- Apartment Type D: 0
- Apartment Type E: 2
- Maisonette Type A: 0

Total dwellings: 32



4th Floor P = +18.500

12.5 m
1 : 500

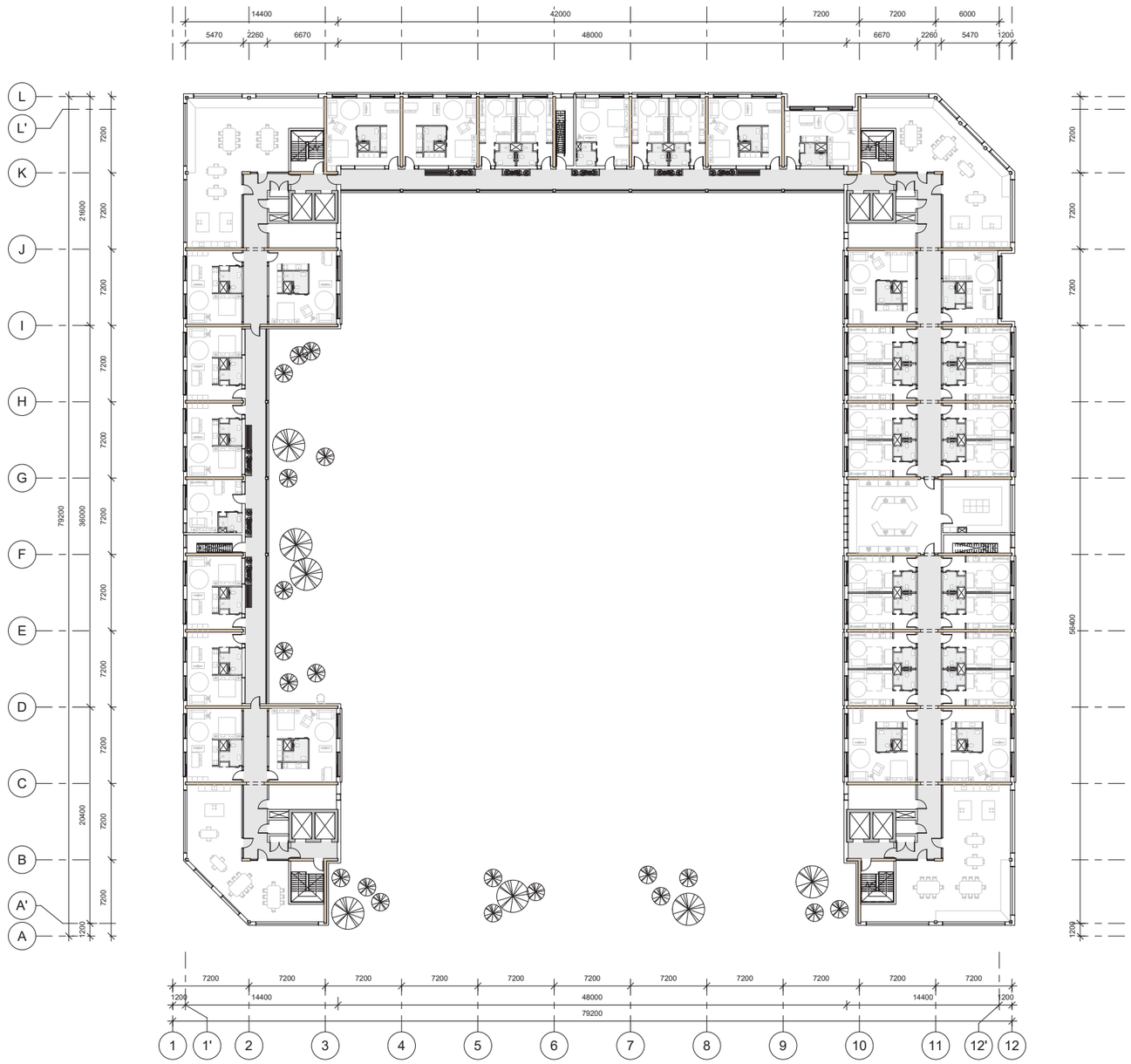
5th FLOOR P = +22.000

- From this level and higher, balconies will be used. Mainly at the places where setbacks are realised.
- A dynamic shape is realised due to the setbacks, balconies and removed masses.

DWELLINGS:

- Apartment Type A: 8
- Apartment Type B: 20
- Apartment Type C: 8
- Apartment Type D: 1
- Apartment Type E: 1
- Maisonette Type A: 0

Total dwellings: 38



5th Floor P = +22.000

N

12.5 m

1 : 500

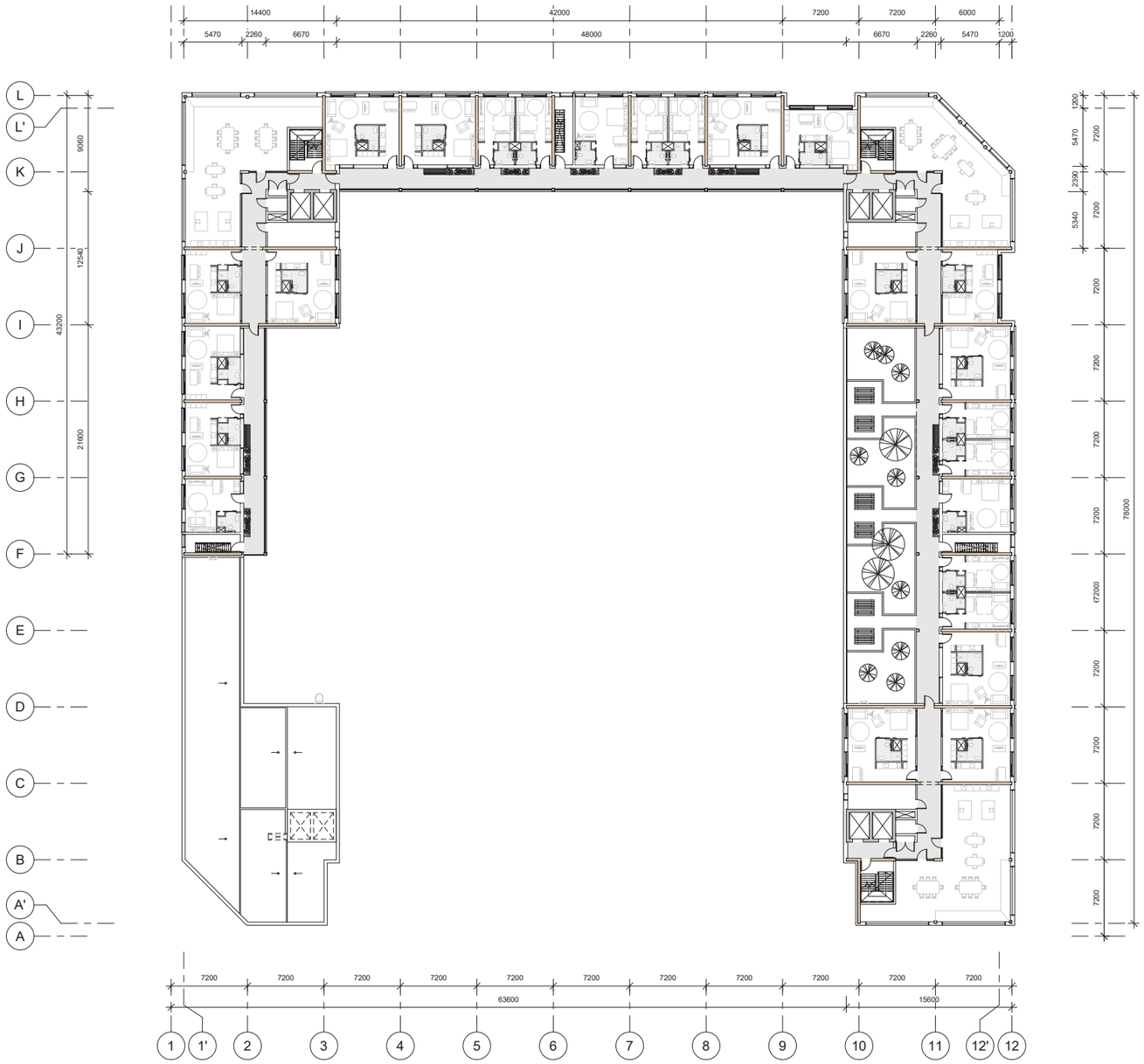
6th FLOOR P = +25.500

- More massing will be removed to reduce the oppressiveness and to create a smooth transition between the lowest and highest chamfered corner.
- A collective outdoor space is just like on the fourth floor realised but now on the right side of the building.

DWELLINGS:

- Apartment Type A: 9
- Apartment Type B: 8
- Apartment Type C: 5
- Apartment Type D: 2
- Apartment Type E: 1
- Maisonette Type A: 0

Total dwellings: 25



6th Floor P = +25.500

12.5 m
1 : 500

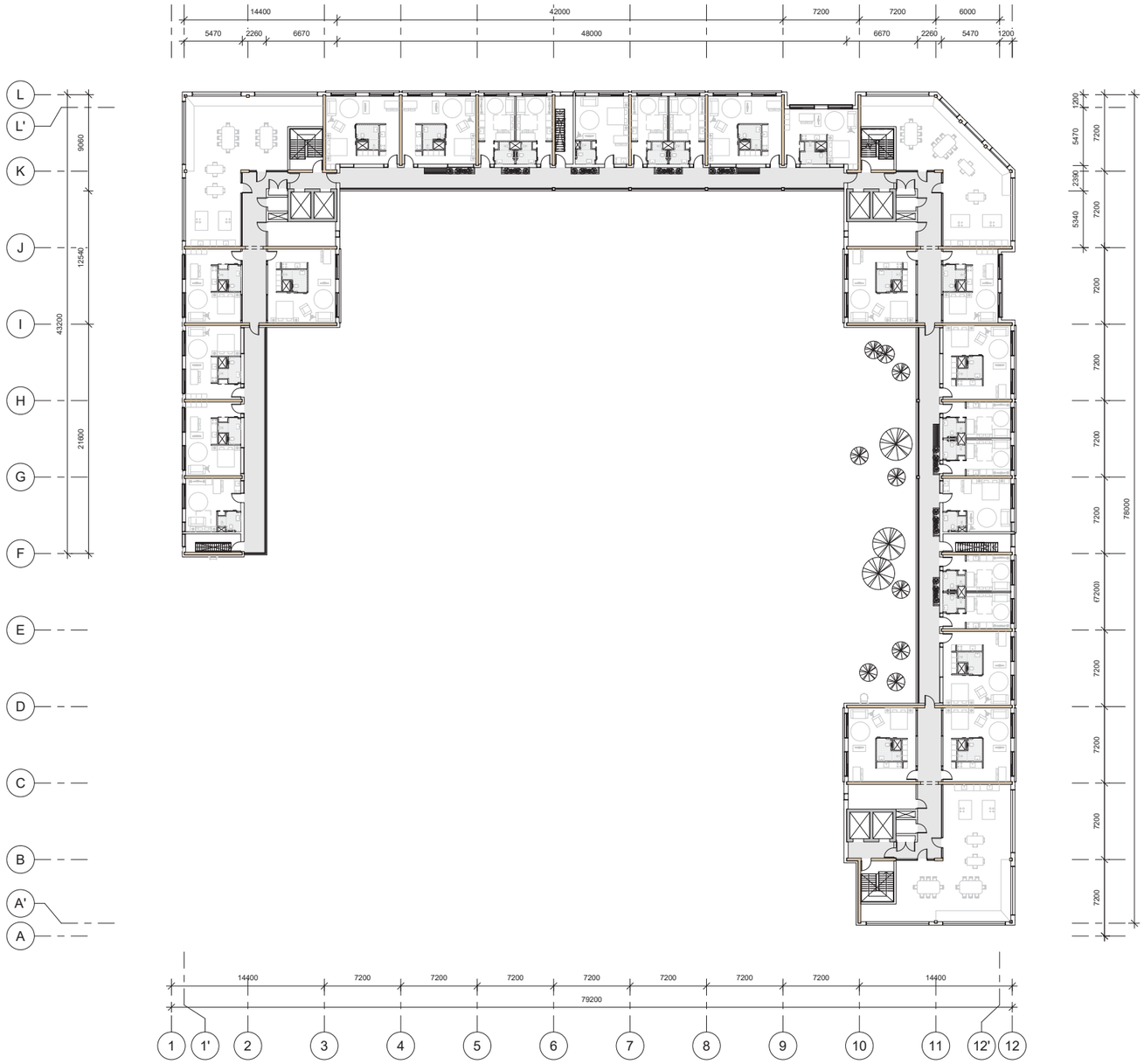
7th FLOOR P = +29.000

- This floor has the same organisation as the 6th floor.

DWELLINGS:

- Apartment Type A: 9
- Apartment Type B: 8
- Apartment Type C: 5
- Apartment Type D: 2
- Apartment Type E: 1
- Maisonette Type A: 0

  Total dwellings: 25



7th Floor P = +29.000

12.5 m

1 : 500

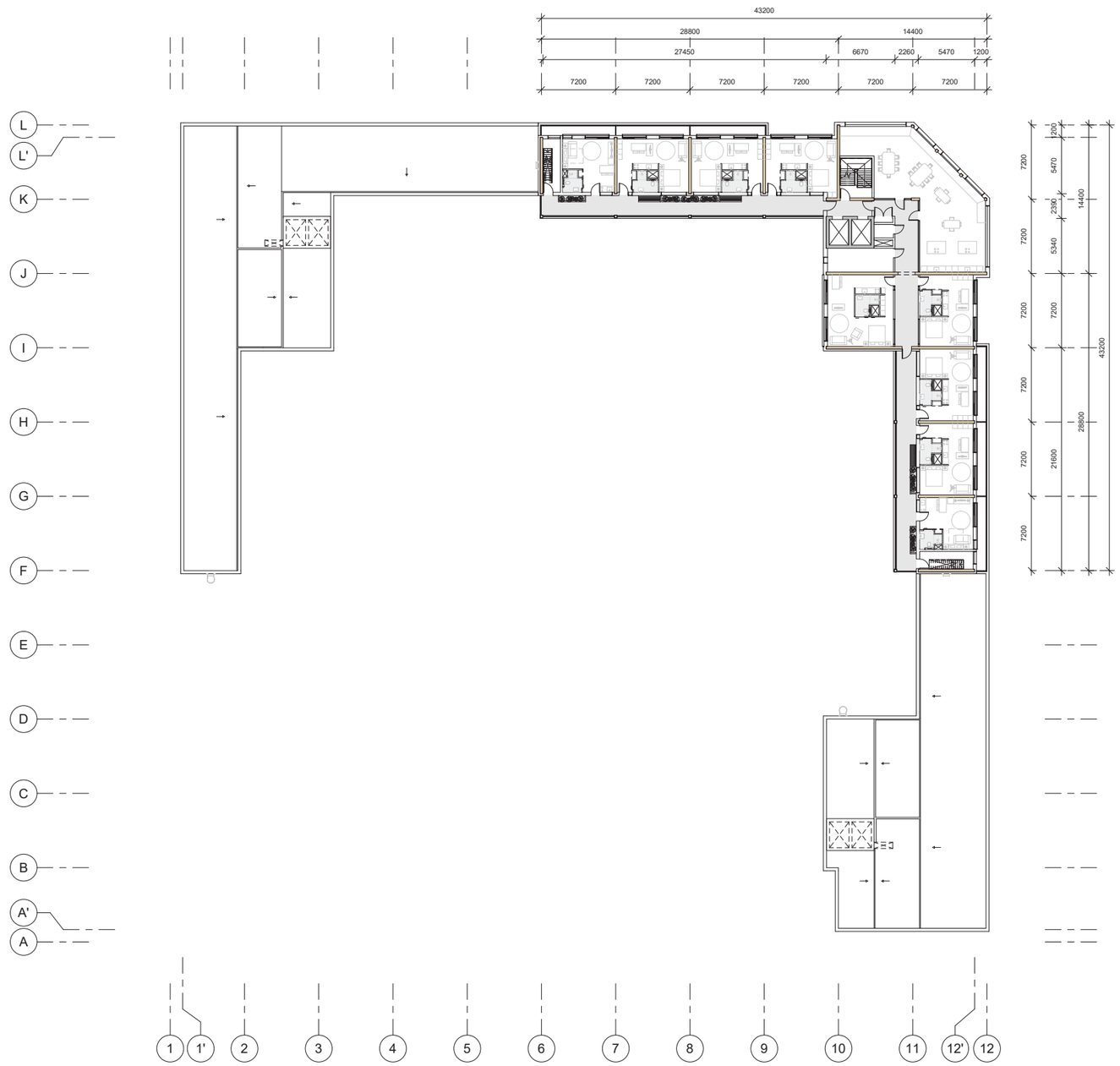
8th FLOOR P = +32.500

- From this floor the chamfered corner with two wings will continue which is good visible in the elevations.
- The apartments are mainly accessible by a gallery circulation. This makes it possible to have windows on both facades of the dwelling. In that way enough day- and sunlight enters in the North orientated dwellings.

DWELLINGS:

- Apartment Type A: 1
- Apartment Type B: 0
- Apartment Type C: 6
- Apartment Type D: 0
- Apartment Type E: 2
- Maisonette Type A: 0

Total dwellings: 9



8th Floor P = +32.500

12.5 m
1 : 500

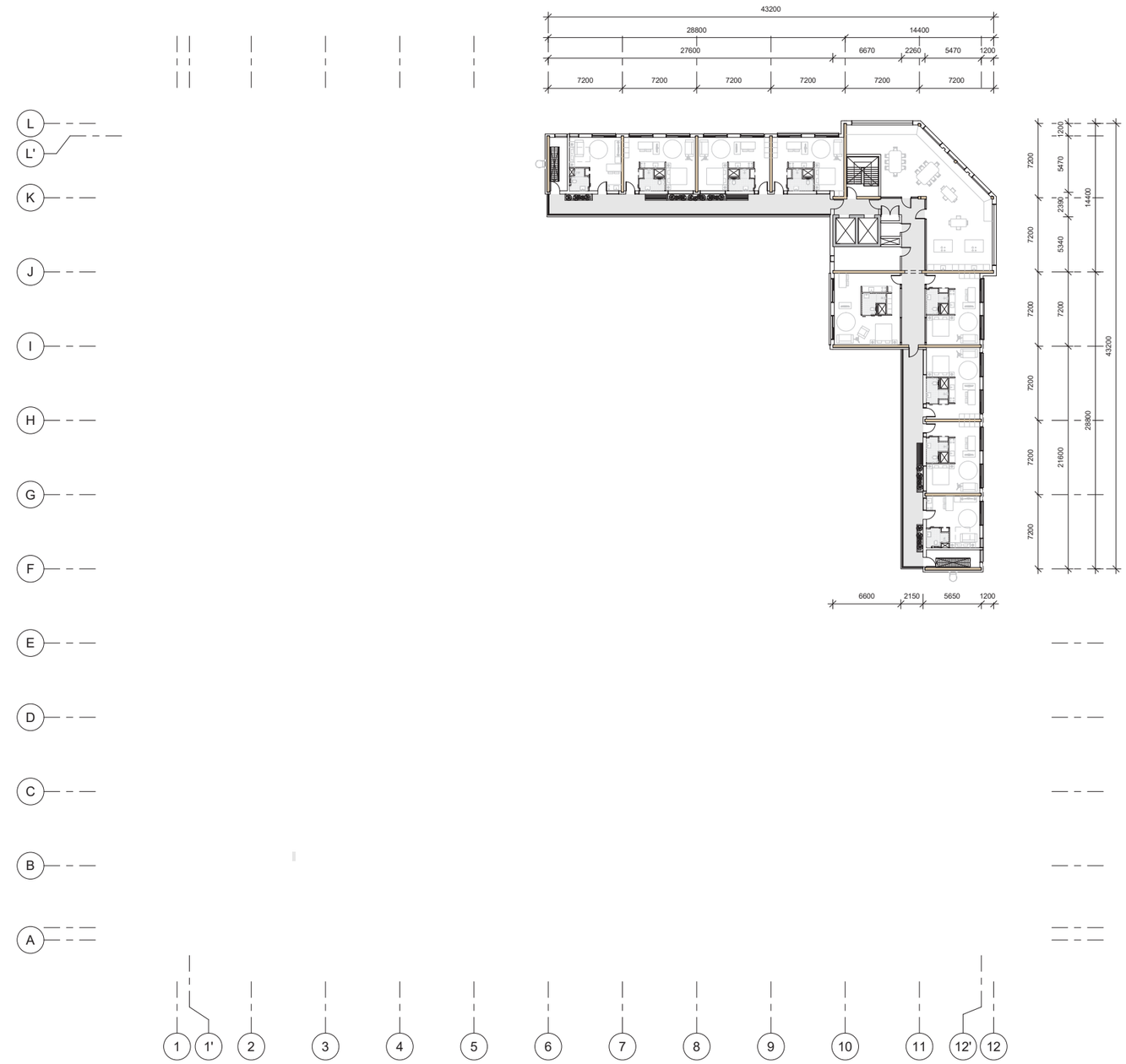
9th FLOOR P = +36.000

- This floor has the same organisation as the 8th floor.

DWELLINGS:

- Apartment Type A: 1
- Apartment Type B: 0
- Apartment Type C: 6
- Apartment Type D: 0
- Apartment Type E: 2
- Maisonette Type A: 0

Total dwellings: 9



N

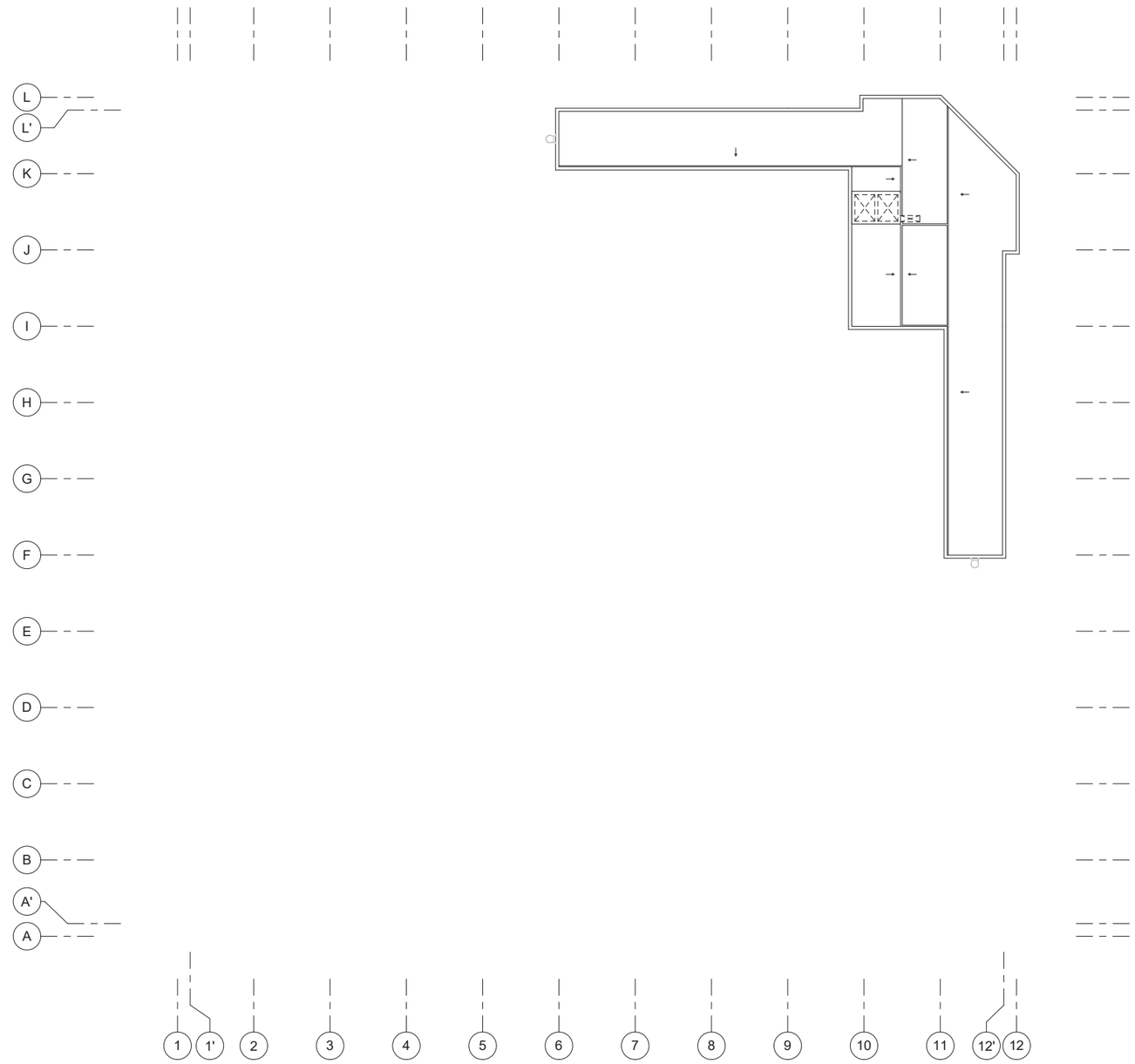
12.5 m

1 : 500

9th Floor P = +36.000

ROOF P = +39.500

- Just like the other roofs a network of sloped insulation is applied to transport the rainwater to the shafts. From there the water will be transported to many small water storage tanks on every floor level. More information can be found at the climate paragraph.



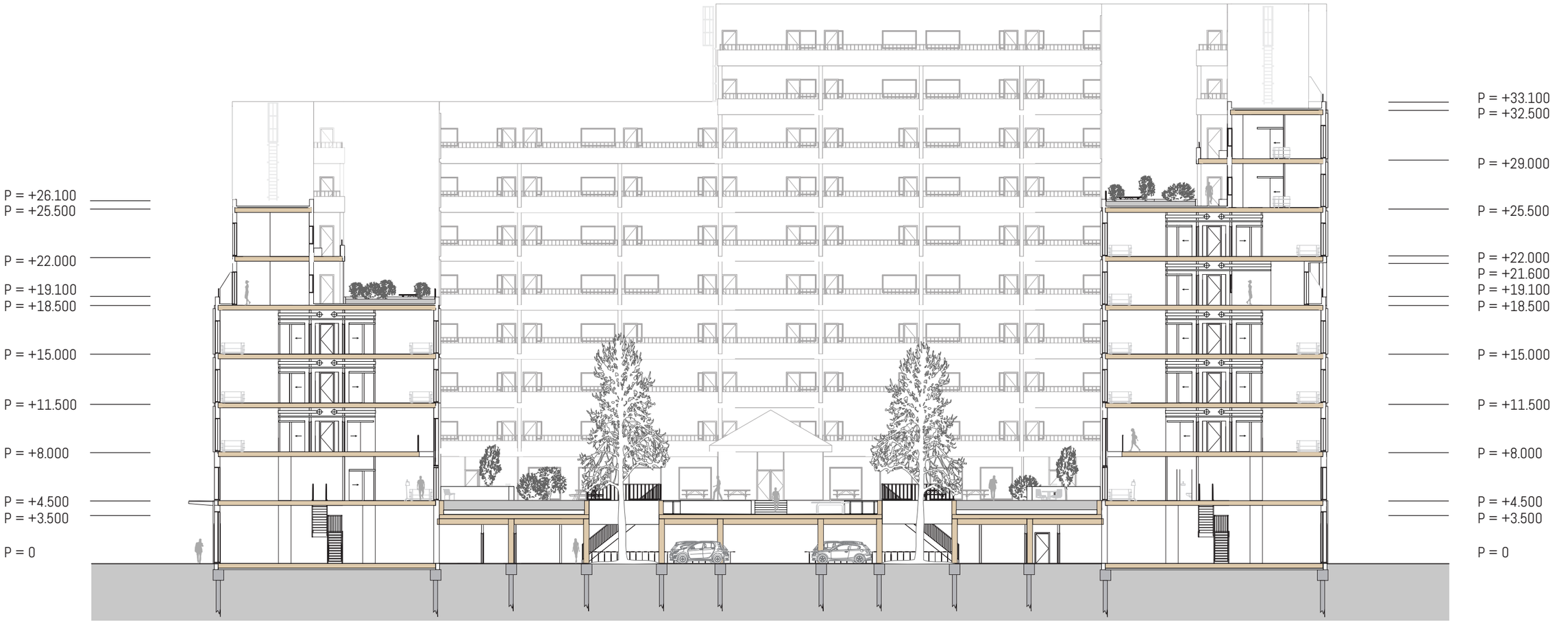
N

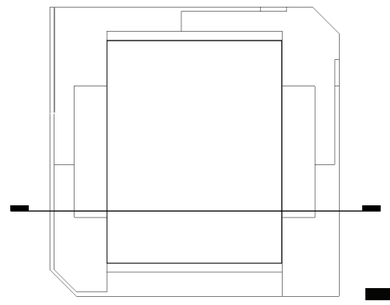
ROOF P = +39.500

12.5 m
1 : 500

SECTIONS

EAST - WEST SECTION

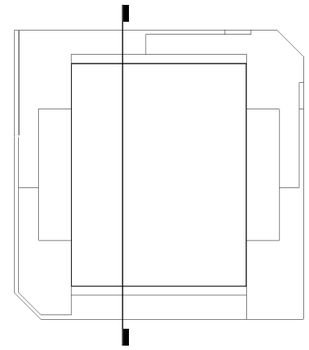




7.5 m

1 : 300

NORTH - SOUTH SECTION



N

7.5 m

1 : 300

FACADES

NORTH FACADE

7.5 m
1 : 300

EAST FACADE

7.5 m
1 : 300

SOUTH FACADE

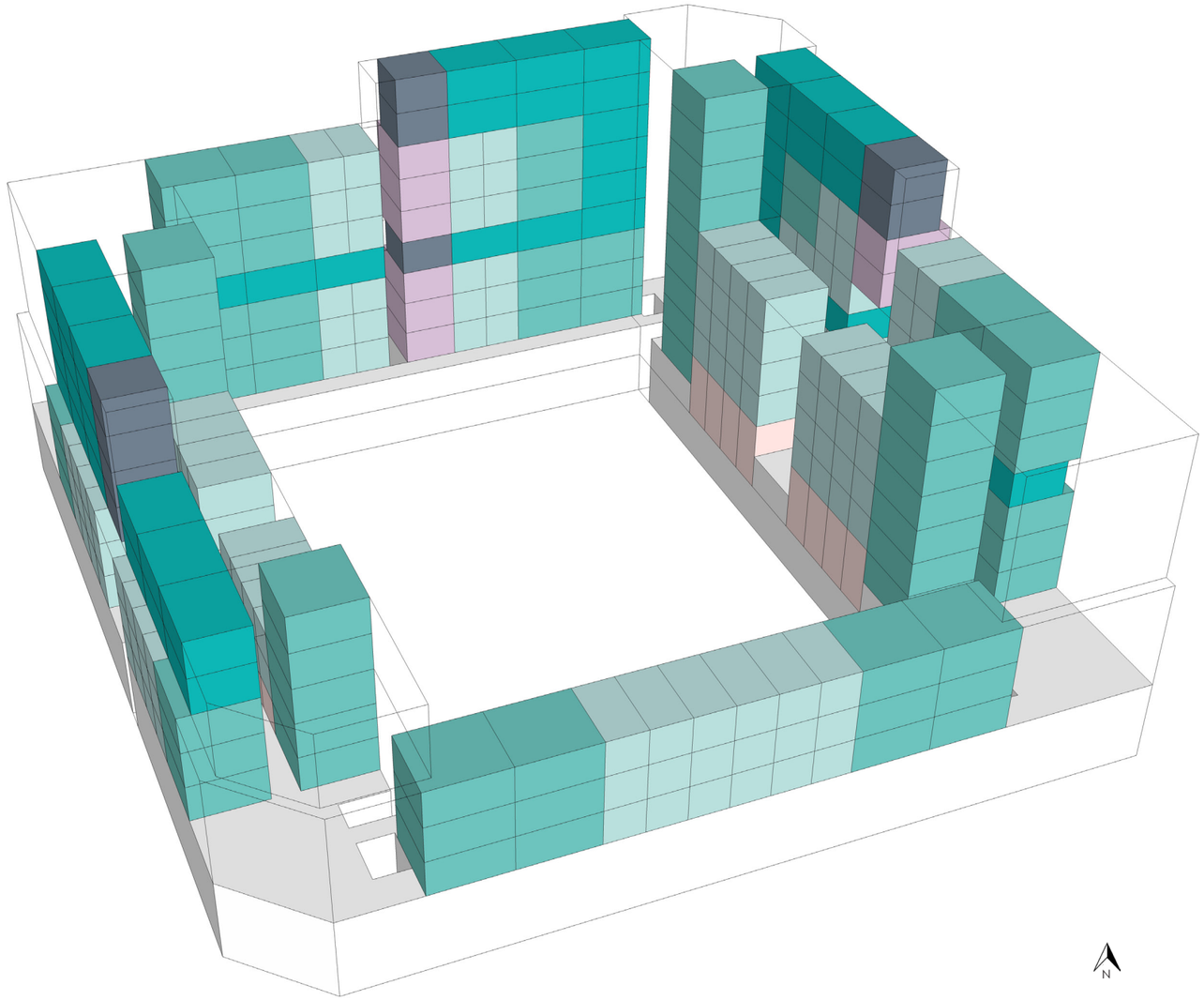
7.5 m
1 : 300

WEST FACADE

7.5 m
1 : 300

DWELLINGS

OVERVIEW BUILDING



Dwellings per floor	
Ground Floor	0
Courtyard	0
1st Floor	59
2nd Floor	59
3rd Floor	59
4th Floor	32
5th Floor	38
6th Floor	25
7th Floor	25
8th Floor	9
9th Floor	9 +
	315 Total Apartments

Density		
Minervahaven	30,5	ha
Building blocks	22	avg.
Surface per block	1,4	ha/block
Municpality wants	200	dwellings/ha
My proposal	315	dwellings/block
	227	**dwellings/ha**

Apartment	Surface (GBO)	Amount	Percentage	Percentage of total
Type A	43,2 m2	80	26,8%	25,4%
Type B	21,3 m2	154	51,5%	48,9%
Type C	34,9 m2	48	16,1%	15,2%
Type D	31,2 m2	8	2,7%	2,5%
Type E	25,6 m2	9	3,0%	2,9%

Maisonette	Surface (GBO)	Amount	Percentage of 1 floor	Percentage of total
Type A	36,7 m2	16	100,0%	5,1%
		16	**100,0%**	**5,1%**

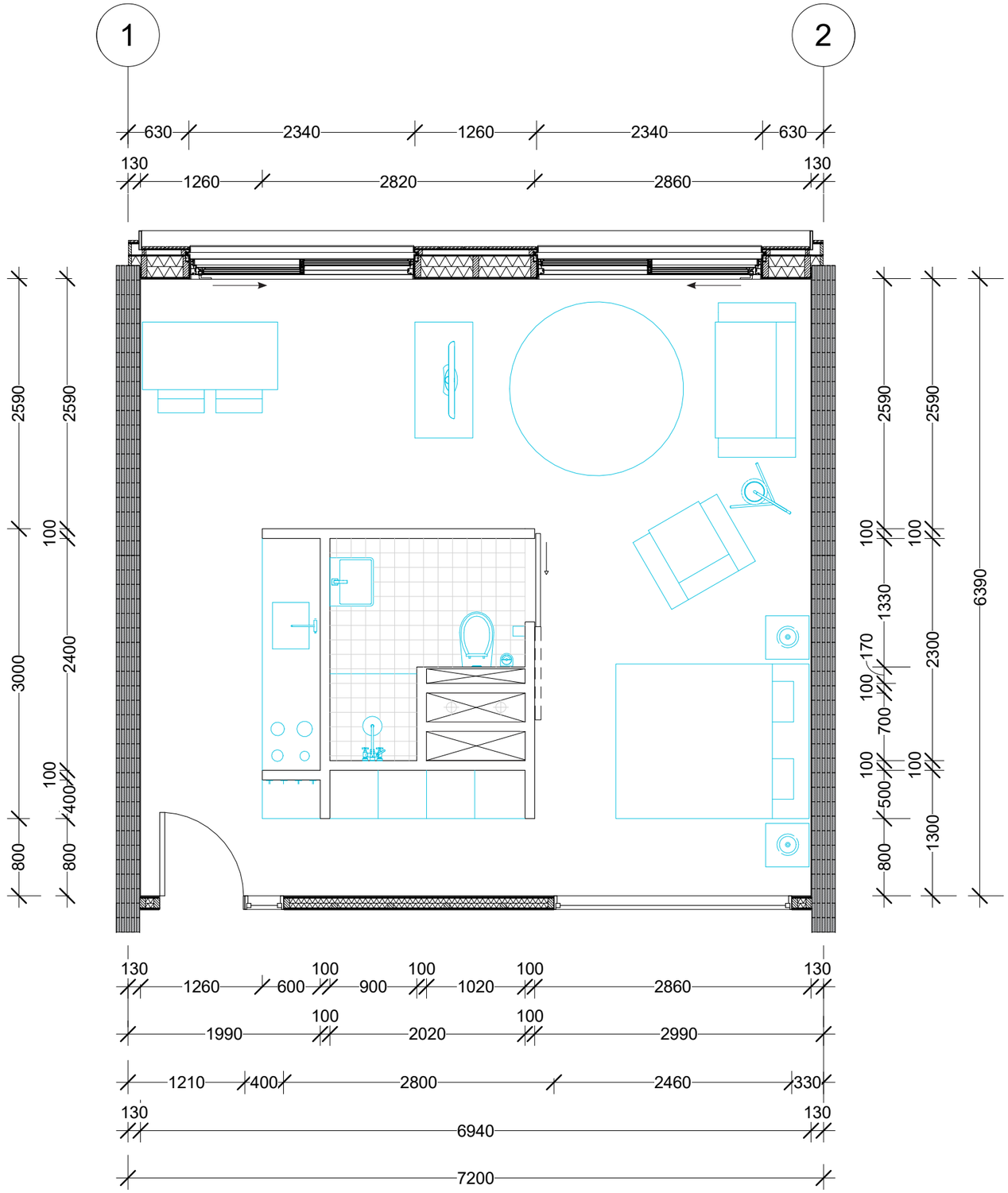
315	Apartments	100,0%

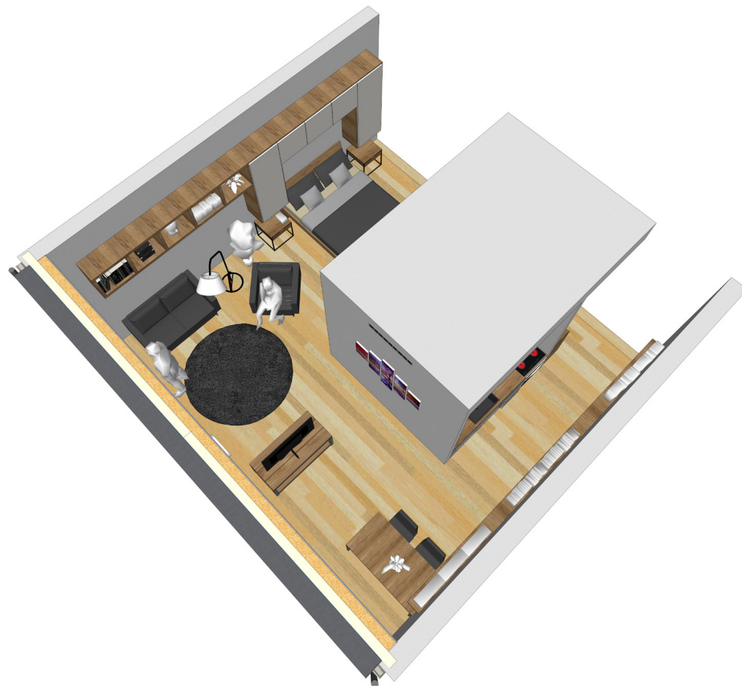
APARTMENT TYPE A
APARTMENT TYPE B
APARTMENT TYPE C
APARTMENT TYPE D
APARTMENT TYPE E
MAISONETTE TYPE A

HOUSEHOLD CONFIGURATION

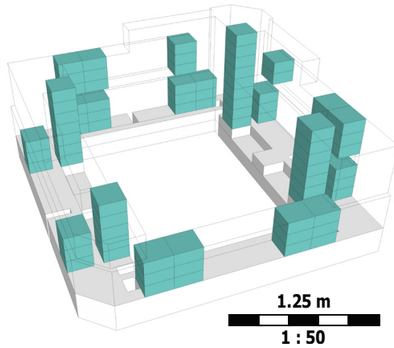
			1x MBO	1x HBO	1x WO	2x MBO	1x MBO + 1x HBO	1x MBO + 1x WO	2x HBO	1x HBO + 1x WO	2x WO
APARTMENT TYPE A	43,2 m^2	€221.620								X	X
APARTMENT TYPE B	21,3 m^2	€109.270		X	X						
APARTMENT TYPE C	34,9 m^2	€179.040					X	X	X	X	X
APARTMENT TYPE D	31,2 m^2	€160.160				X	X	X	X	X	X
APARTMENT TYPE E	25,6 m^2	€131.330			X	X	X	X	X	X	X
MAISONETTE TYPE A	36,7 m^2	€188.270						X	X	X	X

APARTMENT TYPE A: 43,2 m²

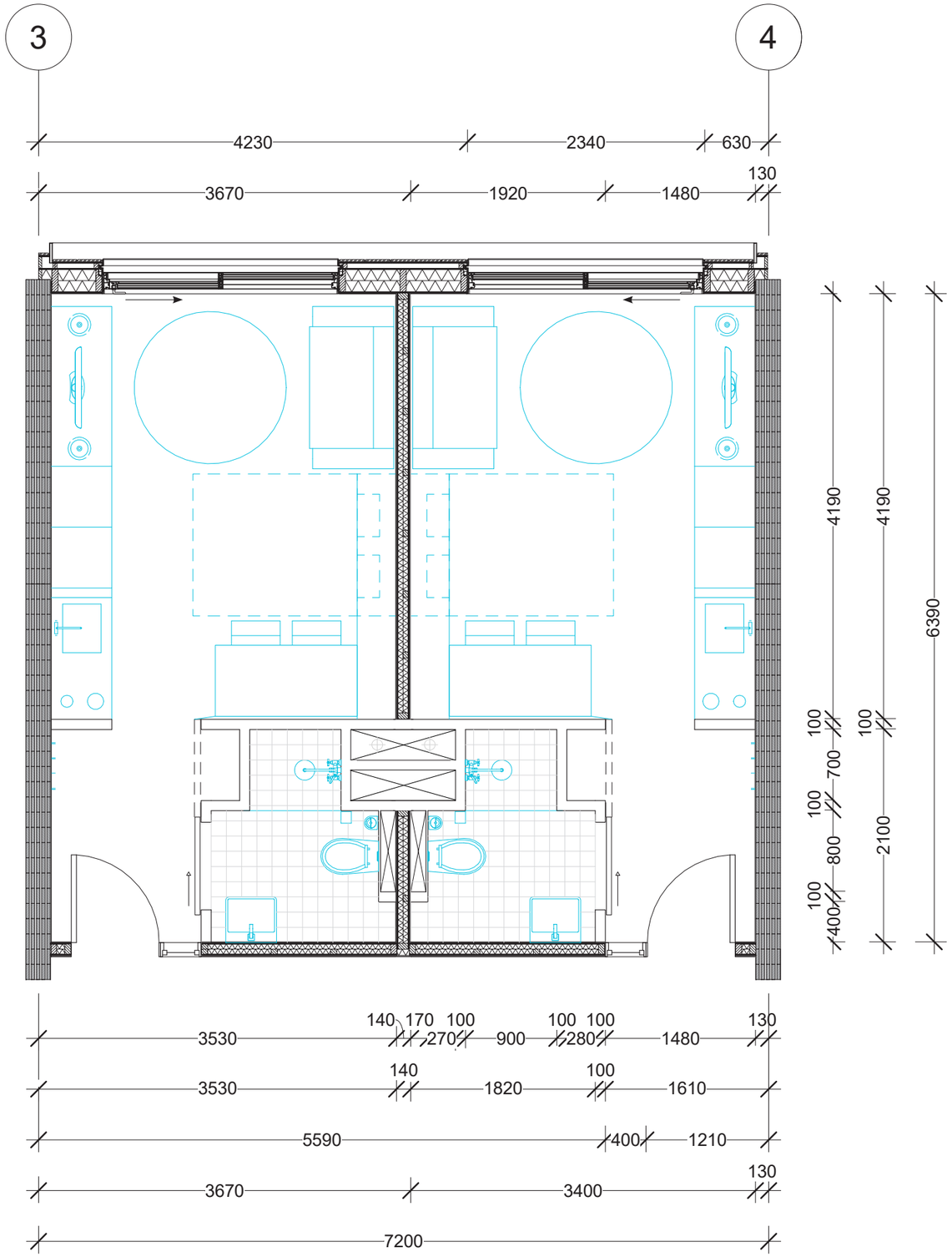


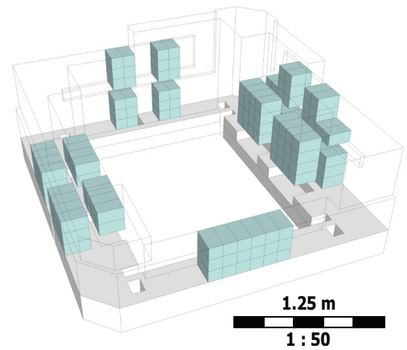


The organisation is focused on creating quality in the compact floor plan. This is done by having one central core, sliding doors, extended ceiling height, limited number of colour variations etc.

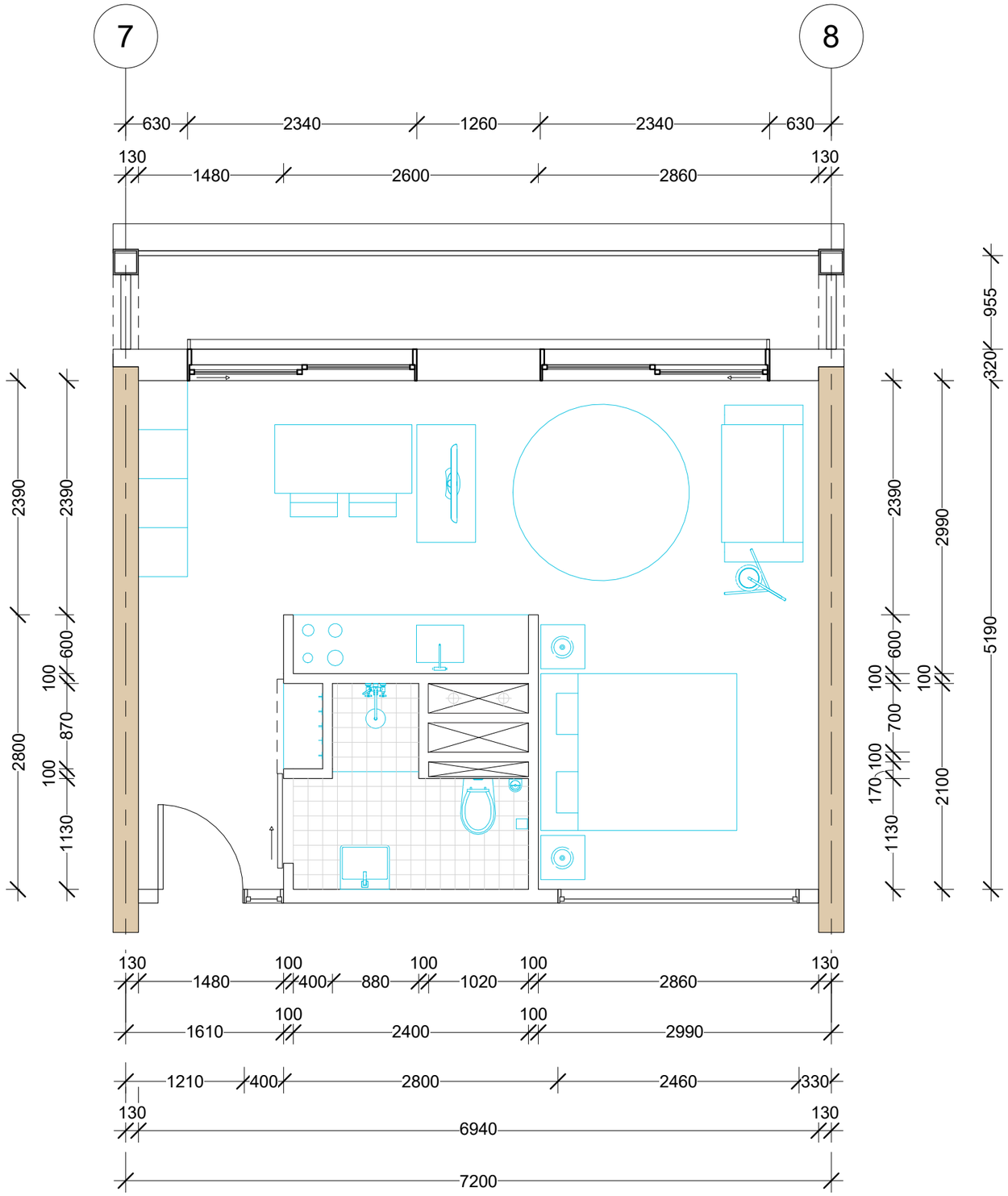


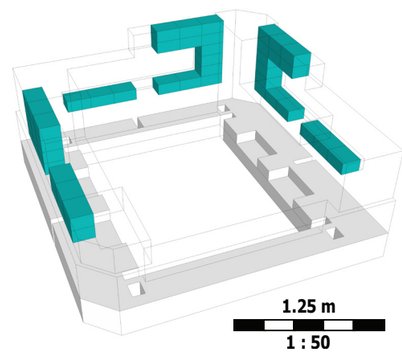
APARTMENT TYPE B: 21,3 m²



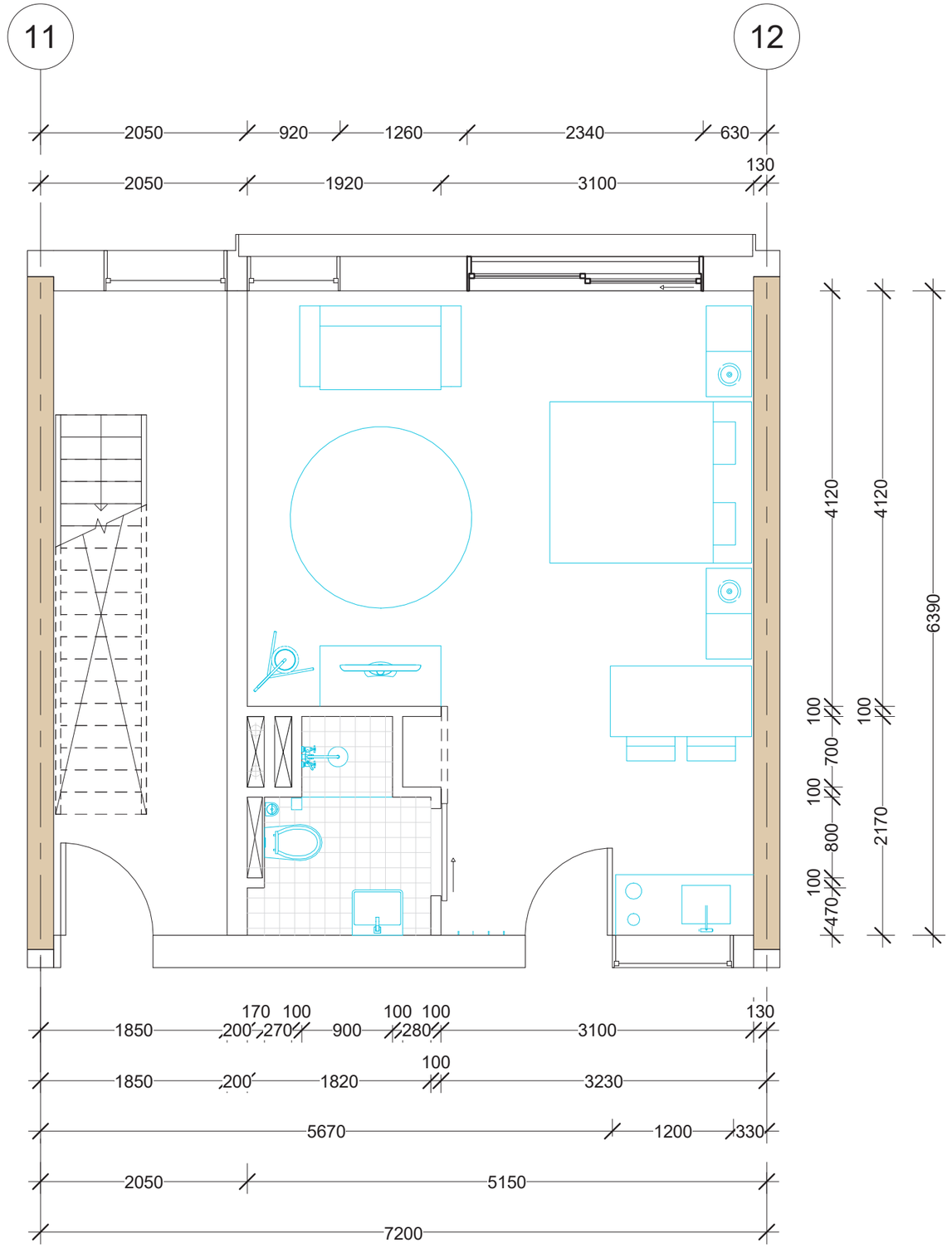


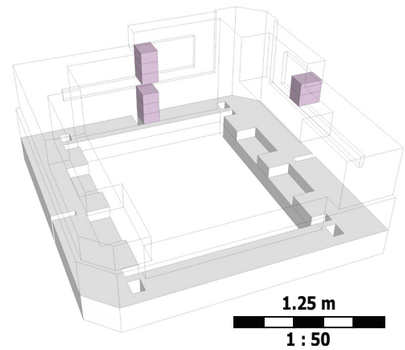
APARTMENT TYPE C: 34,9 m² (WITH A 6,4 m² TERRACE ON THE FOURTH FLOOR)



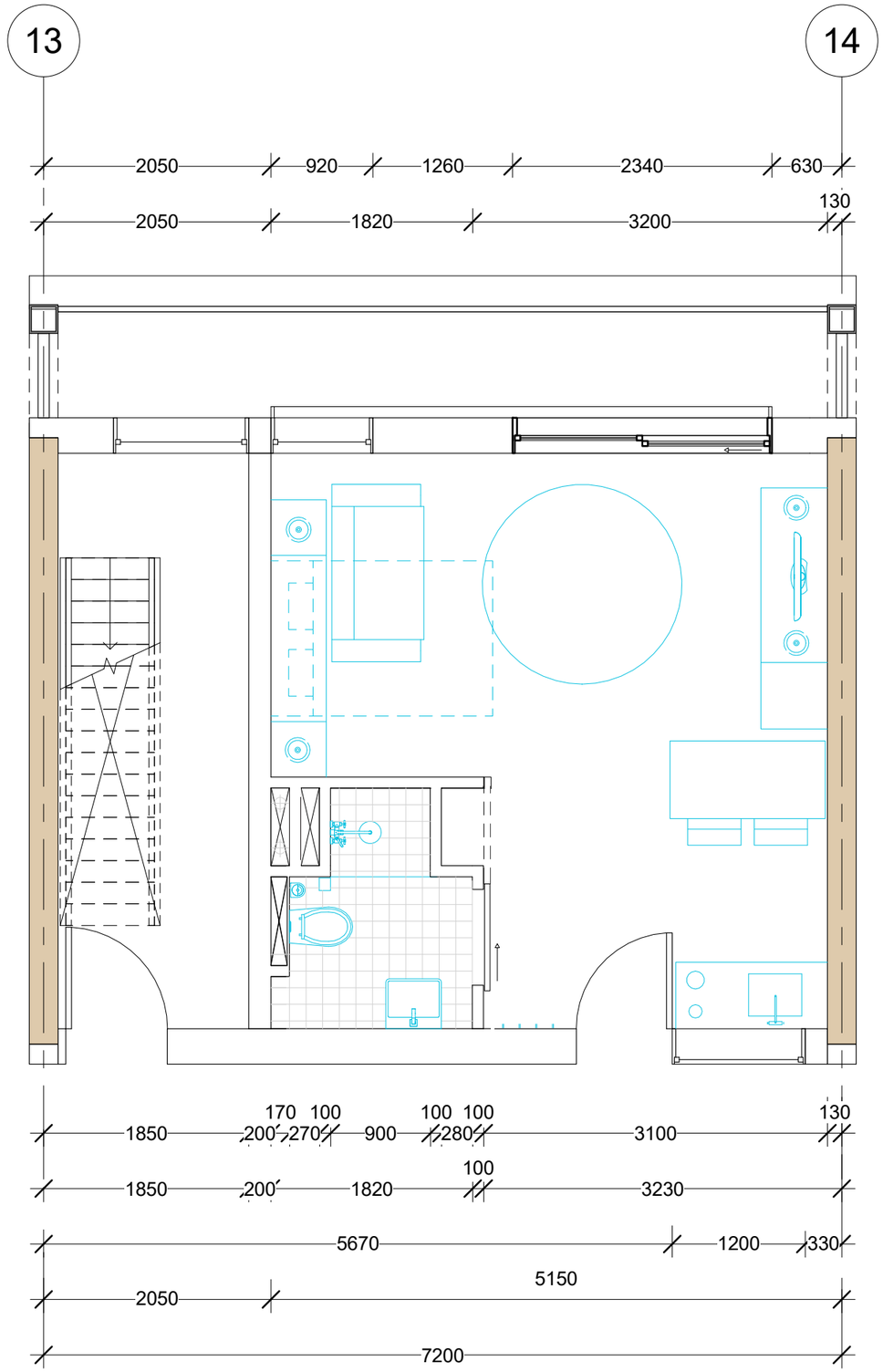


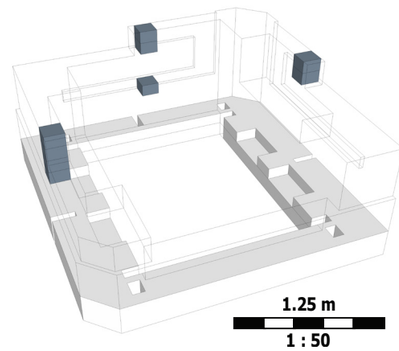
APARTMENT TYPE D: 31,2 m²



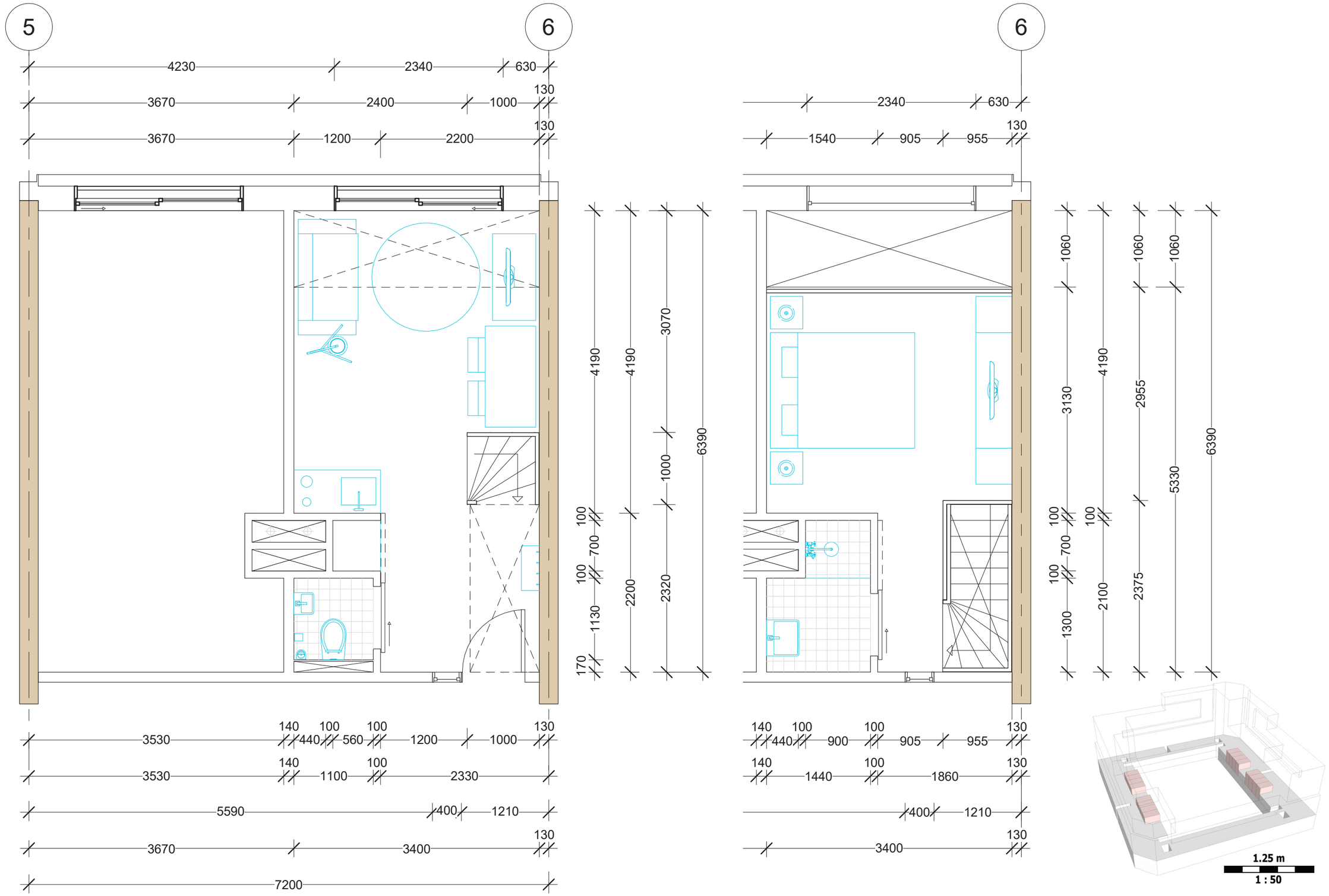


APARTMENT TYPE E: 25,6 m² (WITH A 6,4 m² TERRACE ON THE FOURTH FLOOR)

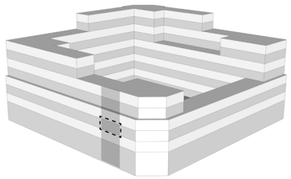


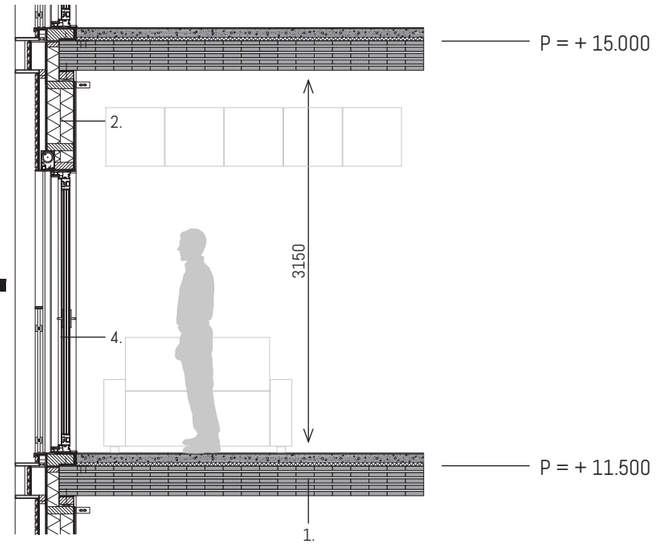


MAISONETTE TYPE A: 36,7 m²



FACADE FRAGMENT





1. FLOOR (350mm) FROM TOP TO BOTTOM
- 10mm parquet floor (interior finishing)
- 70mm concrete in situ with floor heating system with a distance in between of 150mm
- 30mm Kooltherm K3 high pressure floor insulation to prevent noise contact transport
- CLT 243E from Structurlam

2. MODULAR FACADE (500mm) FROM EXTERIOR TO INTERIOR
- 245mm aluminium frame that is sticking out 100mm from the bricks and 165mm from the stone strips
- 20mm stone strips
- 5mm space for mortar
- 10mm Siniat Bluclad panels for connecting the stone strips
- 50mm wooden bars
- Water repellent layer
- 12mm multiplex
- 220mm wooden framework with insulation that has reduced thermal leakage due to the combination of vertical and horizontal bars. Rc = 5,4 to compensate the thermal leakage at the windows
- 12mm multiplex
- Moisture prevention layer
- 8mm white plaster (interior finishing)

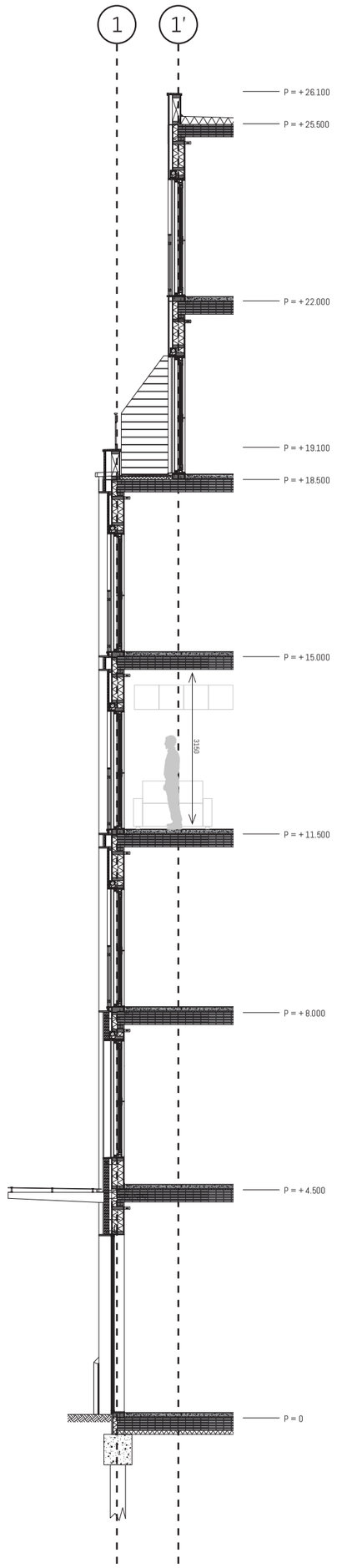
3. LOAD BEARING WALL (259mm) FROM LEFT TO RIGHT
- 8mm white plaster
- CLT 243E from Structurlam. Thick enough to function as noise transport barrier
- 8mm white plaster

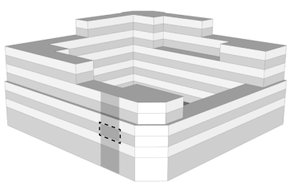
4. WINDOW
- Aluminium CP 155 Reynaers window frame adapted to triple glazing U = 0,6. Triple glazing is divided in 4 - 16 - 4 - 16 - 4mm and has a coating in the 16 mm cavity to lower the U-value
- French balcony with the railing set on 1200mm high
- DucoScreen Front 150 with grey screen that can be controlled electronically for each dwelling
- 12mm window frame is used as finishing

Remark: the shown dwelling floor plans is from apartment type A

1.25 m
1 : 50

OVERVIEW FACADE FRAGMENT

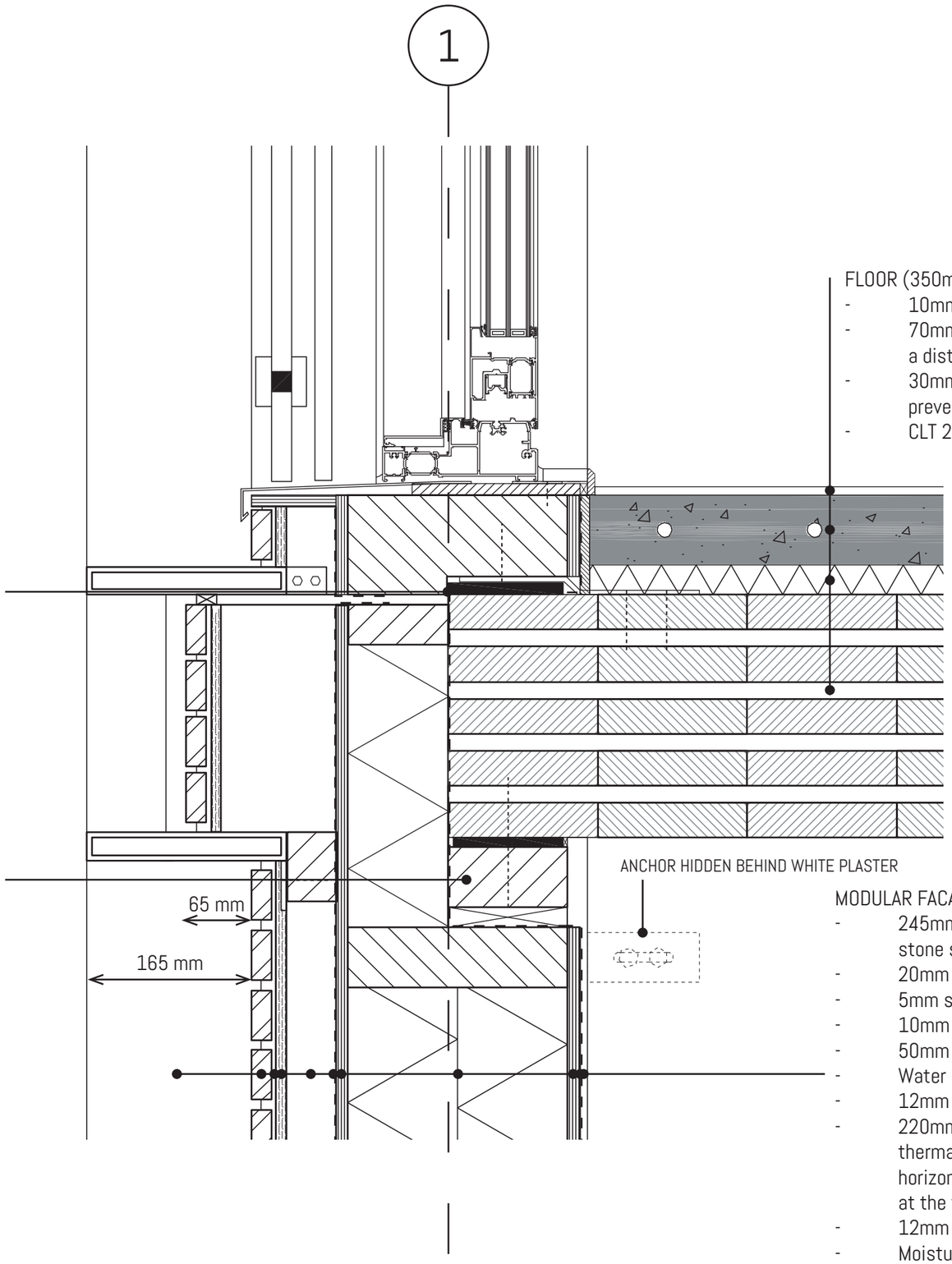




2.5 m
1 : 100

DETAILS

FACADE - FLOOR CONNECTION



FLOOR (350mm) FROM TOP TO BOTTOM

- 10mm parquet floor (interior finishing)
- 70mm concrete in situ and floor heating system with a distance in between of 150mm
- 30mm Kooltherm K3 high pressure floor insulation to prevent noise contact transport
- CLT 243E from Structurlam

P finishing = + 11.660

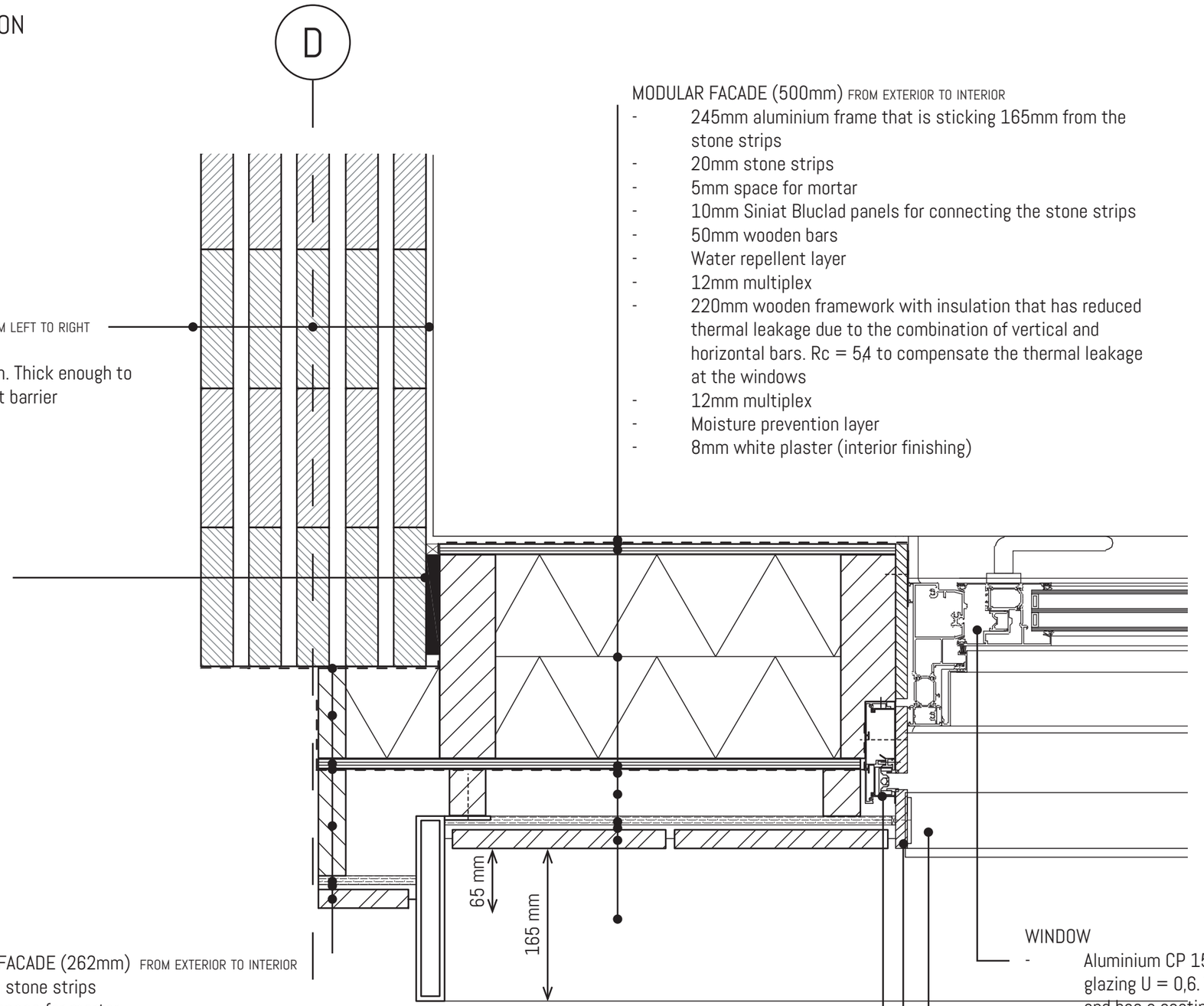
P = + 11.500

MODULAR FACADE (500mm) FROM EXTERIOR TO INTERIOR

- 245mm aluminium frame that is sticking out 165mm from the stone strips
- 20mm stone strips
- 5mm space for mortar
- 10mm Siniat Bluclad panels for connecting the stone strips
- 50mm wooden bars
- Water repellent layer
- 12mm multiplex
- 220mm wooden framework with insulation that has reduced thermal leakage due to the combination of vertical and horizontal bars. Rc = 5$\frac{1}{4}$ to compensate the thermal leakage at the windows
- 12mm multiplex
- Moisture prevention layer
- 8mm white plaster (interior finishing)

0.125 m
1 : 5

FACADE - WALL CONNECTION



LOAD BEARING WALL (259mm) FROM LEFT TO RIGHT
- 8mm white plaster
- CLT 243E from Structurlam. Thick enough to function as noise transport barrier
- 8mm white plaster

NEOPREEN RUBBER TO REDUCE CONTACT NOISE TRANSPORT

MODULAR FACADE (500mm) FROM EXTERIOR TO INTERIOR
- 245mm aluminium frame that is sticking 165mm from the stone strips
- 20mm stone strips
- 5mm space for mortar
- 10mm Siniat Bluclad panels for connecting the stone strips
- 50mm wooden bars
- Water repellent layer
- 12mm multiplex
- 220mm wooden framework with insulation that has reduced thermal leakage due to the combination of vertical and horizontal bars. Rc = 5,4 to compensate the thermal leakage at the windows
- 12mm multiplex
- Moisture prevention layer
- 8mm white plaster (interior finishing)

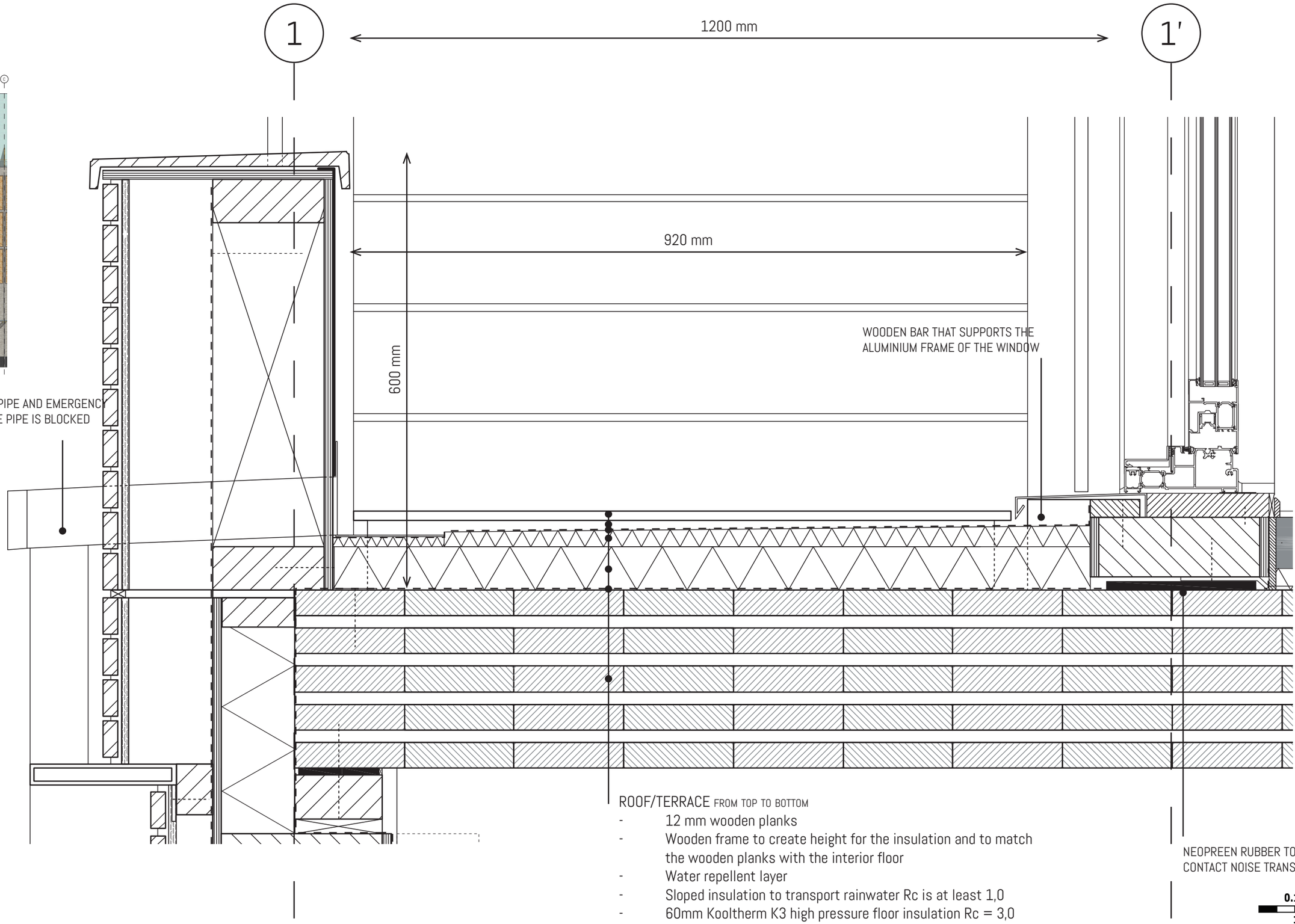
STONE STRIP FACADE (262mm) FROM EXTERIOR TO INTERIOR
- 20mm stone strips
- 5mm space for mortar
- 10mm Siniat Bluclad panels for connecting the stone strips
- 115mm wooden bars
- Water repellent layer
- 12mm multiplex
- 100mm wooden bar with insulation
- Moisture prevention layer

WINDOW
- Aluminium CP 155 Reynaers window frame adapted to triple glazing U = 0,6. Triple glazing is divided in 4 - 16 - 4 - 16 - 4 mm and has a coating in the 16 mm cavity to lower the U-value
- French balcony with the railing set on 1200mm high
- 12mm window frame is used as finishing
- DucoScreen Front 150 with grey screen that can be controlled electronically for each dwelling

0.125 m
1 : 5

SETBACK

80mm WATER PIPE AND EMERGENCY EXIT WHEN THE PIPE IS BLOCKED



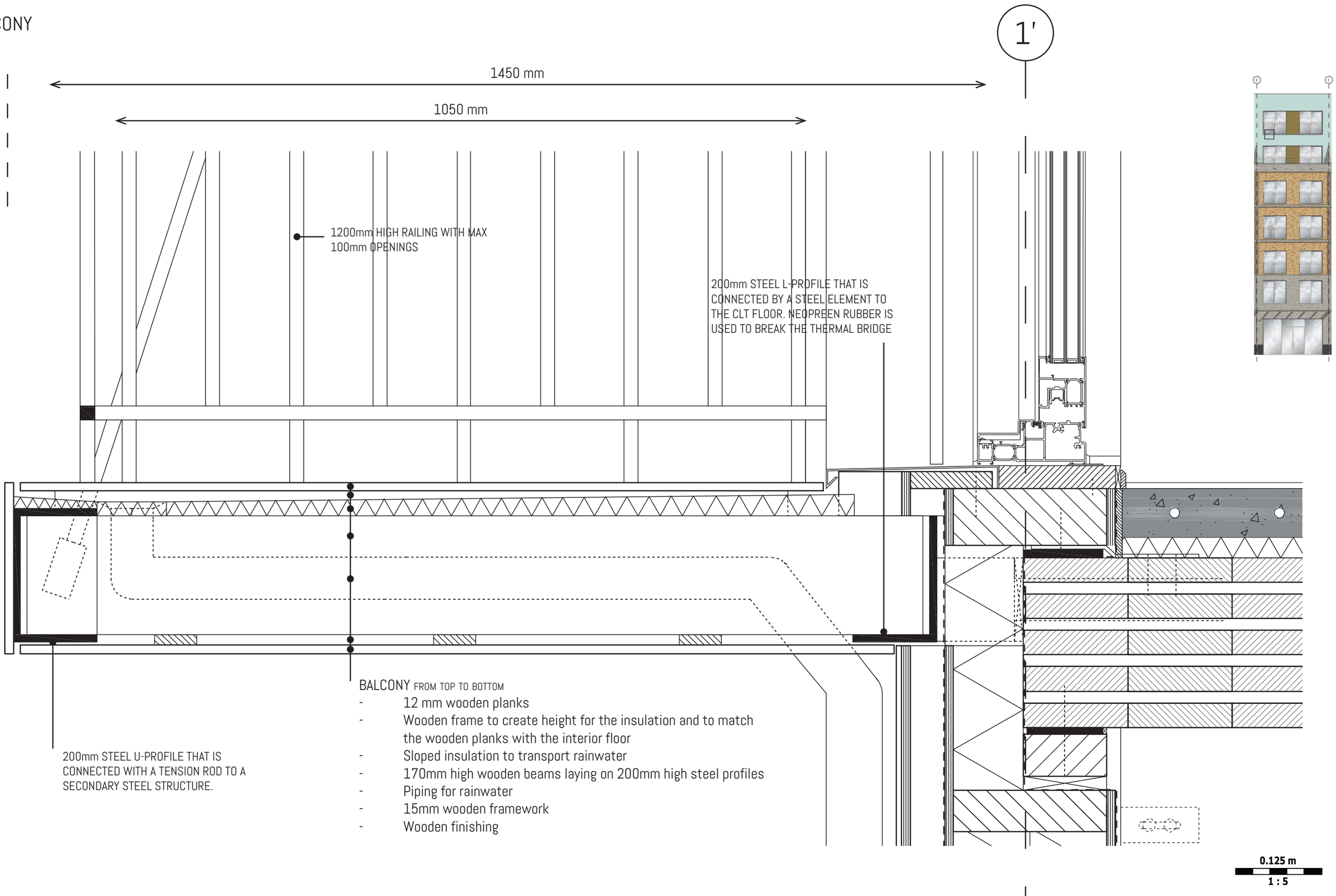
ROOF/TERRACE FROM TOP TO BOTTOM

- 12 mm wooden planks
- Wooden frame to create height for the insulation and to match the wooden planks with the interior floor
- Water repellent layer
- Sloped insulation to transport rainwater Rc is at least 1,0
- 60mm Kooltherm K3 high pressure floor insulation Rc = 3,0
- Moisture prevention layer
- CLT 243E from Structurlam Rc = 2,0

NEOPREEN RUBBER TO REDUCE CONTACT NOISE TRANSPORT

0.125 m
1 : 5

BALCONY



BALCONY FROM TOP TO BOTTOM

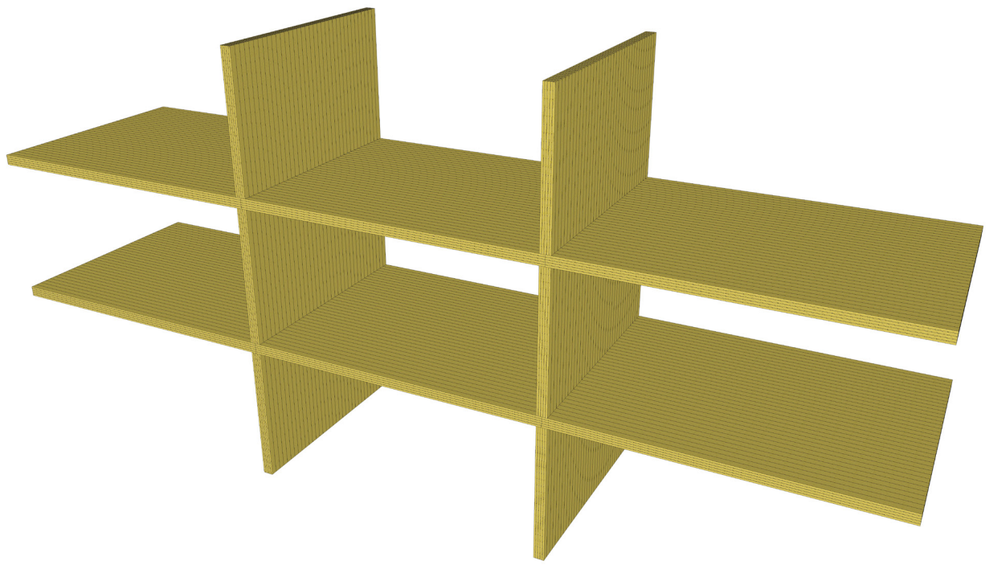
- 12 mm wooden planks
- Wooden frame to create height for the insulation and to match the wooden planks with the interior floor
- Sloped insulation to transport rainwater
- 170mm high wooden beams laying on 200mm high steel profiles
- Piping for rainwater
- 15mm wooden framework
- Wooden finishing

Remark: the balconies were from an earlier design phase. It is not present in the final design. Still it is good to see how the balcony detail would have looked like.

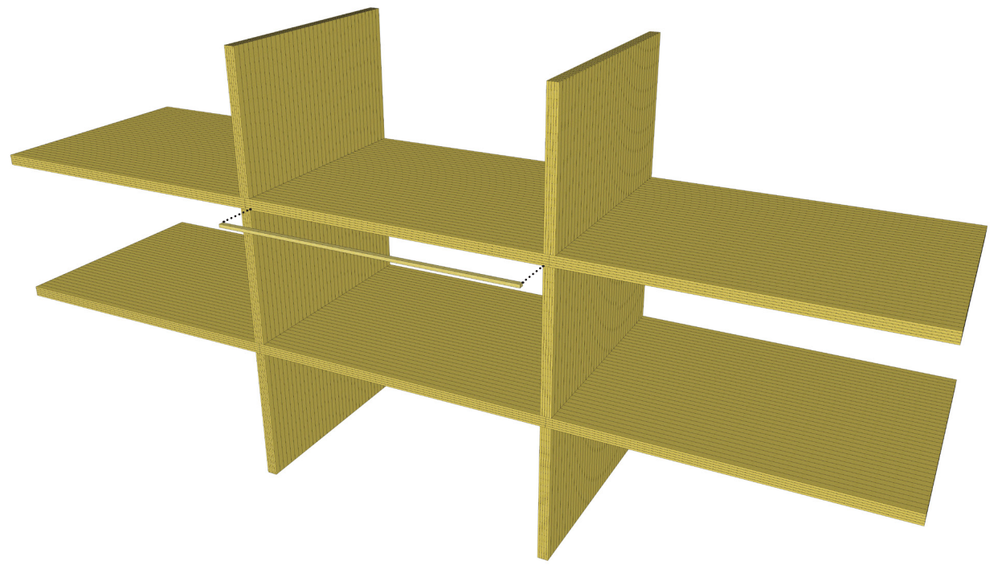
FACADE ASSEMBLY

CONNECTION WITH PRIMARY STRUCTURE

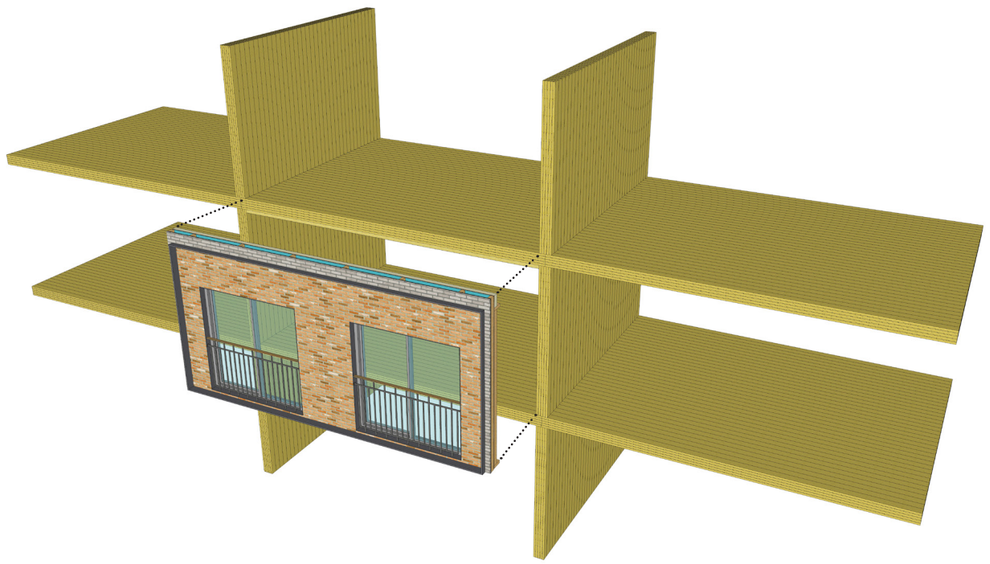
1) LOAD BEARING CLT STRUCTURE



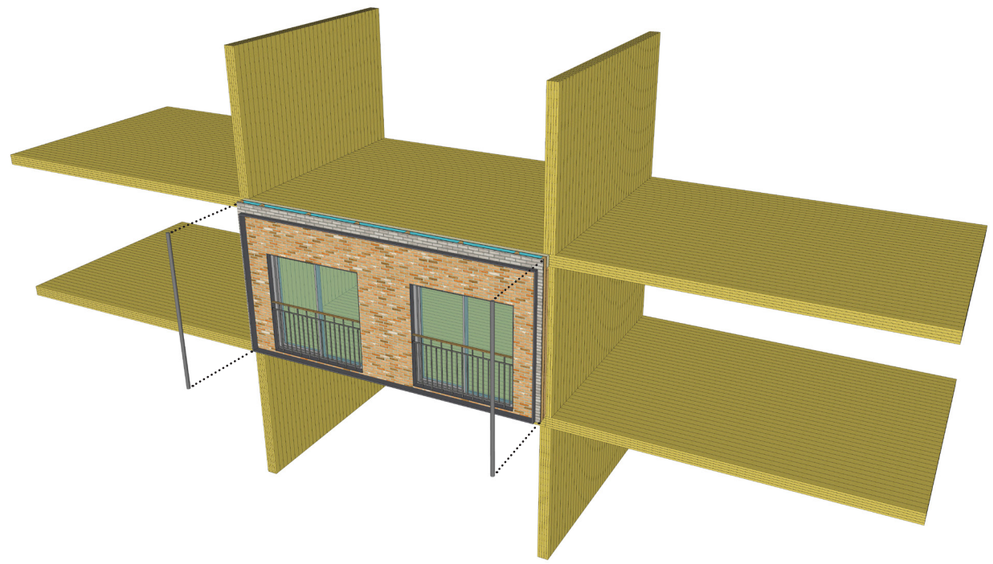
2) WOODEN BAR CONNECTED TO THE PRIMARY STRUCTURE. THE BAR IS NEEDED TO HAVE A CERTAIN TOLERANCE AND TO PLACE THE MODULE CORRECTLY.



3) PREFAB MODULE WILL BE CONNECTED TO THE PRIMARY STRUCTURE AND THE WOODEN BAR

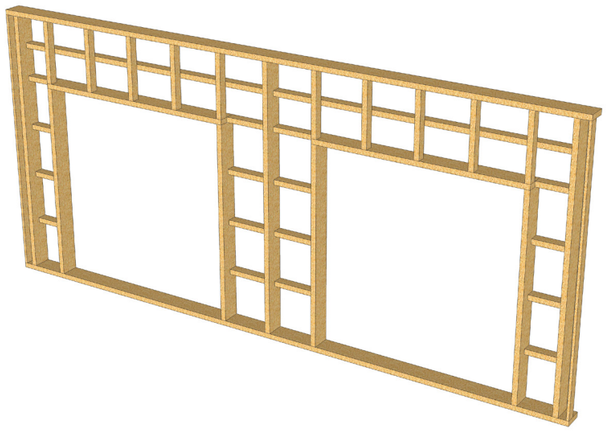


4) AFTER CONNECTING (ALL) THE PREFAB MODULE(S), THE REMAINING (FINISHING) WILL BE APPLIED

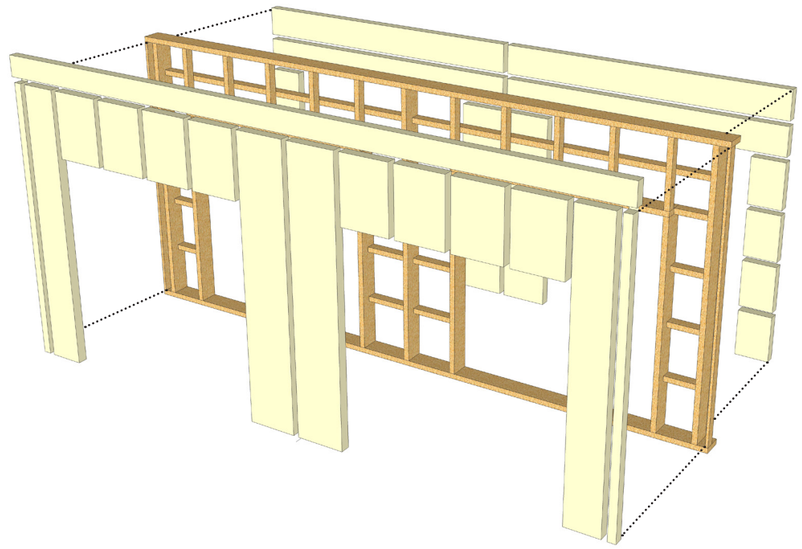


PREFAB MODULE PRINCIPLE

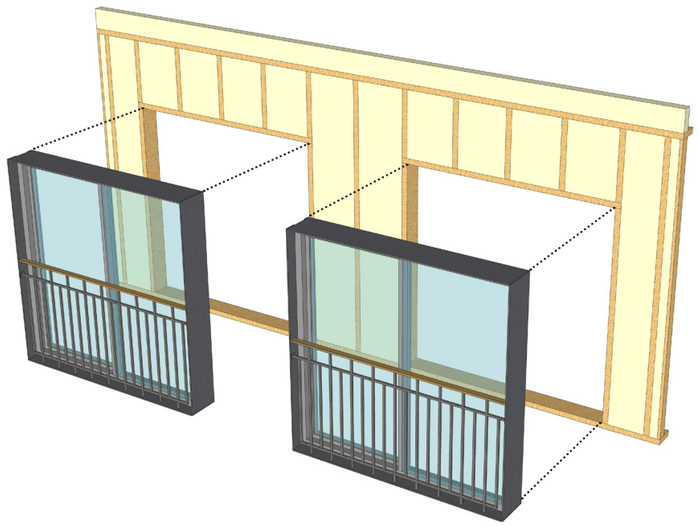
1) 220mm WOODEN NON-LOAD BEARING FRAMEWORK THAT HAS REDUCED THERMAL LEAKAGE DUE TO THE VERTICAL AND HORIZONTAL BARS



2) WOODEN FRAMEWORK WILL BE INSULATED. THE 220mm THICKNESS IS NEEDED TO COMPENSATE THE THERMAL LEAKAGE FROM THE TRIPLE GLASS WINDOWS

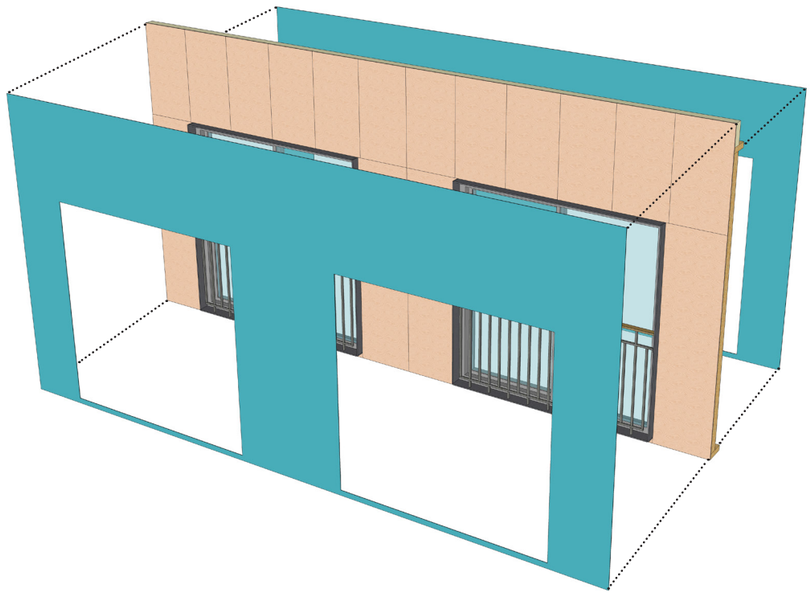


3) ALUMINIUM WINDOW FRAME WITH TRIPLE GLASS SLIDING DOORS WILL BE CONNECTED TO THE WOODEN FRAMEWORK

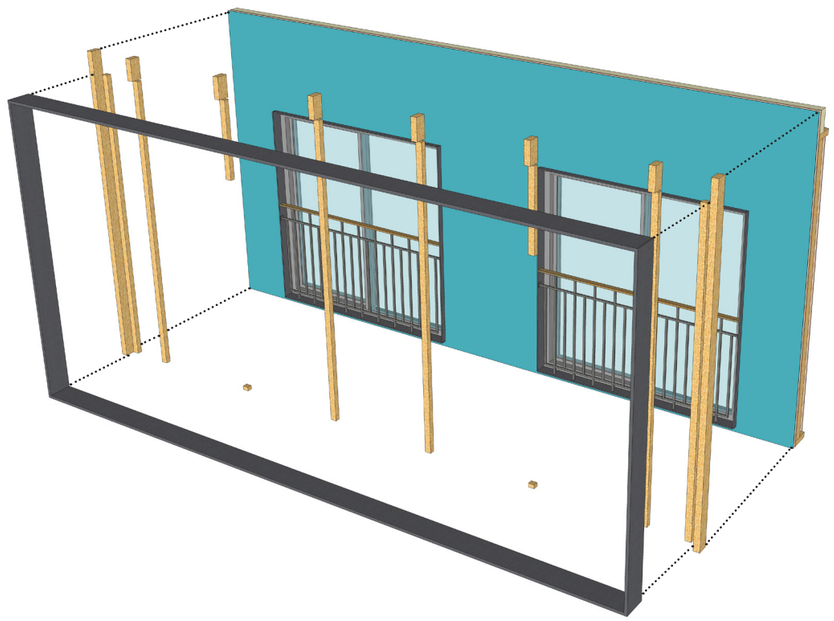


4) 12mm THICK MULTIPLEX WILL ENHANCE THE STIFFNESS OF THE FRAMEWORK

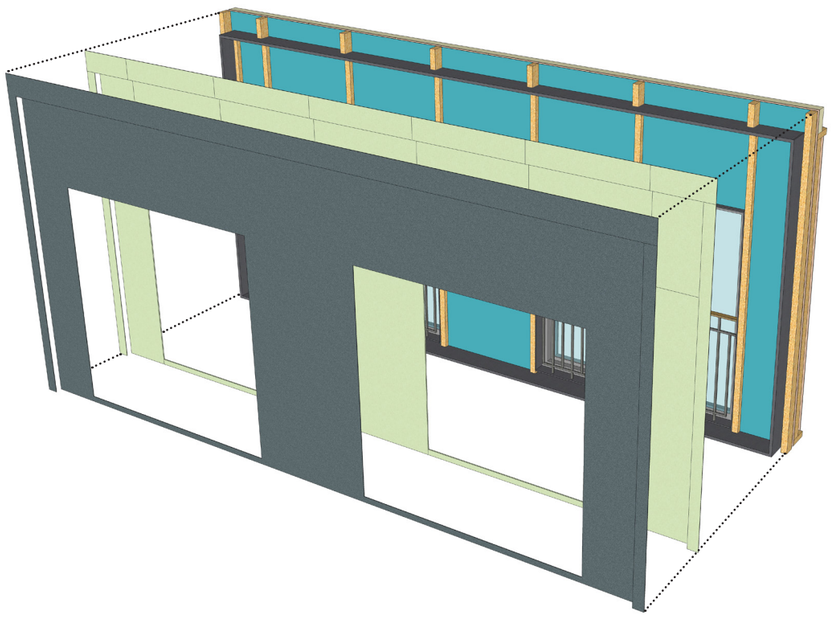
5) A MOISTURE PREVENTION LAYER WILL BE USED AT THE INTERIOR AND A WATER REPELLING LAYER WILL BE USED AT THE EXTERIOR SIDE. THE SURFACE SHOULD BE BIGGER THAN THE MODULE TO CREATE AN OVERLAP WITH THE OTHER MODULES



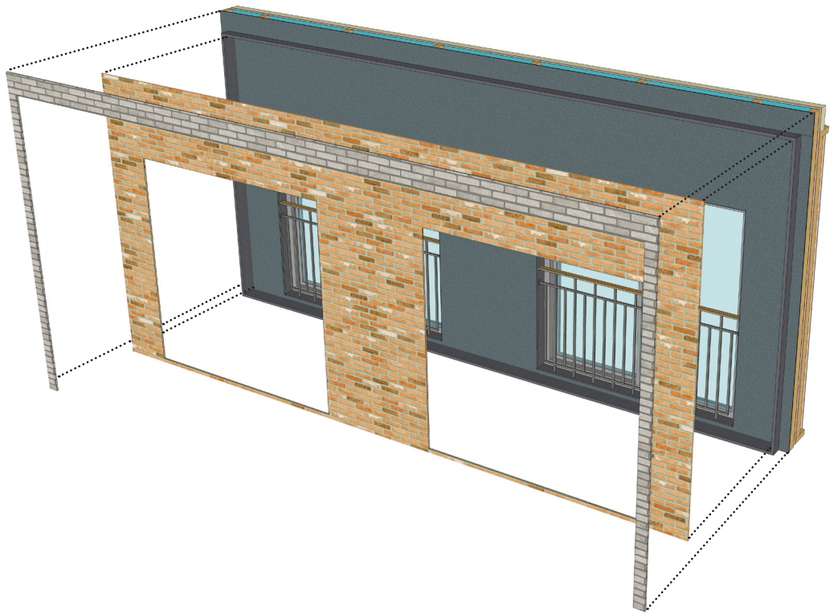
6) WOODEN BARS ARE USED TO CONNECT 10mm SINIAT BLUCLAD PANELS. ALSO THE ALUMINIUM FRAME WILL BE ATTACHED.



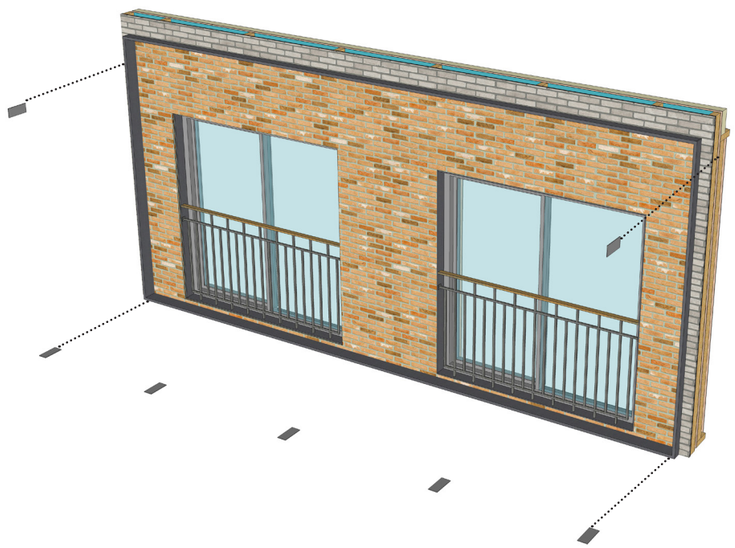
7) 10mm SINIAT BLUCLAD PANELS AND MORTAR WILL BE USED TO CONNECT THE STONE STRIPS TO THE WOODEN FRAME.



8) 20mm STONE STRIPS WILL BE ATTACHED TO THE BLUCLAD PANELS BY USING MORTAR

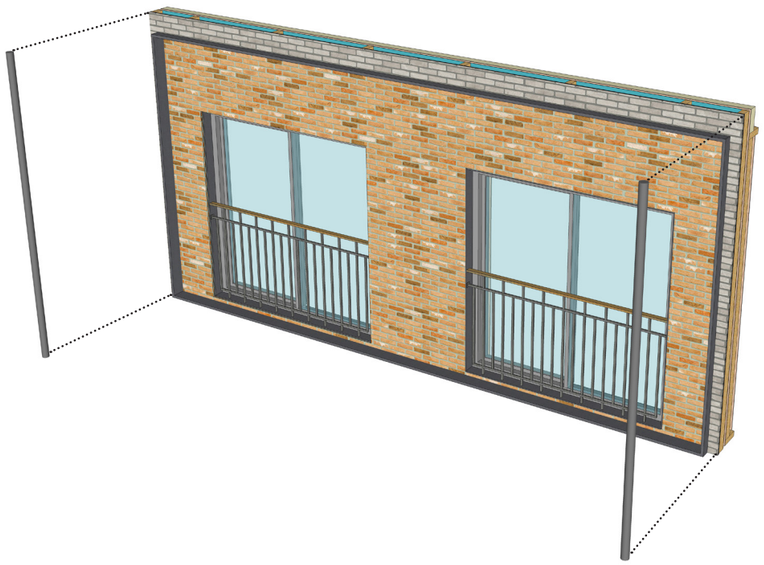


9) ANCHORS THAT ARE ATTACHED TO THE PREFAB MODULE CAN BE BOLTED FROM THE INTERIOR TO THE PRIMARY CLT STRUCTURE



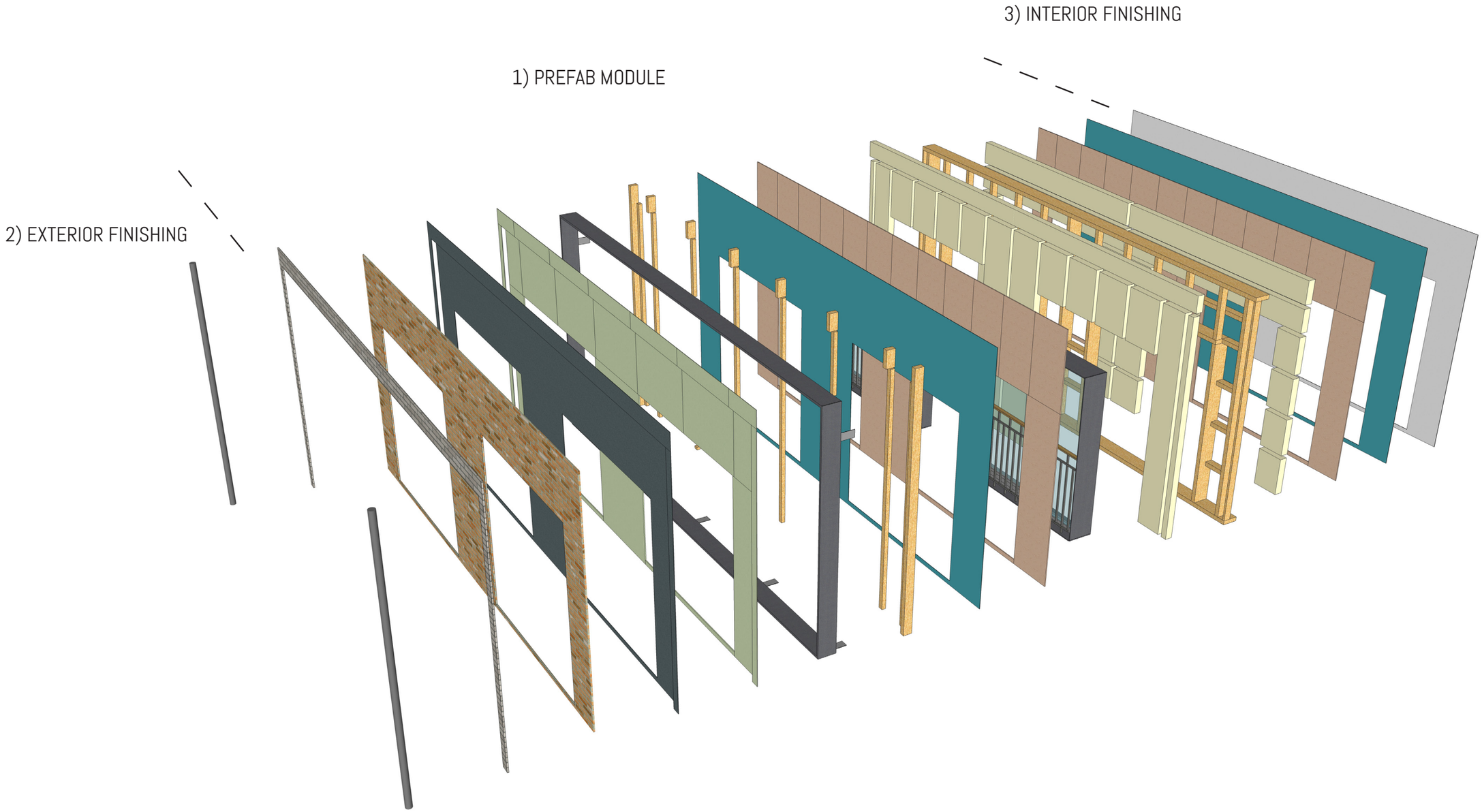
10) THE RESULT OVER ONE BAYWITH OF 7,2m

11) EXTERIOR FINISHING



12) INTERIOR FINISHING

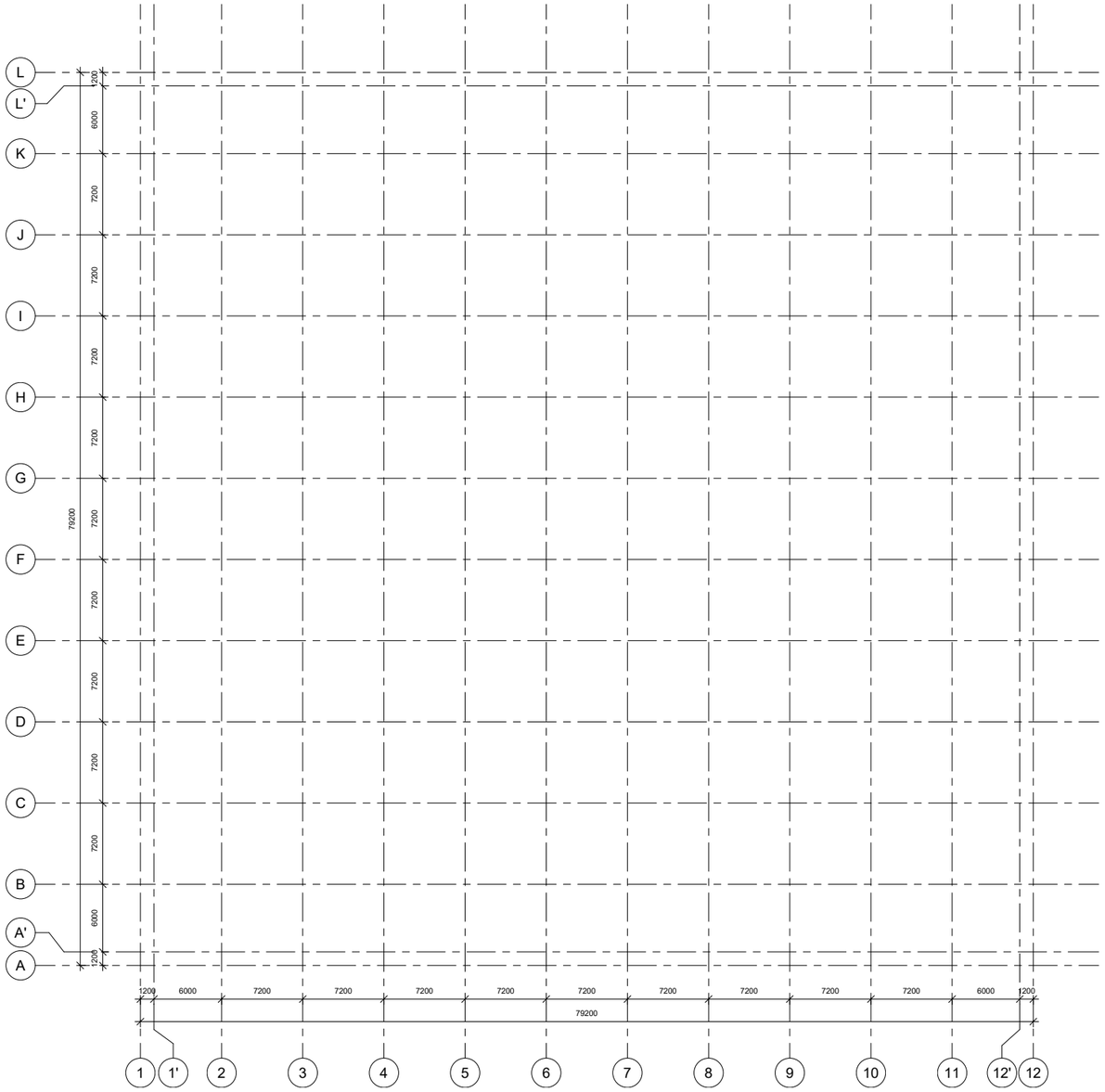
SUMMARY

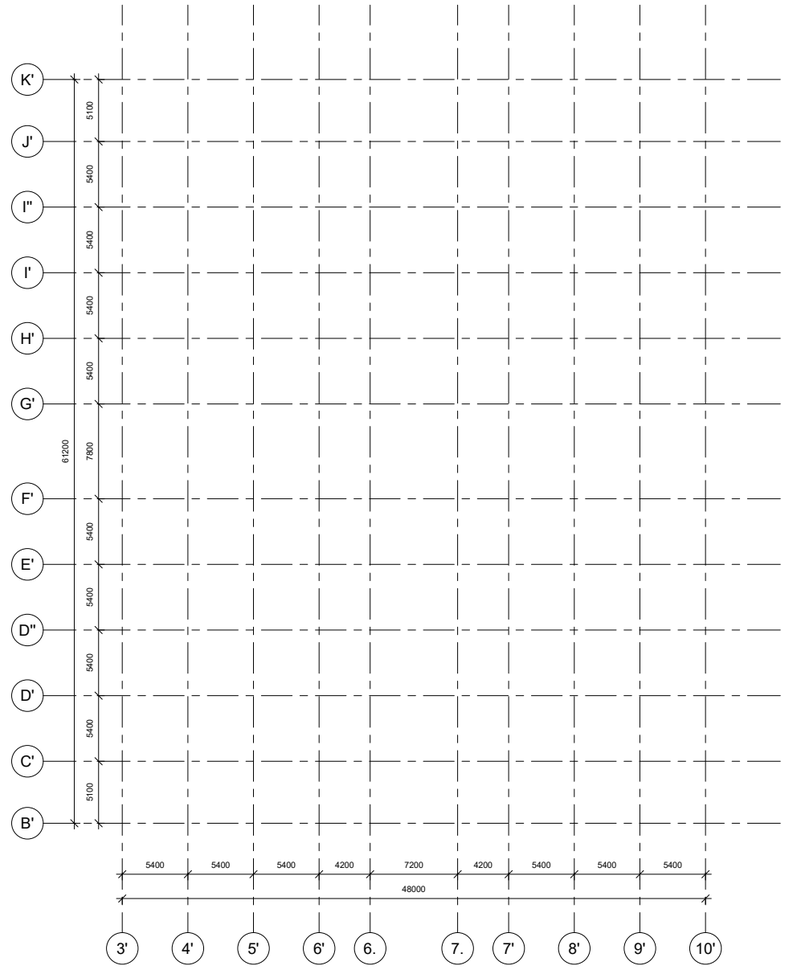


FACADE IMPRESSION

CONSTRUCTION

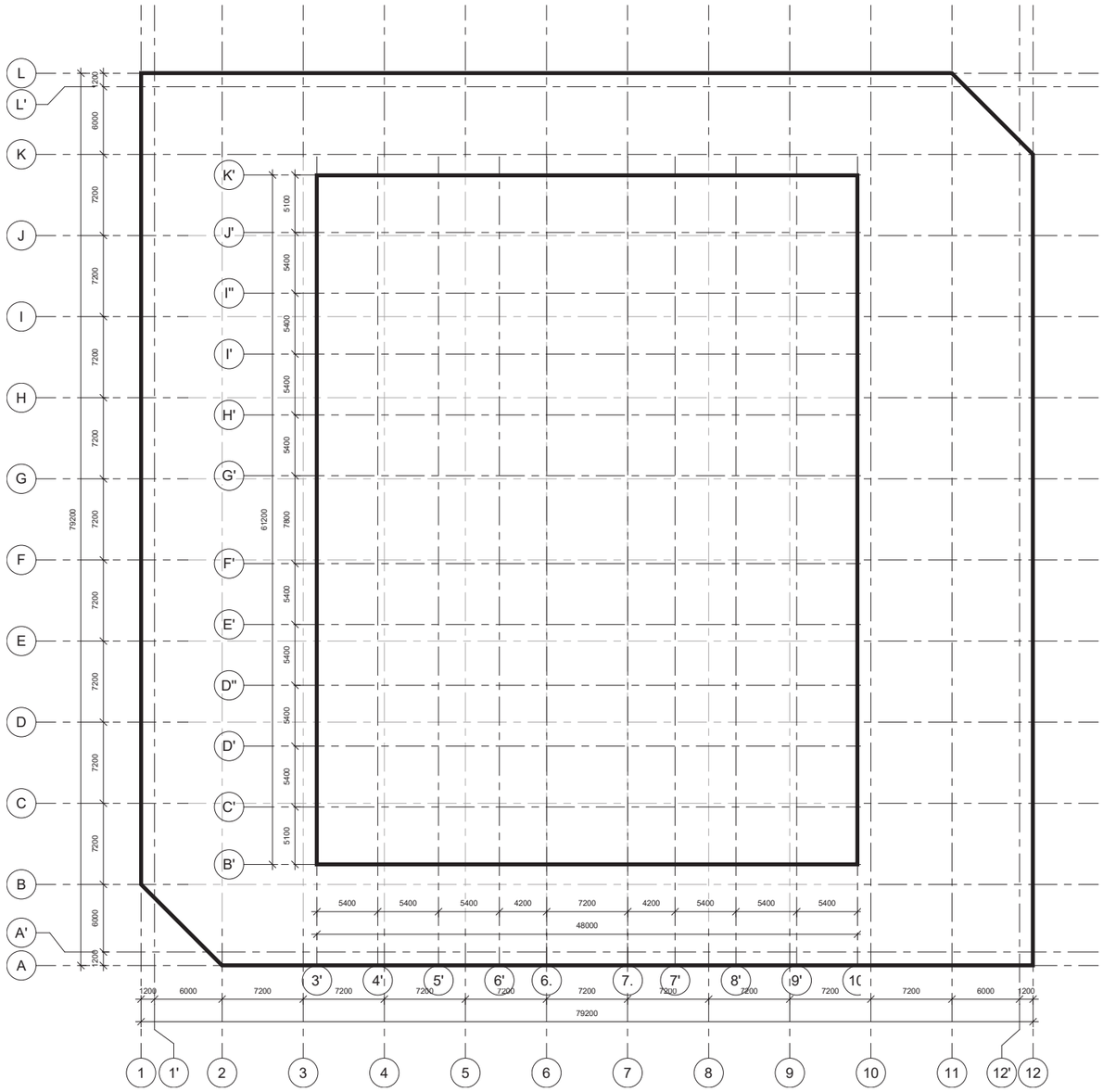
7,2m GRID FOR THE BUILDING & 54m GRID FOR THE BASEMENT
TWO GRID SYSTEMS THAT ARE WORKING INDEPENDENTLY FROM EACH OTHER TO CREATE FLEXIBILITY





12.5 m
1 : 500

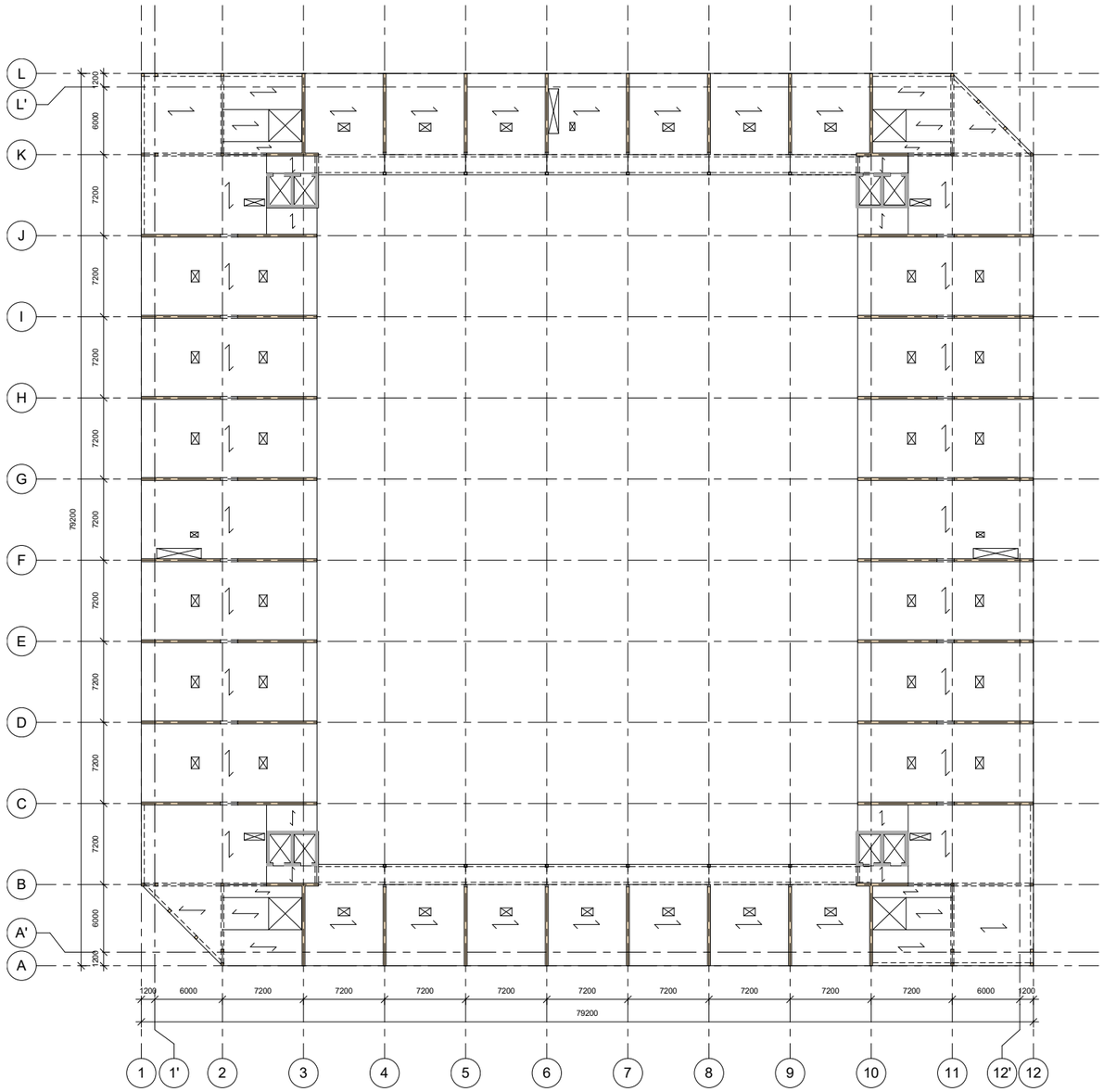
COMBINATION OF THE TWO GRID SYSTEMS + BORDERS

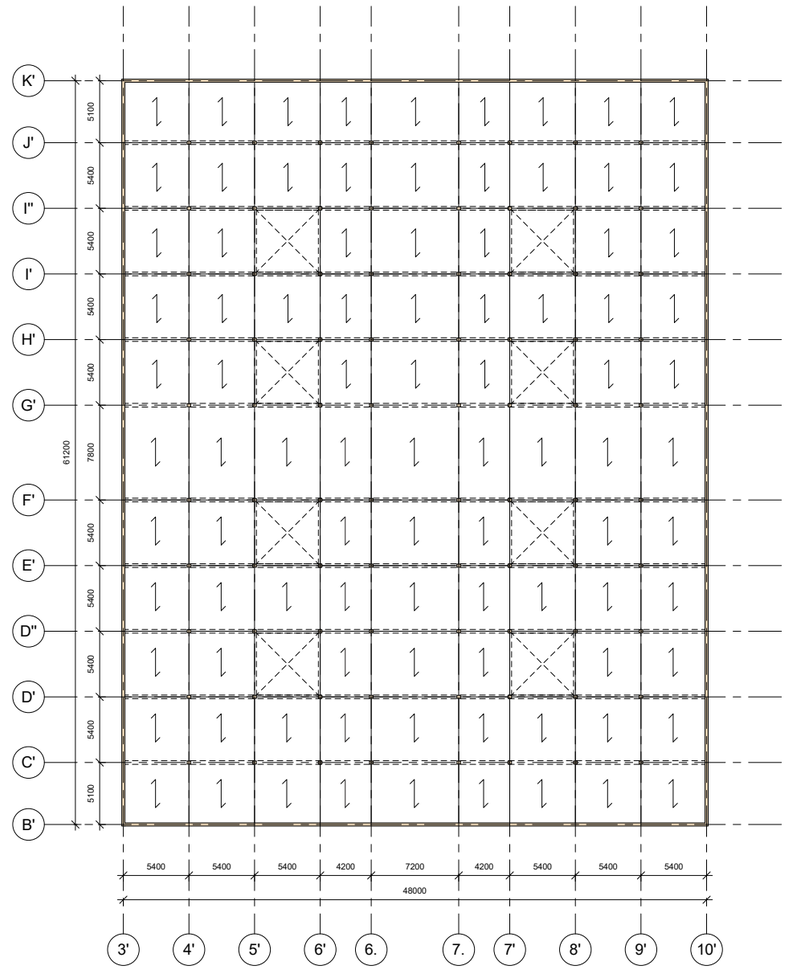


12.5 m

1 : 500

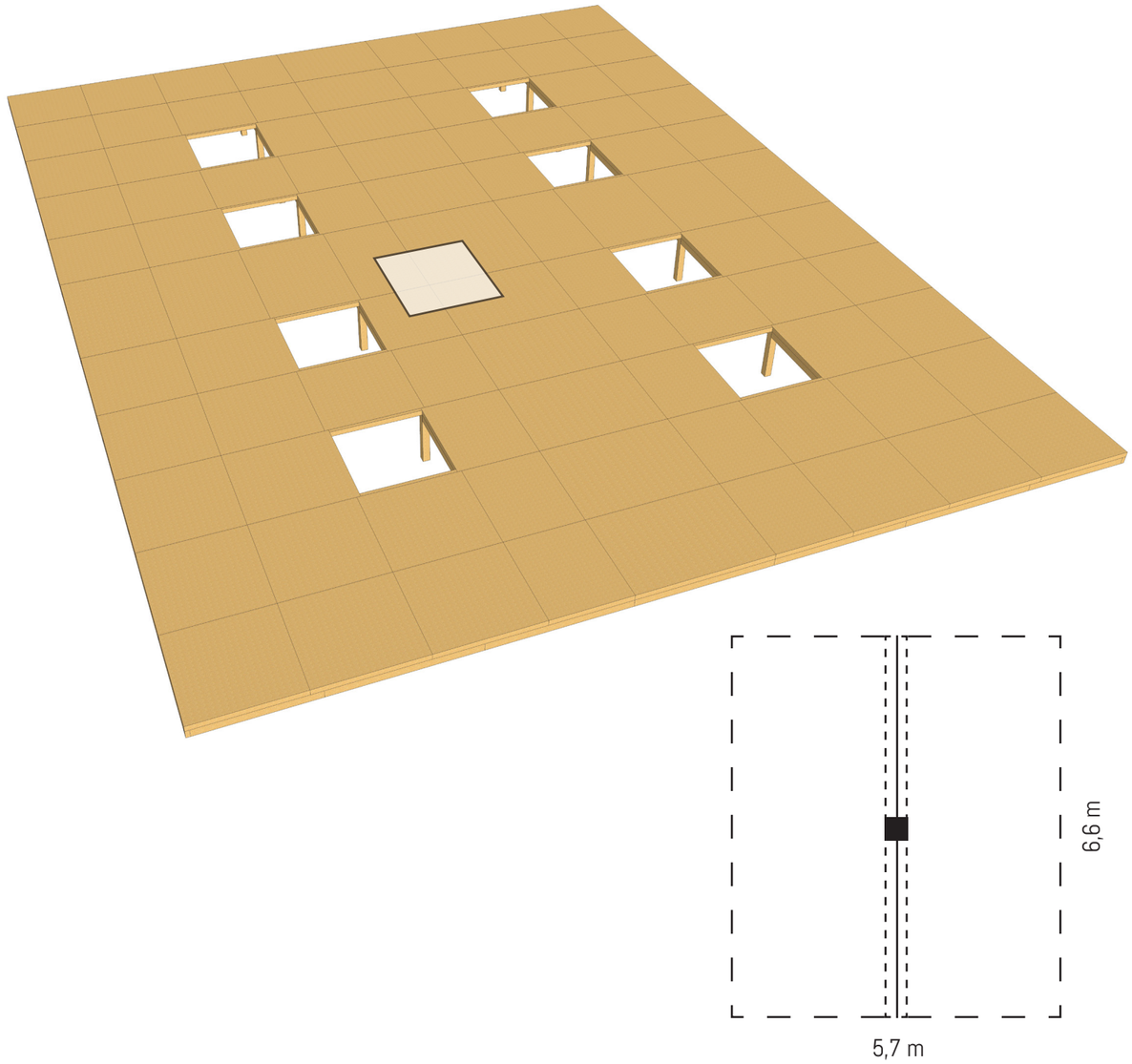
CONSTRUCTION SCHEME OF TYPICAL FLOOR PLAN & BASEMENT





I have chosen for a CLT load bearing structure based on having the benefits of concrete (fire safety) and steel (relatively light) and it has a low carbon footprint. In that way it is a very sustainable building material. With a building height of 39,5m CLT still can be used in a proper way without any consequences for strengthening the structure of it. Based on the 7,2m floor spans, floor height and building height I have chosen for a CLT 243E floor type from Structurlam. It consists of 9 layers of wood which are alternating between a thickness of 17 and 35mm for each panel. Stability is realised by having walls positioned in different direction and the stiff (concrete) elevator core. At the corners, a network of beams and columns is chosen for architectural reasons. These are adapted to the dimensions of the floors and walls and will therefore have 250x250mm dimensions. The assumption is made that the walls will realise enough stability so no further measurements have to be taken at the columns.

COURTYARD COLUMN CALCULATION



Gewichtstabel kolom **onder 1ste verdieping** LET OP DE EENHEDEN!

materiaal: Wood | profiel: | oppervlak doorsnede: | mm

	lengte (hoogte) [m]	breedte [m]	bel./m² of bel./m	blijv. belast. [kN]	tot.blijv. per verd. [kN]	verand. belast. [kN]	fact. ψ	Te reken. ver. bel. [kN]
1ste verdieping								
Verand. belasting =	5,7 x	6,6 x	5 =			188,1 x	1 =	**188,1**
Gew. vloerconstr. =	5,7 x	6,6 x	23,05 =	867,04				
Gewicht ligger =	1 x		3,5 =	3,5				
Gewicht kolom =	0 x		0 =	0 +				
--->				**870,54**				

totaal in kN = blijvende belasting = G: **870,54** | ver. bel. = Q: **188,1**
partiële factor γ voor G: **1,2** | part. factor γ voor Q: **1,5**

Totale belasting UGT: $F_d = \gamma_G \times G + \gamma_Q \times Q =$ **1326,8** kN $\sigma_{c;d} =$ **12,0** N/mm²

WEIGHT CALCULATIONS

FLOOR STRUCTURE:	DENSITY [kg/m3]	HEIGHT [mm]	WEIGHT [kg/m2]	WEIGHT [kN/m2]
CLT	485	300	145,5	1,43
Soil (included moist)	2000	1000	2000	19,62
Vegetation	-	-	-	2 +
				23,05
BEAM STRUCTURE:				
CLT	485	-	350	**3,5kN**

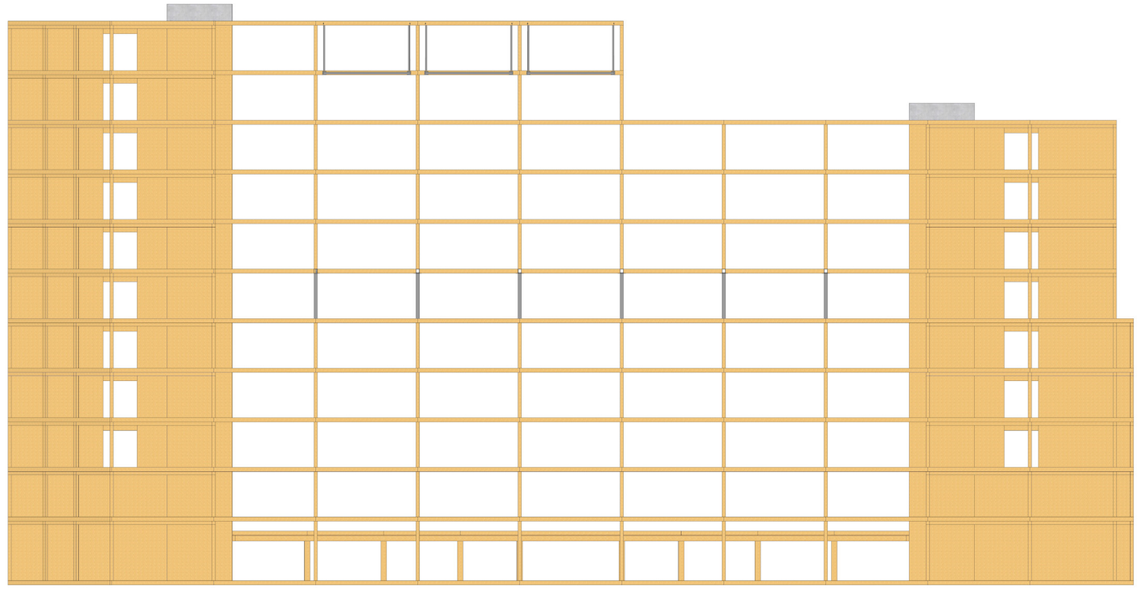
NEEDED COLUMN DIMENSIONS

Total Load	1326,8 kN	
Strength	12,0 N/mm2	
Profile needed	110567 mm2	333 x 333 mm

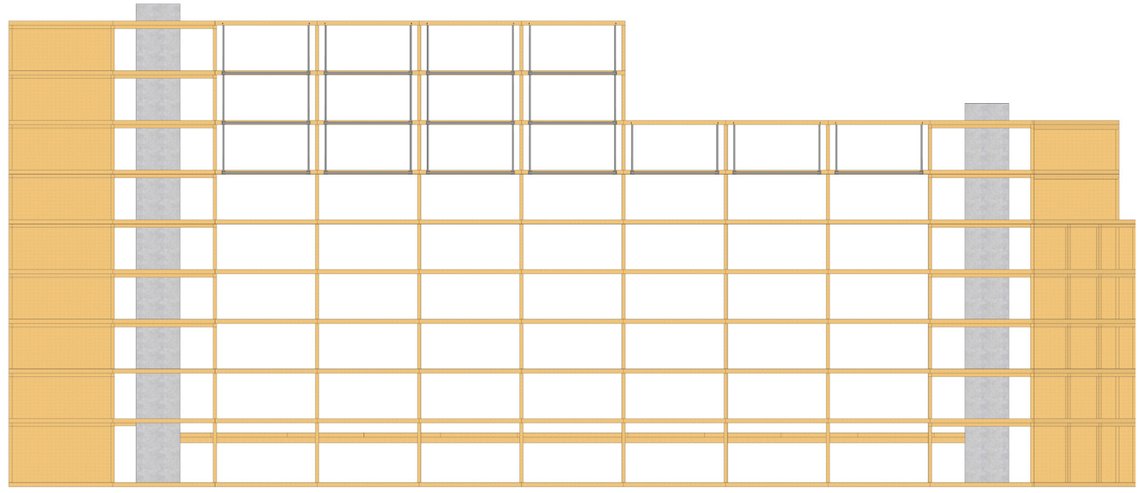
RESULT: Because the courtyard has a lot of vegetation, I calculated the dimensions of the needed structure. Therefore, I have focused on the column(s) with the biggest area it needs to carry. Based on the calculations it becomes clear that a profile of 333x333mm will be sufficient. Eventually, I have chosen for a 350x350mm profile that has an overcapacity to carry things such as the pavilion and (relatively heavy) garden furniture.

ELEVATIONS - FOCUSED ON VERTICAL TRANSPORT OF FORCES

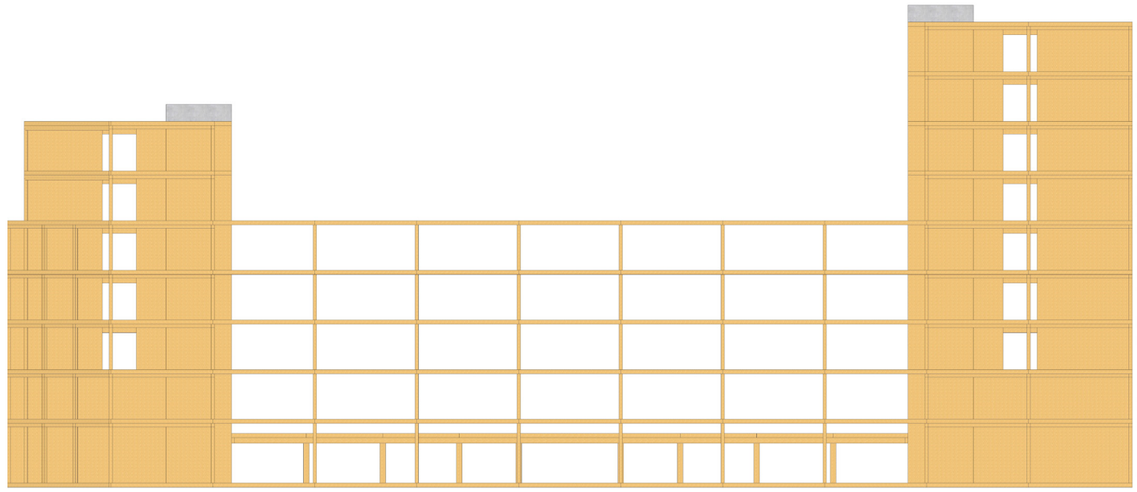
NORTH



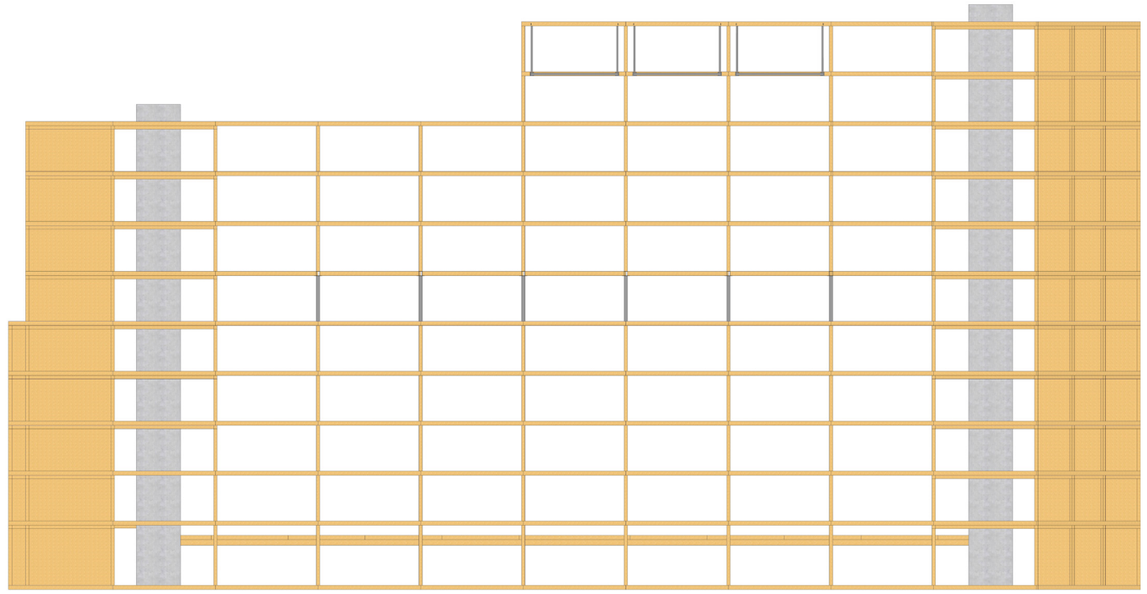
WEST



SOUTH

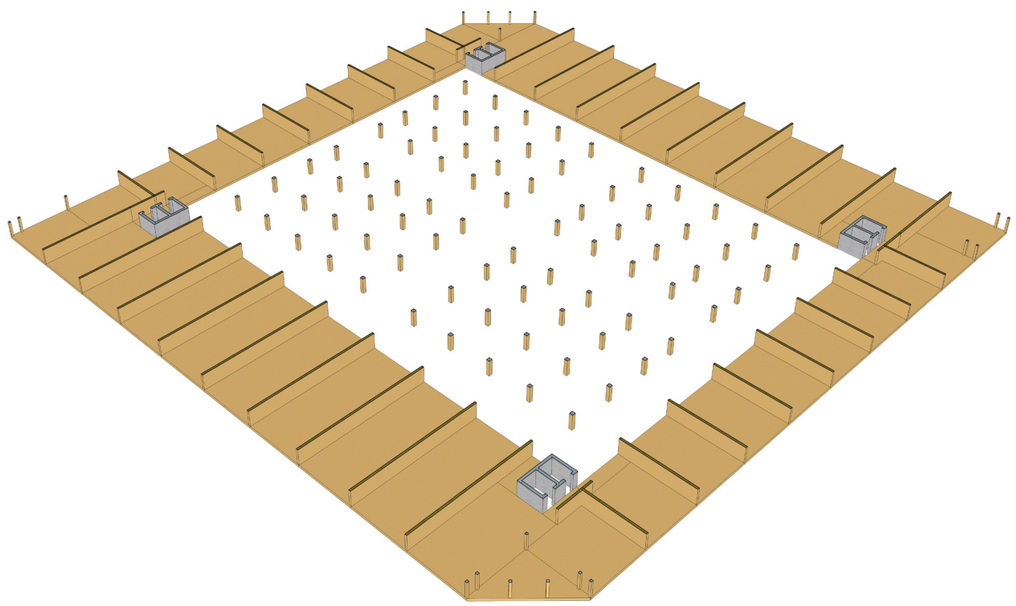


EAST



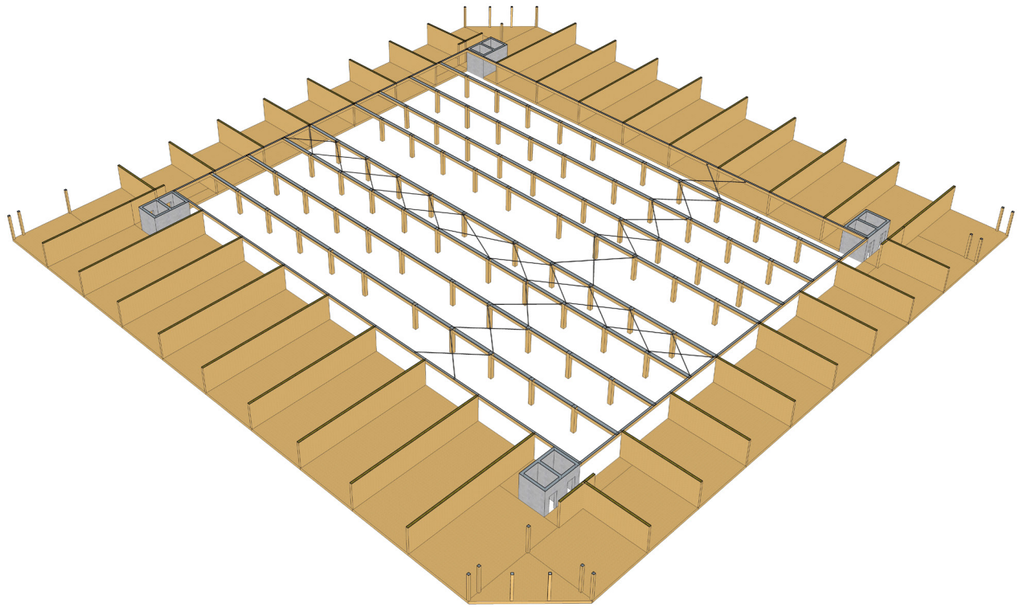
Remark: the balconies were from an earlier design phase. It is not present in the final design. Still it is interesting to see how it relates to the primary structure.

3D CONSTRUCTION MODEL



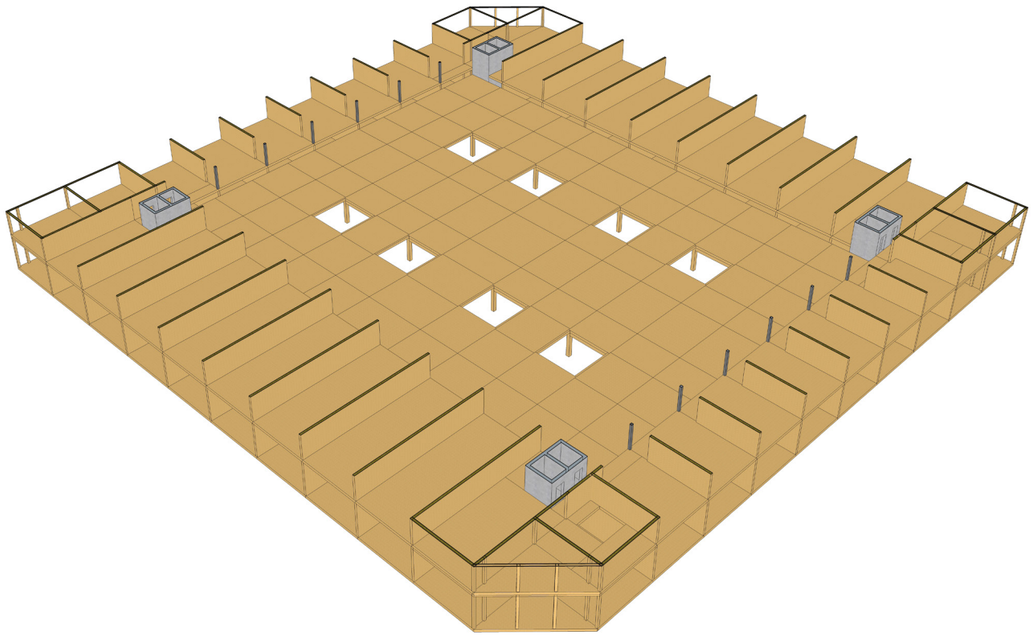
GROUND LEVEL

A clear overview of the 243mm thick CLT walls as starting point for the building and 350x350mm CLT columns for the basement. As said before, the corners are having a network of columns and beams for architectural reasons.



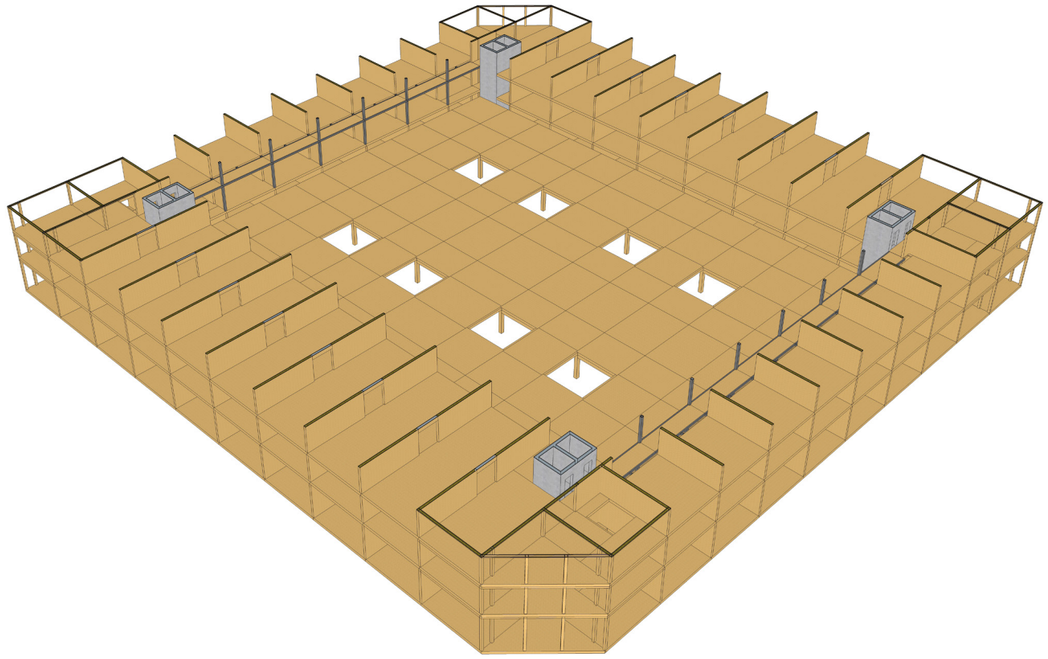
BELT CONSTRUCTION BASEMENT

A belt is used which connects the basement structure with the load bearing structure of the building to create stability. When needed the network of columns and beams can become more stable if steel tensile rods will be used. One remark. The floor span (and the beams) should be according to the structural scheme of page 60 be rotated 90 degrees.

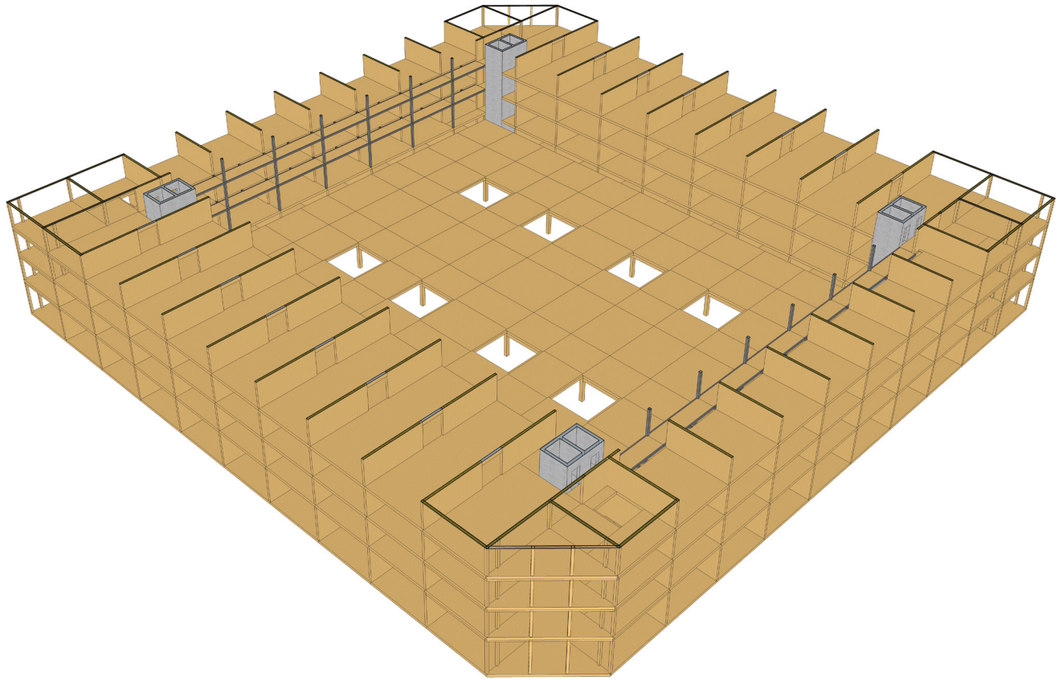


FIRST LEVEL COMMERCIAL PLINTH

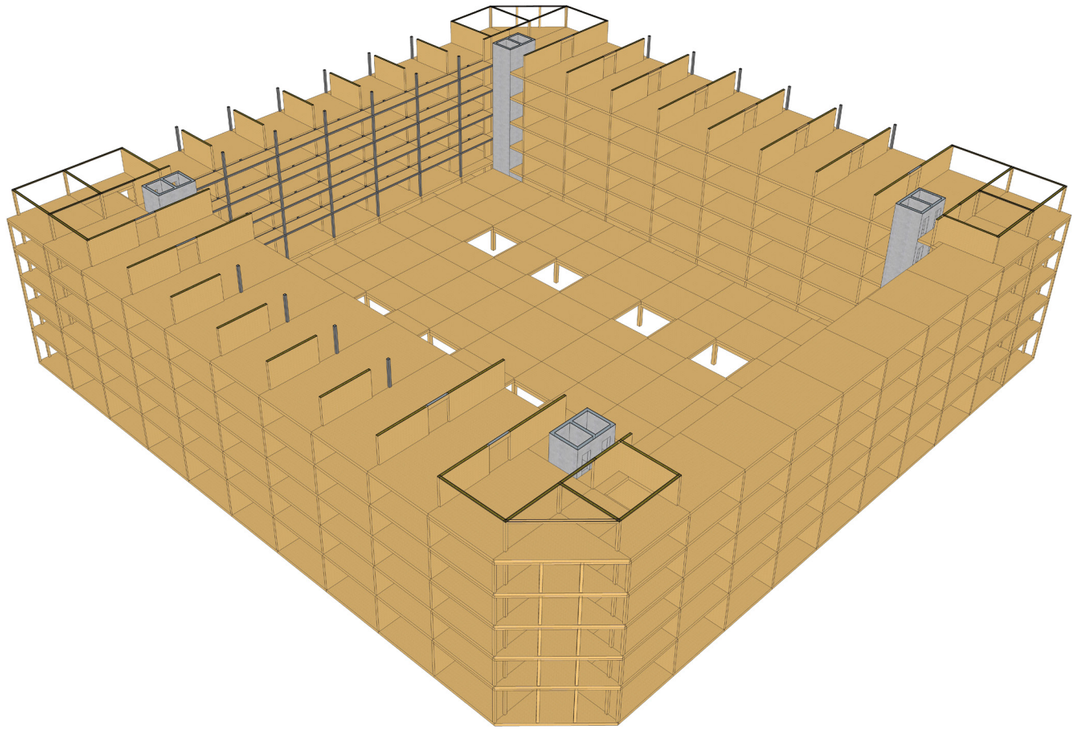
The system of the ground floor is extended. Also, a secondary (steel) structure will be realised to carry the galleries.



FIRST FLOOR

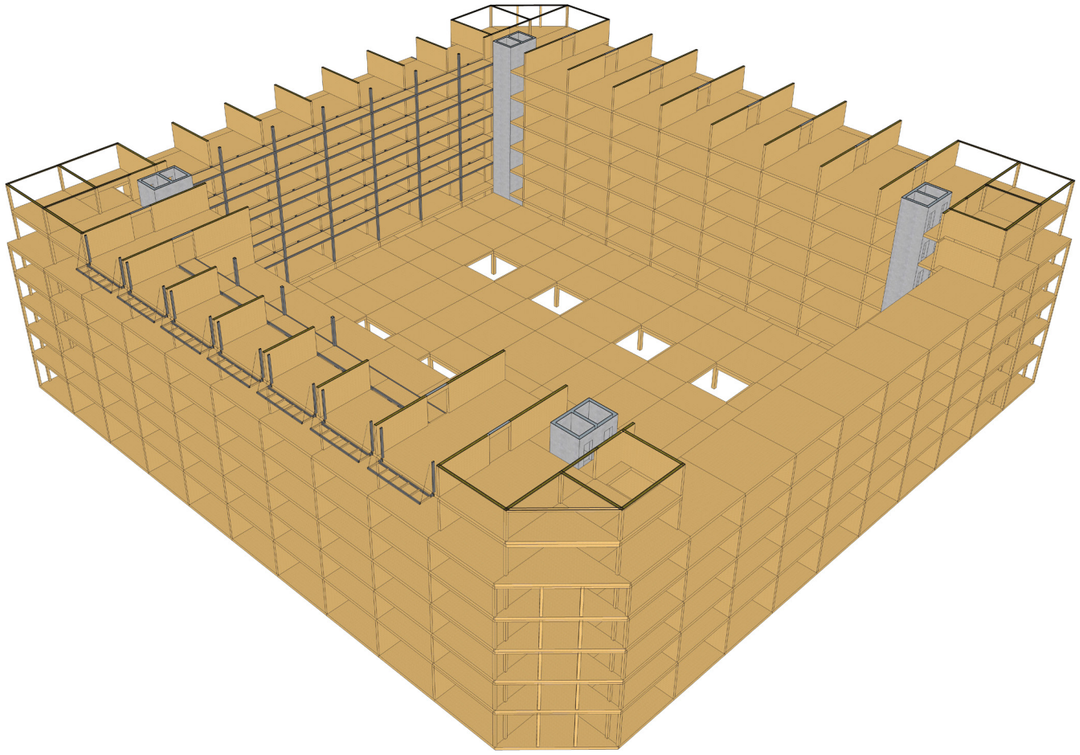


SECOND (AND THIRD) FLOOR



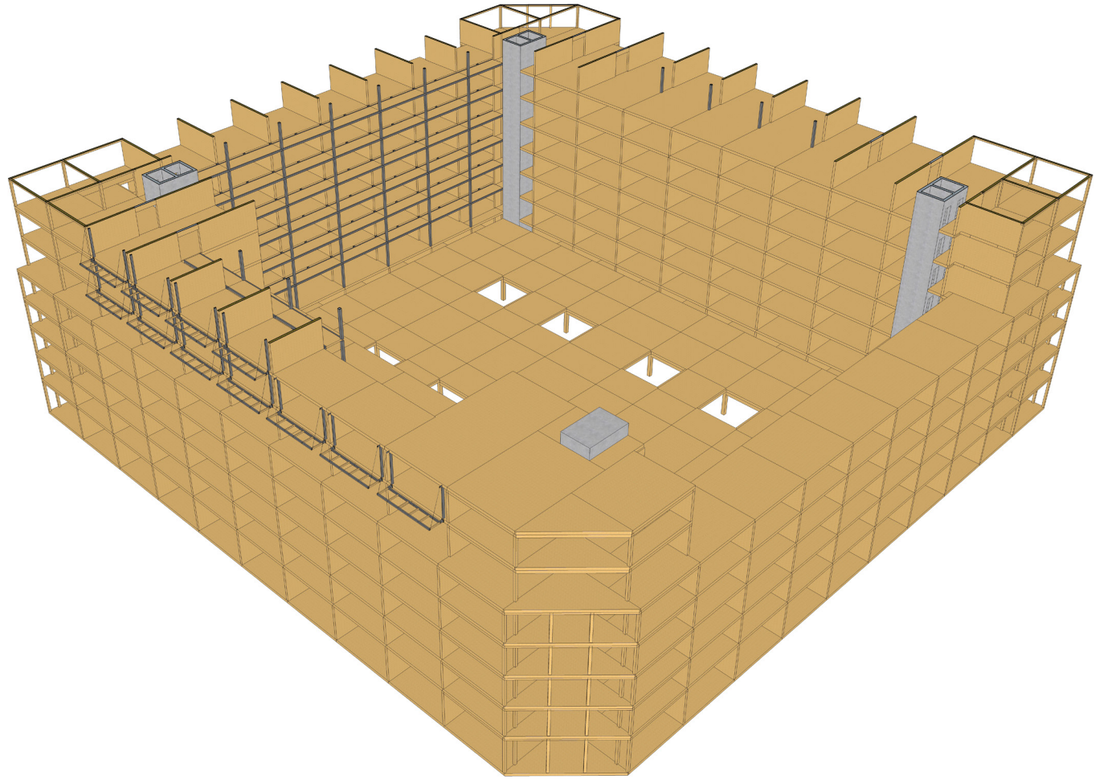
FOURTH FLOOR

Setbacks become visible. These are possible by having made the dwelling separation walls load bearing instead of the facades. Also, the secondary (steel) construction for the cantilevers become visible.



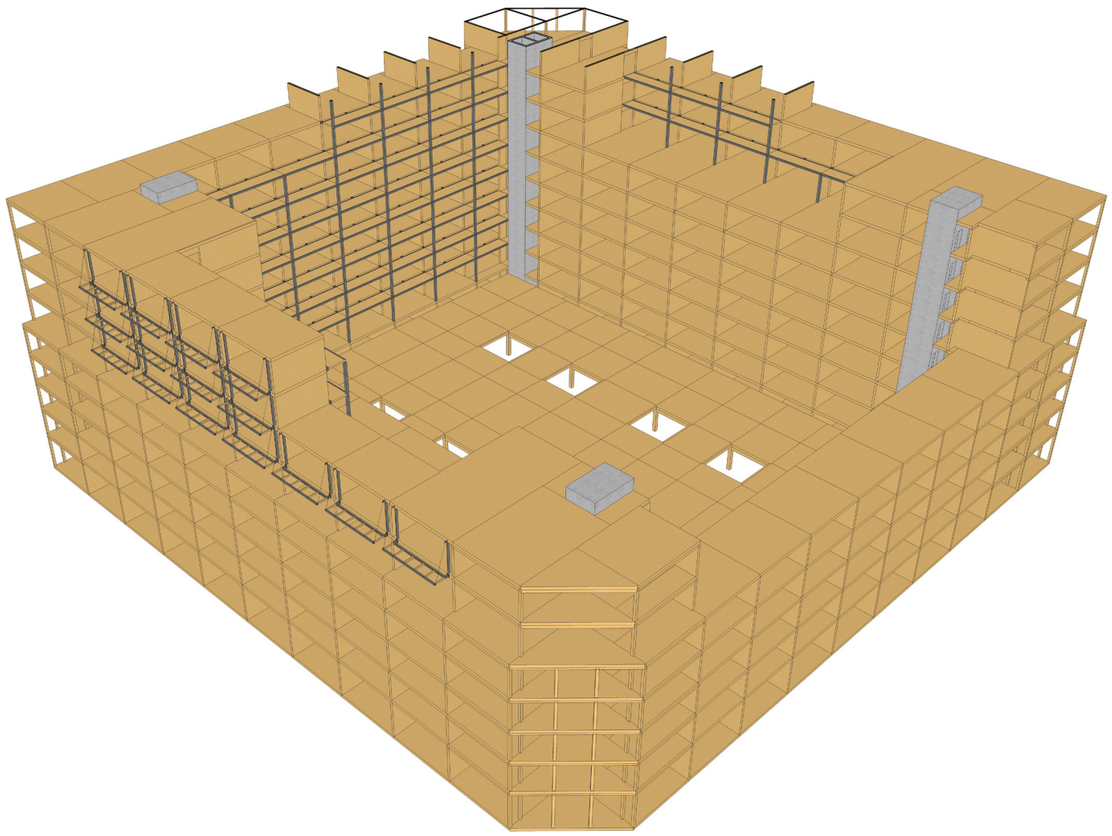
FIFTH FLOOR

The setback continues at some places. At other places the facade is again aligned with the lower floors by the cantilevers that are realised. From this floor level, balconies will be by a secondary (steel) structure attached to the primary structure.

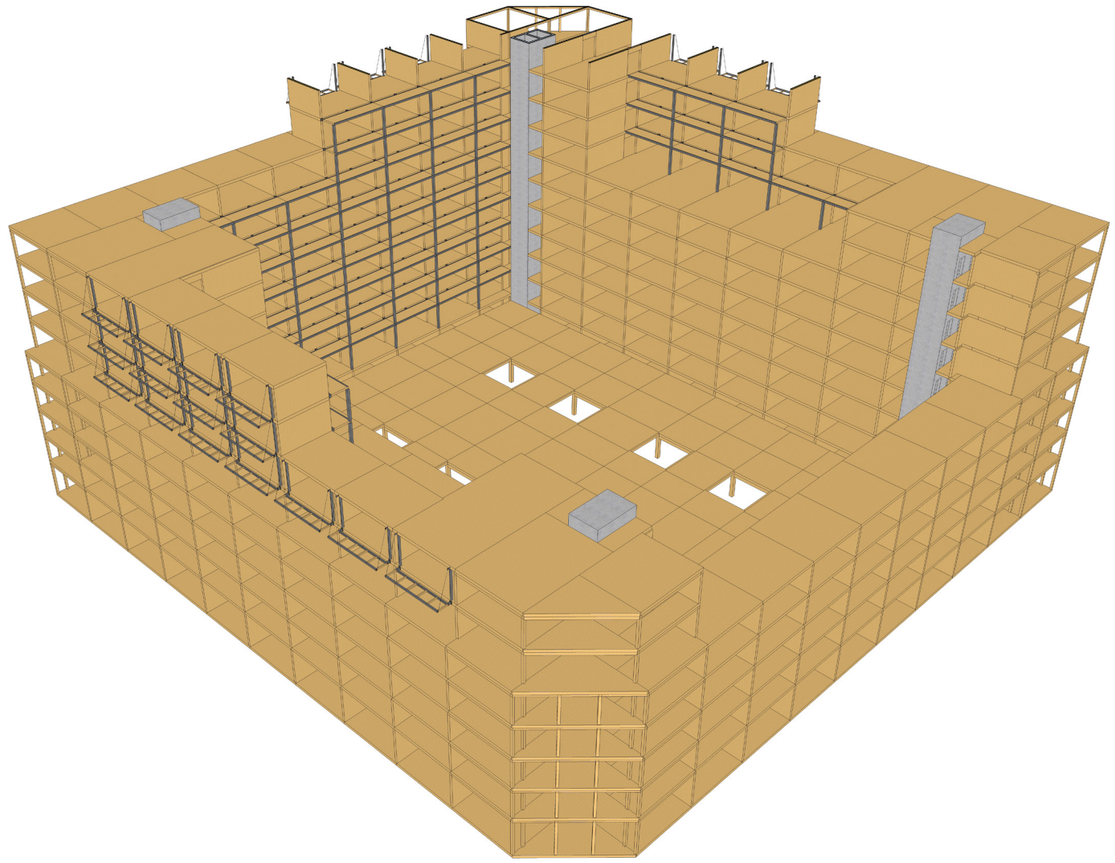


SIXTH (AND SEVENTH) FLOOR

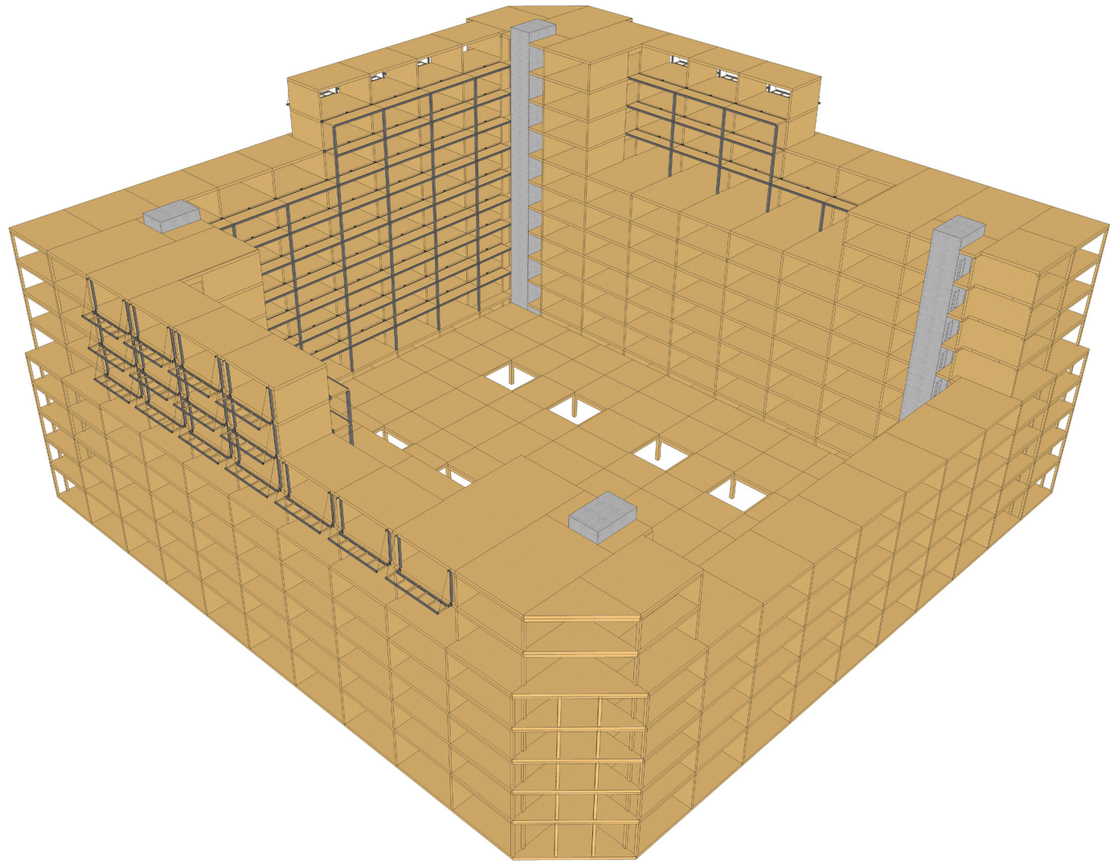
The roofs will have the same floor system. Normally, the roofs can be designed with a lighter construction. But in my case I want to make the roofs accessible and collect rainwater which results in more forces on the roofs than normal.



8TH FLOOR



9TH FLOOR



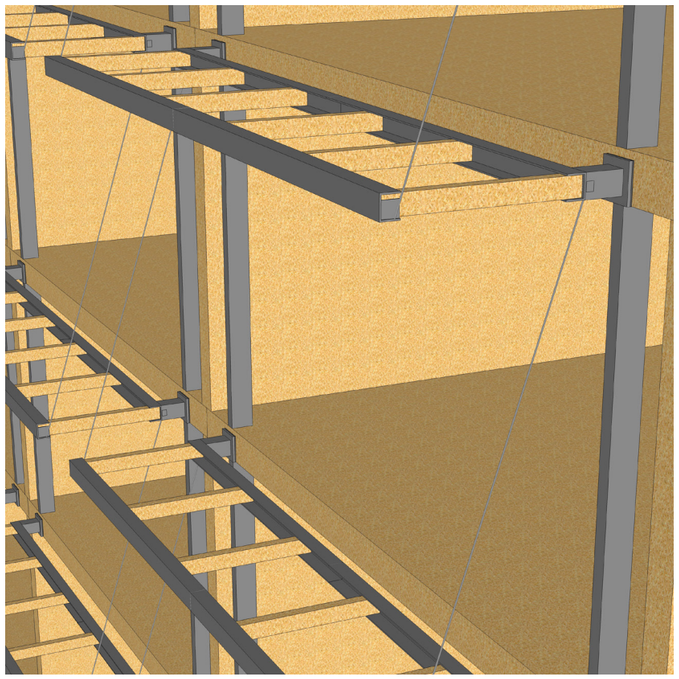
OVERVIEW

The primary CLT structure will be supported by the concrete elevator shafts for stability and a steel secondary construction to realise balconies, galleries and the cantilevers. Eventually, a hybrid construction is realised.

Remark: the balconies were from an earlier design phase. It is not present in the final design. Still it is interesting to see how it relates to the primary structure.

SECONDARY STRUCTURE - CONNECTION DETAILS

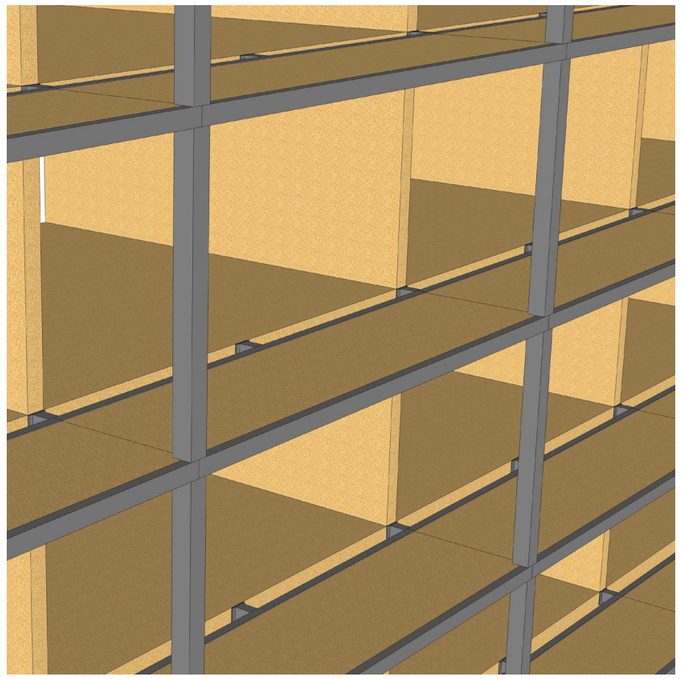
BALCONY



The assumption has been made that the load bearing CLT construction is not strong enough to carry the weight of the balcony. Therefore, a secondary steel construction with u-shaped beams is realised which transport the forces of the balcony through the CLT floor to the CLT walls. The steel profile that is connecting the balcony with the CLT floor is separated from the CLT with a rubber layer to prevent thermal leakage.

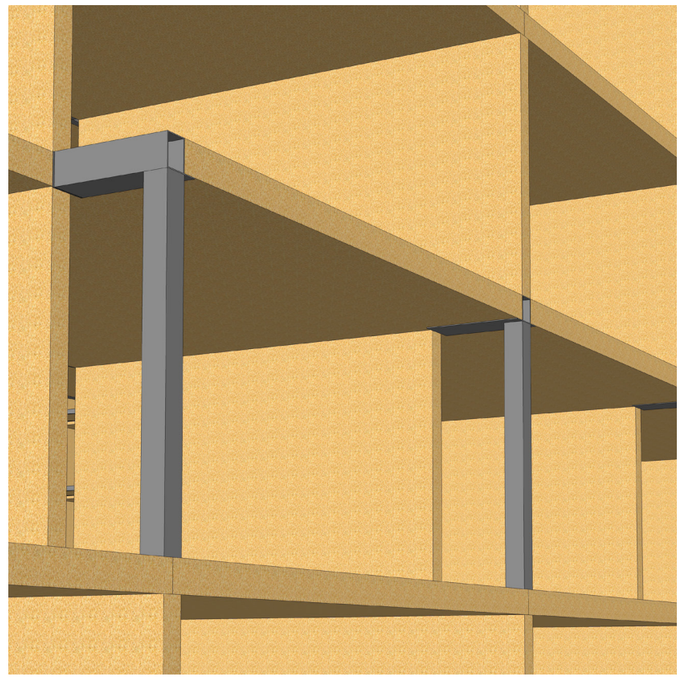
Remark: the balconies were from an earlier design phase. It is not present in the final design. Still it is interesting to see how it relates to the primary structure.

GALLERY



Just like the balcony I have chosen for a secondary structure with u-shaped steel beams. A difference is that the structure is outside which means that no steel columns are needed aligned to the CLT walls. The gallery is at some places connected to the load bearing structure with steel beams that are separated with a rubber to prevent thermal leakage. This connection is needed for stability reasons.

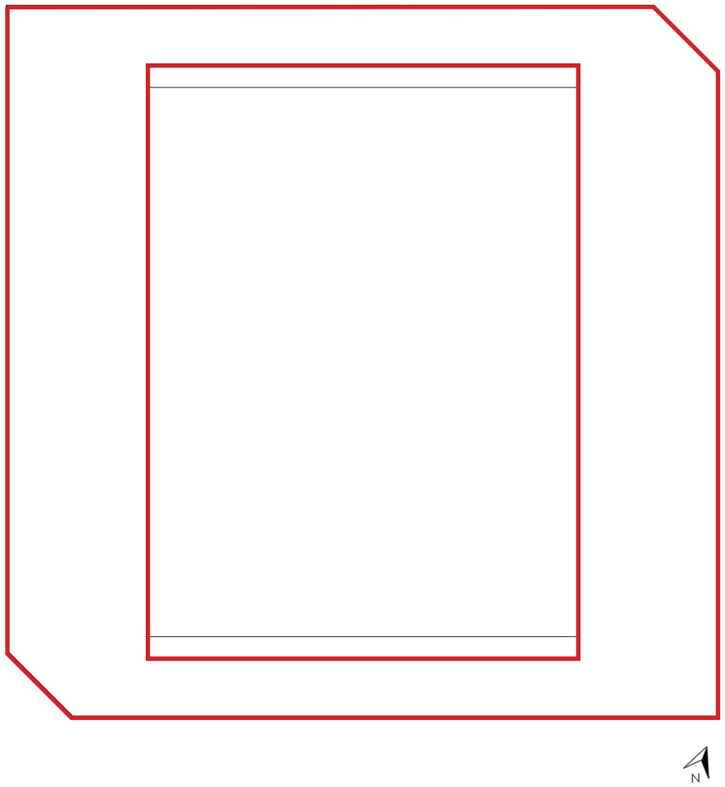
CANTILEVER



To make the 1,2m cantilevers work, I continued with applying a secondary structure. The CLT floor spans in the other direction compared to the balcony and gallery. Therefore, no beam is needed that is connected to both steel columns. The steel beams used are called “hoedliggers” and “petliggers” to reduce the construction height. Also, rubbers are here needed to prevent thermal leakage.

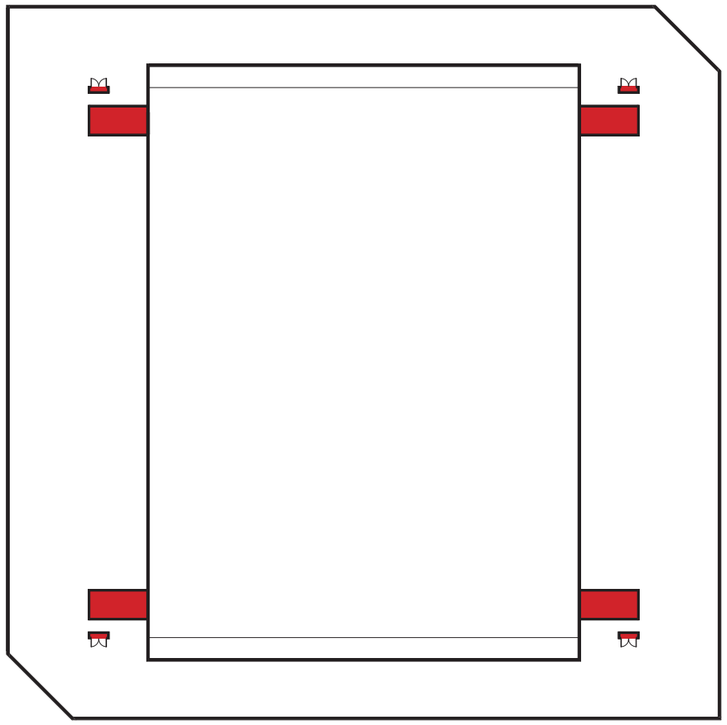
CLIMATE
DIAGRAMS

THERMAL LINE



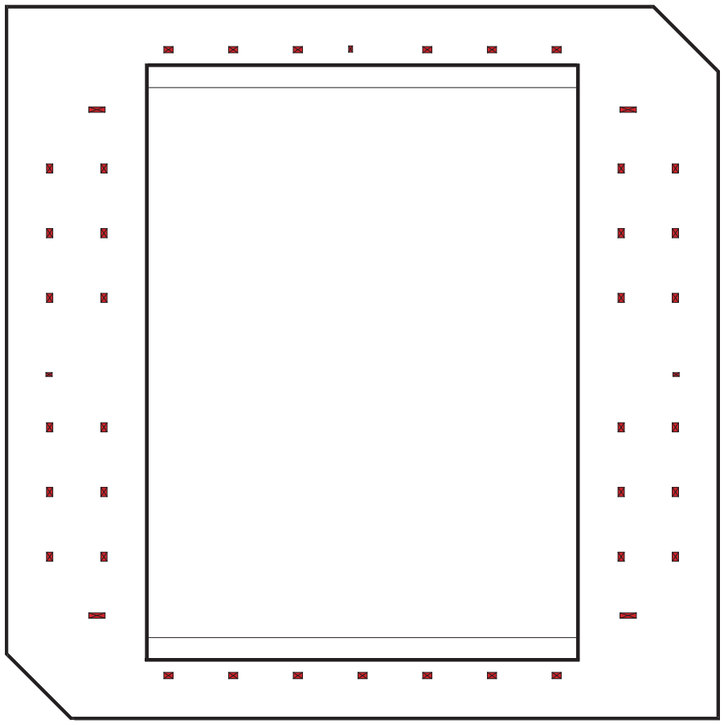
Galleries will be outside to have sunlight entering the dwelling from south direction

TECHNICAL & ELECTRICAL SERVICE ROOMS



Located at vertical circulation to have a central place from where everything can be controlled

SHAFTS

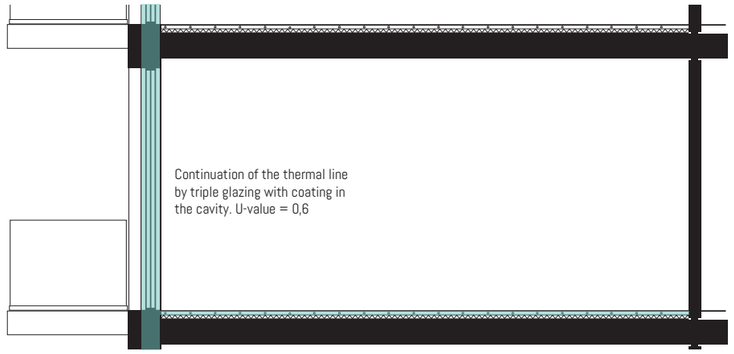


Dwelling shafts will be used for plumbing related to (sewage) water. Ventilation pipes will be horizontally organised to the big shafts close to every technical room

COMFORT IN THE COMPACT DWELLINGS

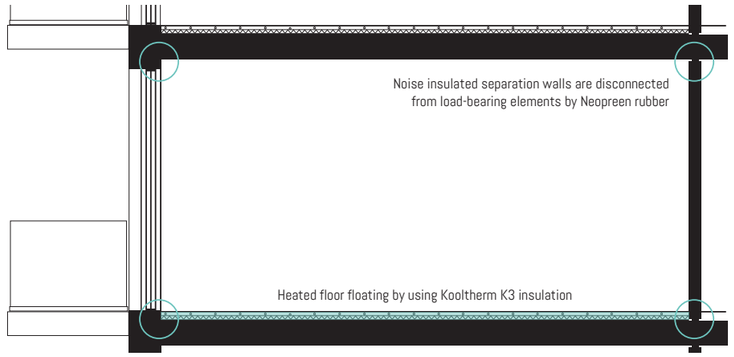
How these aspects has been realised in building technology point of view can be seen in the facade fragment and details.

THERMAL INSULATION



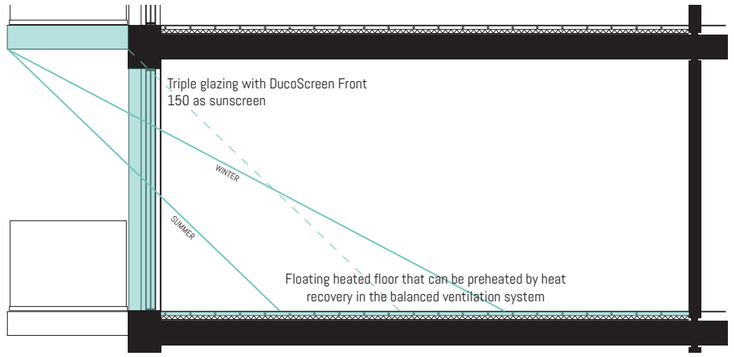
SUSTAINABLE BY: NO THERMAL LEAKAGE, ENERGY LOSS AND HIGH ENERGY BILLS

SOUND INSULATION



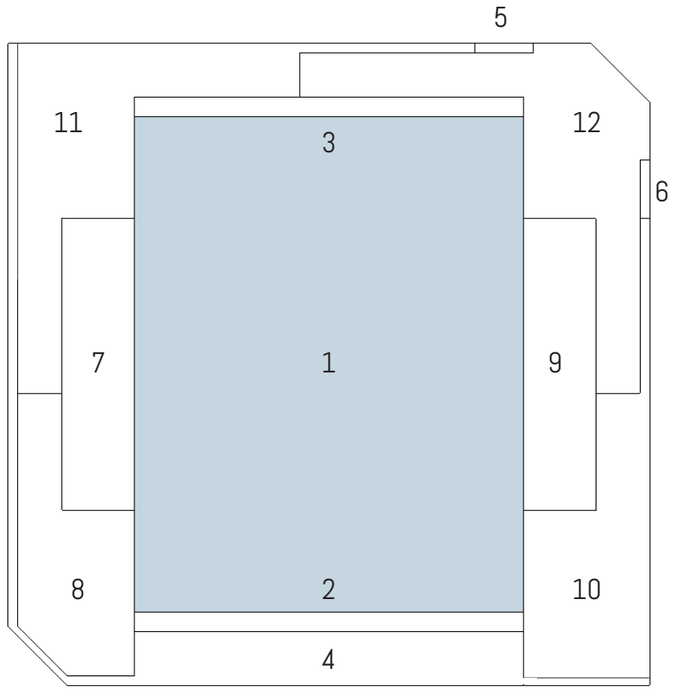
SUSTAINABLE BY: PREVENTING DISTURBANCE FROM CONTACT NOISE BOTH VERTICAL AND HORIZONTAL

REDUCING COOLING AND HEATING NEEDS



SUSTAINABLE BY: LESS COOLING NEEDED IN THE SUMMER AND LESS HEATING NEEDED IN THE WINTER

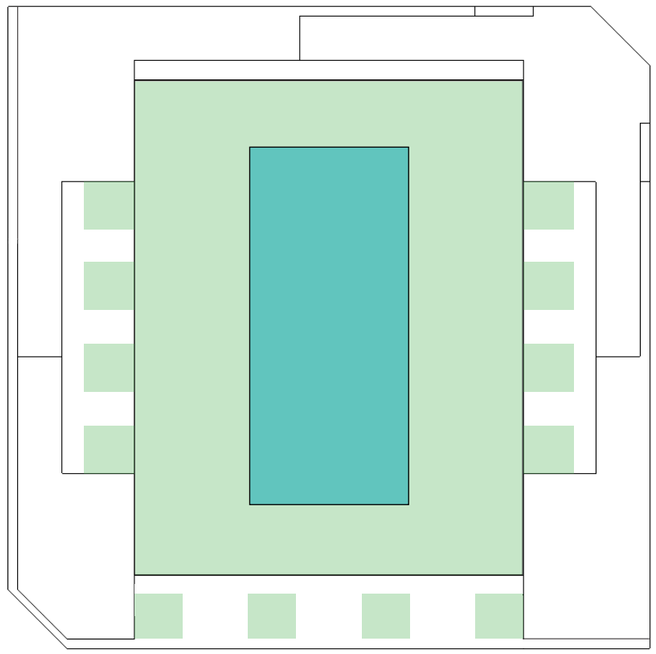
COLLECTING RAINWATER - SUMMARY OF THE RESEARCH



General statistics	
790	L/m2 = average rainfall every year
6220	m2 design area
4.913.800	L of rain every year
570	hours of rain every year
1,39	L/m2/hour of rain
8.621	L/hour of rain
8,6	m3 rainwater/hour of rain

Roof surface

Roof	Surface	Percentage	Rainfall	
1	2935 m2	47,2%	4.067,8 L /hour of rain	2.318.650 L/year
2	115 m2	1,8%	159,4 L /hour of rain	90.850 L/year
3	115 m2	1,8%	159,4 L /hour of rain	90.850 L/year
4	387 m2	6,2%	536,4 L /hour of rain	305.730 L/year
5	9 m2	0,1%	12,5 L /hour of rain	7.110 L/year
6	9 m2	0,1%	12,5 L /hour of rain	7.110 L/year
7	324 m2	5,2%	449,1 L /hour of rain	255.960 L/year
8	354 m2	5,7%	490,6 L /hour of rain	279.660 L/year
9	324 m2	5,2%	449,1 L /hour of rain	255.960 L/year
10	458 m2	7,4%	634,8 L /hour of rain	361.820 L/year
11	623 m2	10,0%	863,5 L /hour of rain	492.170 L/year
12	567 m2	9,1%	785,8 L /hour of rain	447.930 L/year
	6220 m2	**100,0%**	**8.620,7 L/hour of rain**	**4.913.800 L/year**



800 m2 surface area used for the water square.

Vegetation and soil can retain water with a capacity of 45 L/m2 (70% water retention)

SUMMARY OF THE CALCULATIONS TO MAKE IT FEASIBLE:

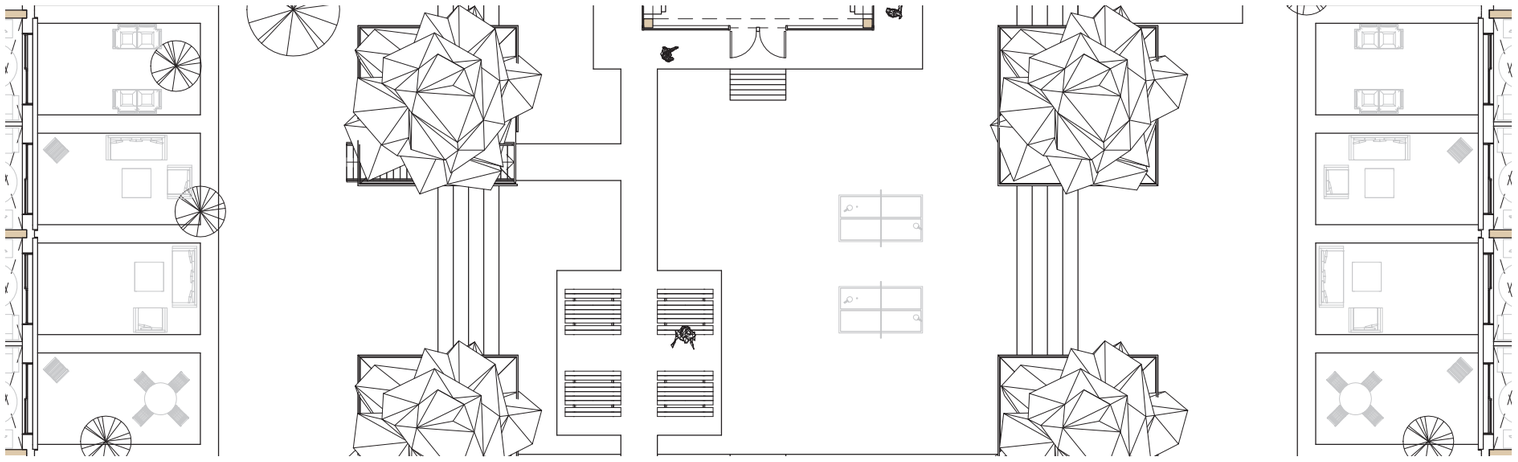
- At least 373.800 L rainwater should be able to be stored to cover a 60 L/m2 rainfall period. The storage tanks will be big enough to also cover the less extreme but longer rainfall periods.
- 163.945 L (43,9%) of rainwater will be absorbed by vegetation and 161.855 L (43,3%) can be used to flush the toilets. 48.000 L (12,8%) of rainwater will directly land in the water square.
- 75,0% of the annual toilet usage in the building can be covered by using rainwater which is equal to the toilet usage of 315 persons per year. A special coating is used in the toilets that reduce the needed amount of water with 44,9%. The amount of rainwater that can be used for flushing the toilets is equal to the annual water usage of 46 persons (10,9% of the total persons in the building).

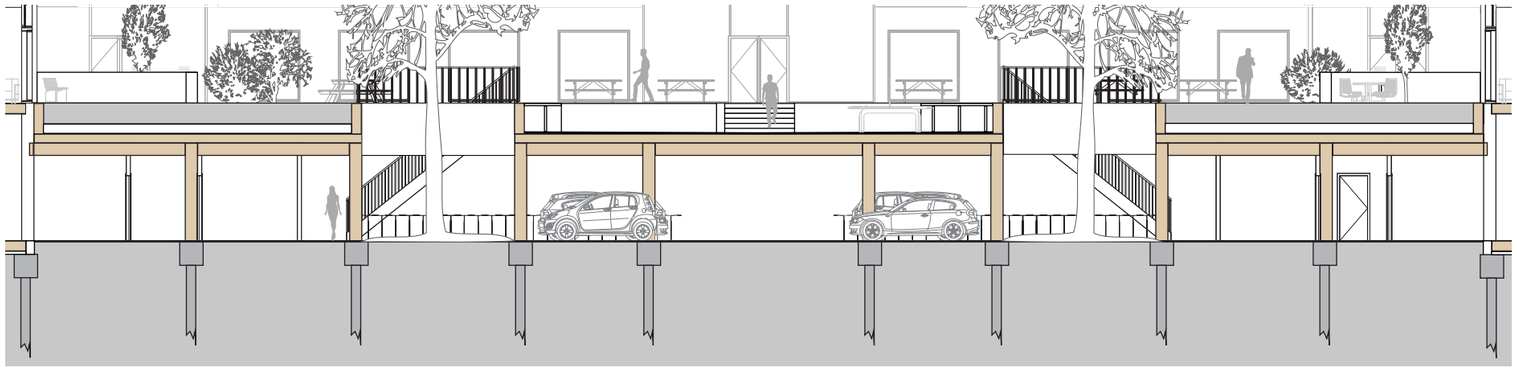
TO PUT THE CALCULATIONS INTO PERSPECTIVE:

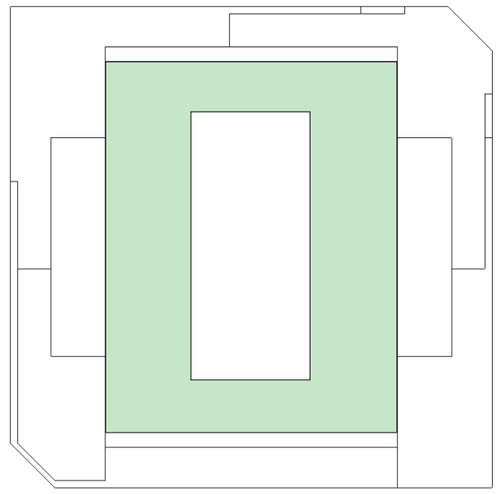
- Building will be resistant to rainfalls of 60 L/m2 which is 43,2 times more extreme rainfall periods compared to the annual average.
- From 50mm of rain/hour it is called heavy rain, which occurs at least 6 times every summer in the Netherlands.

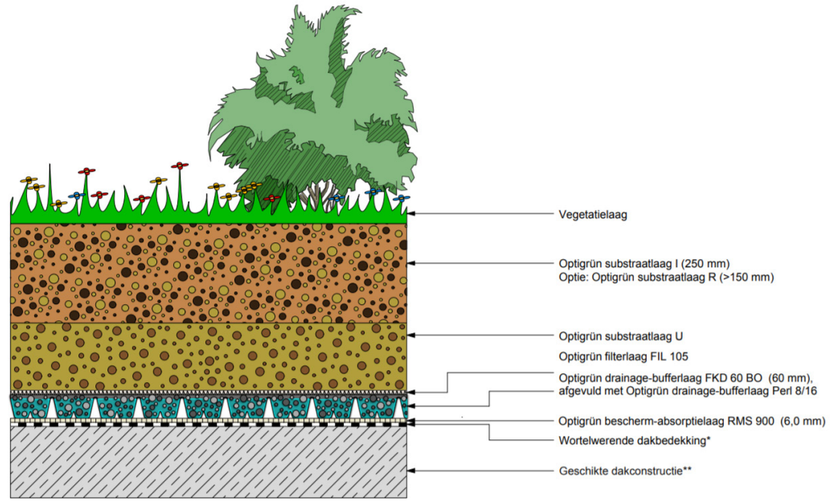
COLLECTING RAINWATER - CONCEPT

ABSORBING WATER BY USING VEGETATION



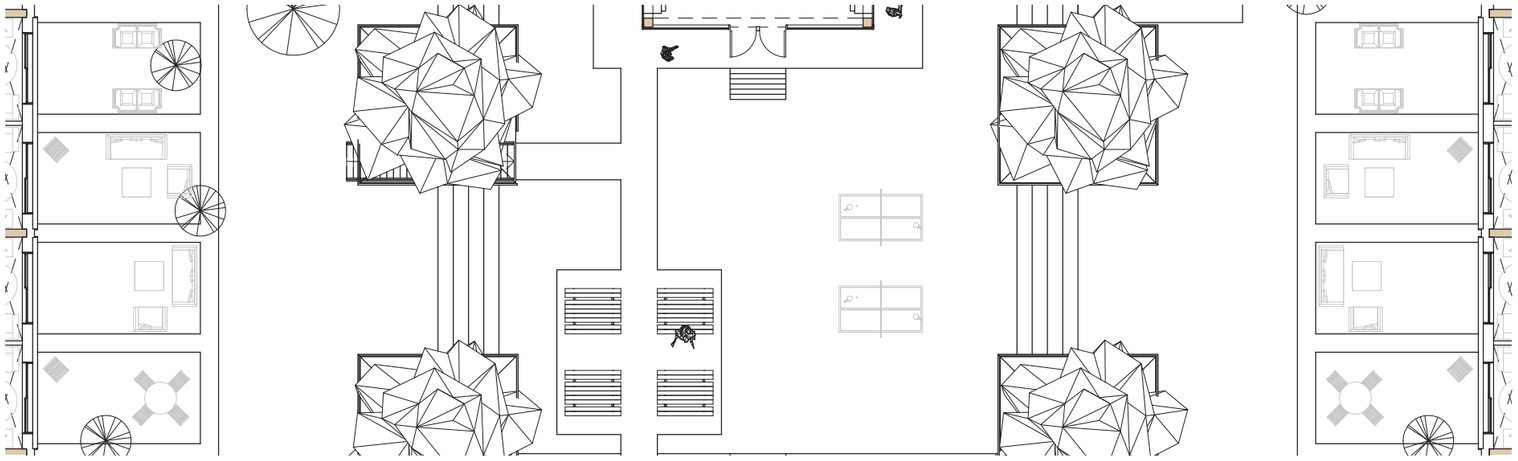


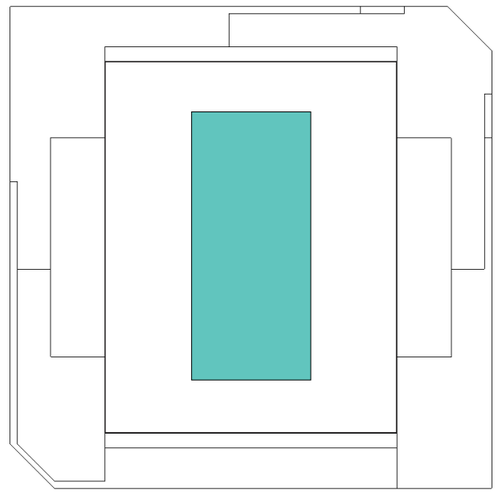


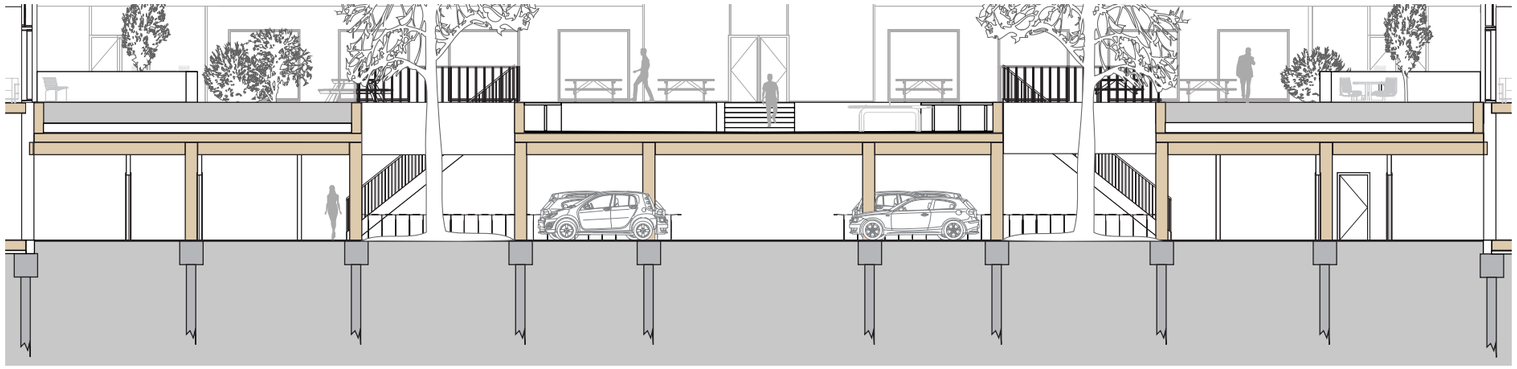


A variation in the courtyard is visible in how the building deals with the extreme rainfall. On one hand I applied a relatively dense vegetation that uses the concept of Optigroen (see image on the right). With this vegetation system 70% - 99% of the fallen rainwater will be absorbed by the vegetation and soil. The remaining will be transported to the water square. The courtyard is 2935 m^2 of which 2135 m^2 will be soil/vegetation. That means that during an extreme rainfall of 60L/m^2 163.945 L will fall on that area. A maximum of 49.184 L of rainwater can be transported to the water square. Enough height is reserved between the CLT structure and the soil to filter the water and transport it.

WATER BUFFER IN THE FORM OF A USEABLE WATER SQUARE

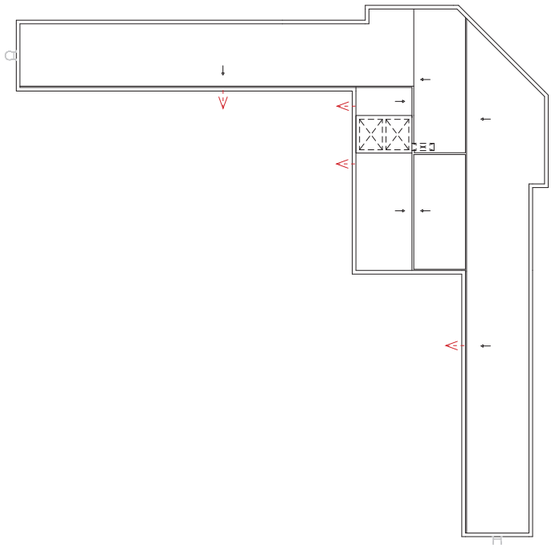




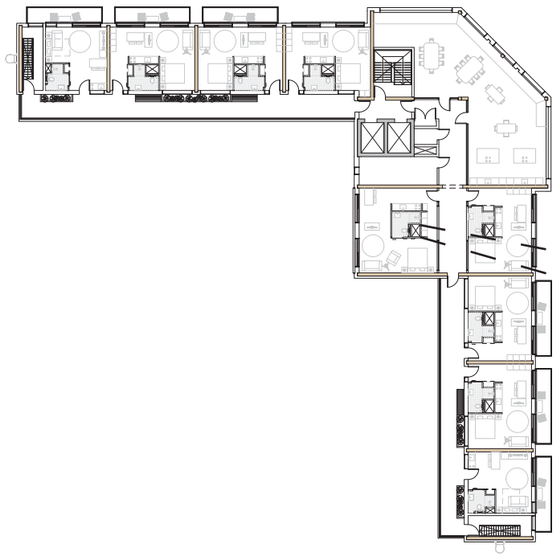


The other way to deal with extreme rainfall is the water square. This water square has the same characteristics as the famous Benthemplein water square in Rotterdam (see the image on the right). It is a square that can be used by people when it is not raining. When it rains it will function as water storage. However, the rainwater in the square won't be transported to the sewage system but can be used to litter the vegetation in the courtyard since we also face extreme dry periods. As said earlier, a maximum of 30% of the fallen rainwater on the soil/vegetation will go to the water square. With an area of 800 m^2 for the water square means that 48.000 L will fall directly in the square. So, the square should have a minimum capacity of 97.184 L in case of one extreme rainfall period. With the design I have made I have created an overcapacity because it can store 351.300 L of rainwater. This overcapacity is done to enhance the quality of the square and to create a better balance between vegetation and square.

COLLECTING RAINWATER ON THE ROOFTOPS TO FLUSH THE TOILETS



ROOF P = +39.500



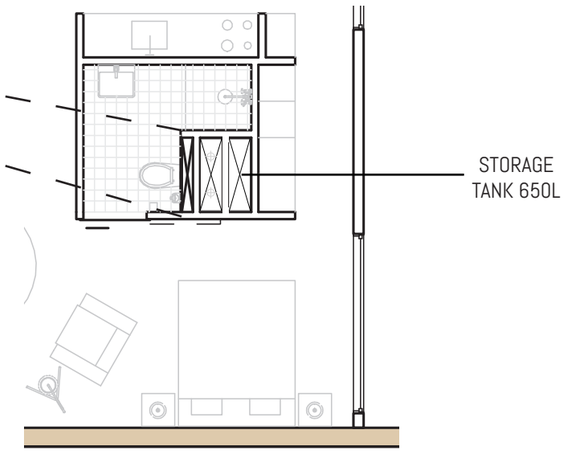
9th Floor P = +36.000

RAINWATER TRANSPORTATION:

- On every roof a network of sloped insulation will be applied to transport the rainwater.
- The shaft next to the elevators are related to the technical rooms. From there, the water will be transported to each storage tank that is located in the shafts of the dwellings.
- Voids in the roof edge are needed as emergency exit for the rainwater when for whatever reason it can't be transported to the storage tanks.
- This system is applied on every corner which makes it possible to collect as much rainwater as possible and to divide the water load on the structure.

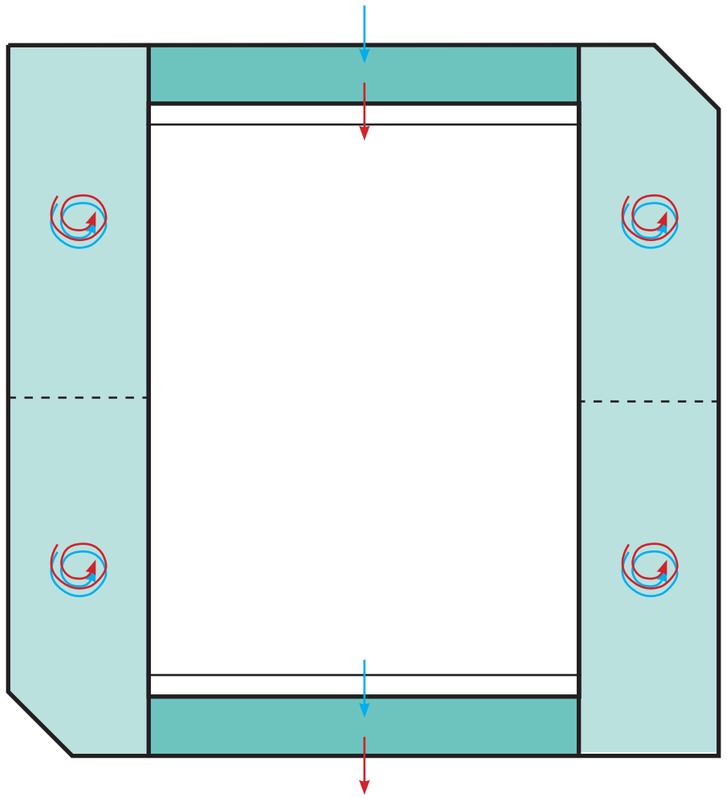
DIMENSIONS STORAGE TANK

- 161.855 L of rainwater should always be able to be stored.
- 258 storage tanks in the dwellings (next to the shafts) will be used to divide the weight of the water and reduce the distance for toilet usage.
- Each tank should have a capacity of at least 627 L.
- The dimensions for each tank will be 250x1000x2600 mm (lxwxh). An overcapacity will be applied for maintenance and to have a buffer in case less rainwater will be absorbed by the vegetation.



VENTILATION - DIAGRAMS & CALCULATIONS

ZONES



Balanced mechanical ventilation (Type D)

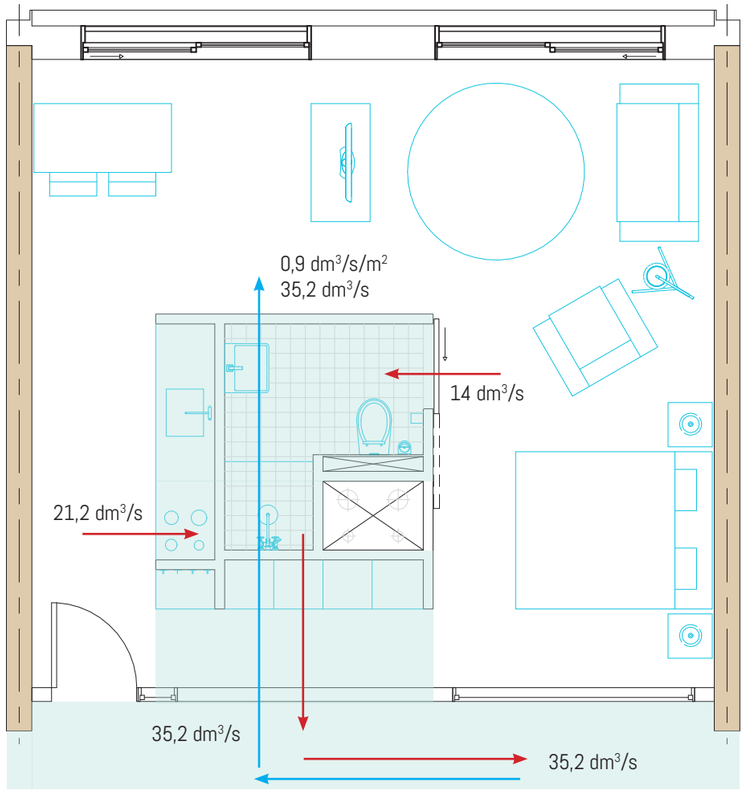
Natural ventilation (Type A)

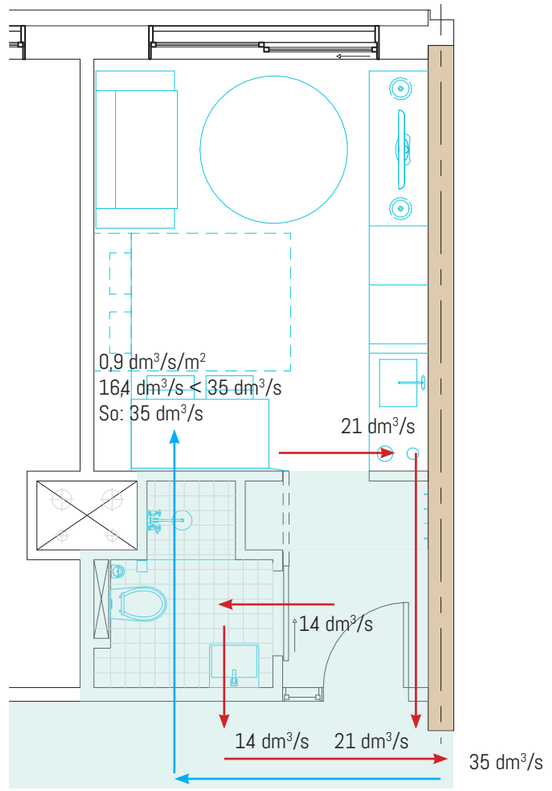
Separation of two of the same ventilation systems to create smaller zones

Due to the dwelling orientation an indoor and outdoor circulation space is realised. Therefore, two ventilation systems will be used to prevent difficult and expensive details when willing to apply one system.

Remark: The natural type A ventilation concept might also be changed to Type B, which means that the shafts in the dwellings will be used to extract the dirty air which will exit at the roof. From now on, the focus will be on the balanced ventilation.

CAPACITY (FOR THE MOST COMMON DWELLING TYPES A AND B)





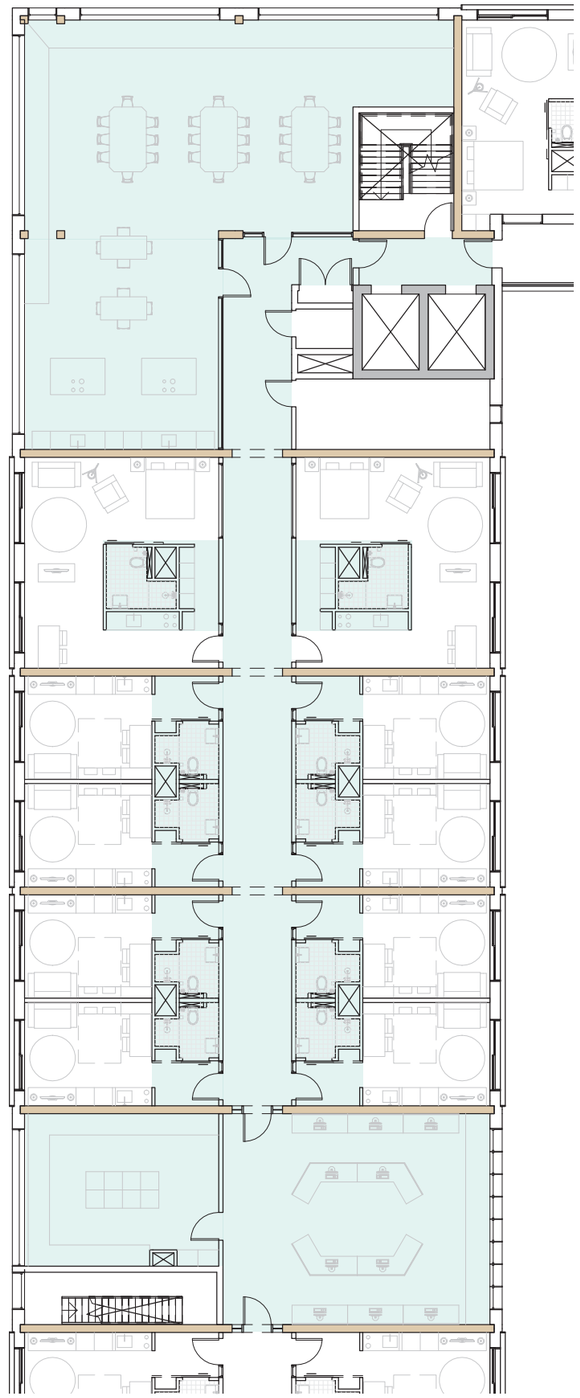
Lowered ceiling for horizontal piping network

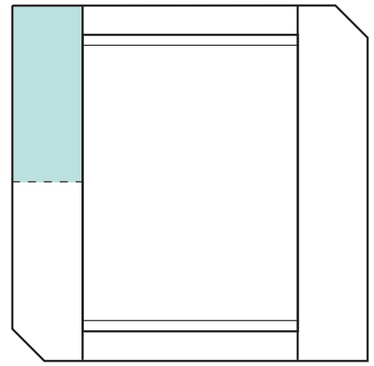
Due to the compact dwellings a very small difference in ventilation demand is visible between the biggest and smallest dwelling. This means that all the other dwelling types will have a ventilation demand of 35 dm³/s as well.

Every zone with balanced mechanical ventilation will ventilate 10 dwellings and 1 or 2 collective spaces. For the dwellings, a capacity of 350 dm³/s (1260 m³/h) is needed. The collective spaces are ranging from 50 to 150m². The needed ventilation capacity is 0,5 dm³/s/m² for collective spaces, which means that in each zone between 25 and 75 dm³/s of ventilation is needed. The functions in these spaces can cause smell, heat and moisture which means that it needs to be ventilated properly. Therefore, the assumption is made that every collective room should be ventilated with 75 dm³/s (270 m³/h). This results that for every zone a minimal ventilation capacity of 1530 - 1800 m³/h is needed.

VENTILATION - OVERVIEW LOWERED CEILINGS

It becomes visible that a lot of ceiling will be lowered. This won't be any problem because of the raised floors (3,5m instead of 3,0m) I have applied from the start of the design. Even with the lowered ceilings enough height will remain to meet the minimal height regulations. An advantage is that the dwellings only partly have a lowered ceiling which means that the third dimension is kept to enhance the quality of living in the compact dwelling.

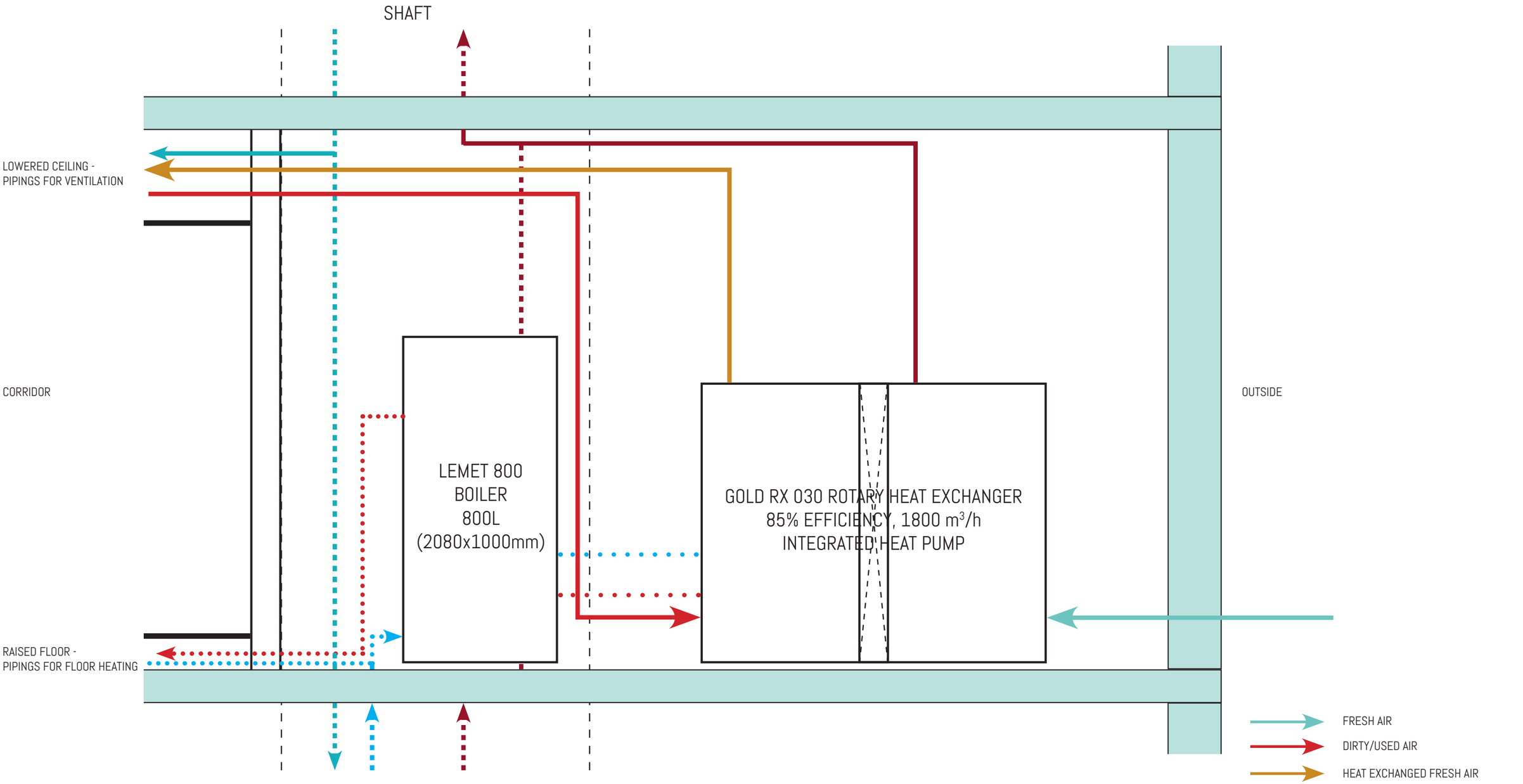




1st Floor P = +8.000

5 m
1 : 200

ORGANISATION TECHNICAL ROOM

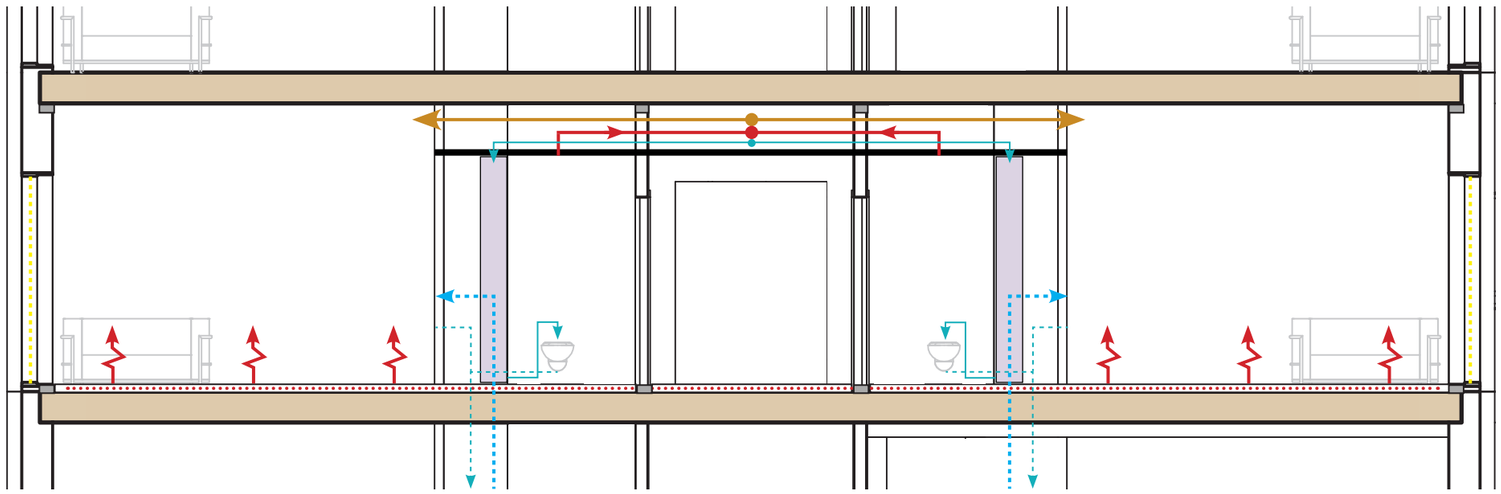


The technical room contains two devices. The first device is the air treatment device. It makes sure that a balanced ventilation is realised. 85% of the energy can be reused by exchanging heat. This means that the fresh air that will go to the dwellings and collective spaces will be warmer (in winter) and colder (in summer) than the outside air temperature. Less energy is needed which makes it sustainable. The assumption is made that the air can't be heated or cooled enough so a floor heating/cooling system will be used. Therefore, an 800L boiler is needed to have enough water for the 10 dwellings and 1 or 2 collective spaces per zone. This system is sustainable as well, because the rotary heat exchanger of the air treatment device both heats and cools the air and water. The incoming water of the boiler will be hotter than normal which reduces the energy needed.

CLIMATE CONCEPT OVERVIEW

To summarise:

- Mechanical balanced ventilation which needs lowered ceilings to hide the pipings (architectural choice). Fresh air is preheated by heat recovery from the air treatment device. The dirty air will go through the main shaft at the technical room to the roof.
- The preheated fresh air won't be sufficient to heat (or cool in summer) the dwelling units. Therefore, a floor heating/cooling system will be applied. The piping is located underneath the corridor floor which automatically aligns the floor height with the dwelling floor height.
- Collected rainwater can be used to flush the toilets and will afterwards be transported through the dwelling shafts to the sewage system. Each dwelling has their own rainwater storage tank.
- The triple glass windows make sure that enough day- and sunlight can enter the compact dwelling unit. A vertical sunscreen is applied that can be controlled by the residents.
- The dwelling separation walls are indirectly connected to the load-bearing structure to create a noise transport barrier.



HEAT EXCHANGED FRESH AIR

DIRTY/USED AIR

FRESH WATER

RAINWATER

USED WATER

COLD WATER FLOOR HEATING SYSTEM

HOT WATER FLOOR HEATING SYSTEM

FLOOR HEATING

SUNSCREEN

650 L RAINWATER STORAGE TANK

RUBBER TO REDUCE TRANSPORT OF CONTACT NOISE

6. IMPRESSIONS

STREET LEVEL

SOUTH CHAMFERED CORNER

CAFÉ

NORTH FACADE

NORTH CHAMFERED CORNER

EAST AND SOUTH FACADE

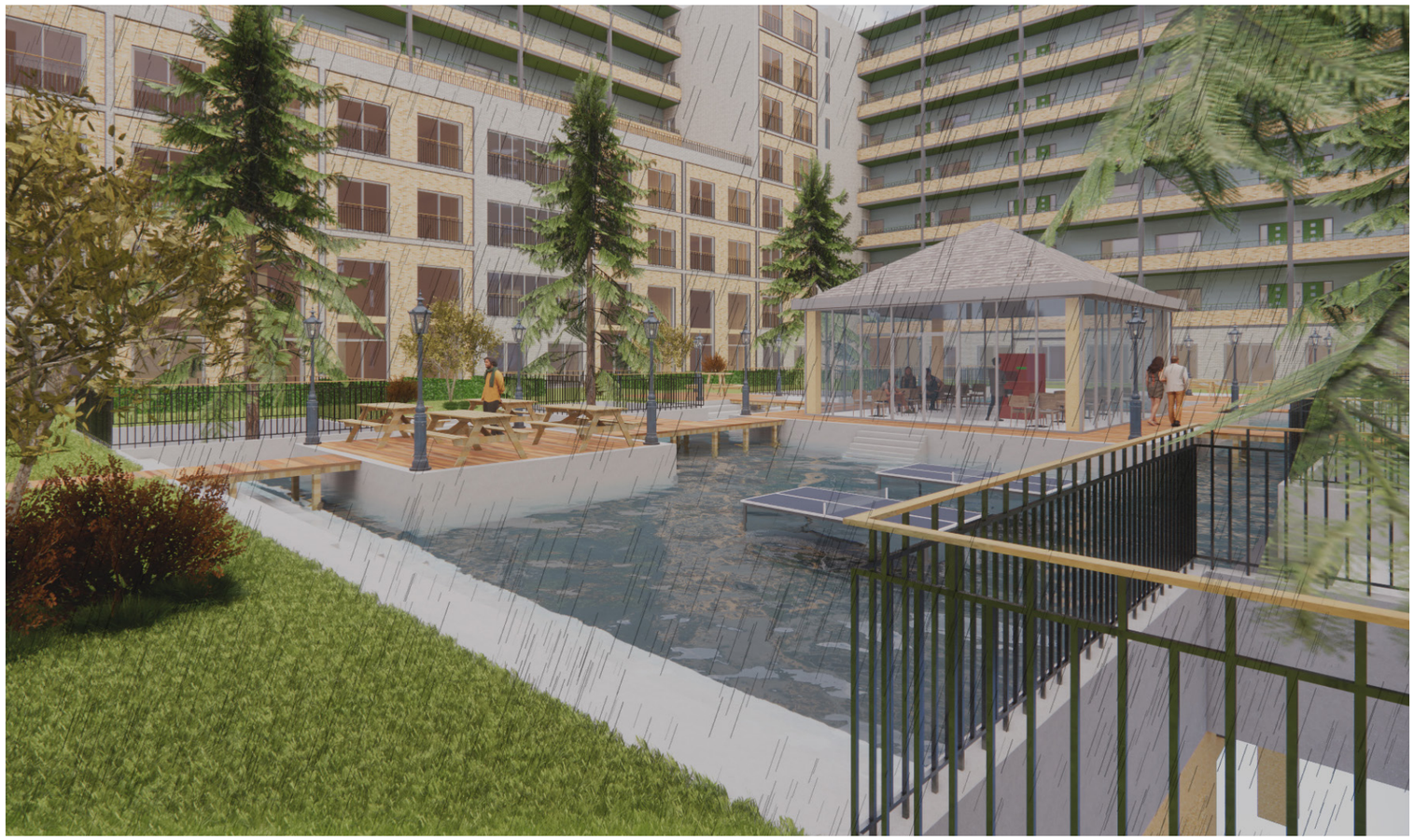
GALLERY

CORRIDOR

DWELLING STUDIO (TYPE A)

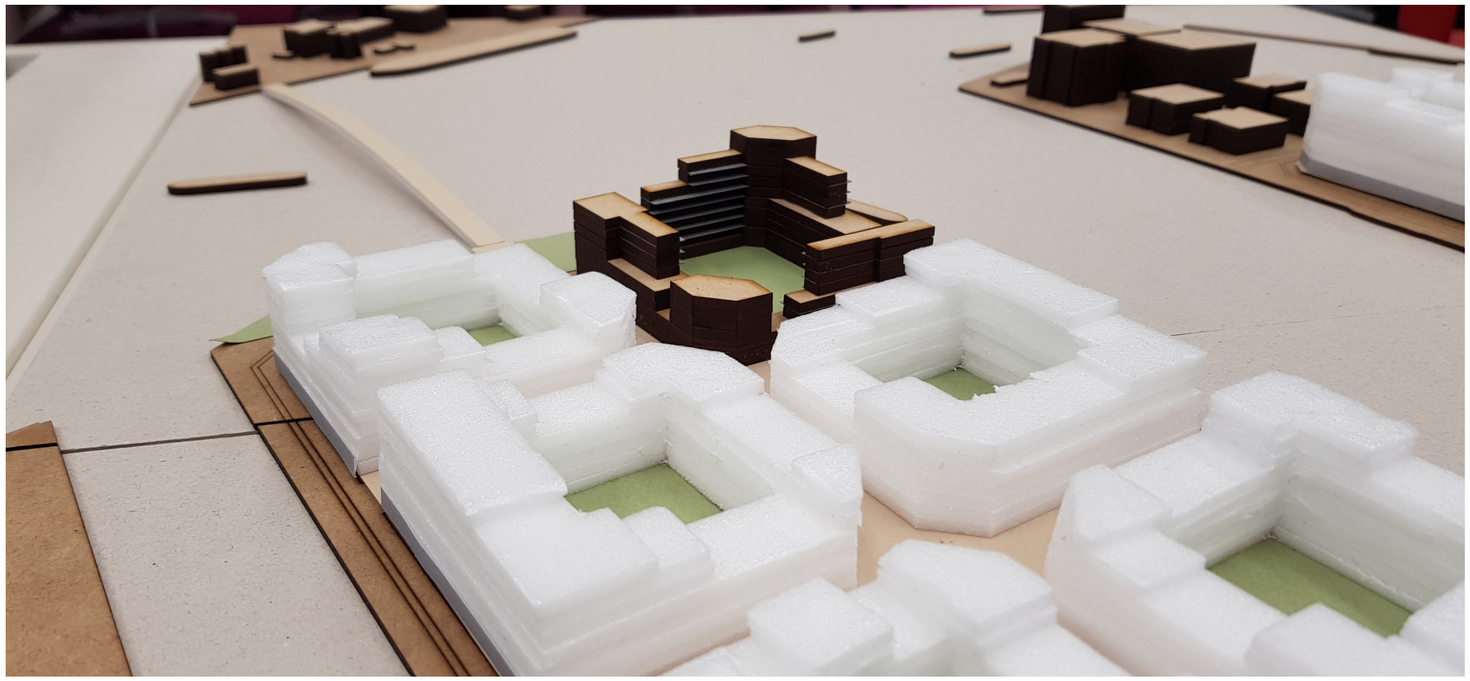
COURTYARD - DRY

COURTYARD - RAIN



7. MASSING MODELS

1:1000 URBAN MASTER PLAN - PICTURES ARE CONTAINING OLD MASSING PROPOSAL



1:200 MODEL - USED FOR DEFINING NEW MASSING AND FACADE RESEARH