PRODUCTIVE NEIGHBORHOODS
RESEARCH BY DESIGN

Keywords: housing crisis, agricultural transition, industrial urban areas, transformation, local ecologies, inclusive neighborhoods, affordable housing.

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3rd of July, 2024

Advanced Housing Design
AR3AD100

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INTRO DUCTION

This design report illustrates how the research strategies, as formulated in the research report by the author ‘Towards Productive Neighborhoods’ (J. Vermeulen, 2024), can be applied to case studies on various scale levels. These range from the national scale, to the urban planning scale, the architectural scale, the level of the dwelling and even down to the details and materials. Potential solutions are investigated by research through design in addition to the theoretical research in the research report. The design research is based around the research question:

“Can industrial urban areas be redeveloped in response to the agricultural transition and mitigate the housing crisis with inclusive, affordable housing communities?”

The design research is subdivided into several chapters that aim to introduce the problem statements, the research scope and answer the subquestions:

“Why do we face a housing crisis & what does an agricultural transition entail?”

“How can industrial urban areas be redeveloped into mixed-use neighborhoods?”

“Can industrial buildings be transformed into mixed-use housing communities?”

“How to realize affordable housing types without losing essential qualities?”

This aims to find answers to these question through research by design. It starts by exploring an industrial urban area in Rotterdam; the Spaanse Polder. Through the gathering of data and information, a better profile is illustrated of the area, and the future plans. A strategy is formulated that aims to re-arrange the urban fabric while respecting the existing functions. A more efficient use of space could allow for a mix of various functions which can co-exist in harmony. The second part of the research zoom in to the architectural scale, investigating how an existing building could be transformed into a mixed-use building. Topics such as massing studies, circulation principles, structural integrity, and the programmatic mix are discussed. After establishing a general architectural approach, part three of the research takes off; designing dwellings. Not just ordinary homes, but living clusters. Larger units that house a variety of dwelling types for a broad range of tenants. Collective use and social interaction is an important starting point for the arrangement of space. Every floor plan has dedicated ‘shared spaces’ for social gathering and leisure. From shared courtyards, to shared kitchens for optimal interaction and community building. The last part of the research delves into the building technology; how can such an idea be realized and constructed? The last chapter discusses themes as sustainability and circularity principles. Structural integrity, installation technique and climate design, and facade engineering and detailing with local bio-based materials.

RESEARCH QUESTION

NATIONAL STRATEGIES

I

WHY DO WE FACE A HOUSING CRISIS AND
WHAT DOES AN AGRICULTURAL TRANSITION ENTAIL?

II

URBAN STRATEGIES

CAN INDUSTRIAL URBAN AREAS BE REDEVELOPED
INTO MIXED-USE NEIGHBORHOODS?

CAN **INDUSTRIAL URBAN AREAS** BE **REDEVELOPED** IN RESPONSE TO THE **AGRICULTURAL TRANSITION** AND MITIGATE THE **HOUSING CRISIS** WITH **INCLUSIVE, AFFORDABLE HOUSING COMMUNITIES**?

CAN INDUSTRIAL BUILDINGS BE RE-PURPOSED INTO
MIXED-USE, INCLUSIVE HOUSING COMMUNITIES?

BUILDING STRATEGIES

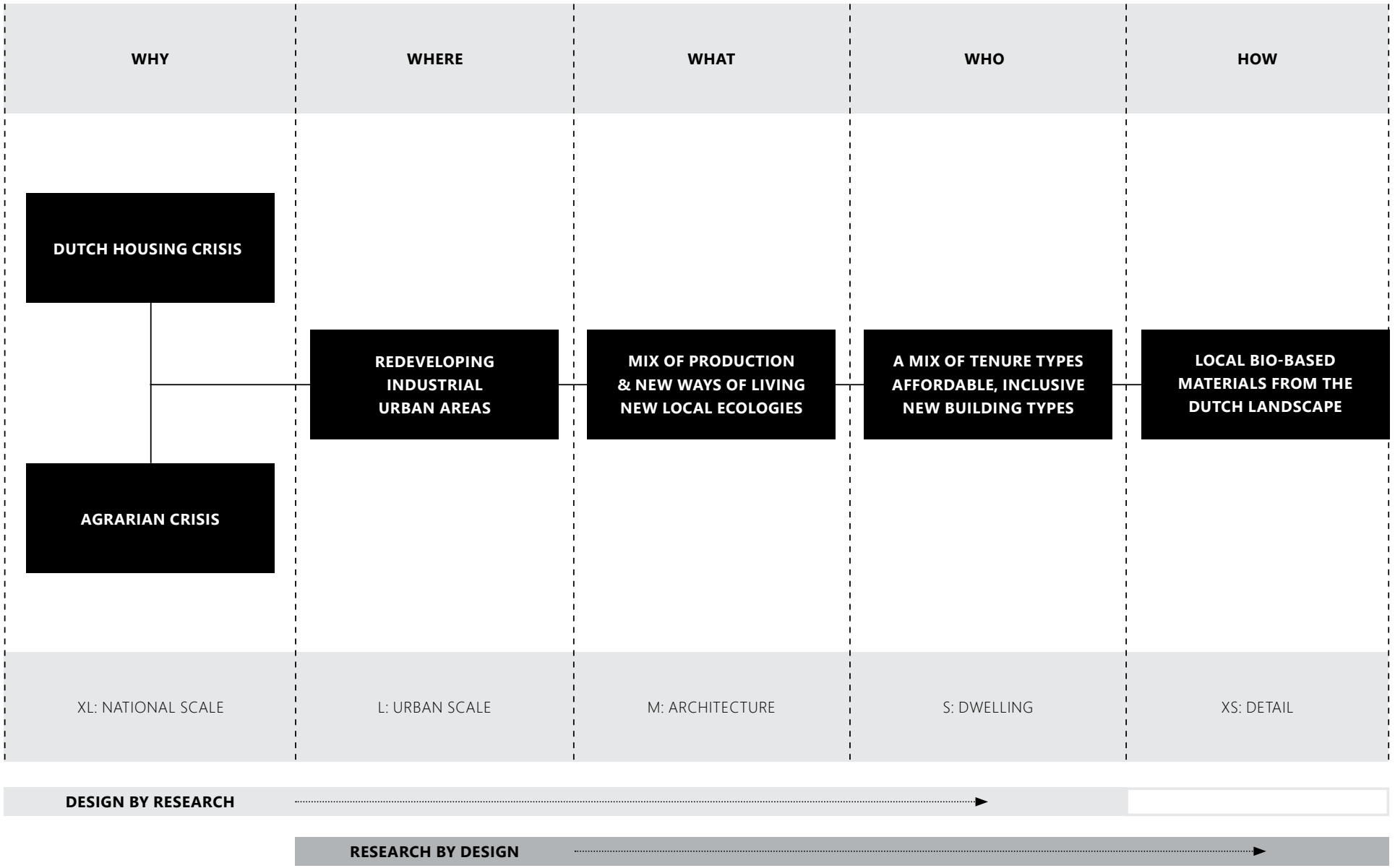
III

IV

HOW TO REALIZE AFFORDABLE HOUSING TYPES
WITHOUT LOSING ESSENTIAL LIVING QUALITIES?

DWELLING STRATEGIES

RESEARCH SCOPE



“Why do we face a housing crisis,

and what does an agricultural transition entail?”

HOUSING CRISIS

Figure 1. *Cabinet Pierson, formulators of ' de Woningwet' (1898).*

Figure 2. *Rotterdam Blaak, destruction caused by WWII (1945).*

Figure 3. *Riots during the succession day of Queen Beatrix (1980).*

Figure 4. *Demonstrations to bring attention to the need for affordable public housing (2021).*

PROBLEMS

AGRARIAN CRISIS

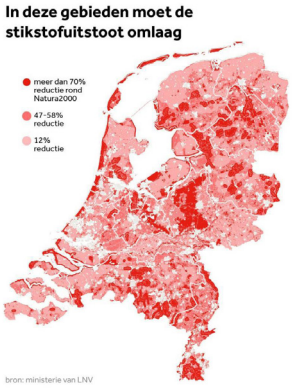


Figure 5. *NOx Reduction chart (NOS, 2022).*

Figure 6. *Tractors blocking the highway; a form of protest (NOS, 2022).*

Figure 7. *The government and municipalities buy farmlands to control the national carbon budget (RTL, 2022).*

Figure 8. *The countryside is evolving into an artificially optimized indoor production machine (AMO, 2020).*

"WE NEED TO BUILD 1 MILLION HOMES". (BY 2030)
- ACCORDING TO MOST DUTCH POLITICAL PARTIES

Figure 9. *National map of the Netherlands (2021).*

NOx, CO2, CH4

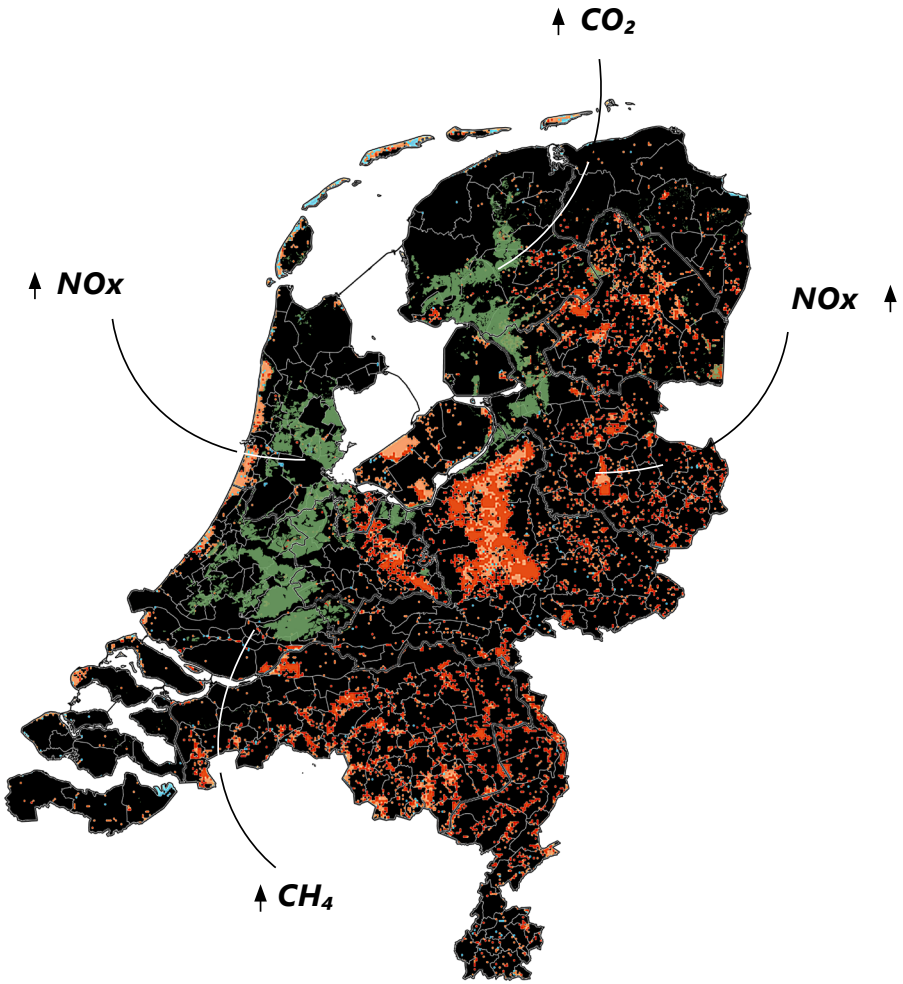


Figure 10. *Illustration of eutrophication and potential sequestration in the Netherlands (2021).*

“Can industrial urban areas be part of the solution,

and provide space for a mix of functions?”

HOUSING CRISIS

AGRARIAN CRISIS

WE NEED A LOT OF SPACE TO ACCOMMODATE FOR THESE TRANSITIONS

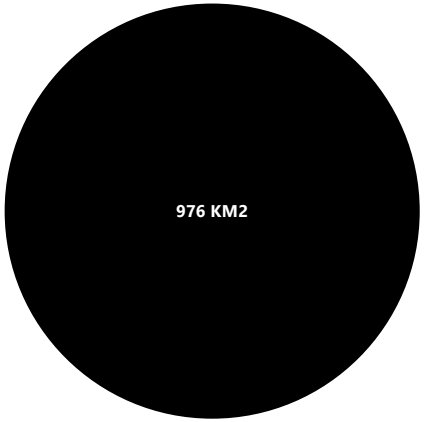
WHERE CAN WE BUILD?

SPATIAL SOLUTION?

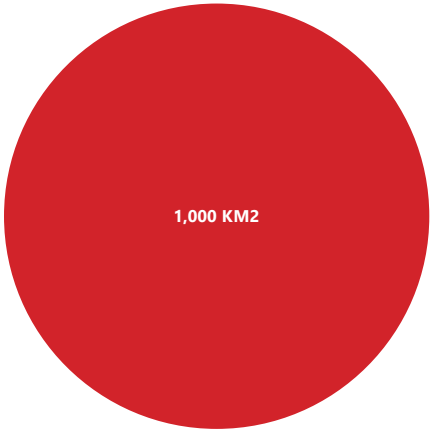
1000 KM2 OF INDUSTRIAL AREAS

IN THE NETHERLANDS - A LOT OF SPACE TO LIVE AND WORK

Figure 11. *A representation of the industrial areas in the Netherlands (2021).*



MAJOR DUTCH CITIES COMBINED



INDUSTRIAL AREAS COMBINED

\+

CITIES COMBINED: 976 KM2

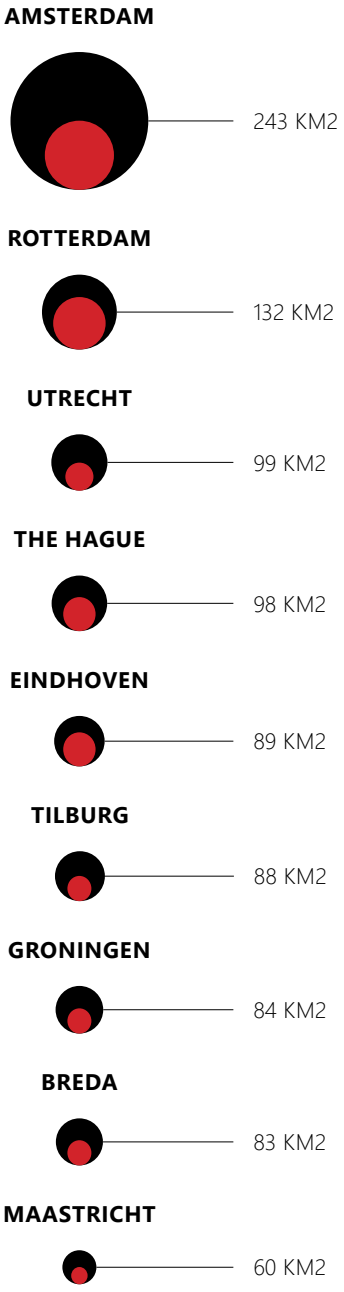
INDUSTRIAL AREAS: 1000 KM2

SPATIAL SOLUTION?

1000 KM2 OF INDUSTRIAL AREAS

IN THE NETHERLANDS - A LOT OF SPACE TO LIVE AND WORK

Figure 11. *A representation of the industrial areas in the Netherlands (2021).*



SPATIAL SOLUTION?

1000 KM2 OF INDUSTRIAL AREAS

IN THE NETHERLANDS - A LOT OF SPACE TO LIVE AND WORK

Figure 11. *A representation of the industrial areas in the Netherlands (2021).*

INDUSTRIAL AREAS
IN ROTTERDAM

TOTAL:
88 KM2

HARBOR:
73 KM2

URBAN:
15 KM2

DEVELOP ONLY 10% OF 15 KM2 = 1,500,000 M2

ALREADY A LOT OF SPACE TO ACCOMMODATE

SPATIAL SOLUTION?

IN THE NETHERLANDS - A LOT OF SPACE TO LIVE AND WORK

ROTTERDAM

132 KM2

Figure 12. *A representation of the industrial areas and peat soil landscapes in South-Holland, the Netherlands (2021).*

RE-DEVELOPMENT CASE STUDY: INDUSTRIAL URBAN AREA THE SPAANSE POLDER

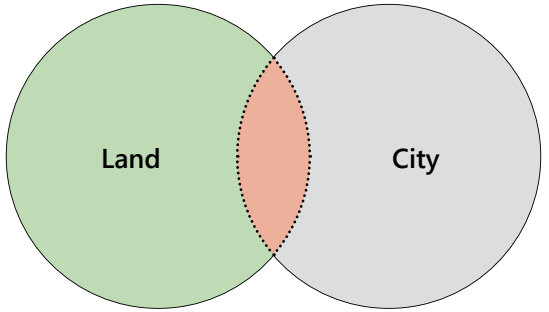
Regional Map. *The surroundings and siuation of Midden-Delfland, enclosed by large cities and industry (GE, 2024).*

THE INTERSECTION OF LAND AND CITY

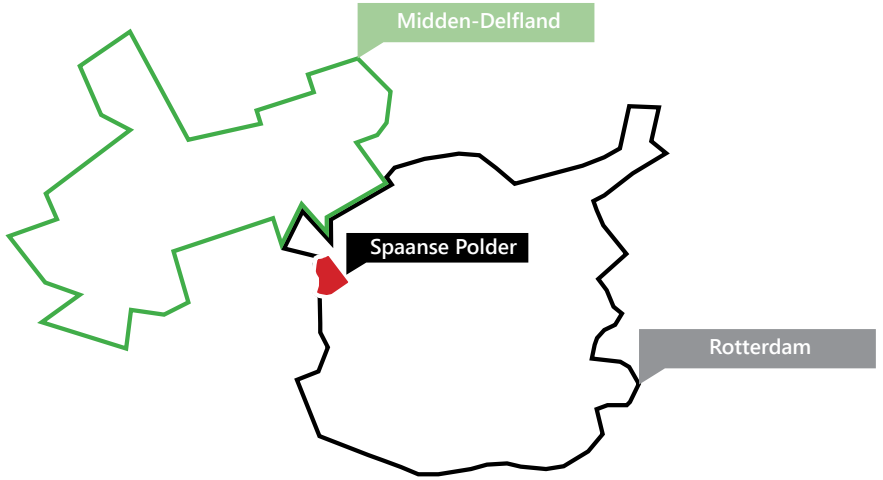
Midden-Delfland is a large agrarian landscape situated between the cities Rotterdam, Delft, The Hague and Westland. All the surrounding urban regions exert pressure on the residue landscape of Midden-Delfland; cities want to expand their suburbs into the polders, and Westland (the large horticulture region) wants to expand its greenhouses into the landscape as they cover much ground, which is running out in Westland. Although the current landscape is considered to be unsustainable (both financially and ecologically) by experts, plans have been made to redevelop this area into a national production park. it can become an area with significant biodiversity, the potential to store and filter large amounts of water, and to store enormous amounts of CO2 (which would otherwise be emitted due to the subsidence of the peat landscape). A transition towards a sustainable production landscape would also indicate that a lot of functions, people and activities that would usually take place on the landscape will migrate elsewhere as they make place for new activities.

On the other hand, the surrounding urban areas are faced with a continuously growing demand for housing and lack of space to construct these new dwellings. While expansion of the urban fabric into the landscape can result in new space for housing, it is not a very sustainable planning method as it requires a lot of additional energy, resources (infrastructure, facilities, utilities, and public space). These would need to be created from scratch, while there is a lot of space already available in cities, but this space simply needs to be discovered or re-arranged. One of the areas in the Netherlands that hold potential to be redeveloped are industrial urban areas. Although these areas are also needed for other activities and facilities, there is a lot of square meters available for rearrangement. Especially industrial areas in close proximity to city centers hold potential, as these often are large in area square meters, infrastructure is already in place, and facilities are nearby. The Spaanse Polder, an industrial urban area in Rotterdam is situated at the intersection of both the large landscape of Midden-Delfland and Rotterdam, potentially providing solutions for various transitions. The design research analyzes the Spaanse Polder, the future plans of the district, and how it could play a role for the many spatial transitions we face. A strategy for the redevelopment of the area will be formulated and architectural interventions are further elaborated on during this research.

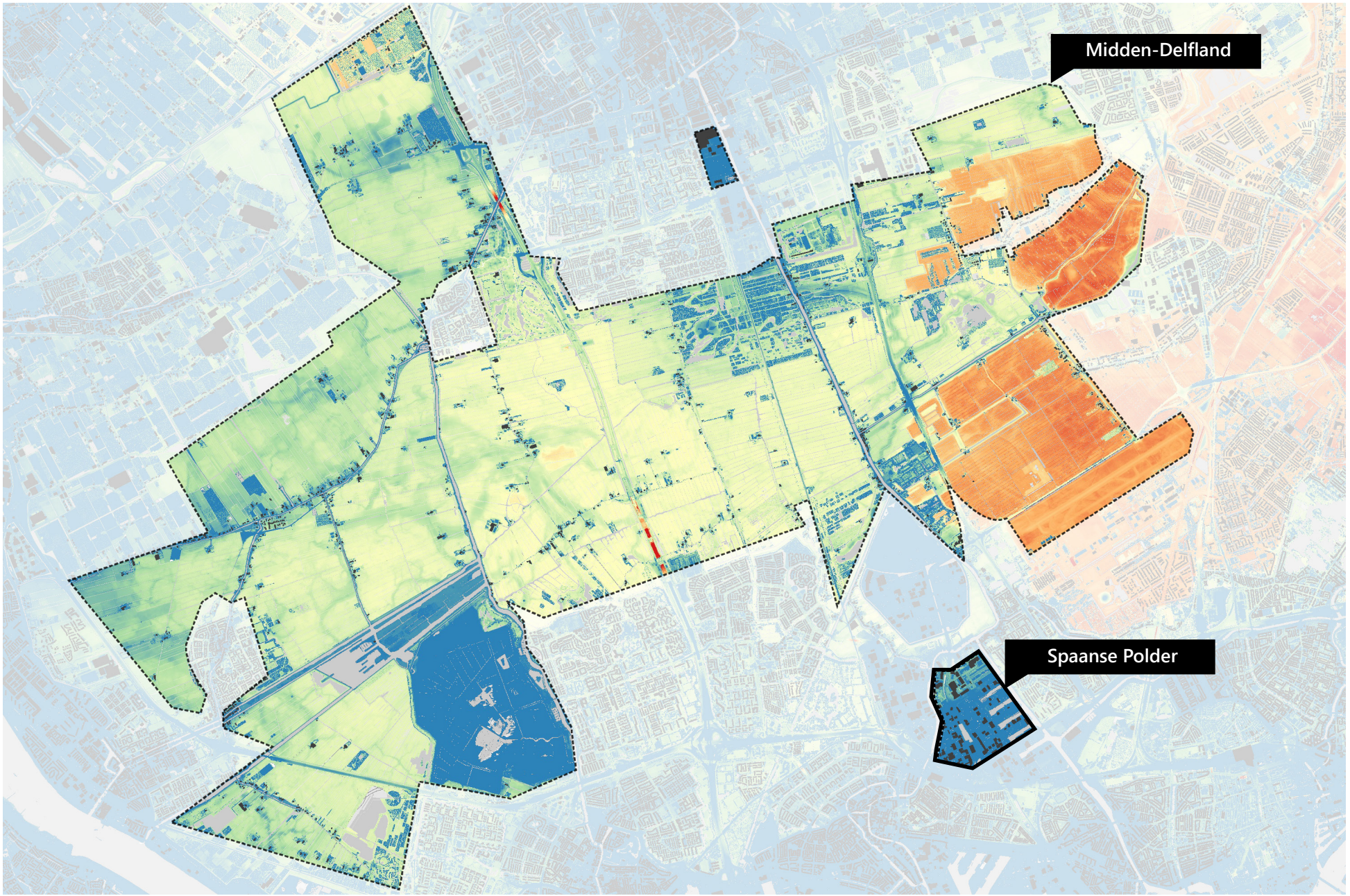
Spaanse Polder



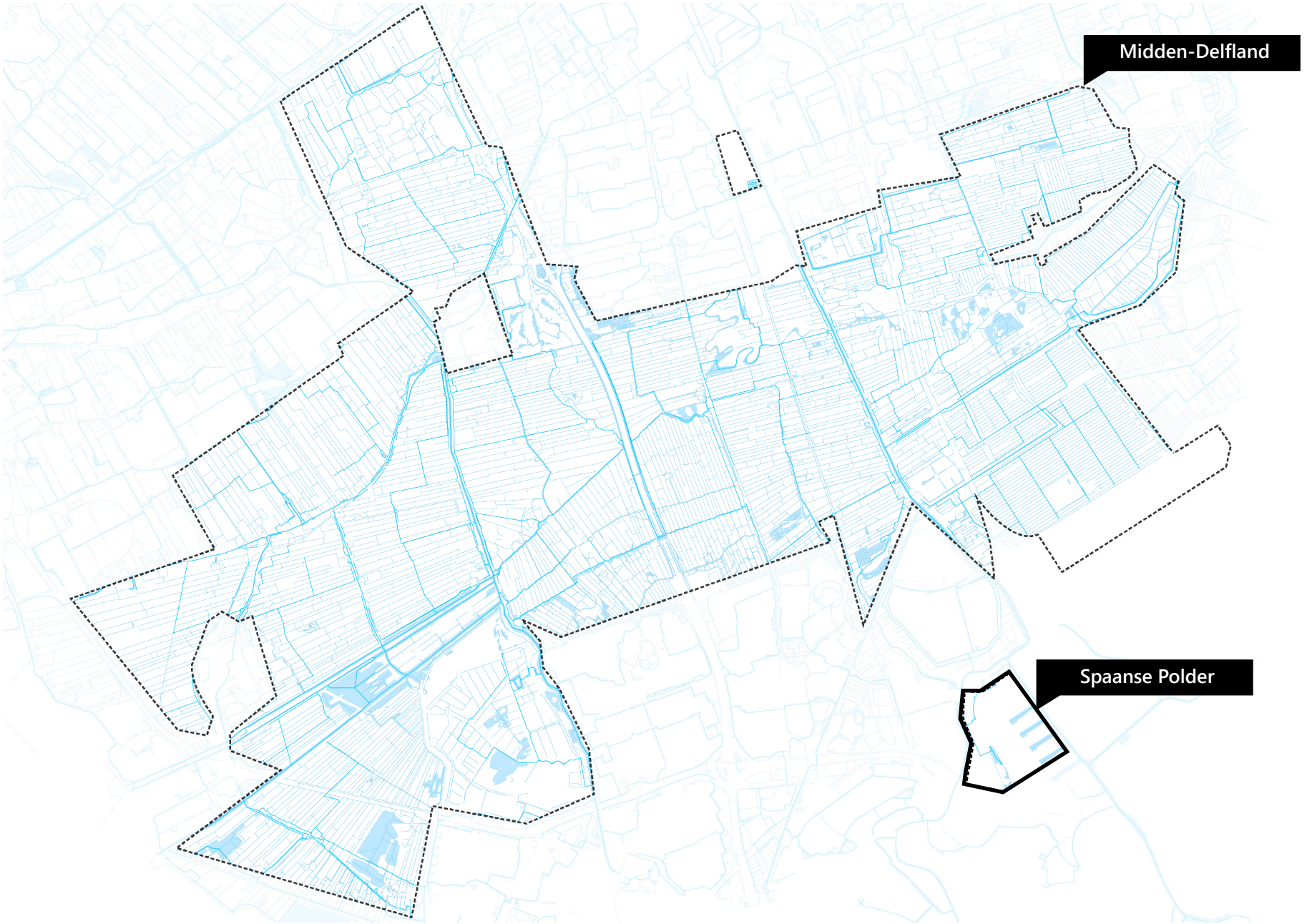
The industrial urban area is situated
at the intersection of both land and city



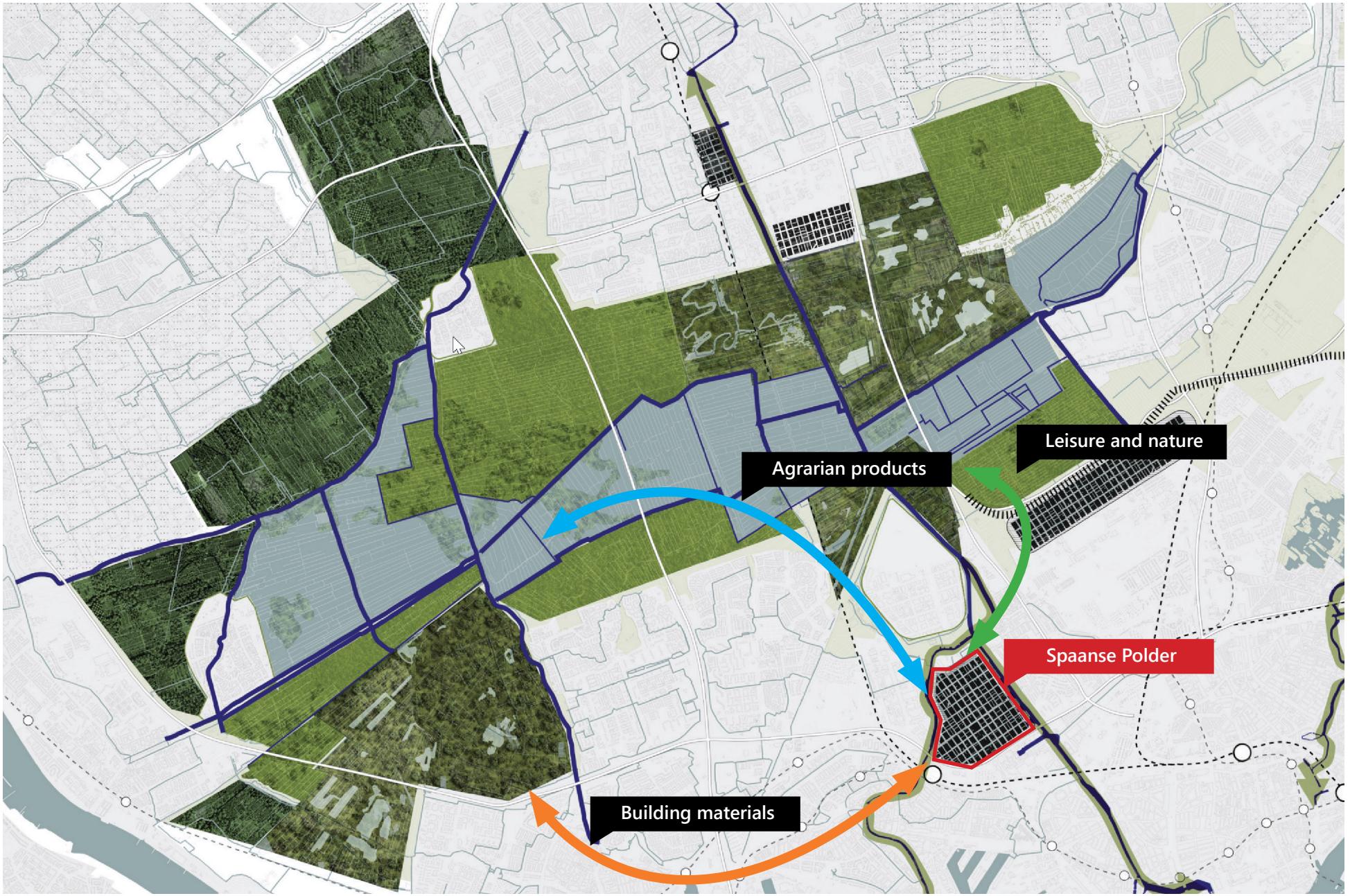
Midden-Delfland. *The landscape of Midden-Delfland is characterized by an intricate tapestry of ditches and waterways (BGT, 2021).*



Midden-Delfland. *Due to the subsidence of the peat landscape, the majority of Midden-Delfland is situated below sea level (AHN, 2021).*



Midden-Delfland. *A complex, expensive and unsustainable water management system is required to irrigate the landscape (BGT, 2021).*

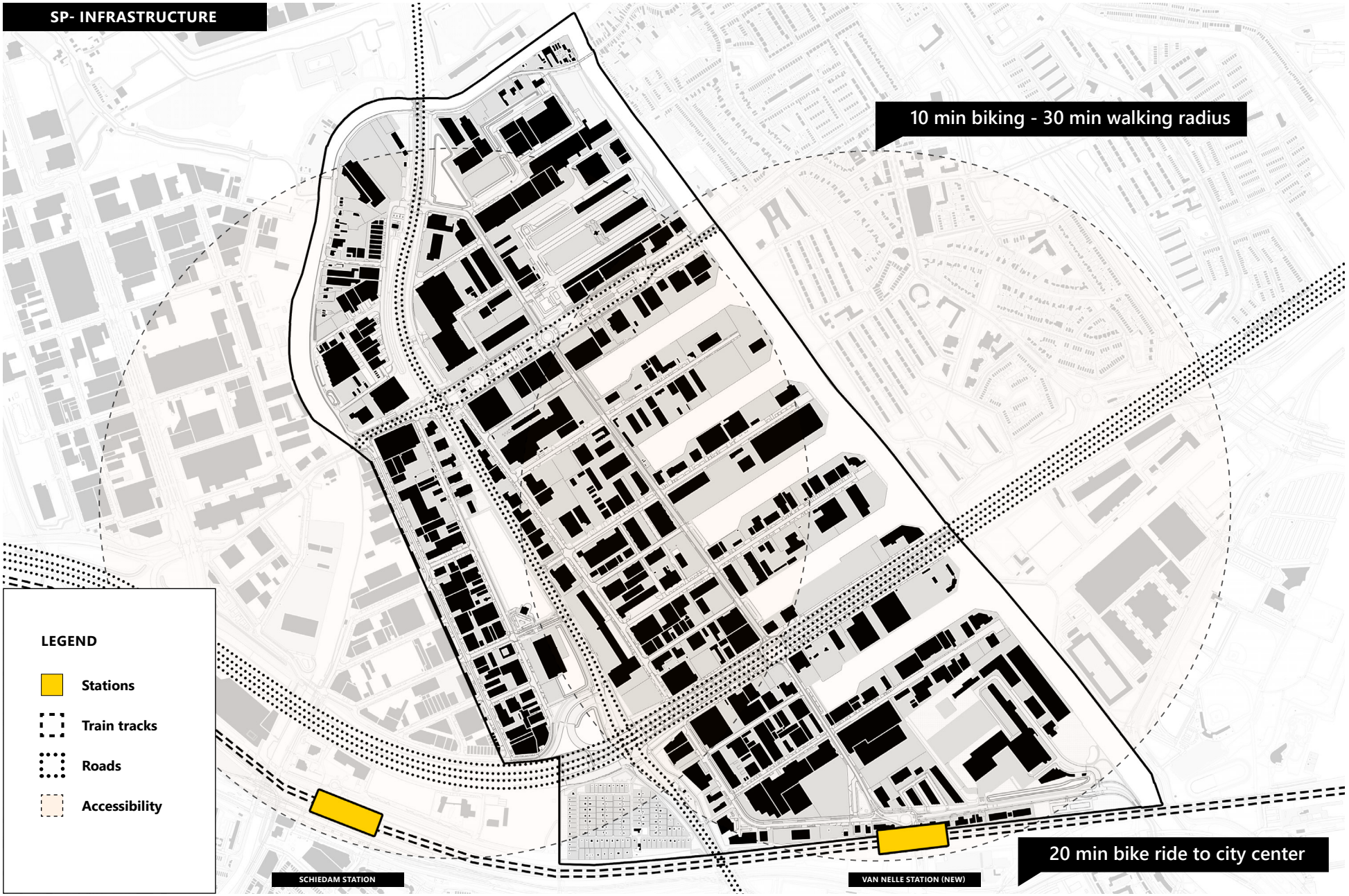


Midden-Delfland. *The master plan for a new Productive Landscape of Midden-Delfland, by ZUS, Flux and Sweco (RDD, 2021).*

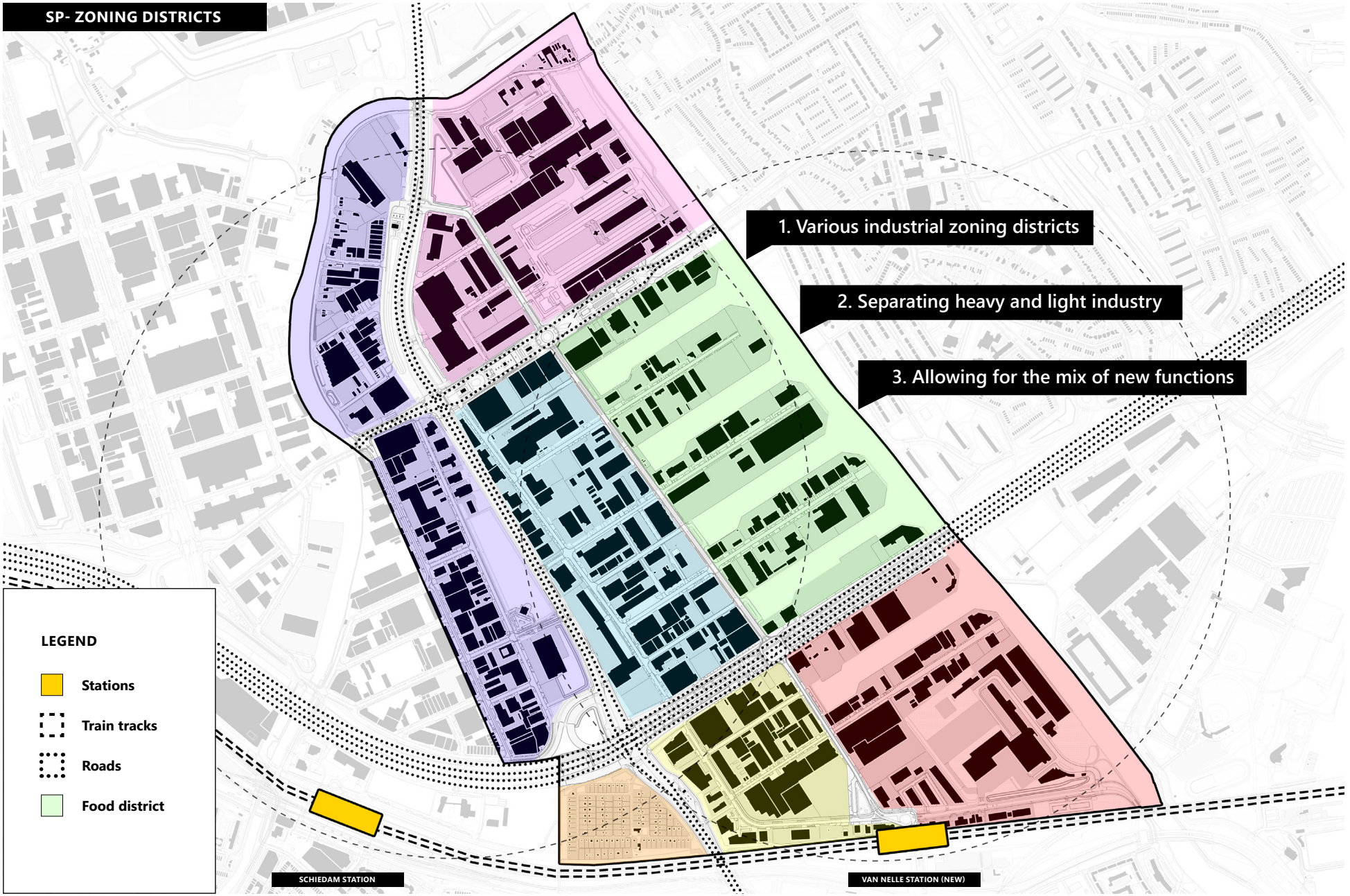

SPAANSE POLDER SIZE
2,000,000 m2
Center of Delft = 1,840,000 m2

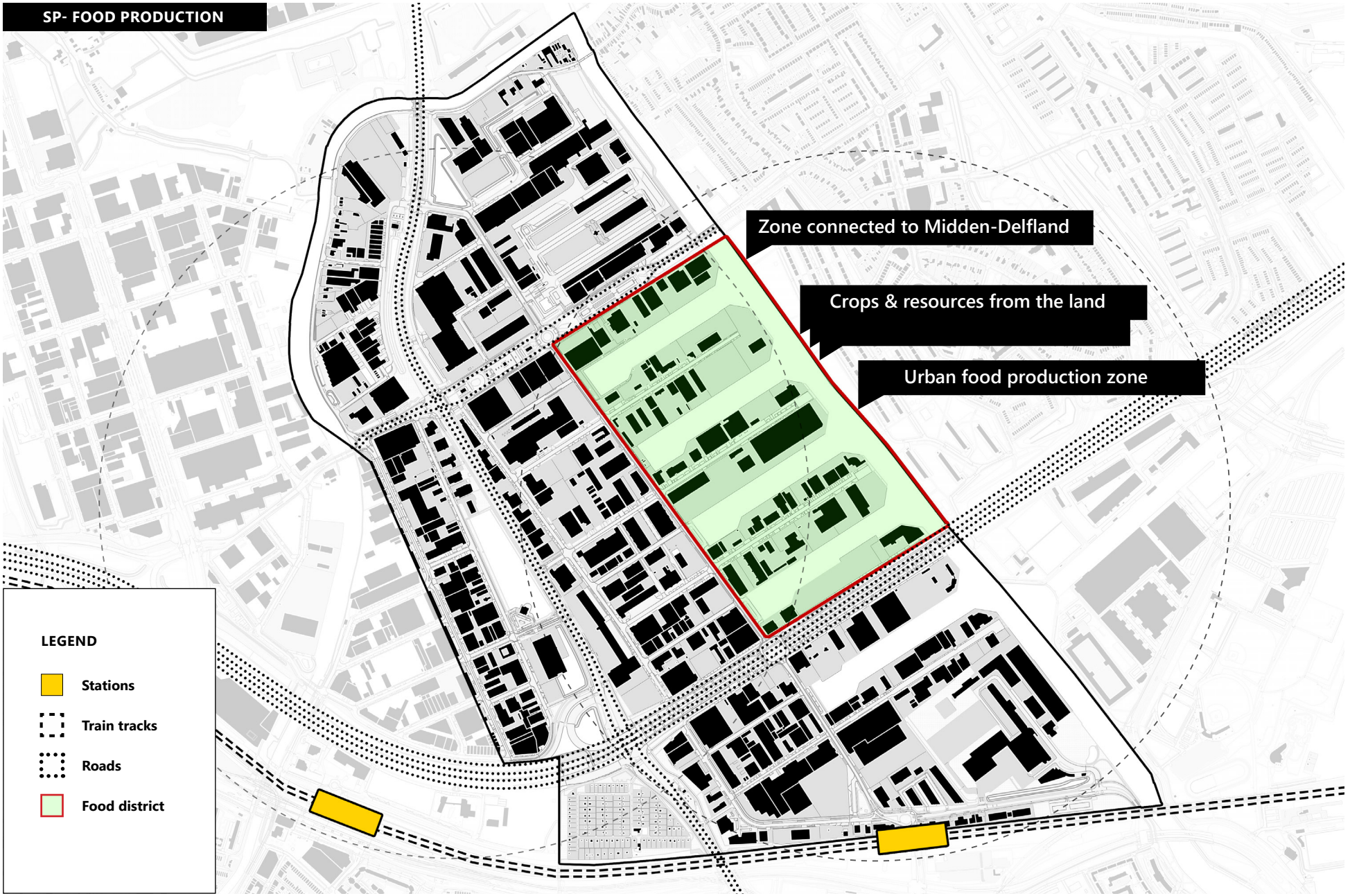
SP - HISTORICAL BUILDINGS

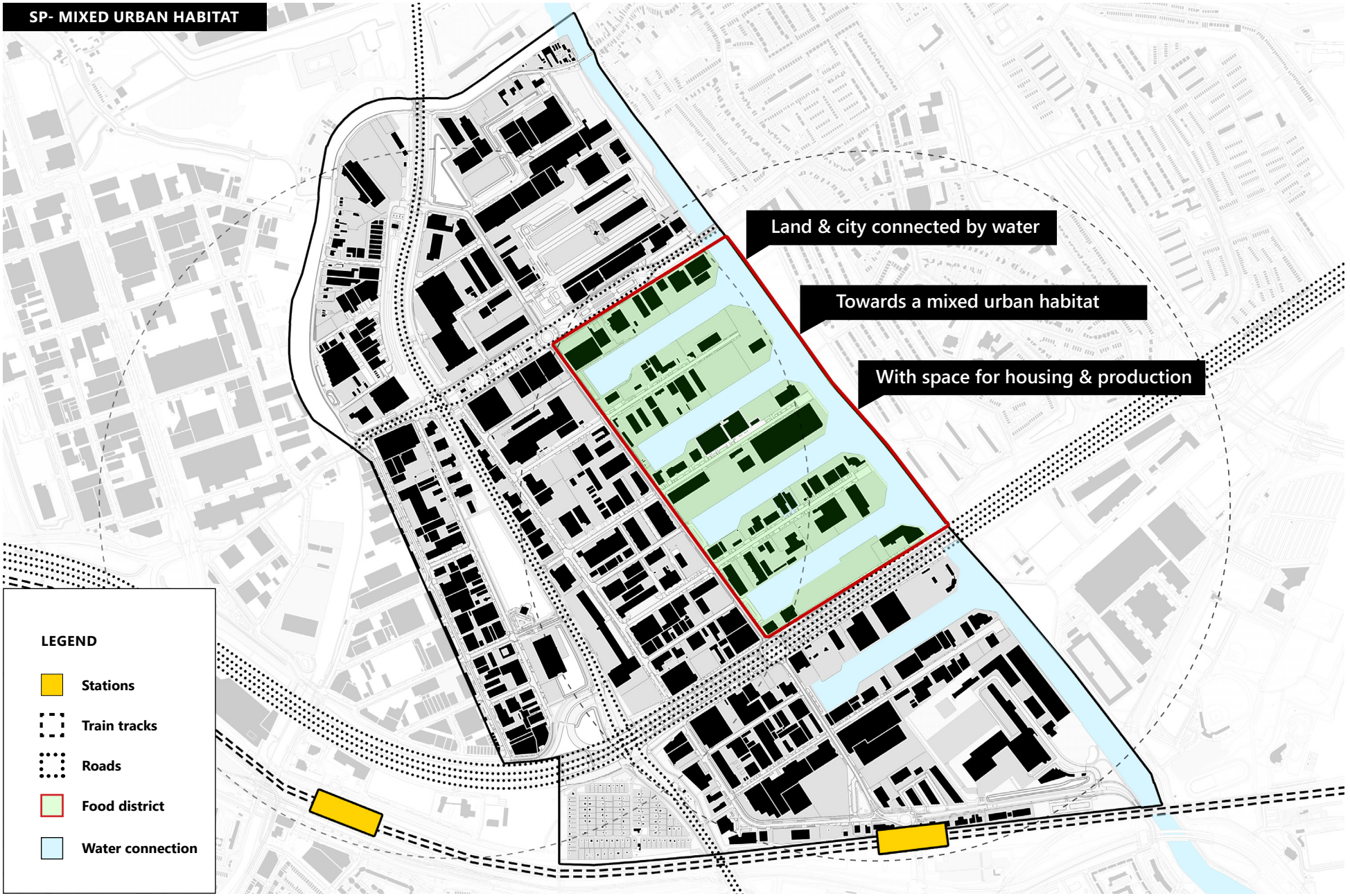

SP - FUNCTIONS
Only 28 residential buildings
748 Industrial buildings
LEGEND
Retail
Industrial
Offices
Services
Restaurants

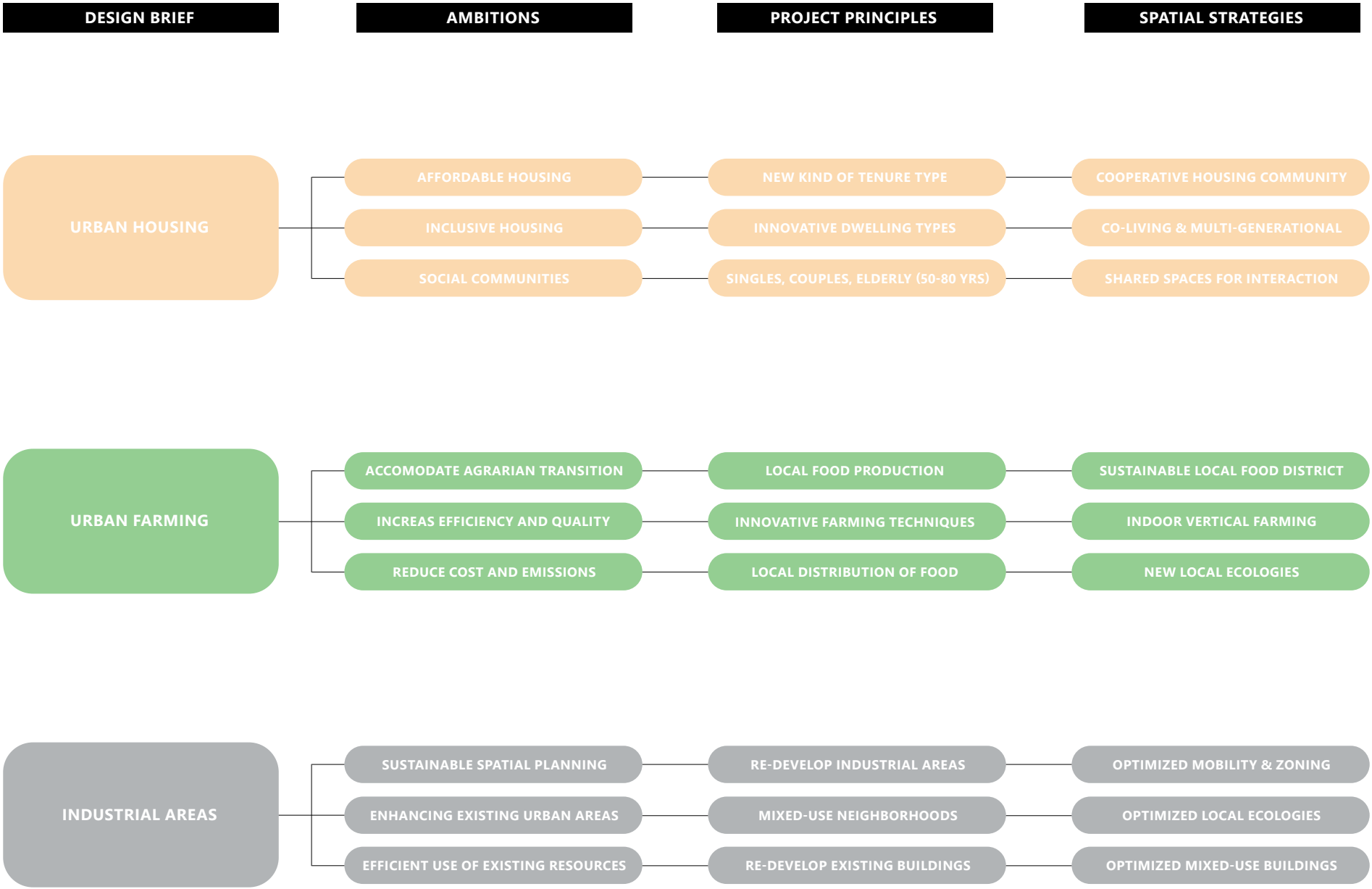

SP- INFRASTRUCTURE
10 min biking - 30 min walking radius
LEGEND
Stations
Train tracks
Roads
Accessibility
SCHIEDAM STATION
VAN NELLE STATION (NEW)
20 min bike ride to city center

SP- VISION FOR 2035


SP- ZONING DISTRICTS
1. Various industrial zoning districts
2. Separating heavy and light industry
3. Allowing for the mix of new functions
LEGEND
Stations
Train tracks
Roads
Food district
SCHIEDAM STATION
VAN NELLE STATION (NEW)

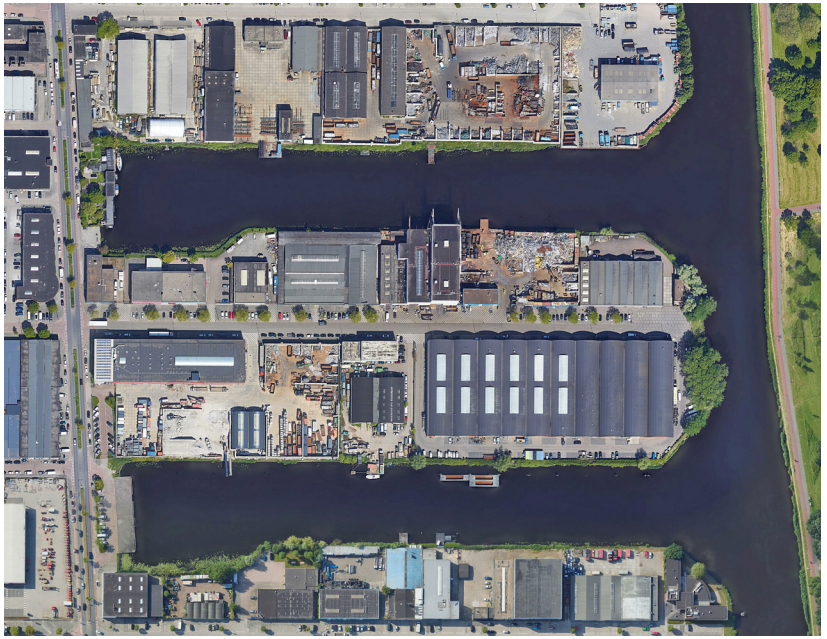

SP- FOOD PRODUCTION
Zone connected to Midden-Delfland
Crops & resources from the land
Urban food production zone
LEGEND
Stations
Train tracks
Roads
Food district


SP- MIXED URBAN HABITAT
Land & city connected by water
Towards a mixed urban habitat
With space for housing & production
LEGEND
Stations
Train tracks
Roads
Food district
Water connection

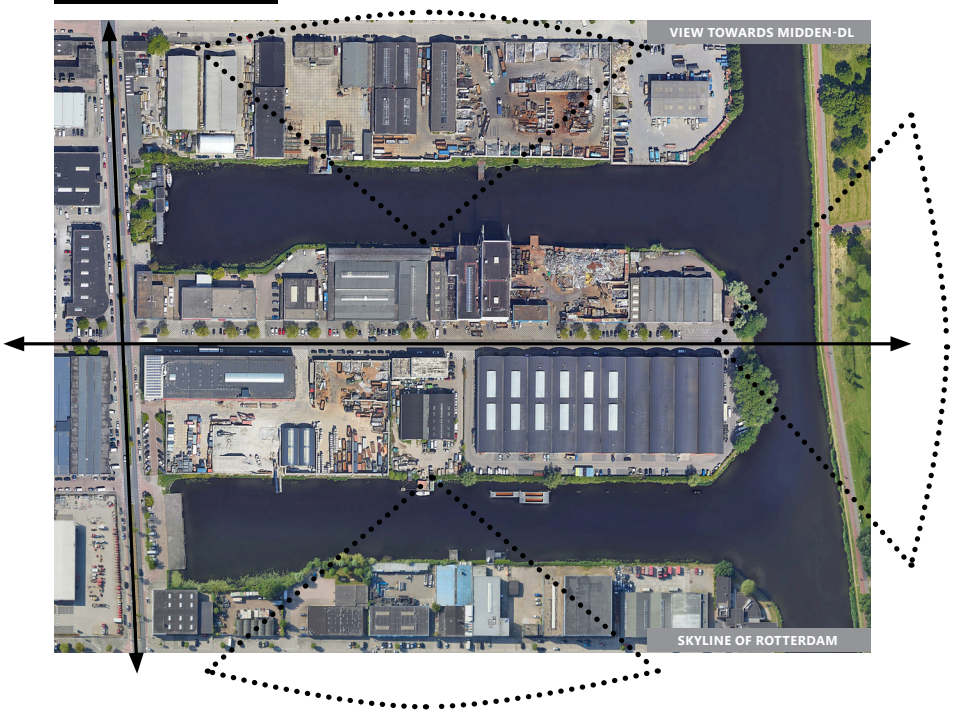

DESIGN BRIEF
AMBITIONS
PROJECT PRINCIPLES
SPATIAL STRATEGIES
URBAN HOUSING
AFFORDABLE HOUSING
INCLUSIVE HOUSING
SOCIAL COMMUNITIES
NEW KIND OF TENURE TYPE
INNOVATIVE DWELLING TYPES
SINGLES, COUPLES, ELDERLY (50-80 YRS)
COOPERATIVE HOUSING COMMUNITY
CO-LIVING & MULTI-GENERATIONAL
SHARED SPACES FOR INTERACTION
URBAN FARMING
ACCOMODATE AGRARIAN TRANSITION
INCREAS EFFICIENCY AND QUALITY
REDUCE COST AND EMISSIONS
LOCAL FOOD PRODUCTION
INNOVATIVE FARMING TECHNIQUES
LOCAL DISTRIBUTION OF FOOD
SUSTAINABLE LOCAL FOOD DISTRICT
INDOOR VERTICAL FARMING
NEW LOCAL ECOLOGIES
INDUSTRIAL AREAS
SUSTAINABLE SPATIAL PLANNING
ENHANCING EXISTING URBAN AREAS
EFFICIENT USE OF EXISTING RESOURCES
RE-DEVELOP INDUSTRIAL AREAS
MIXED-USE NEIGHBORHOODS
RE-DEVELOP EXISTING BUILDINGS
OPTIMIZED MOBILITY & ZONING
OPTIMIZED LOCAL ECOLOGIES
OPTIMIZED MIXED-USE BUILDINGS

THE SELECTED SITE FOR REDEVELOPMENT & URBAN STRATEGIES

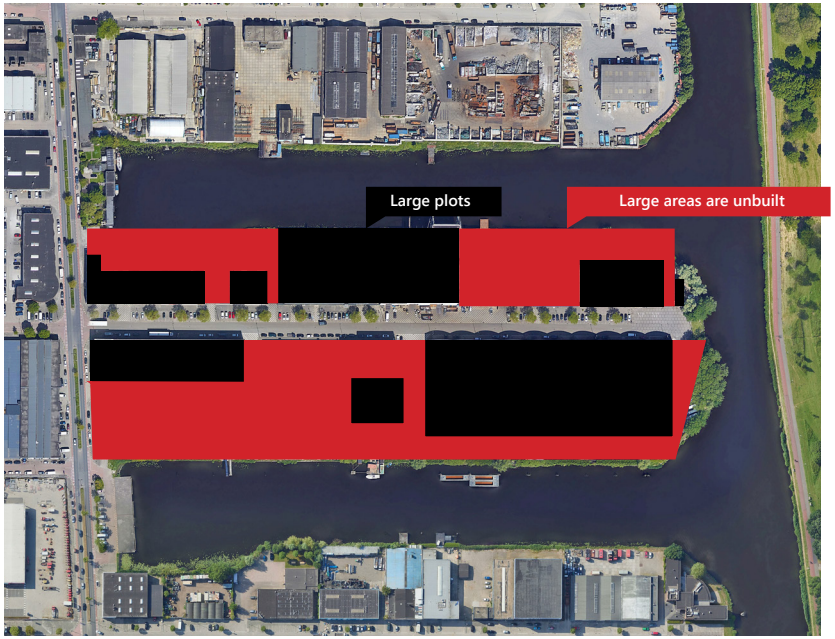
EXISTING SITE - 2023



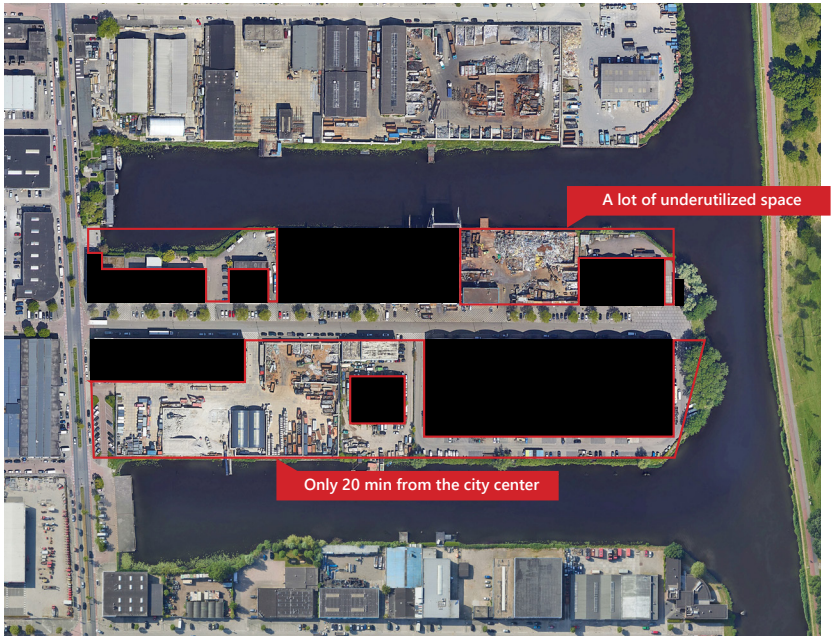
SITE - VIEWS CONTEXT



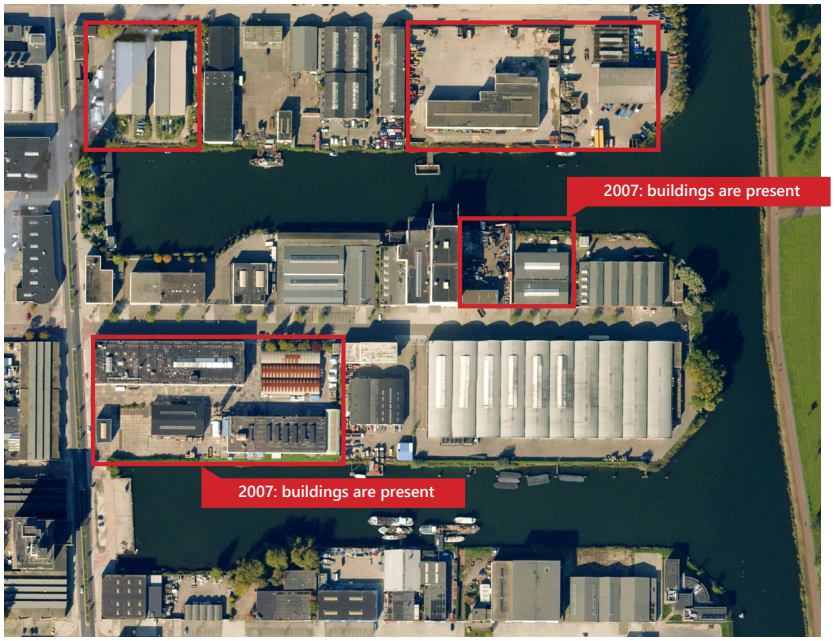
SITE -FOOTPRINTS VS LAND



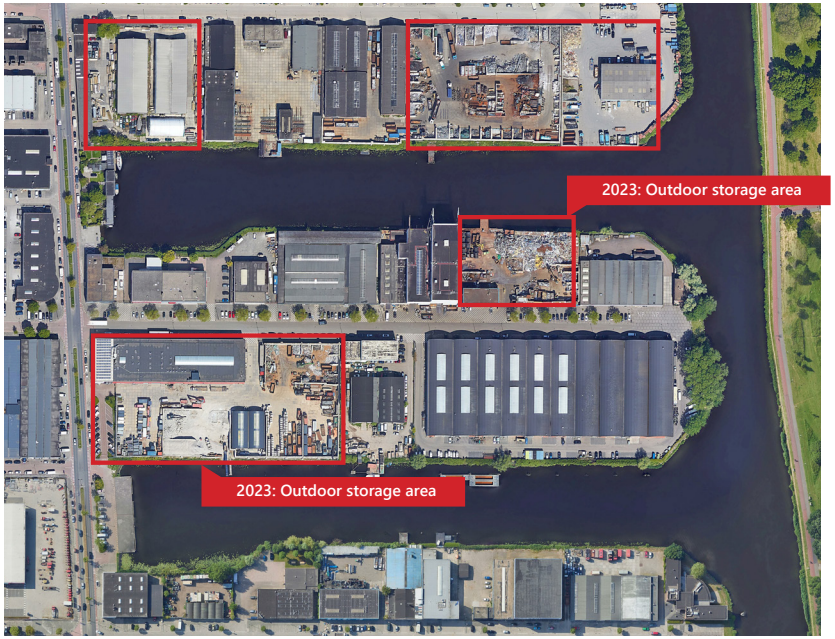
SITE - UNDERUTILIZED LAND



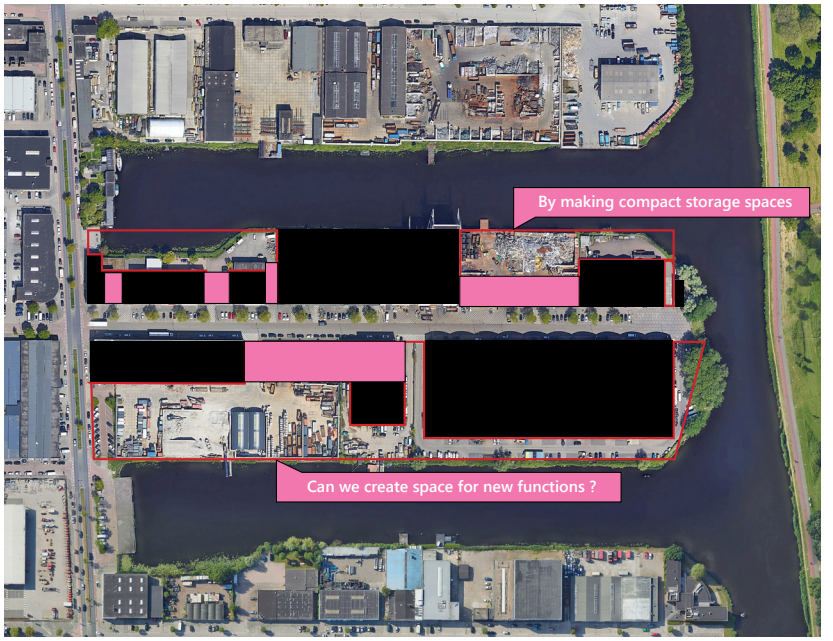
SITE - 2007



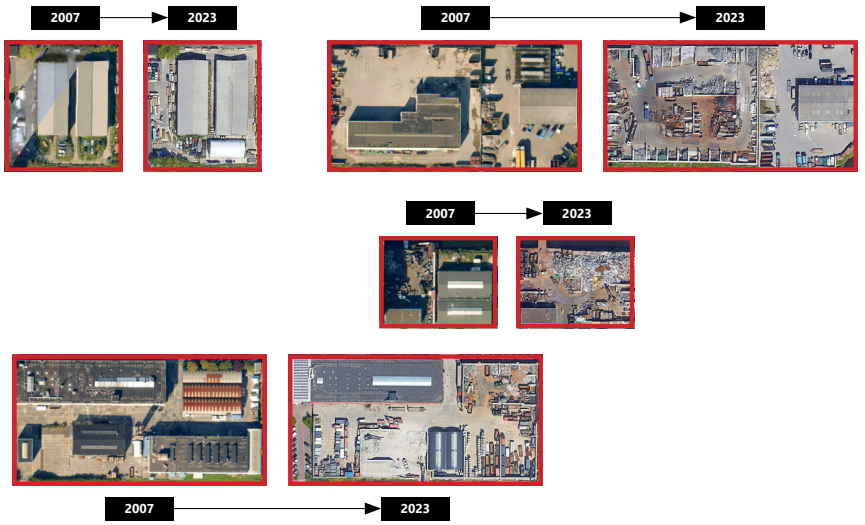
SITE - 2023

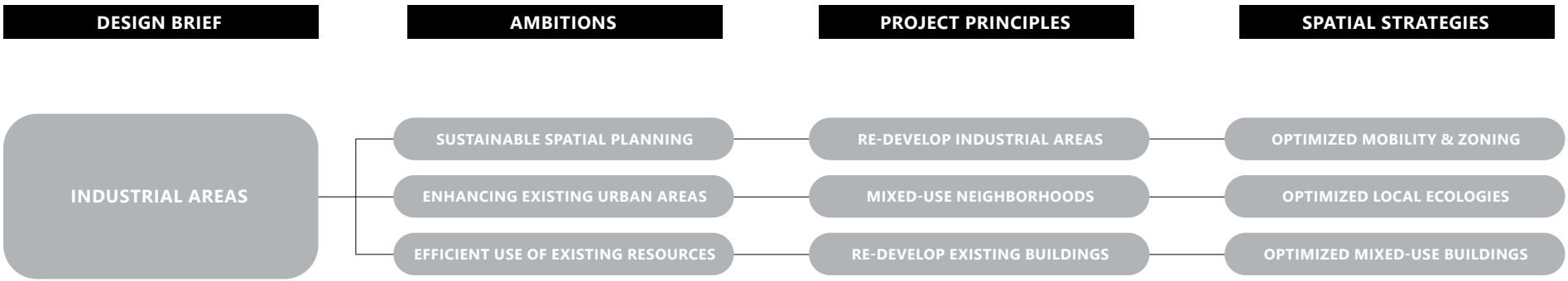


OPTIMIZED STORAGE PROPOSAL



SITE - 2007 VS 2023

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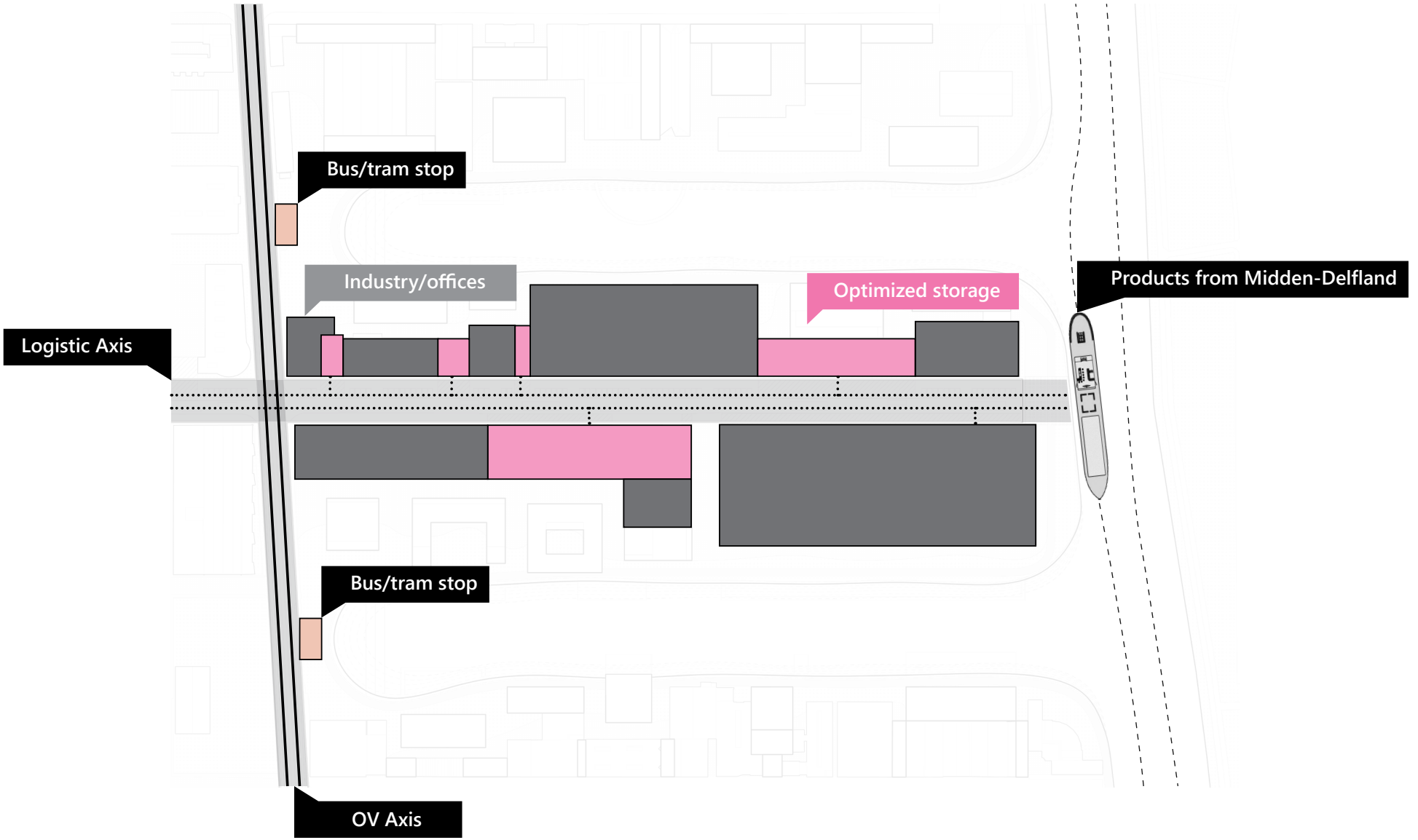
OPTIMIZED LOCAL ECOLOGIES
OPTIMIZED MIXED-USE BUILDINGS

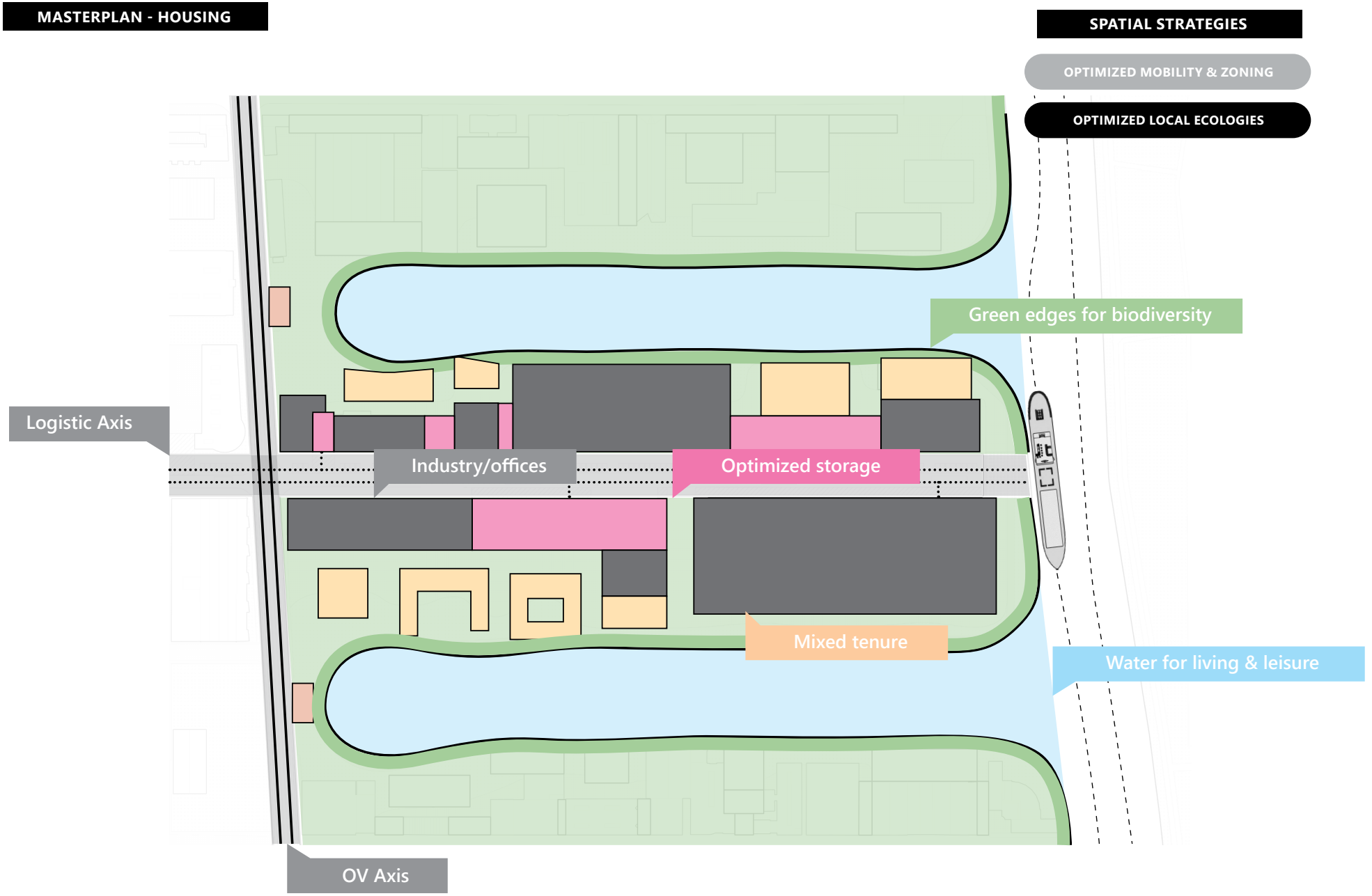
MASTERPLAN - LOGISTICS

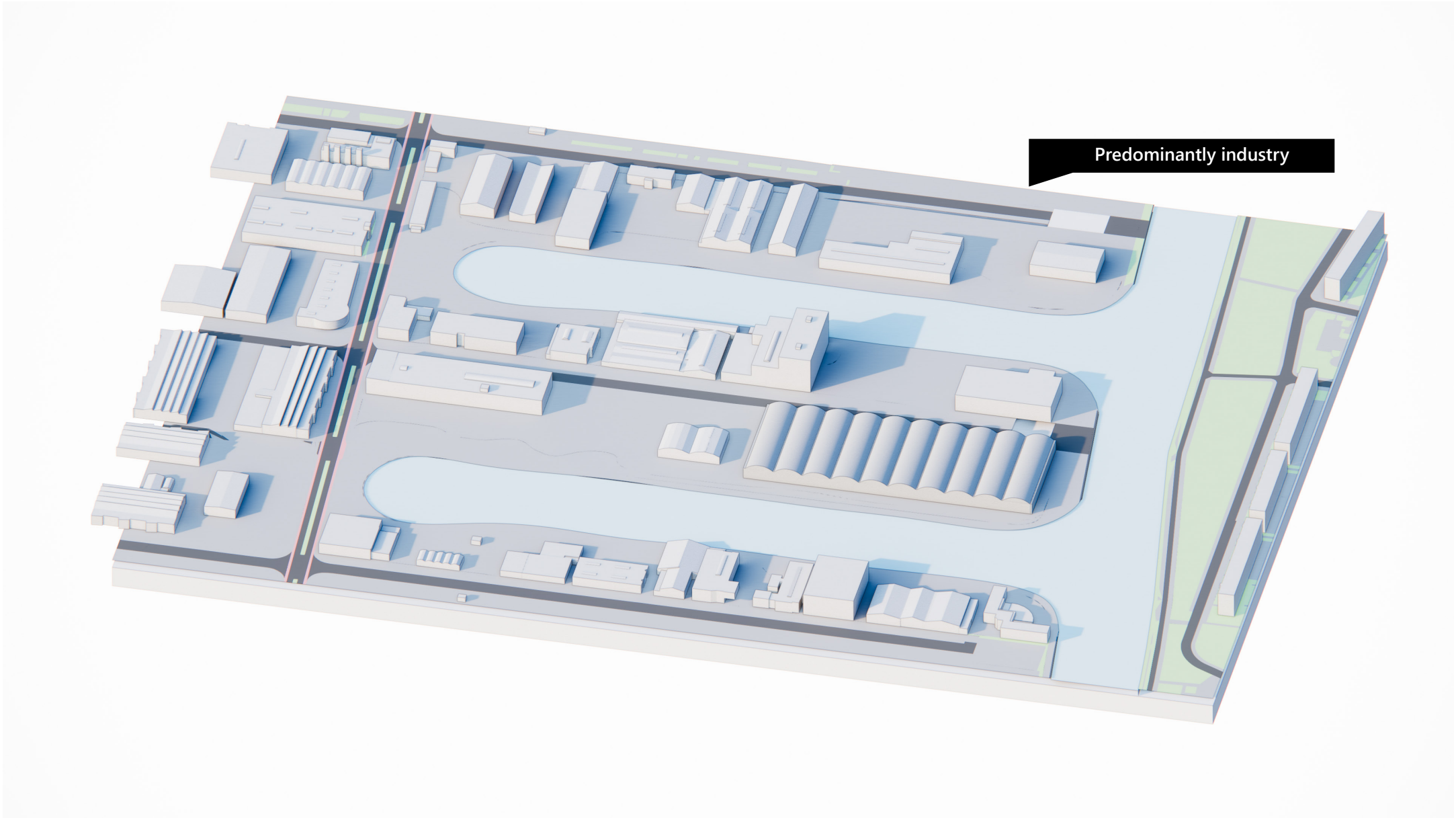
SPATIAL STRATEGIES

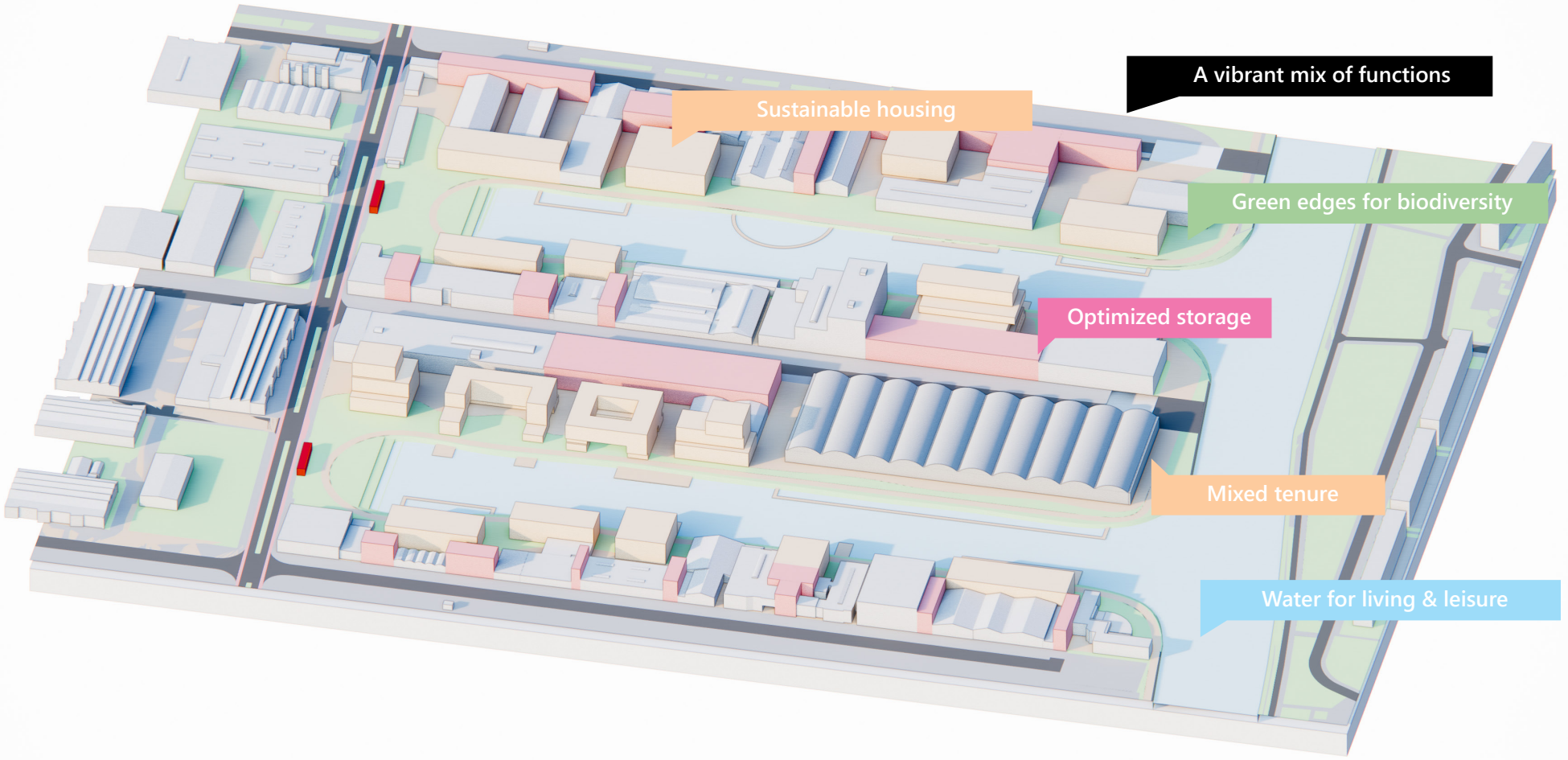
OPTIMIZED MOBILITY & ZONING

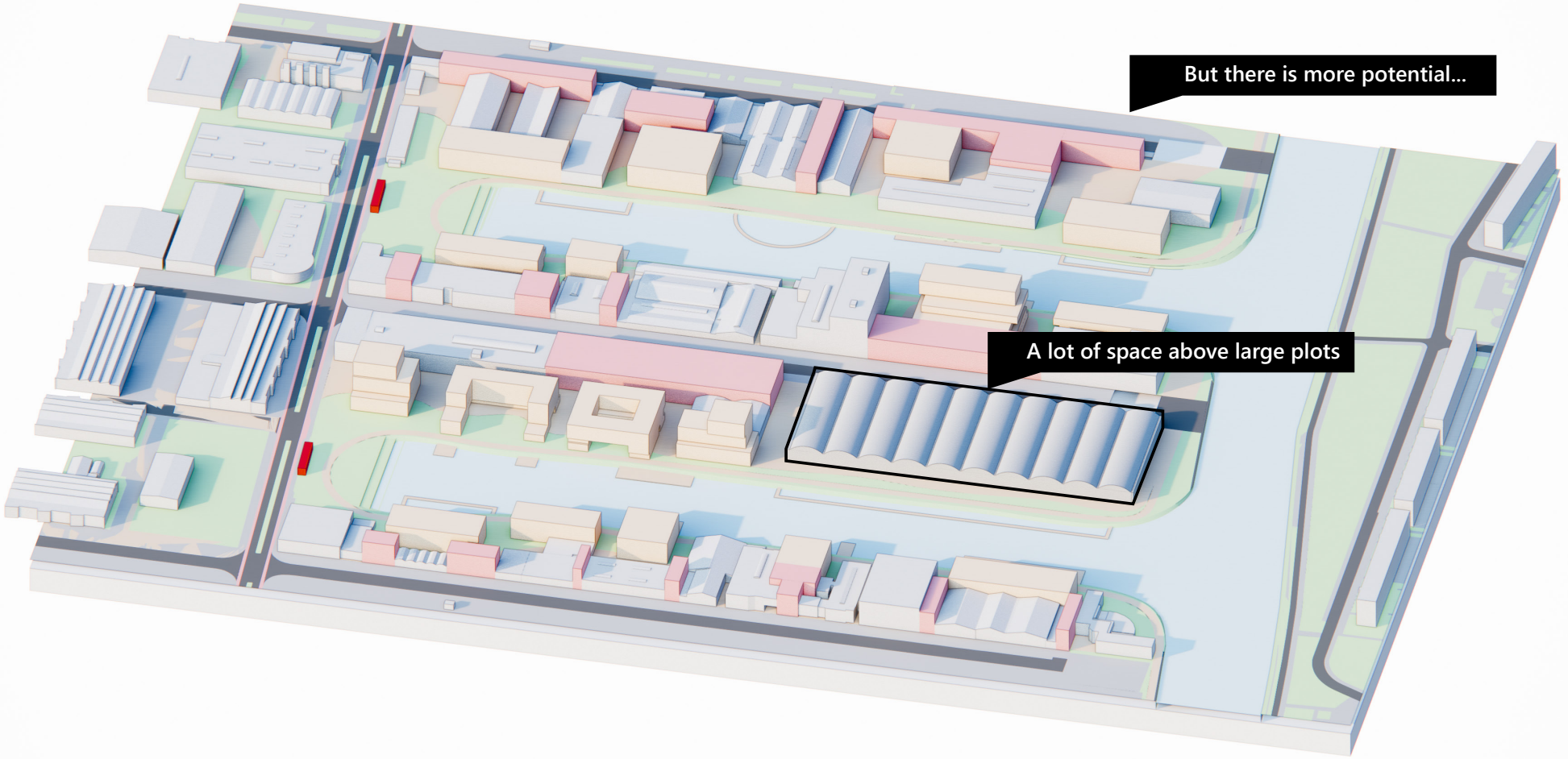


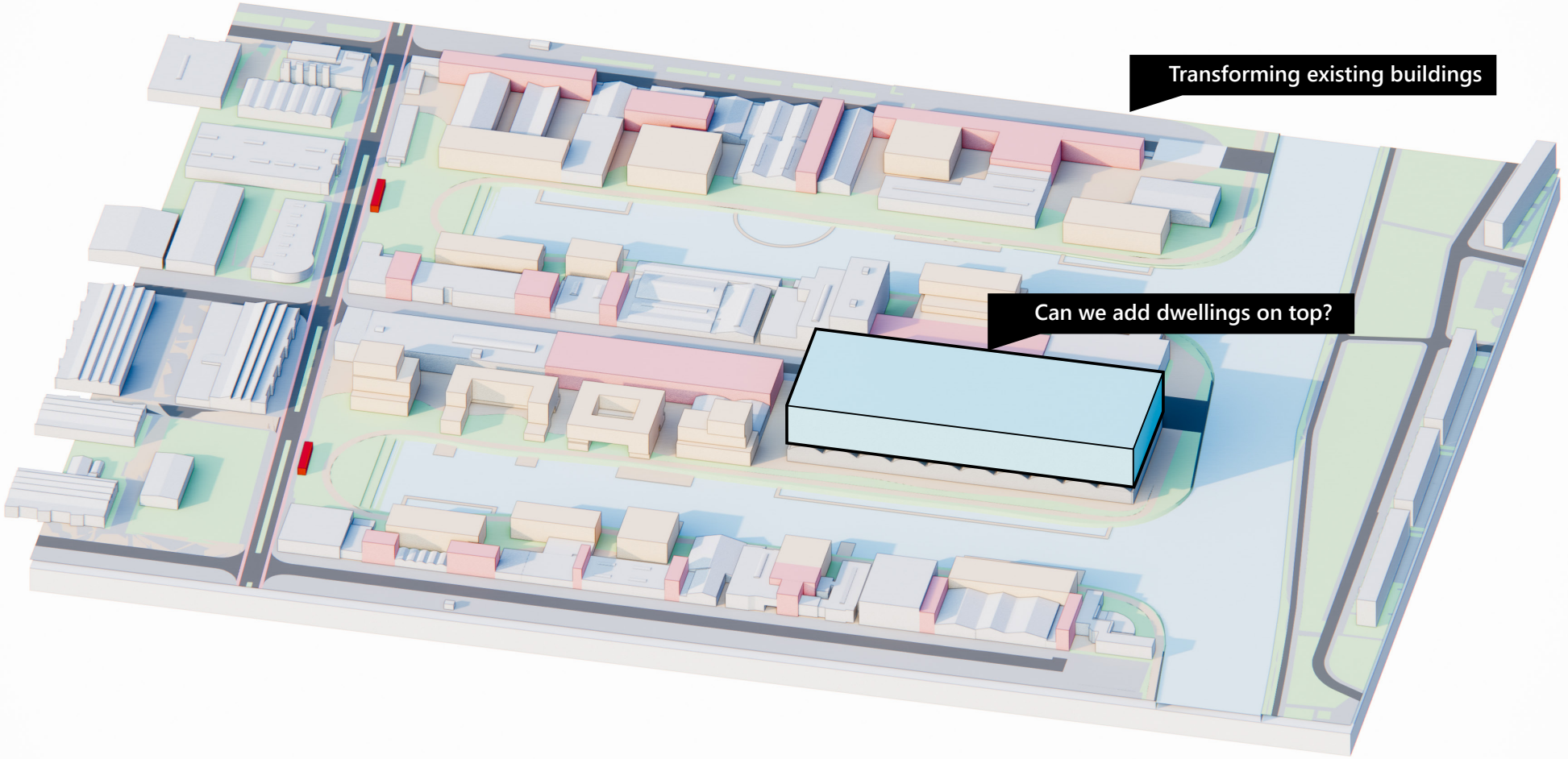
MASTERPLAN - HOUSING




Predominantly industry


A vibrant mix of functions
Sustainable housing
Green edges for biodiversity
Optimized storage
Mixed tenure
Water for living & leisure


But there is more potential...
A lot of space above large plots

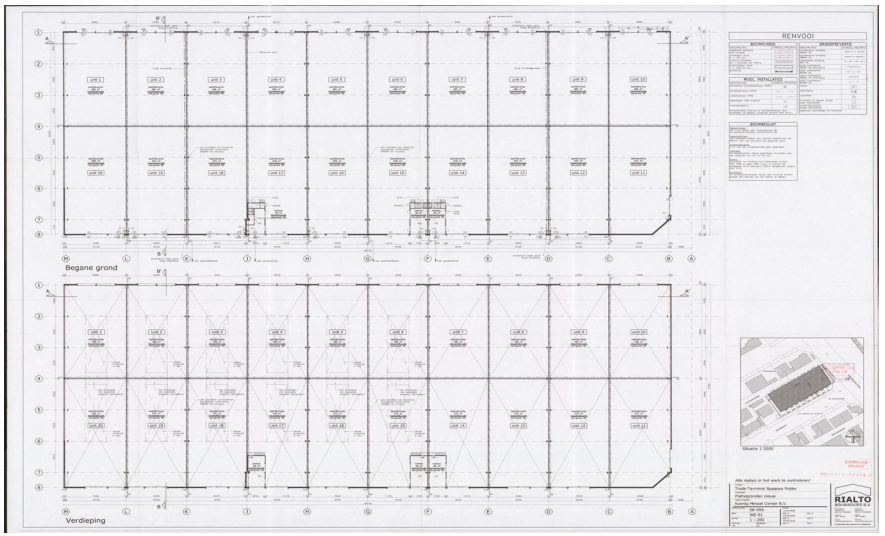

Transforming existing buildings
Can we add dwellings on top?

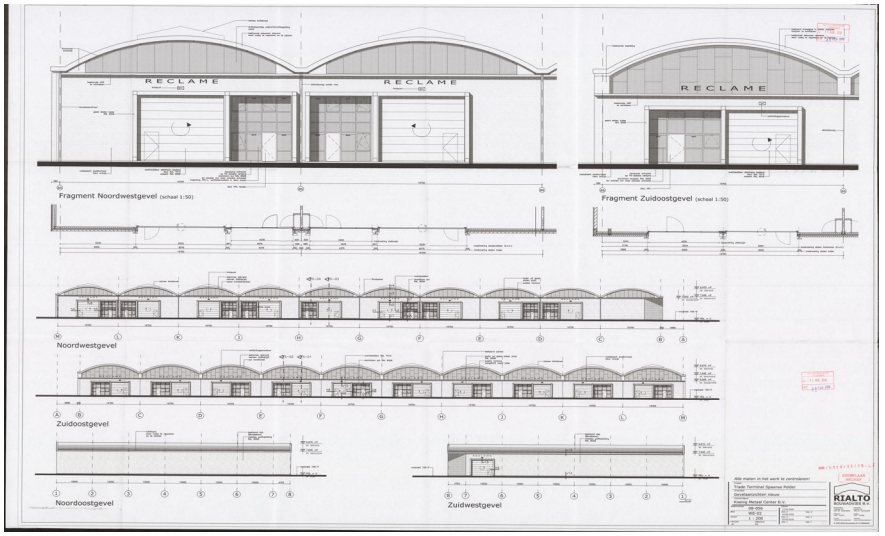
“Can industrial buildings be transformed into inclusive, mixed-use housing communities?”

TRANSFORMATION CASE STUDY:
TRADE TERMINAL SPAANSE POLDER

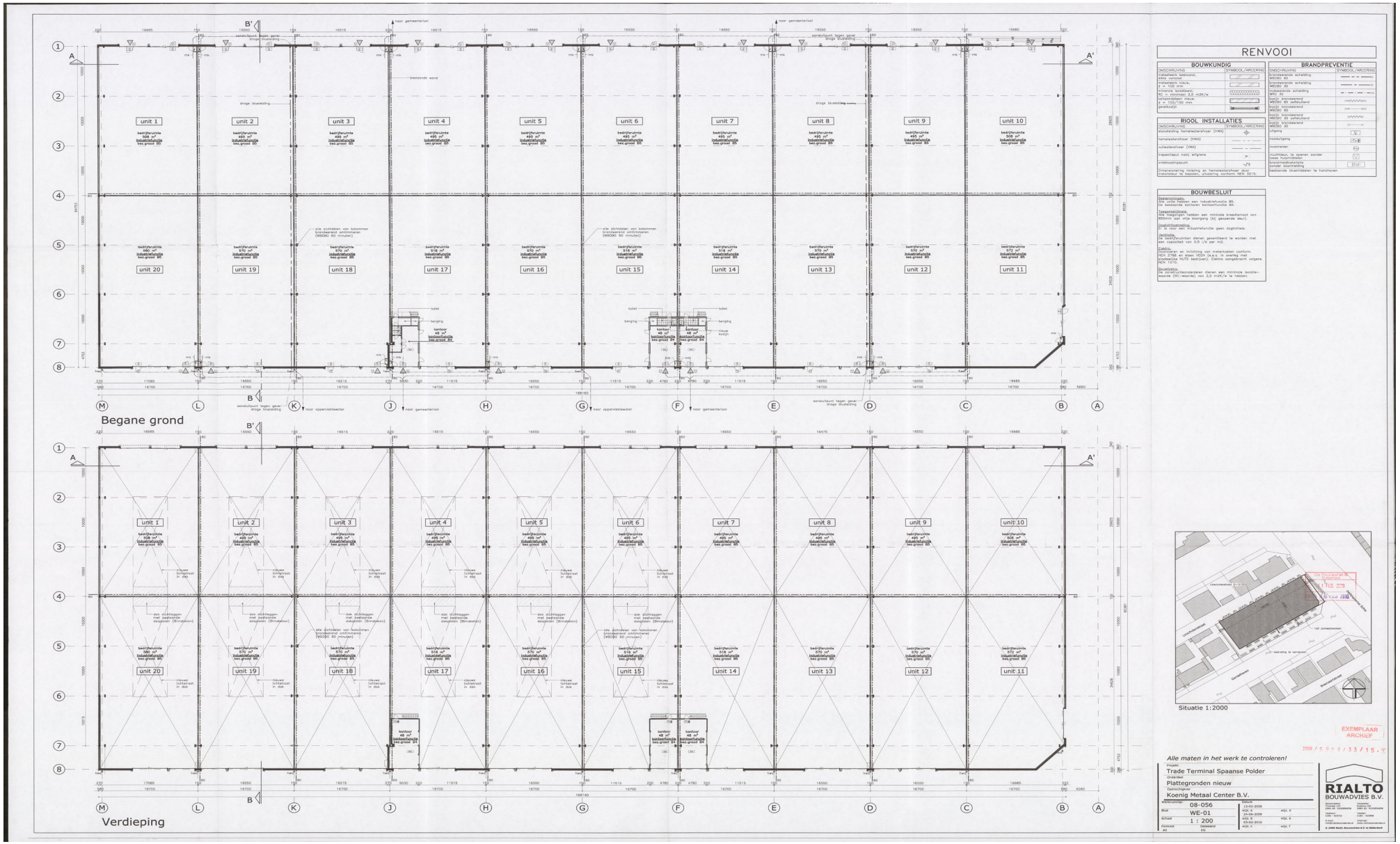
HISTORICAL RESEARCH IN PREPARATION FOR DESIGN APPROACH

ARCHITECTURAL DRAWINGS FROM THE ARCHIVE IN ROTTERDAM

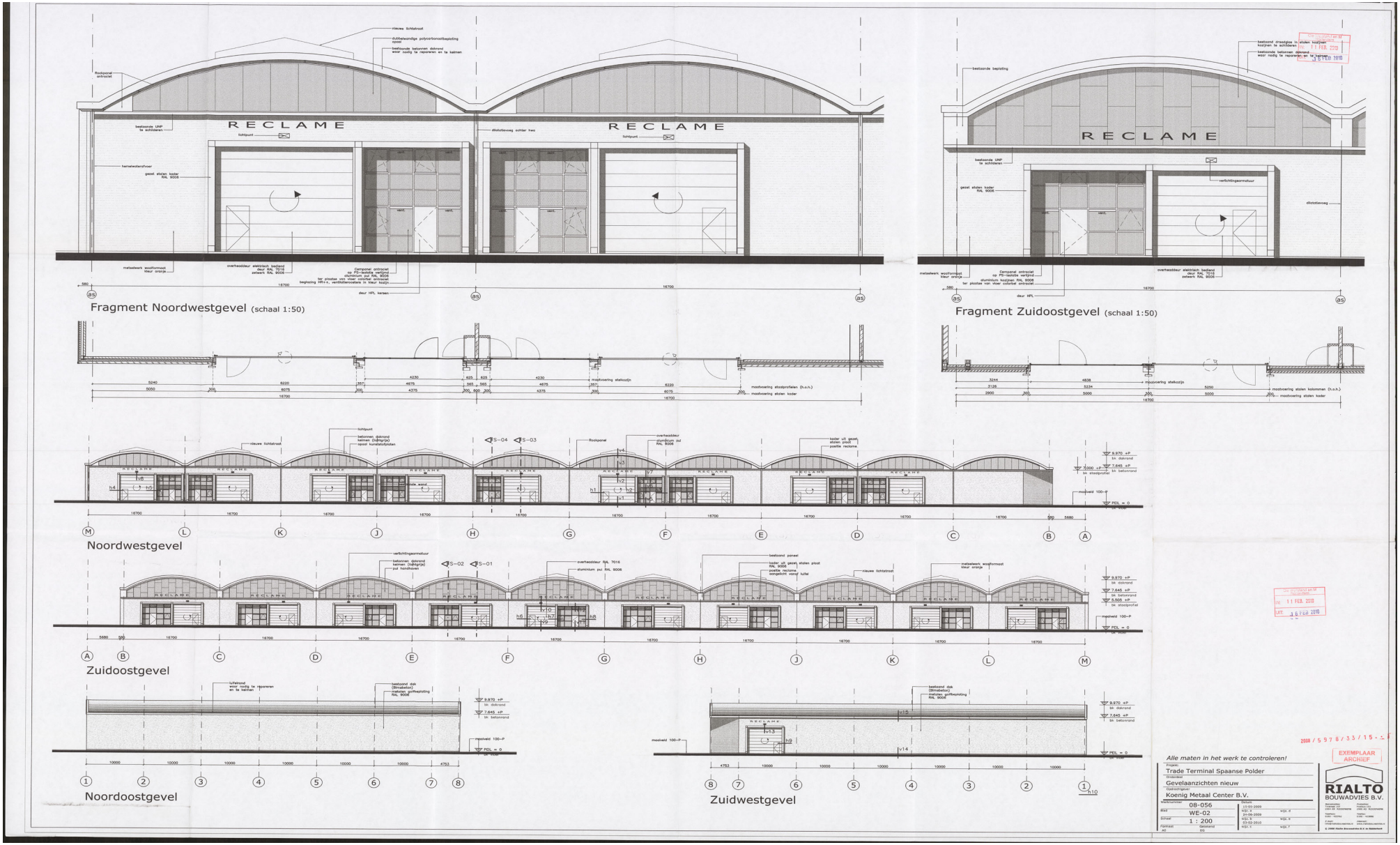




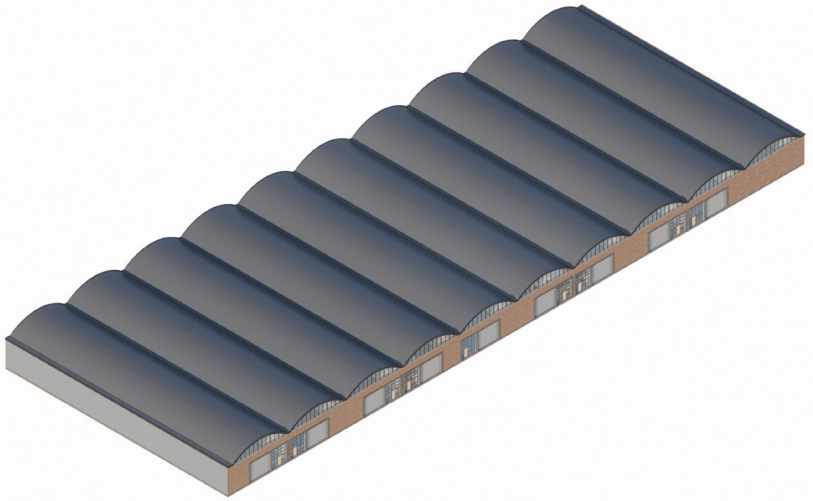
ARCHIVAL PLAN DRAWING OF THE PLAN LAYOUT



ARCHIVAL ELEVATION DRAWINGS OF THE FACADE

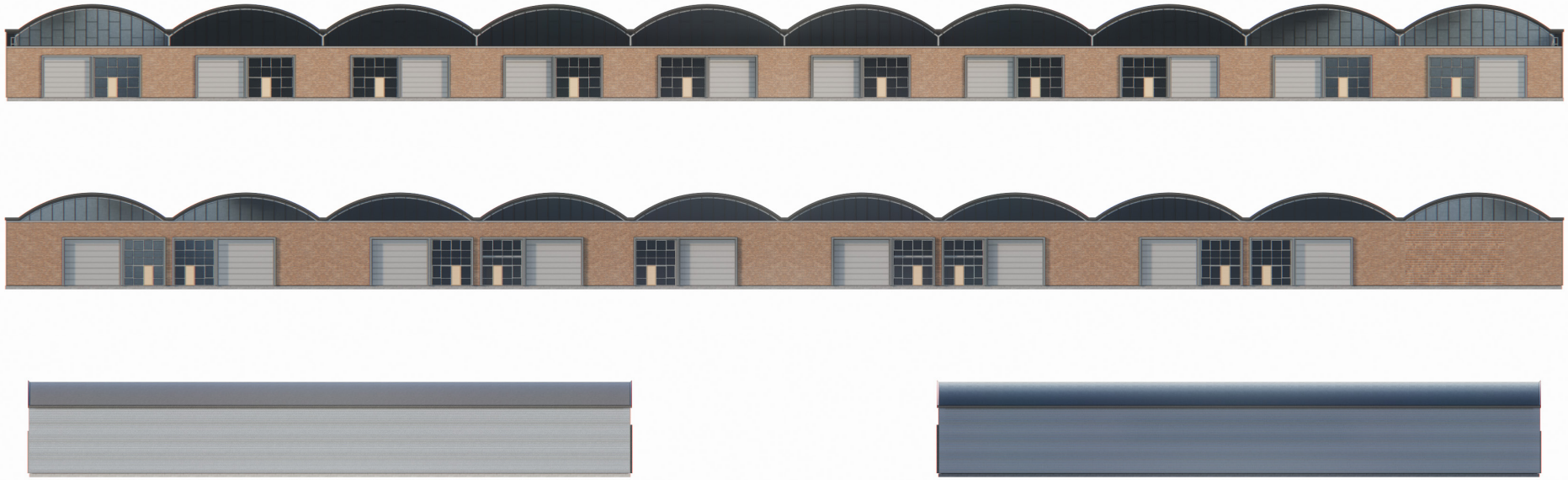


3D MODEL OF THE BUILDING



MAKING A DIGITAL TWIN OF THE (TO BE TRANSFORMED) BUILDING

Nam, con posapiet et molut rem volenis qui dollaudio. Optatquas quatum ius maximax imuscip iciist molorescil excearis verio beaquisquia quunt quoditia velessit fuga. Ovitasit ullupis es dolut enimi, sumendam aute nulpa elicil et dolupta sum soluptatur? Quiam ipsam fuga. Namus sit eum et rehent laborio il molorestiae volecta tempor alia ipissedio. Itatisc idigend igentur?
Et eumque nimin conse eicideb issimust, quam, ea qui to eaque ex enietus, cusdae volupta impos posandis eossunt dit, ut lautem quam, consequ iduntiu sdanis sam vita corit facerro ipsum que niment verore verum ra duciae id quatemp eribusam qui officiant quam doloribere voles explabo. Udis eossiniminia vollate sapit officiam volut int es il minctaectiam sunto id quiamen dipitatetur? Labo. Lame nus alici non everum quatem que volo maioratur am, etur alit vellest esciis dolorunt esequat la qui culpa consequ aspisit vel et pratissi diaerum fugiam faceratum untiis nonet mil is ipis natur, quo odi rectum velignis ea et eat ium nem ut et molo evel iusciis ditas volorepti as simus, quis ium hariat explab ilibustiam id quo blanda nam quia natur sa nos earchita ditatur mo molessenis il everist isitatia nobisci pistis atur? Ipsamustion cus ut vid et magnitio in prae di dolupta nonsequ ibusdae a is dem aditiorro con



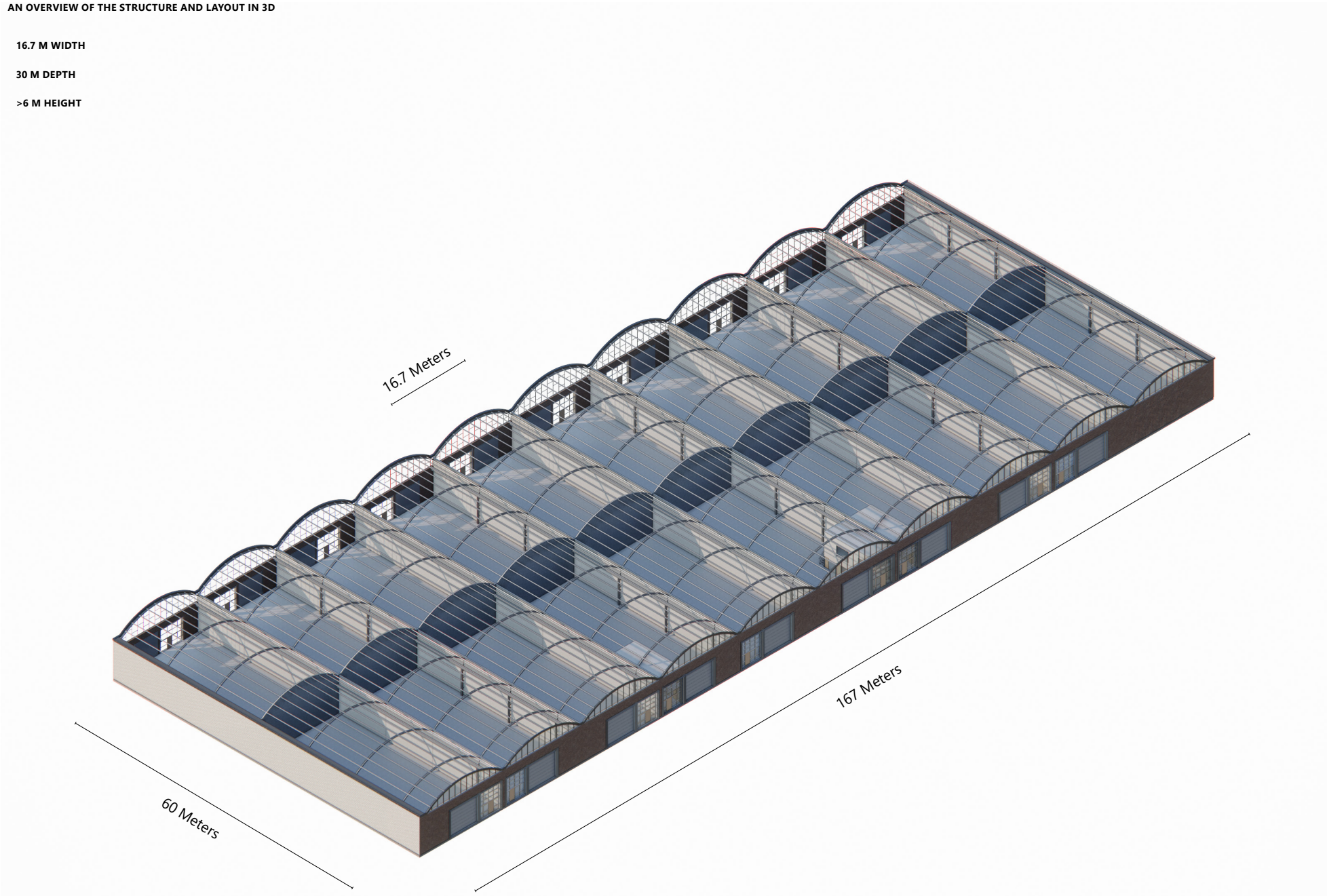
GROUND FLOOR:
INDUSTRIAL RE-USE

AN OVERVIEW OF THE STRUCTURE AND LAYOUT IN 3D

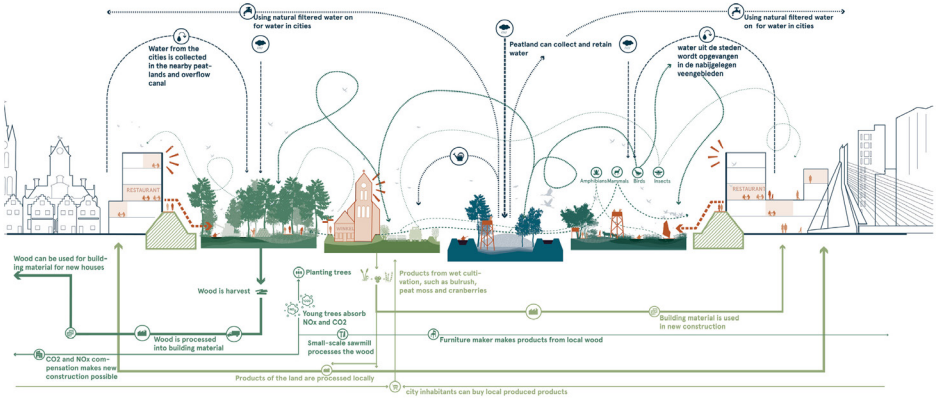
16.7 M WIDTH

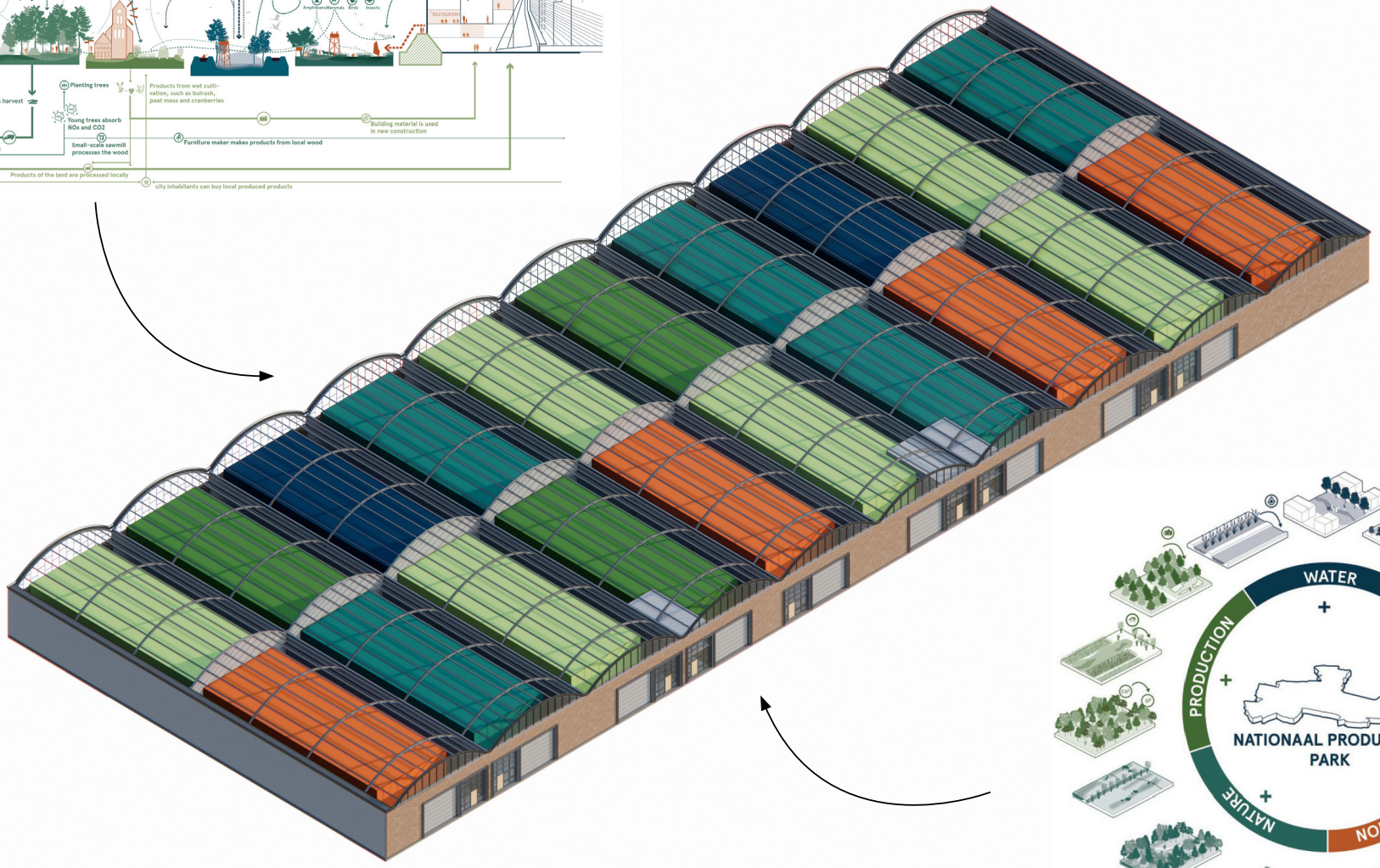
30 M DEPTH

>6 M HEIGHT



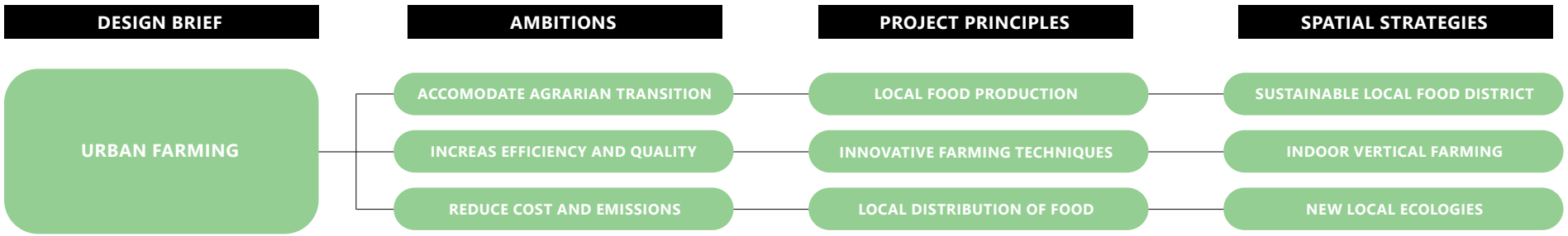
THE EXISTING BUILDING IS VERY SUITABLE FOR RE-USE, ESPECIALLY PRODUCTION RELATED ACTIVITIES



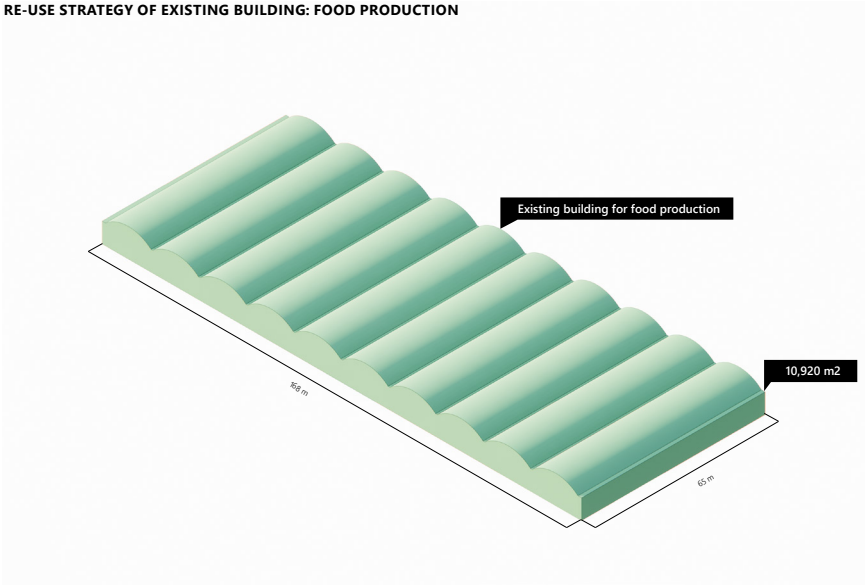


THE EXISTING BUILDING IS VERY SUITABLE

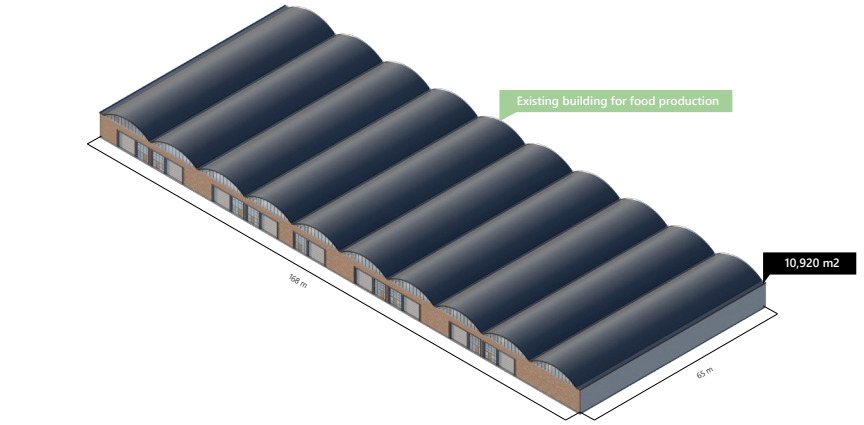
the new functions of the large national production park midden-delfland, close by, could be hosted in this large industrial building which has a significant floor level height of 6m and large open areas suitable for production, the process-ing of goods (food, materials) and the distribution of goods. Espcially because the building is situated in an industrial urban area where infrastructure is present and suitable for logistics.


DESIGN BRIEF
AMBITIONS
PROJECT PRINCIPLES
SPATIAL STRATEGIES
URBAN FARMING
ACCOMODATE AGRARIAN TRANSITION
INCREAS EFFICIENCY AND QUALITY
REDUCE COST AND EMISSIONS
LOCAL FOOD PRODUCTION
INNOVATIVE FARMING TECHNIQUES
LOCAL DISTRIBUTION OF FOOD
SUSTAINABLE LOCAL FOOD DISTRICT
INDOOR VERTICAL FARMING
NEW LOCAL ECOLOGIES

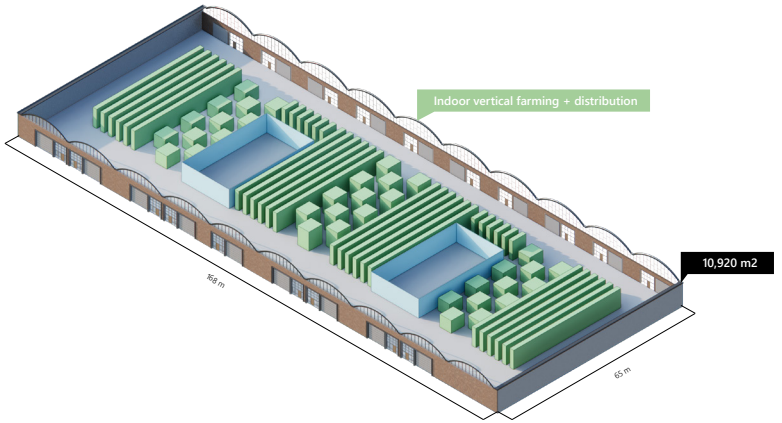
RE-USE STRATEGY OF EXISTING BUILDING: FOOD PRODUCTION



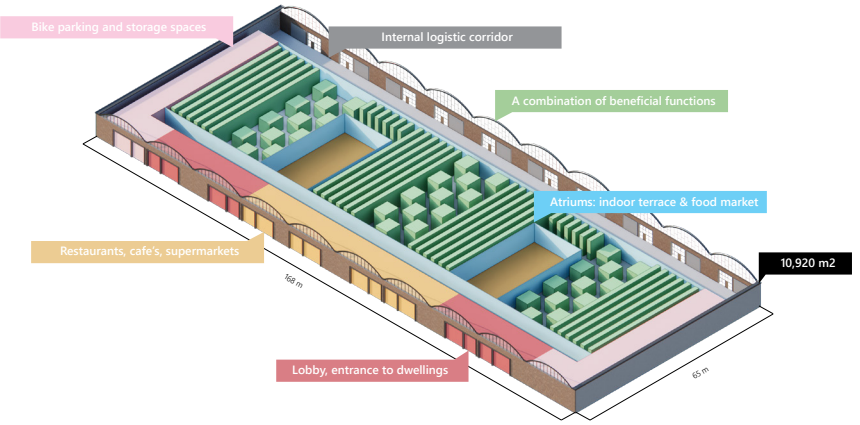
FOOD PRODUCTION HALL



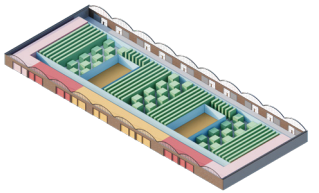
FOOD PRODUCTION HALL

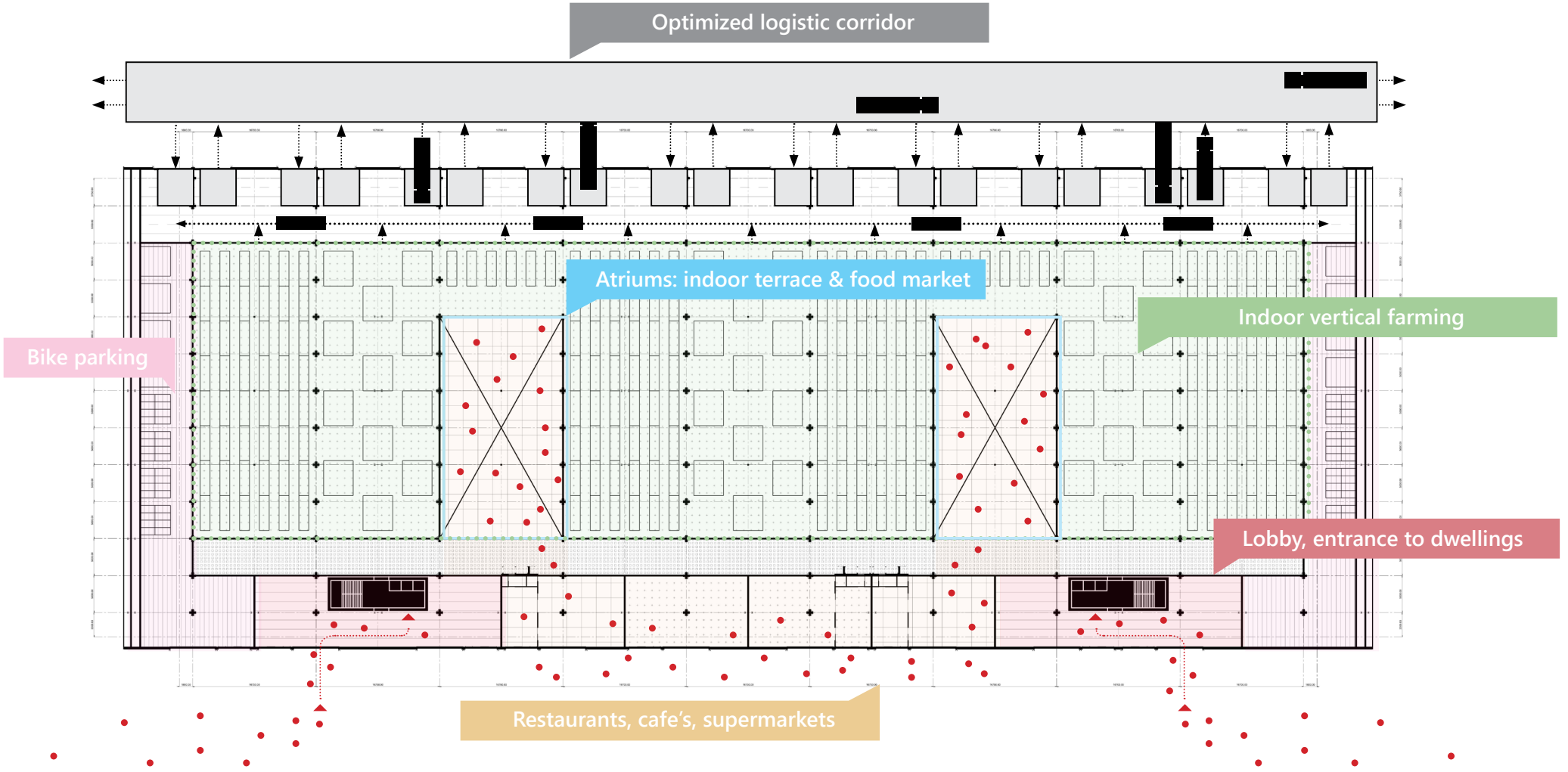


FOOD PRODUCTION HALL

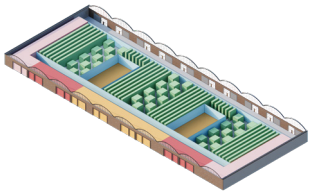


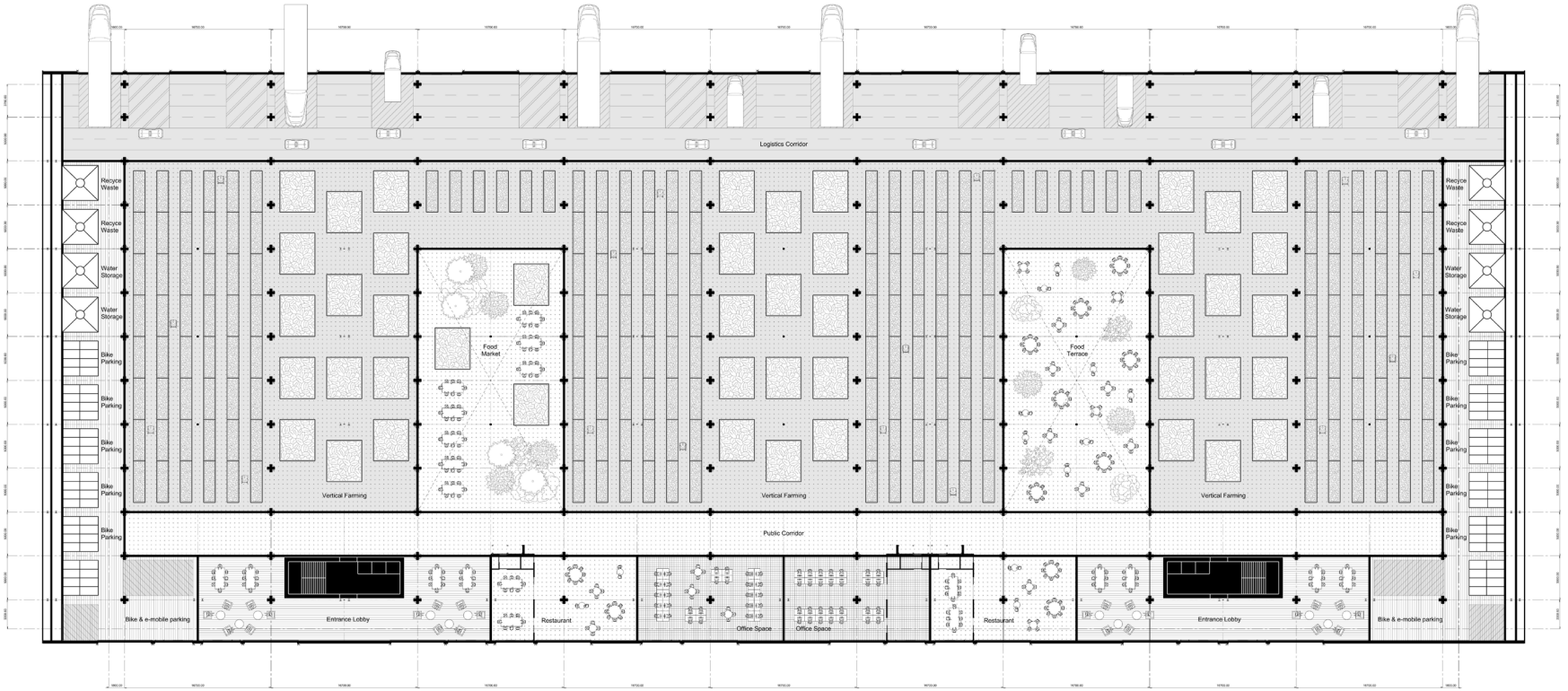
FOOD PRODUCTION PLAN



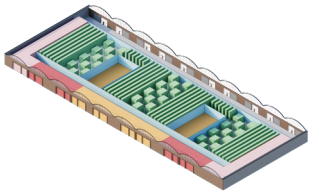


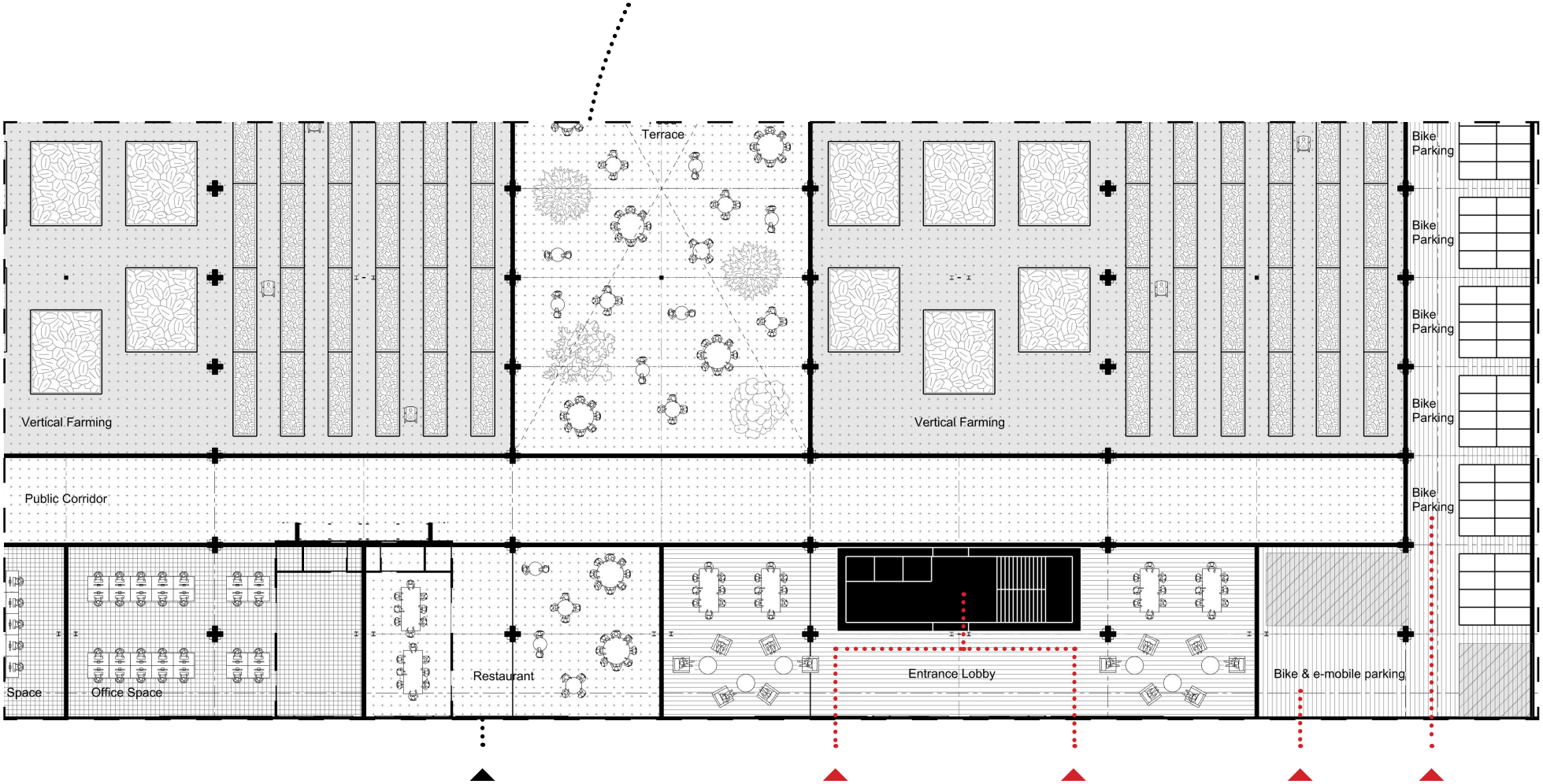
GROUND LEVEL PLAN





GROUND LEVEL PLAN





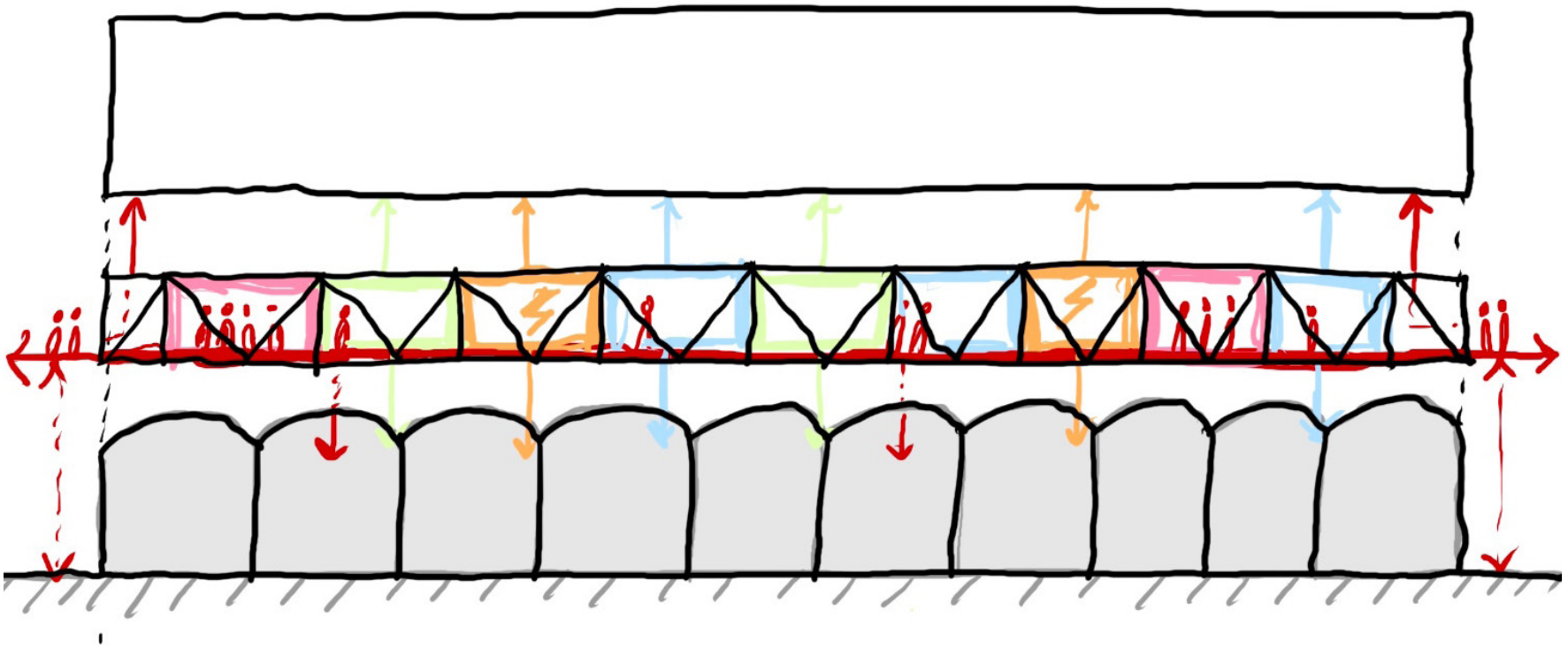
IN BETWEEN LEVEL:
MULTI-FUNCTIONAL LAYER

CONCEPT

A TRANSFER LEVEL THAT ALLOWS FOR STRUCTURAL TRANSFER
LOADS TO MINIMIZE STRUCTURAL PERFORATIONS

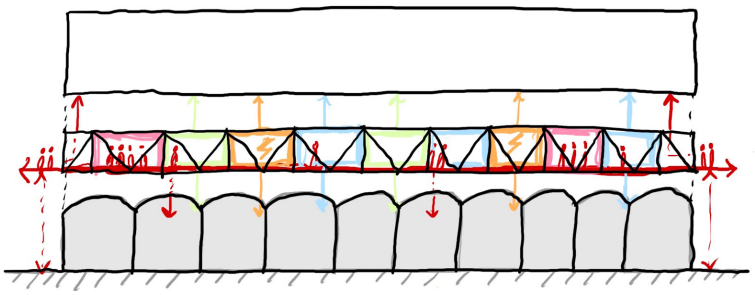
MULTI-PURPOSE IN BETWEEN LEVEL:

CIRCULATION, SOCIAL MEETING SPACES,
ROOM FOR GREEN, ENERGY, WATER STORAGE



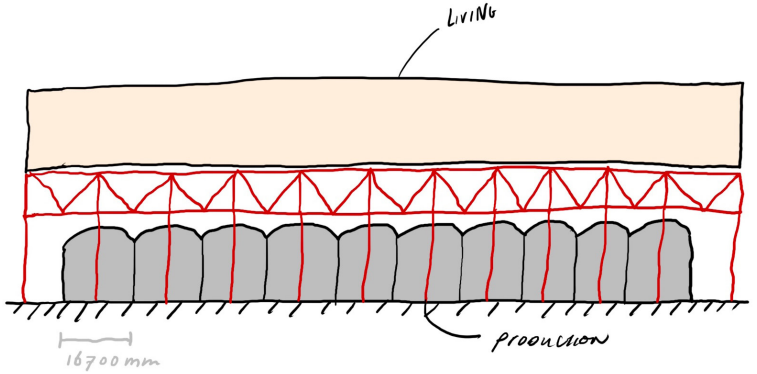
CONCEPT

A TRANSFER LEVEL THAT ALLOWS FOR STRUCTURAL TRANSFER
LOADS TO MINIMIZE STRUCTURAL PERFORATIONS



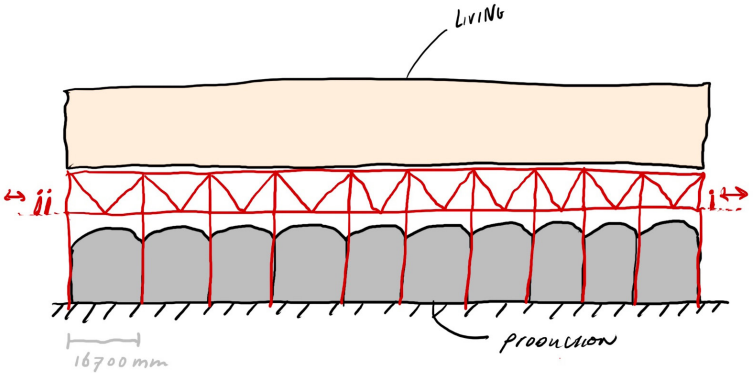
STRUCTURAL OPTION 1

NEW STRUCTURE SEPARATE FROM EXISTING STRUCTURE,
EITHER EXPANDING OVER OR HAVING A SETBACK



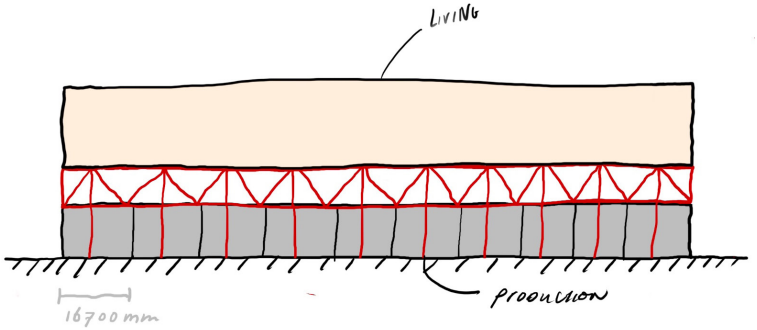
STRUCTURAL OPTION 2

NEW STRUCTURE ALIGNED WITH THE EXISTING STRUCTURE,
NEW VOLUME AND GRID ALIGNED WITH EXISTING

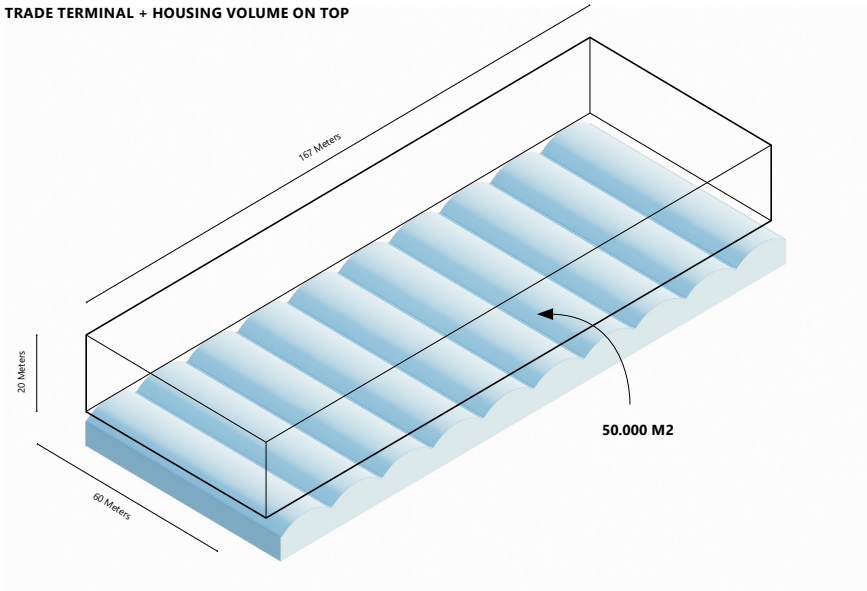


STRUCTURAL OPTION 3

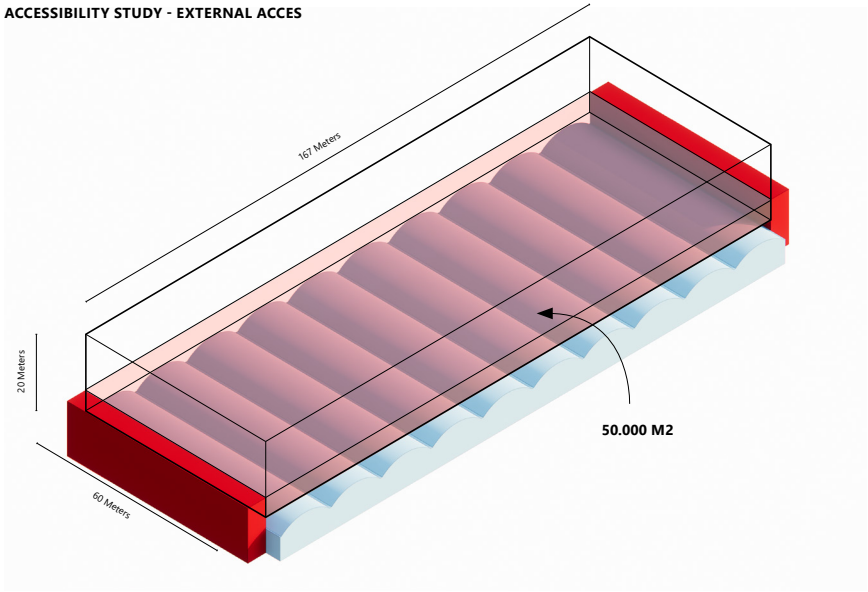
INBETWEEN LEVEL REPLACES ROOF STRUCTURE,
FORMING A MERGED VOLUME OF OLD AND NEW



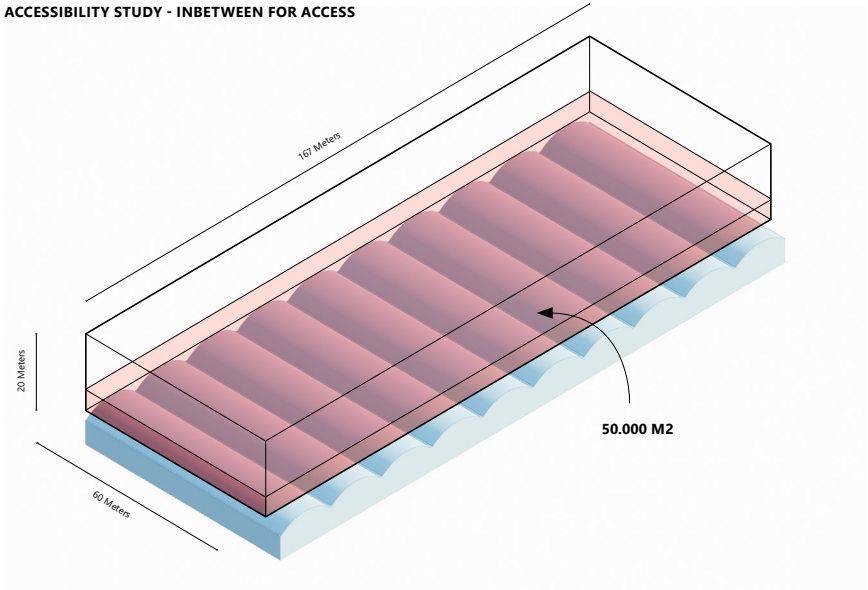
TRADE TERMINAL + HOUSING VOLUME ON TOP



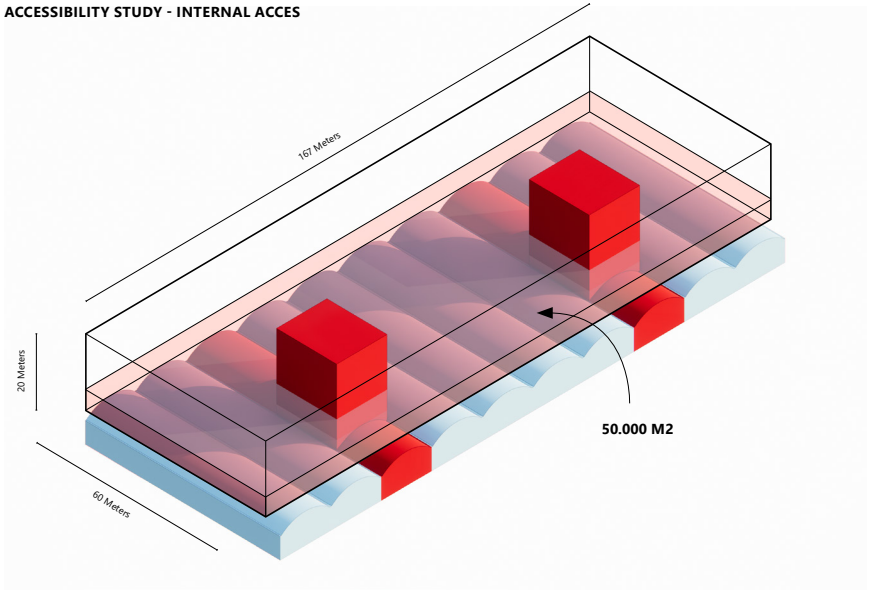
ACCESSIBILITY STUDY - EXTERNAL ACCES



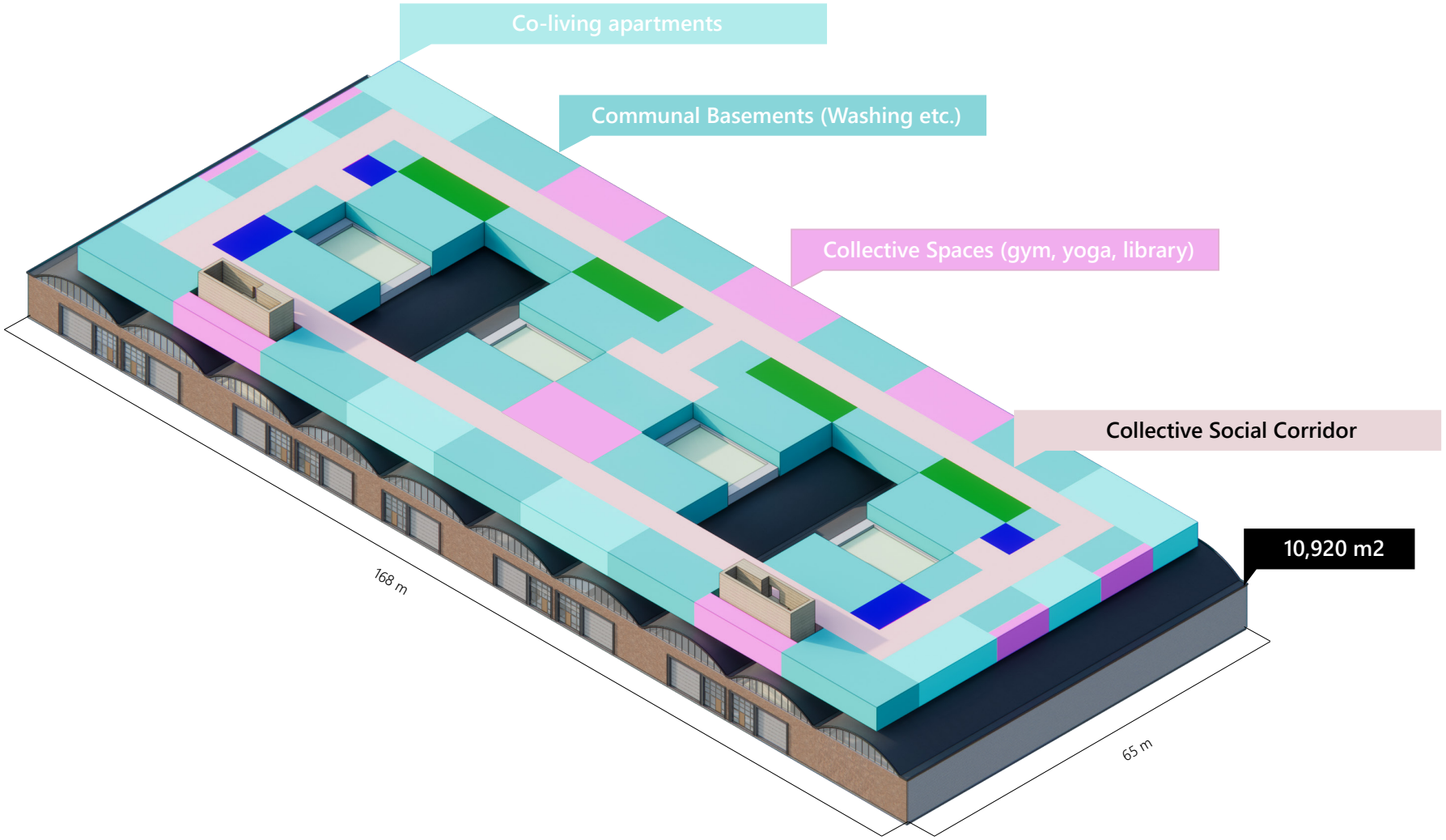
ACCESSIBILITY STUDY - INBETWEEN FOR ACCESS



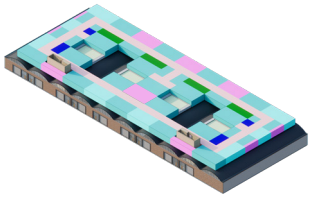
ACCESSIBILITY STUDY - INTERNAL ACCES



INBETWEEN LEVEL

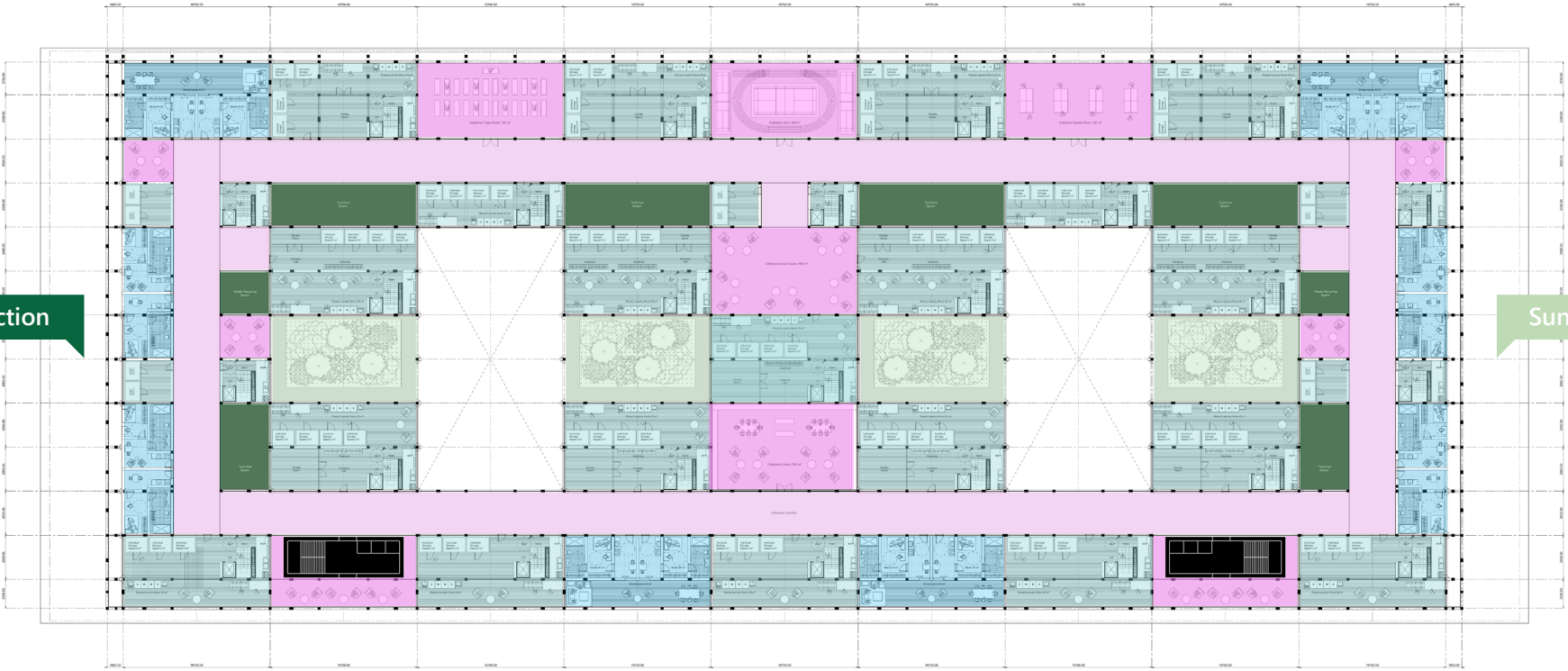


INBETWEEN LEVEL PLAN



Collective Social Corridor

Collective Spaces (gym, yoga, library)



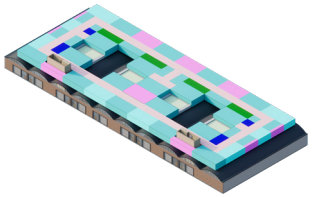
Waste collection

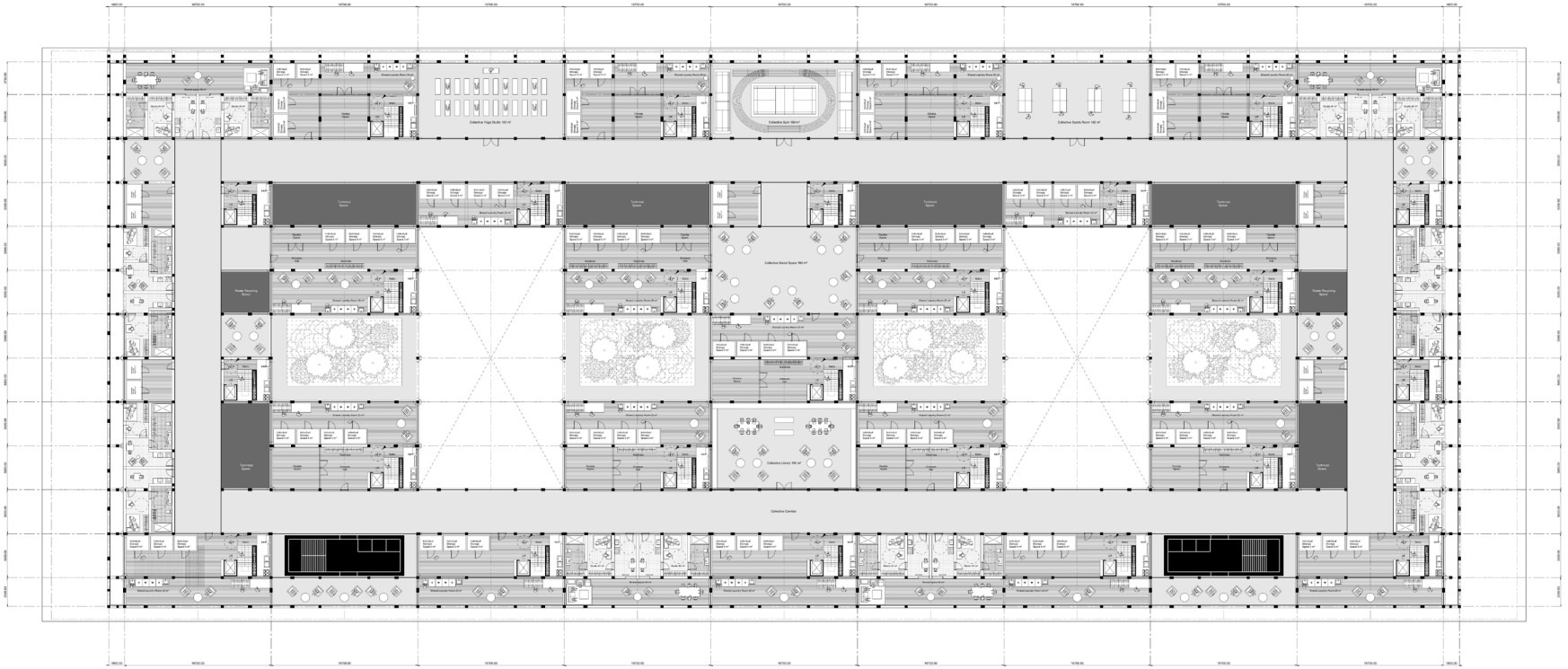
Sunken Gardens

Communal Basements (Washing etc.)

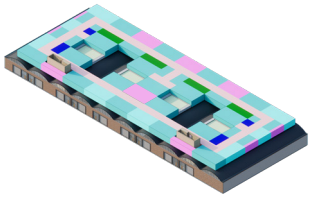
Co-living apartments

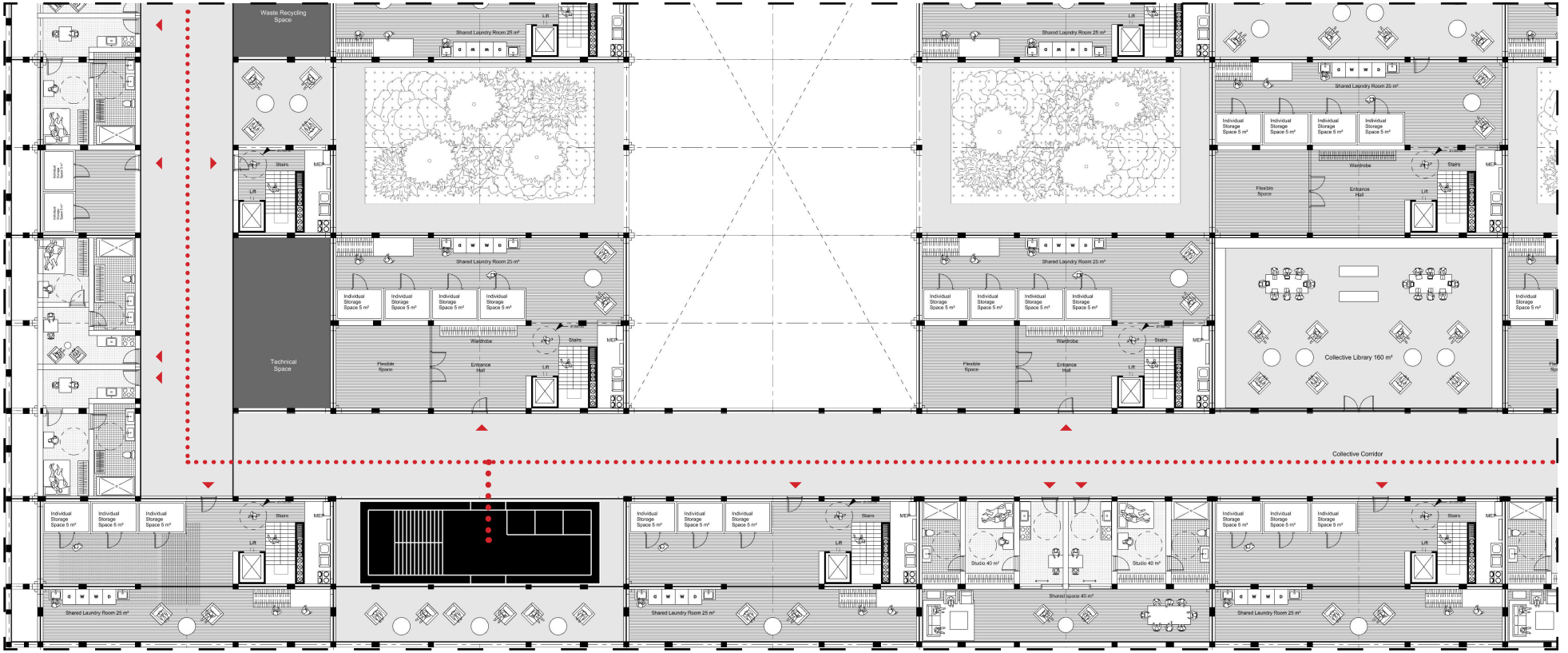
INBETWEEN LEVEL PLAN





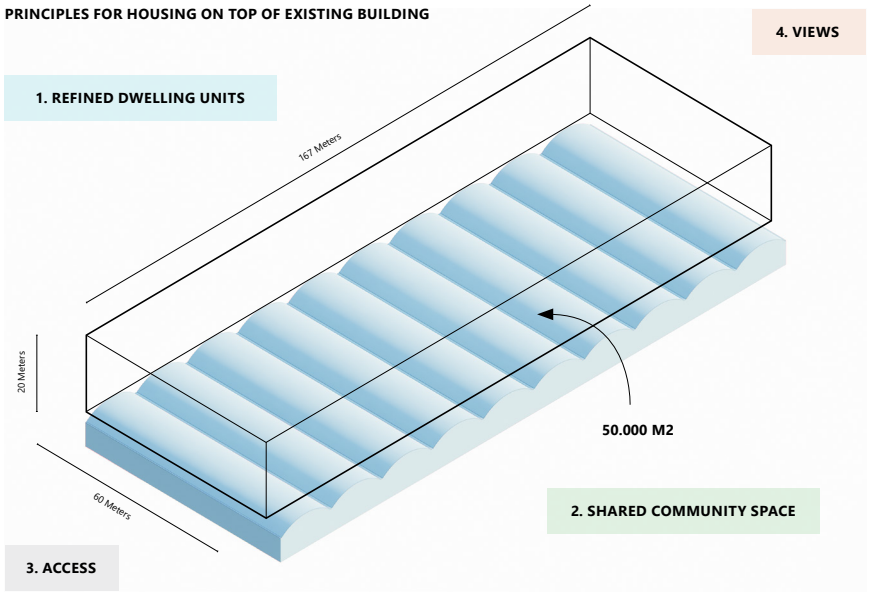
INBETWEEN LEVEL PLAN



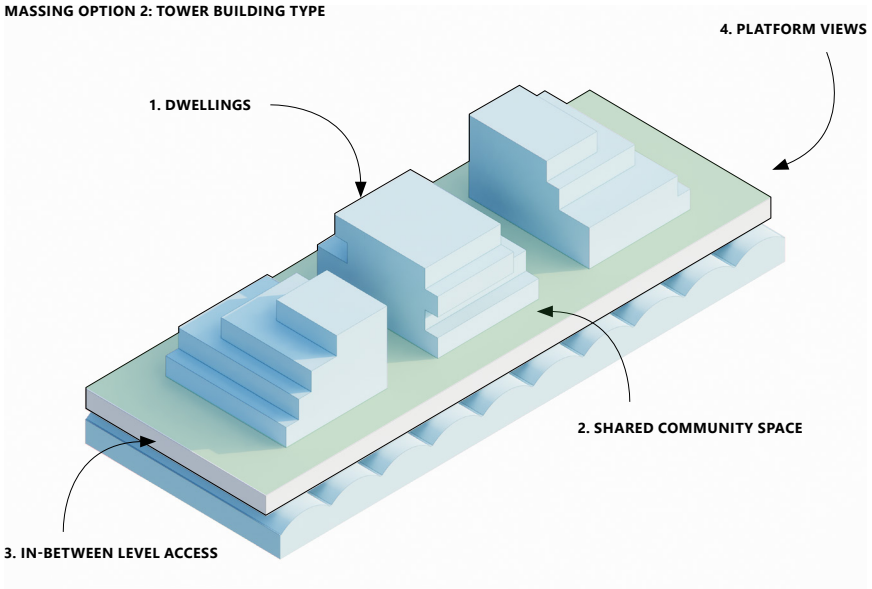


DWELLINGS ON TOP:
CO-LIVING CUMMUNITY

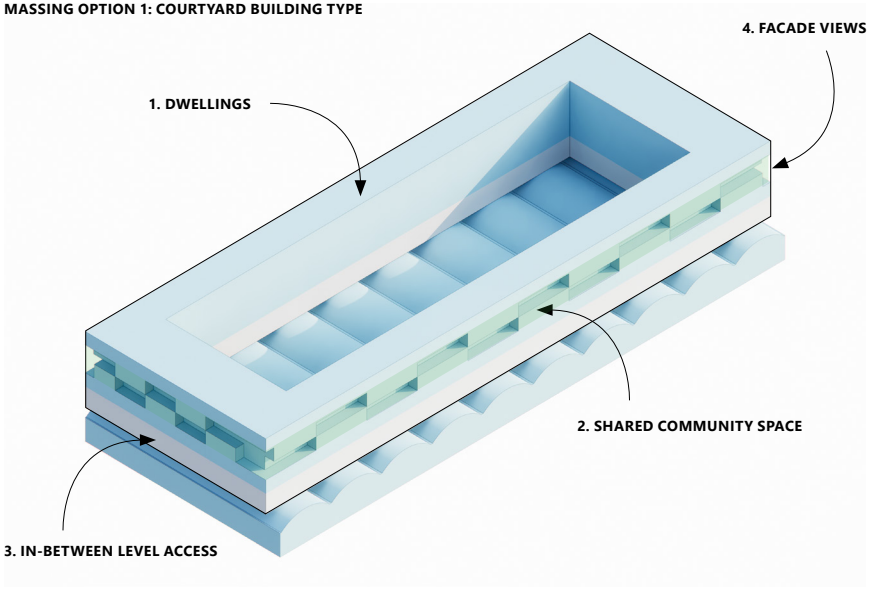
PRINCIPLES FOR HOUSING ON TOP OF EXISTING BUILDING



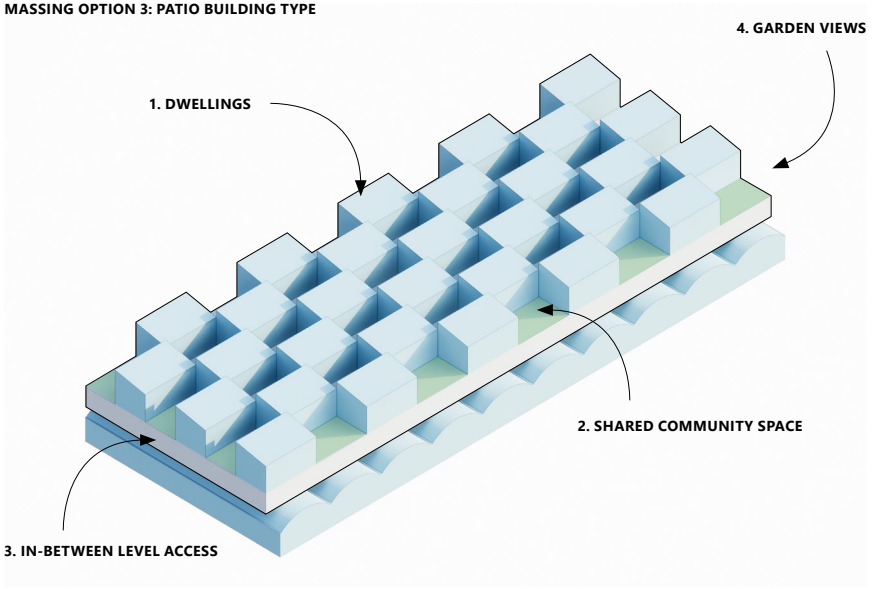
MASSING OPTION 2: TOWER BUILDING TYPE



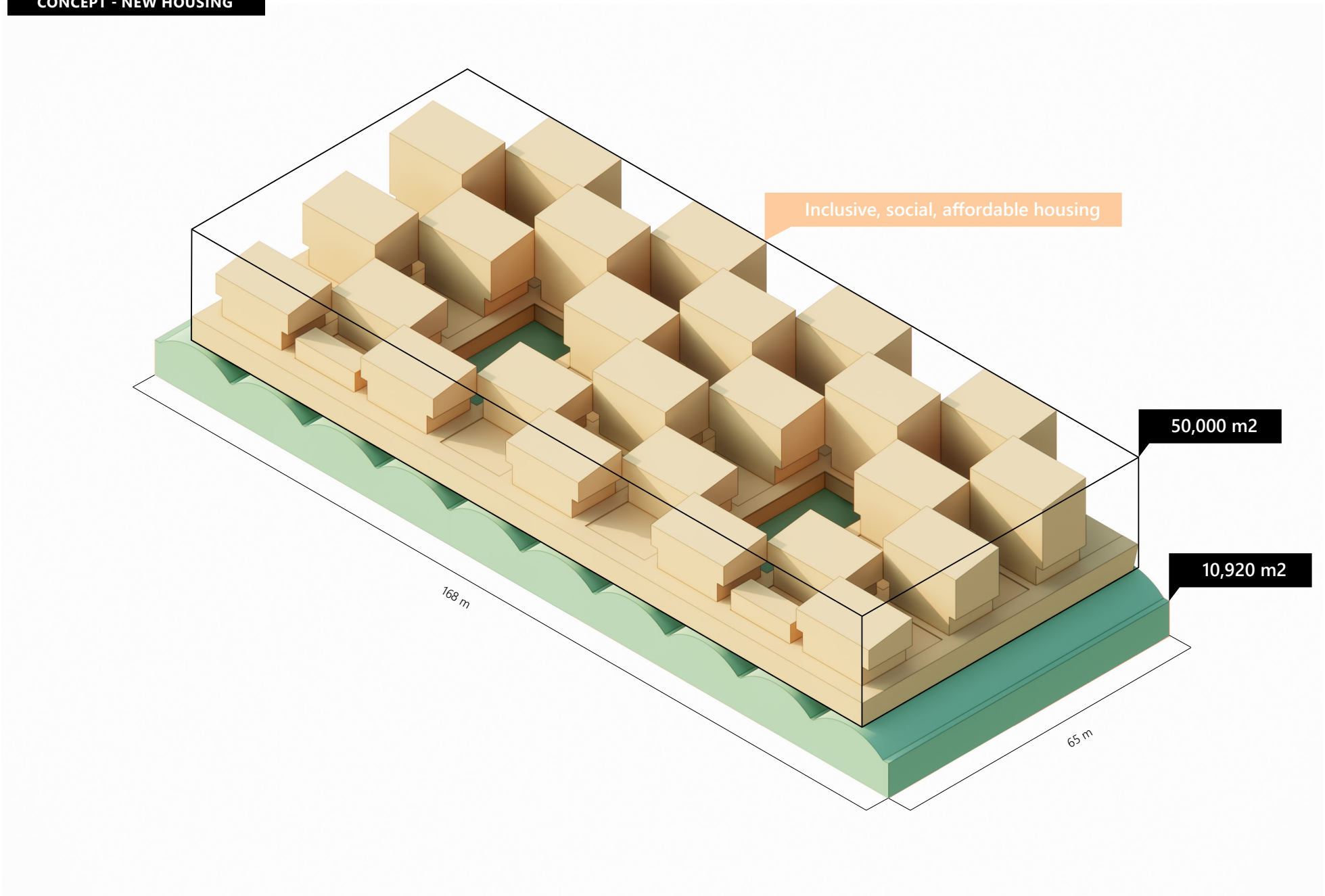
MASSING OPTION 1: COURTYARD BUILDING TYPE



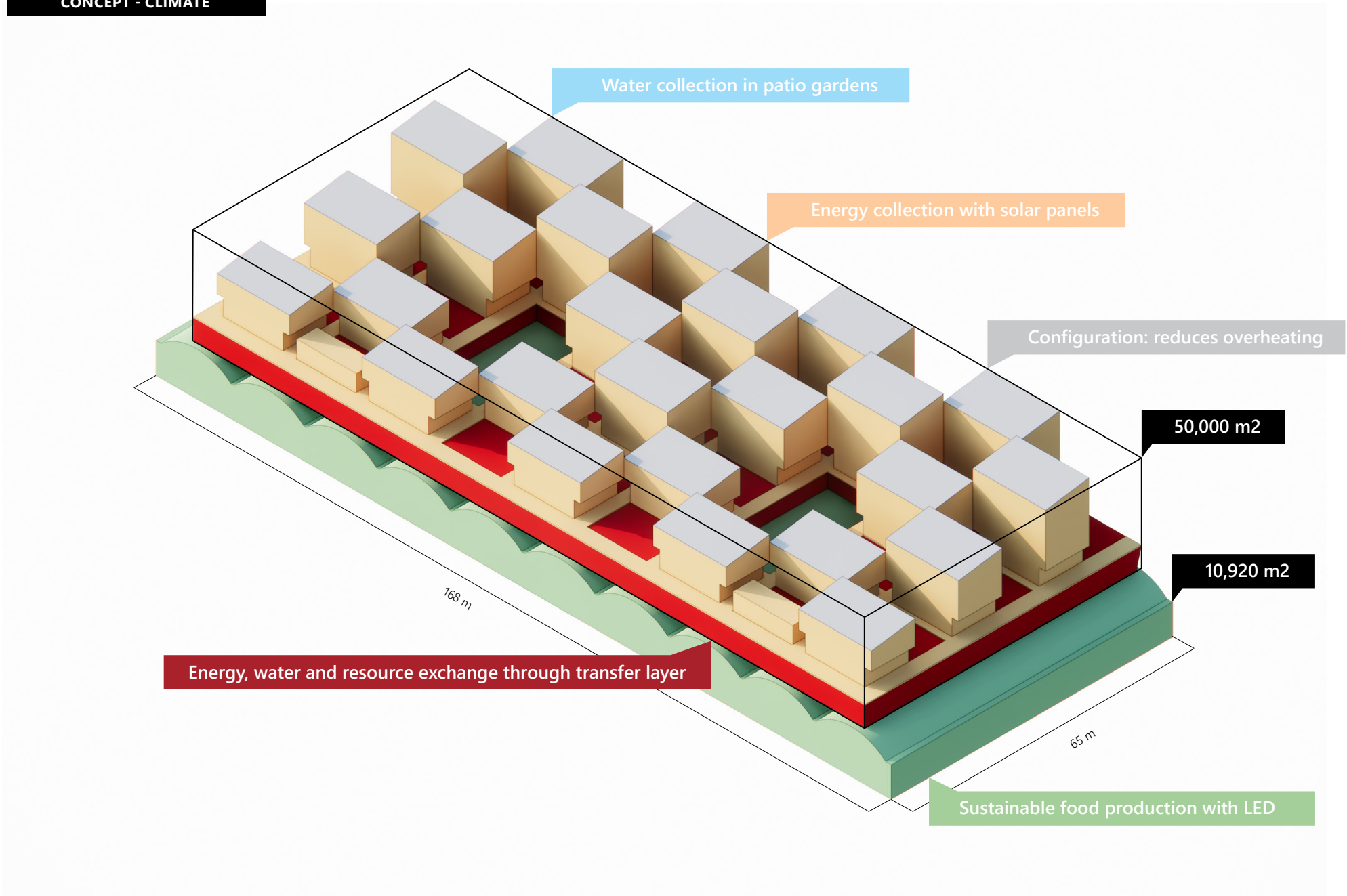
MASSING OPTION 3: PATIO BUILDING TYPE



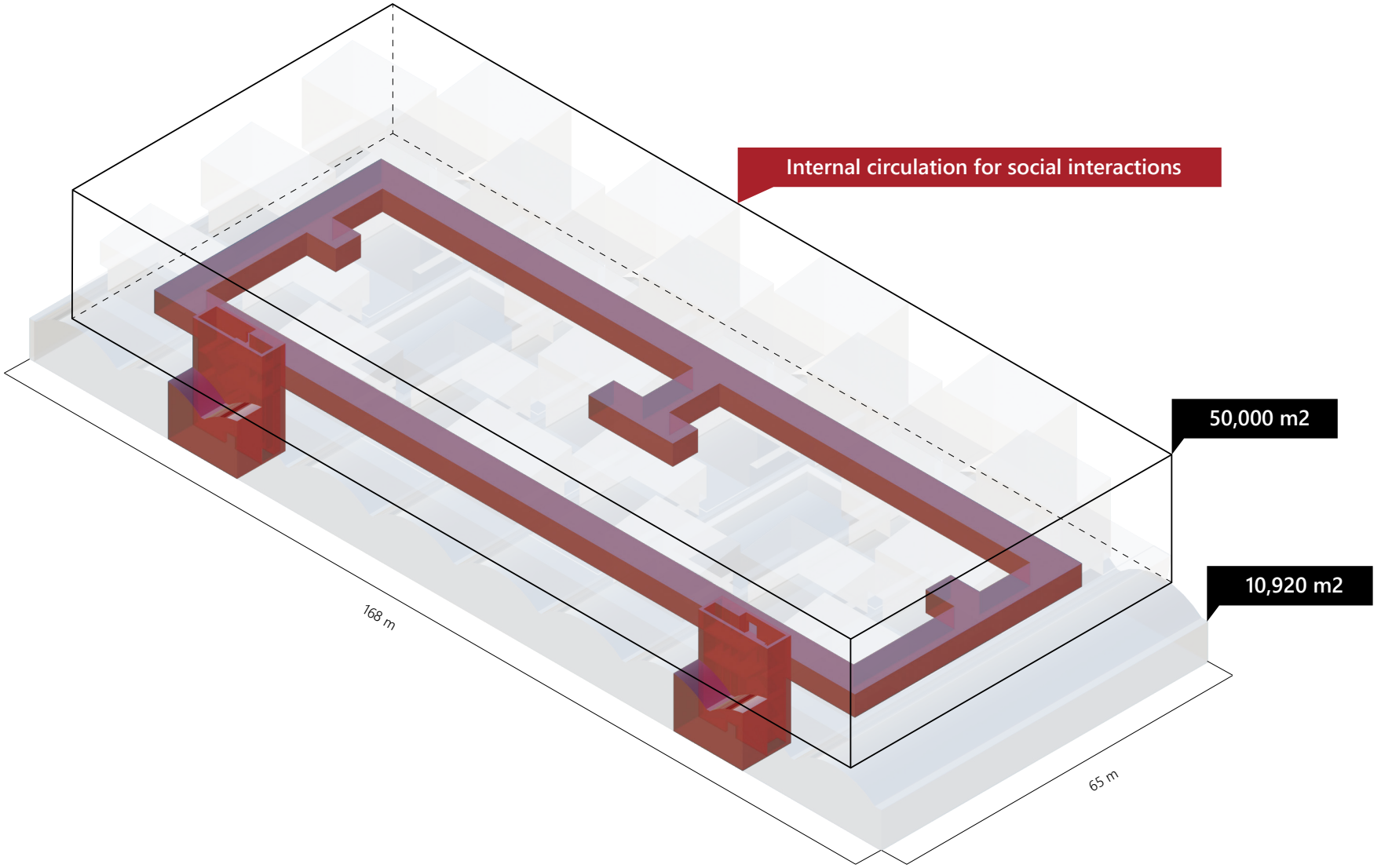
CONCEPT - NEW HOUSING



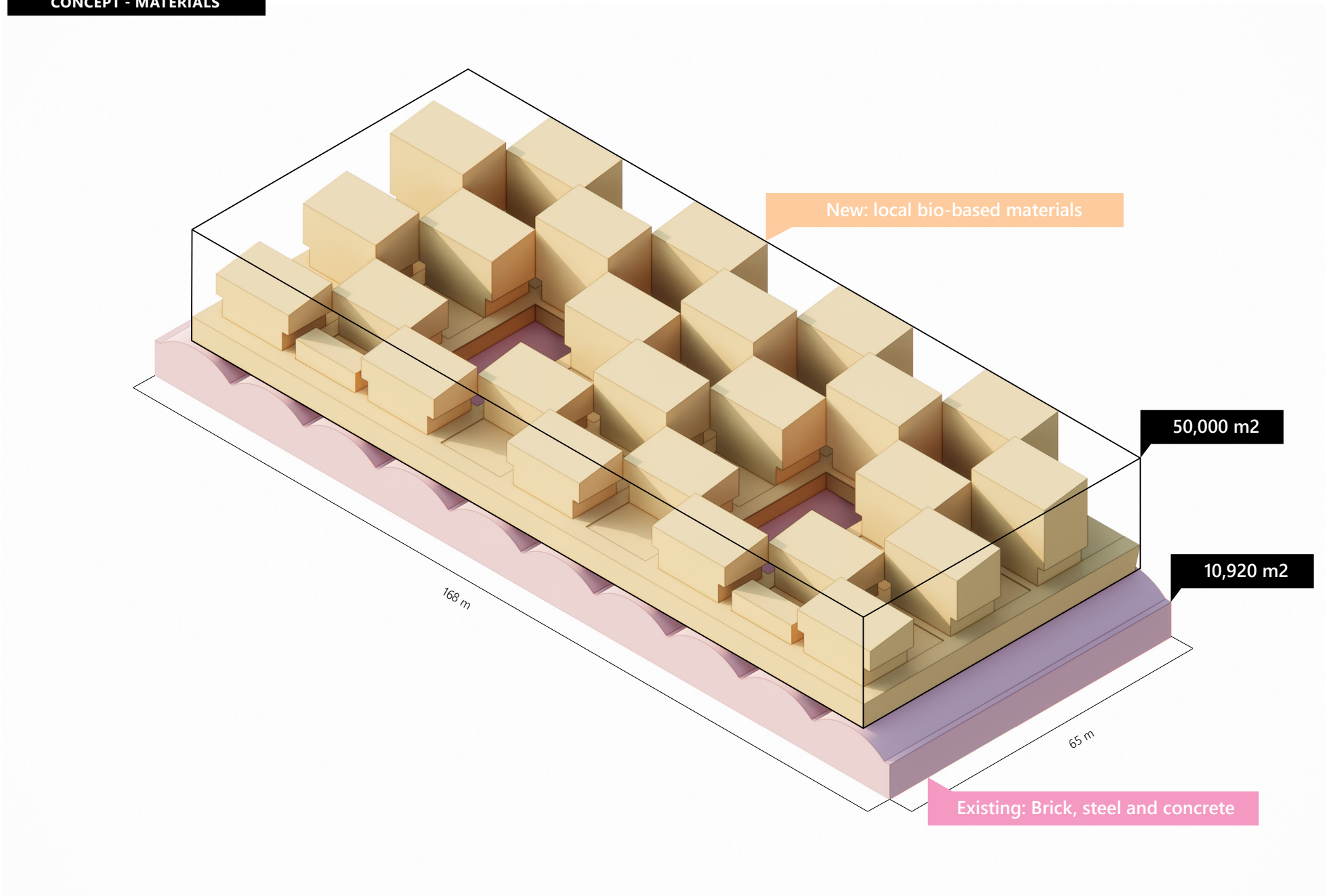
CONCEPT - CLIMATE



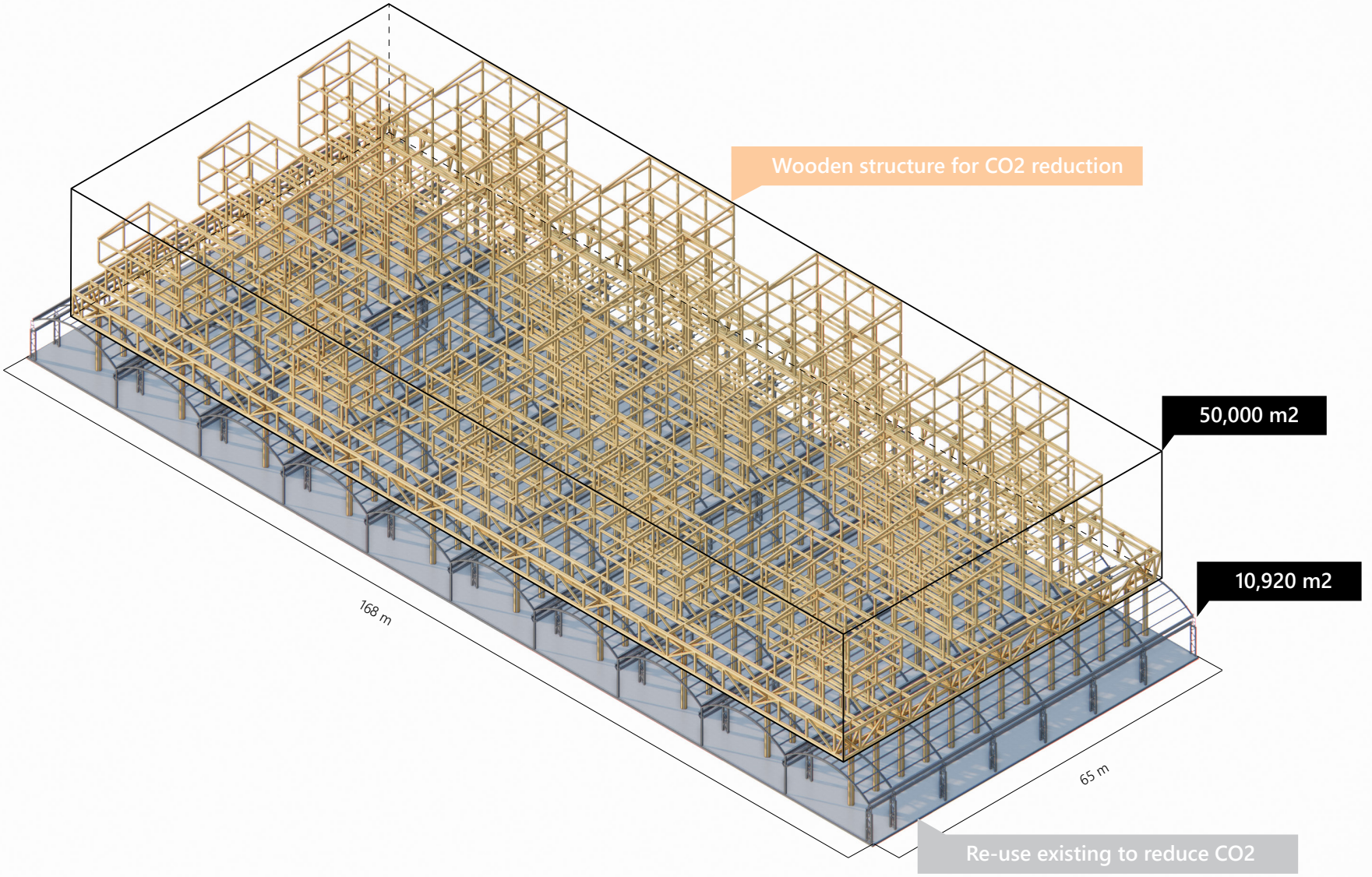
CONCEPT - CIRCULATION



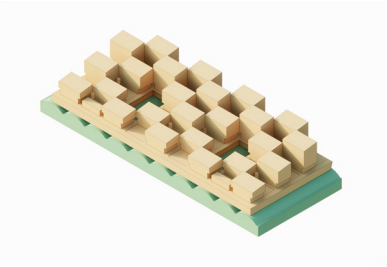
CONCEPT - MATERIALS



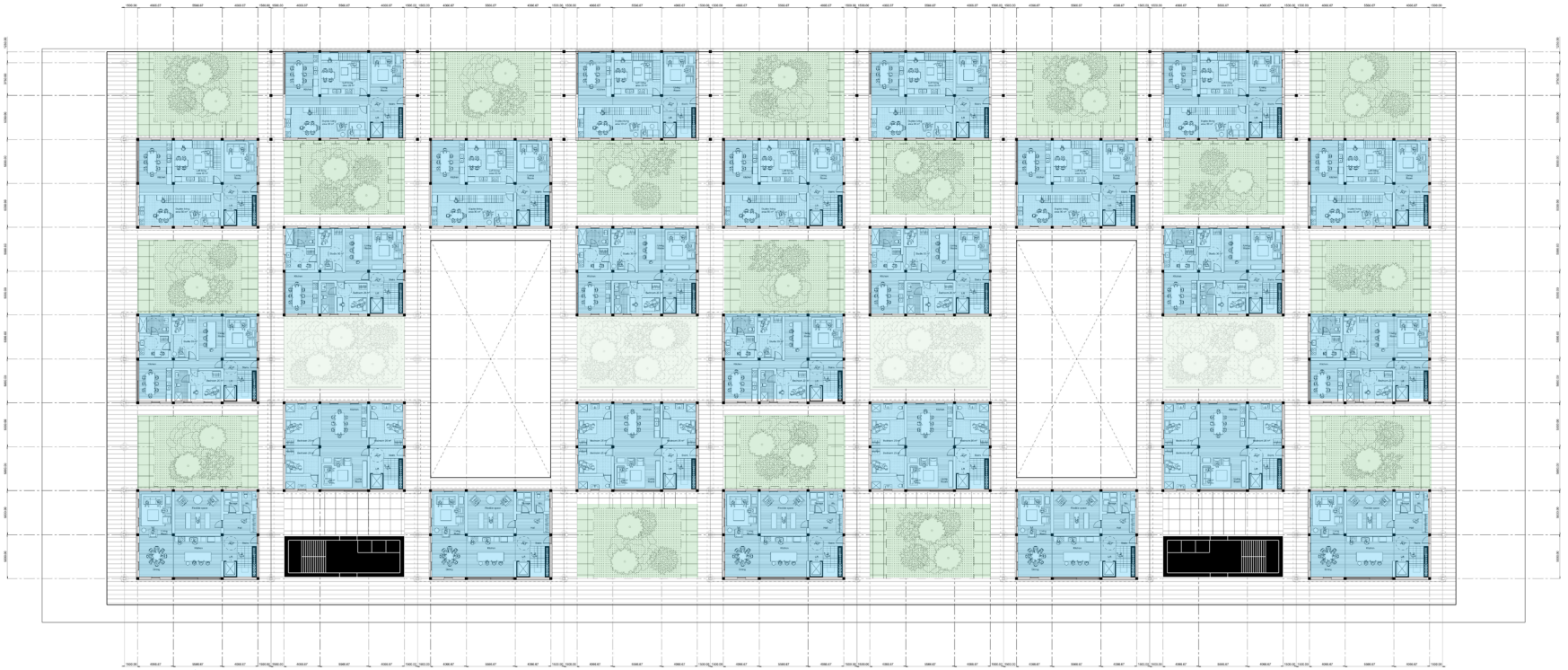
CONCEPT - STRUCTURE



DWELLING LEVEL PLAN

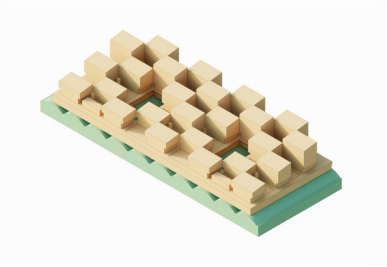


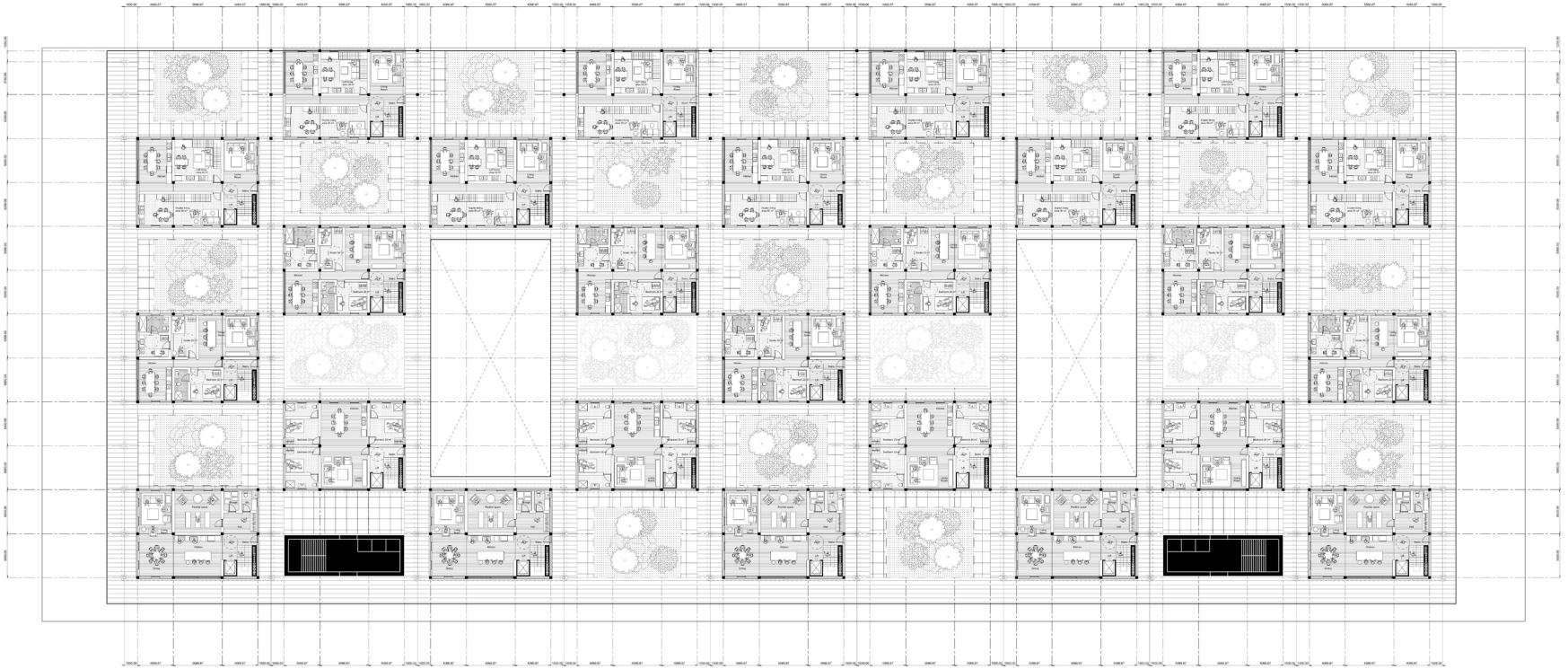
Communal Gardens



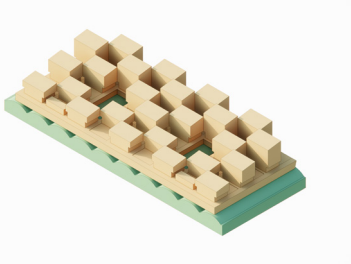
Co-living Clusters

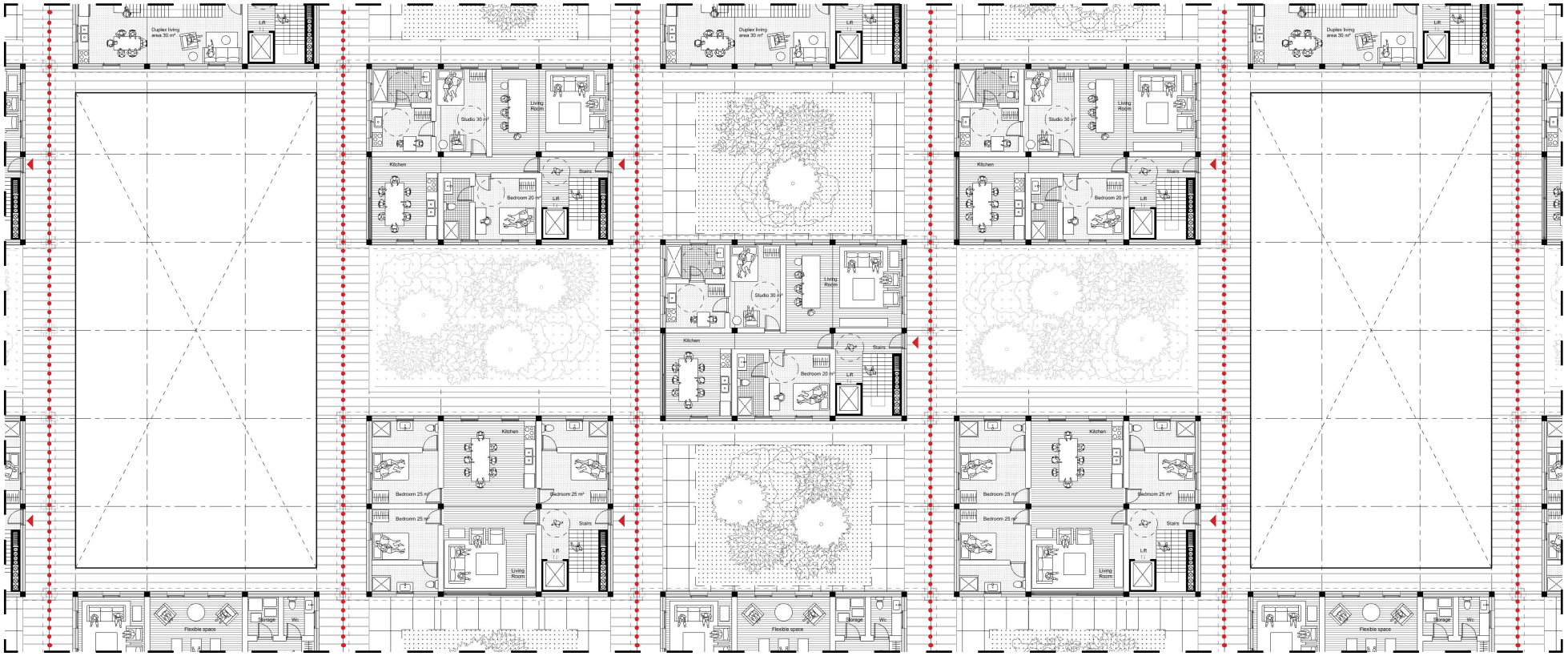
DWELLING LEVEL PLAN

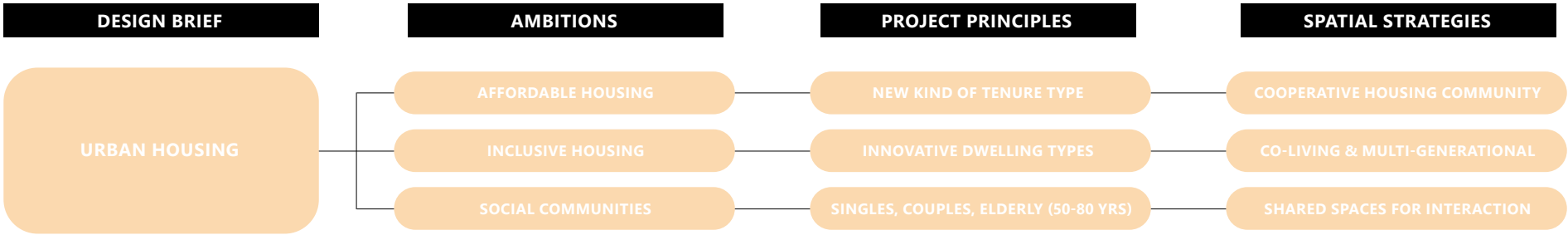




DWELLING LEVEL PLAN

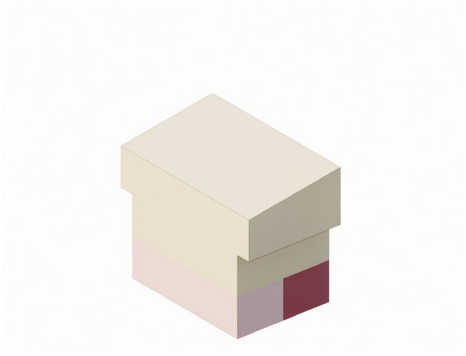





DESIGN BRIEF
AMBITIONS
PROJECT PRINCIPLES
SPATIAL STRATEGIES
URBAN HOUSING
AFFORDABLE HOUSING
INCLUSIVE HOUSING
SOCIAL COMMUNITIES
NEW KIND OF TENURE TYPE
INNOVATIVE DWELLING TYPES
SINGLES, COUPLES, ELDERLY (50-80 YRS)
COOPERATIVE HOUSING COMMUNITY
CO-LIVING & MULTI-GENERATIONAL
SHARED SPACES FOR INTERACTION

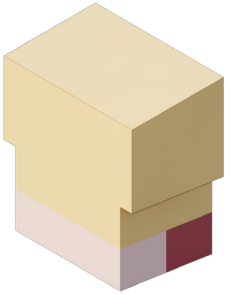
TYPE A: SPLIT LEVEL

STARTERS: SINGLES-COUPLES



TYPE B: SPLIT FLOOR

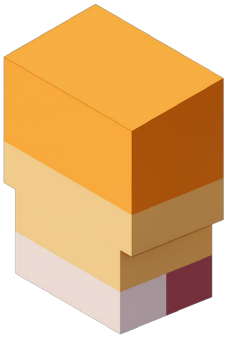
SINGLES-ELDERLY (50+)



TYPE C & D: LOFTS & DUPLEX

MULTI-GENERATIONAL

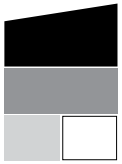
DIVORCED FAMILIES



PRIVATE SPACE

SHARED LIVING SPACE

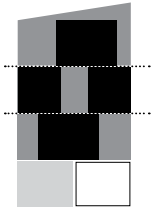
COMMUNAL BASEMENT



ROOMS: 30 M2

ROOMS: 15 M2

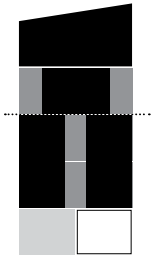
COLLECTIVE HALLWAY



STUDIOS: 30 M2

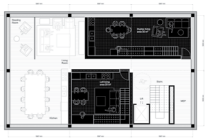
ROOMS: 20 M2

ROOMS: 10 M2



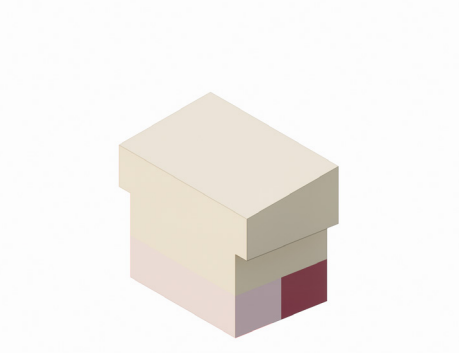
DUPLEX: 150 M2

LOFTS: 50 M2 & 100M2



TYPE A: SPLIT LEVEL

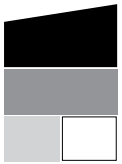
STARTERS: SINGLES-COUPLES



PRIVATE SPACE

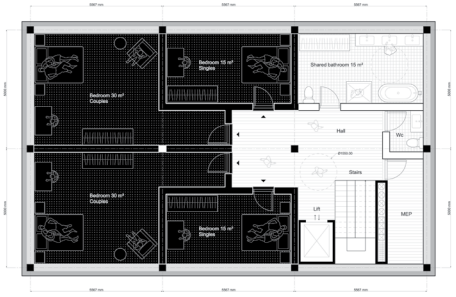
SHARED LIVING SPACE

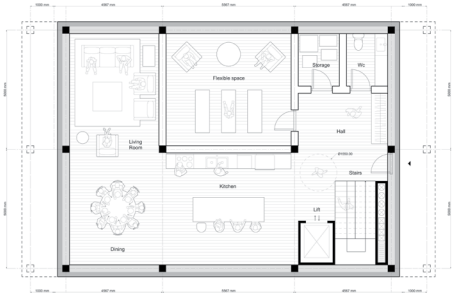
COMMUNAL BASEMENT

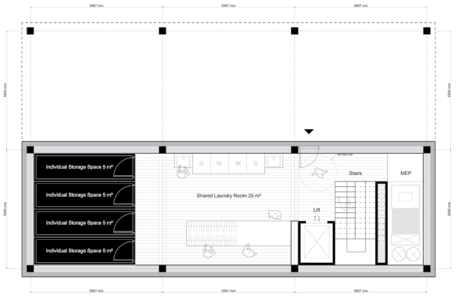


ROOMS: 30 M2
ROOMS: 15 M2

COLLECTIVE HALLWAY

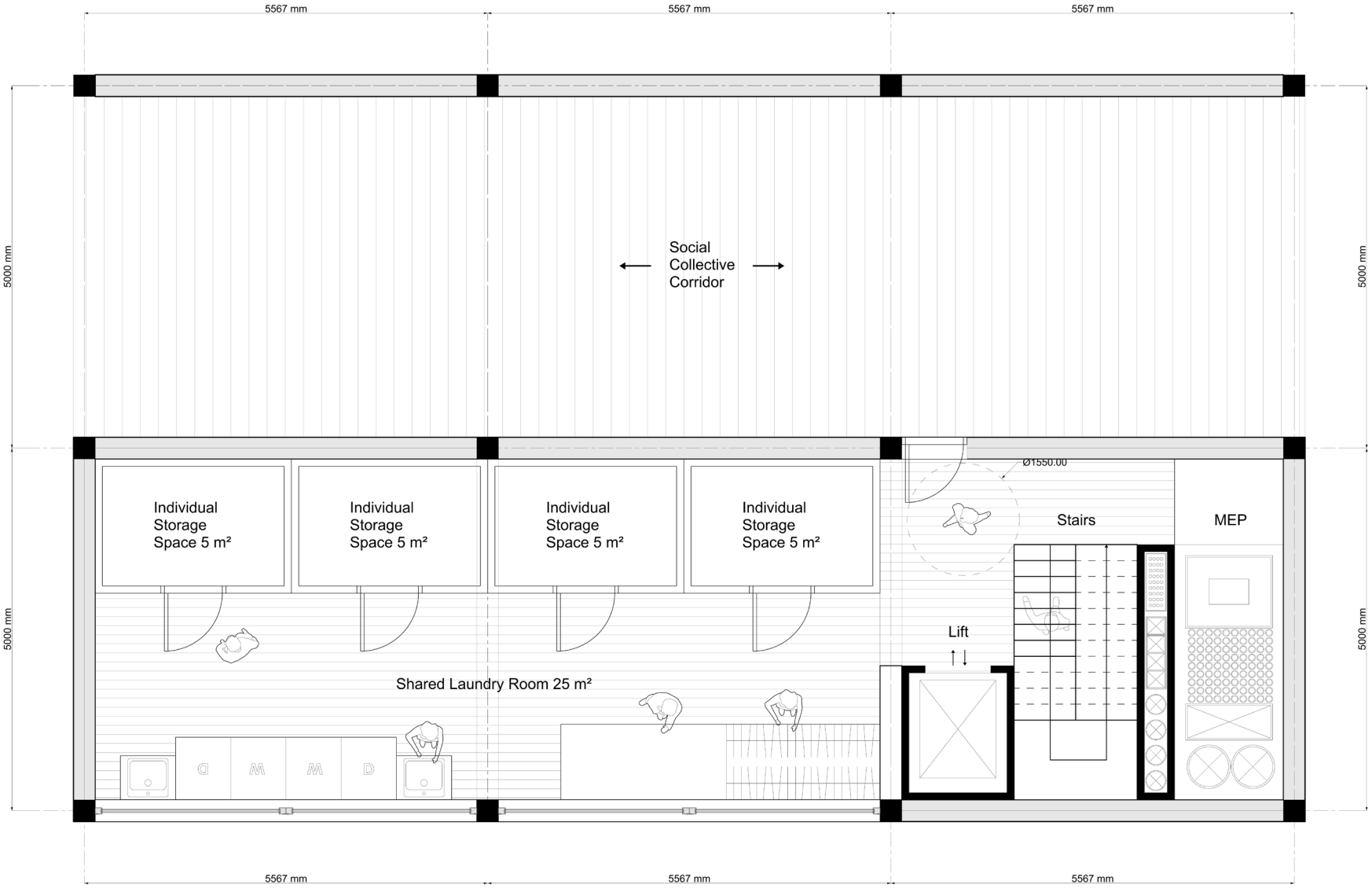






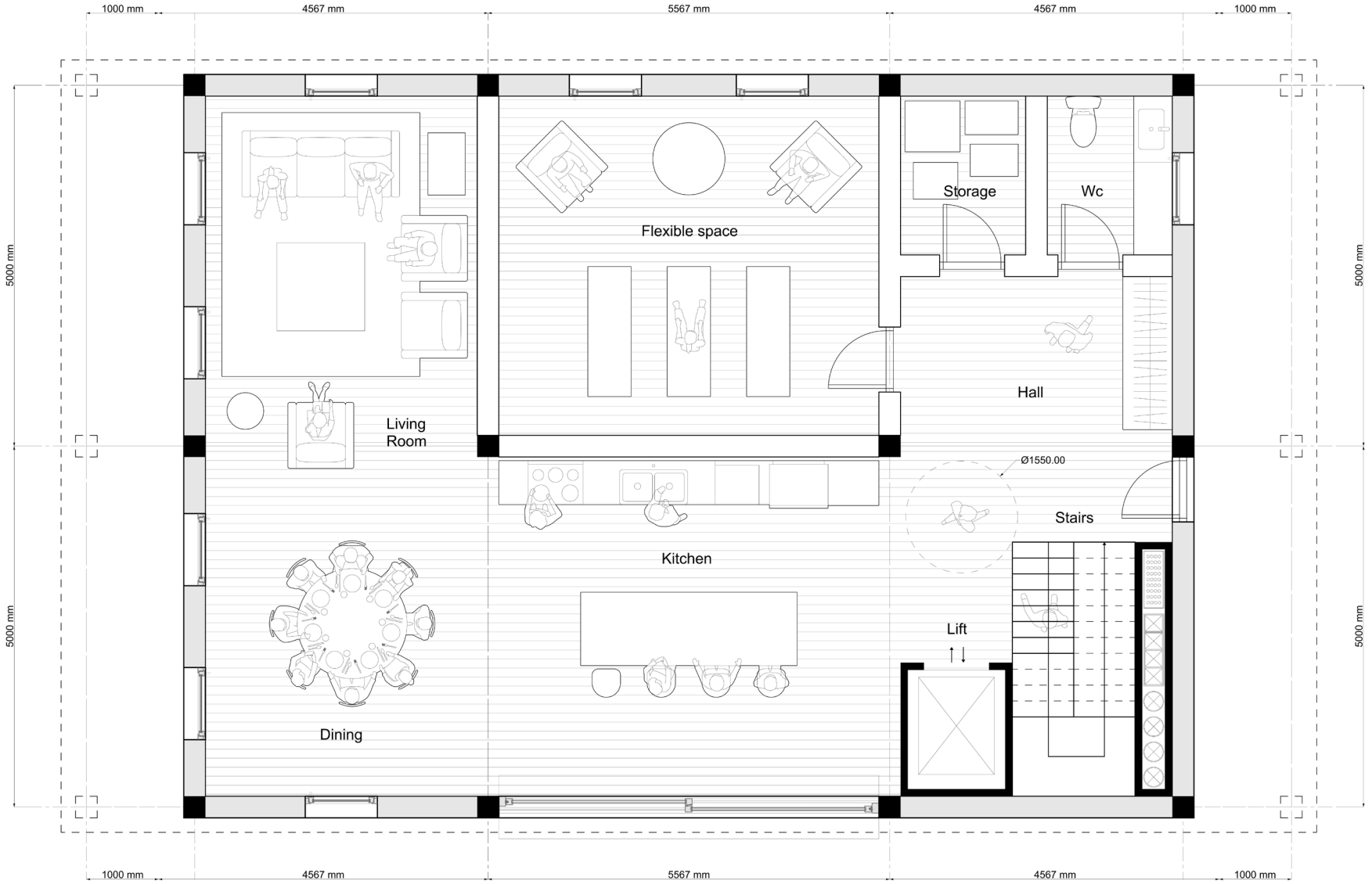
TYPE A: BASEMENT

STARTERS: SINGLES-COUPLES



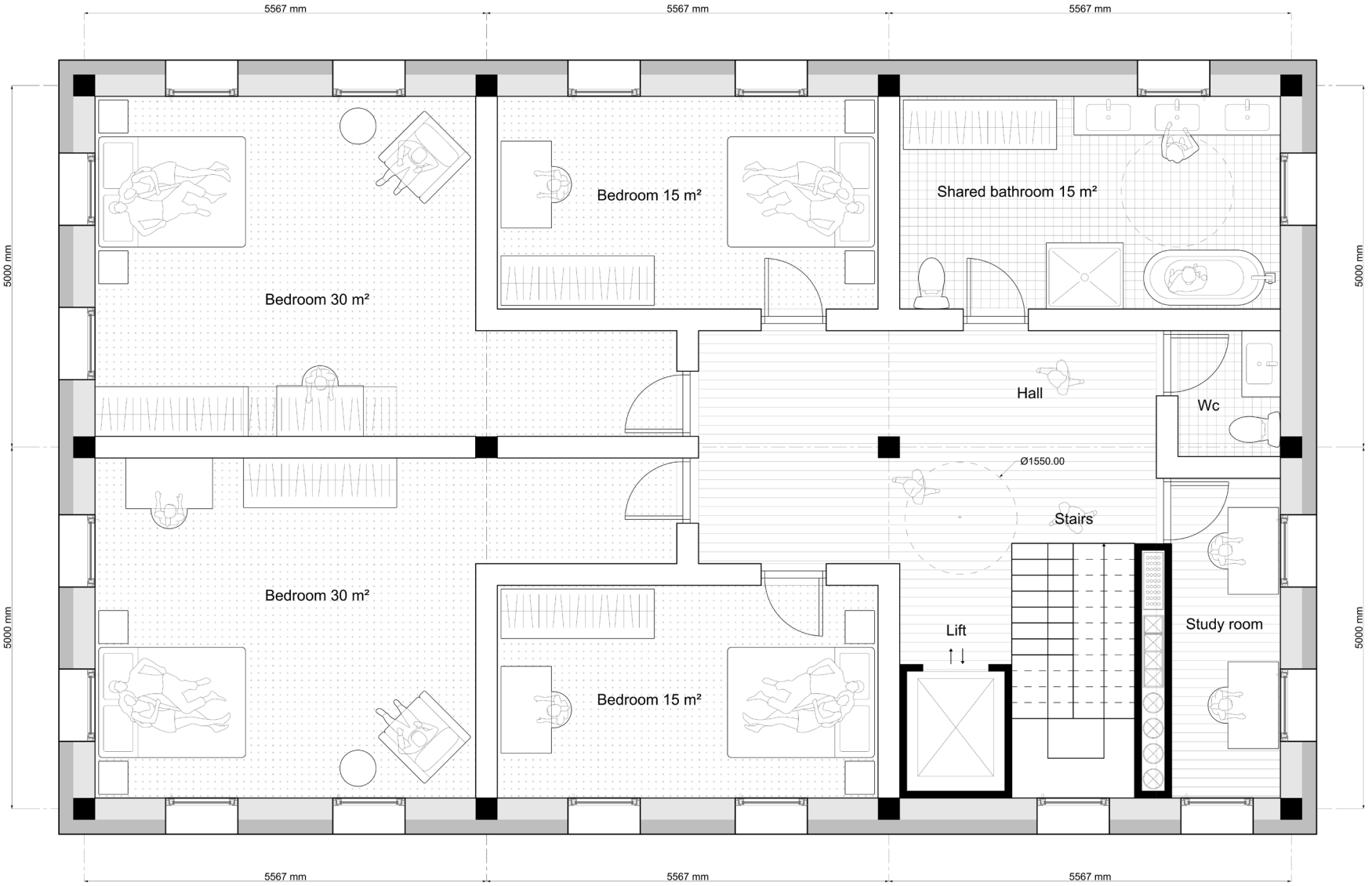
TYPE A: GROUND FLOOR

STARTERS: SINGLES-COUPLES



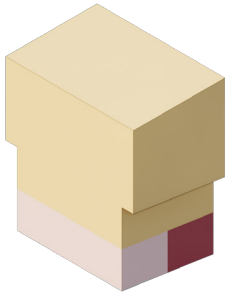
TYPE A: FIRST FLOOR

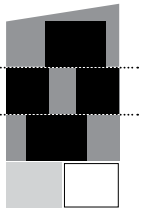
STARTERS: SINGLES-COUPLES



TYPE B: SPLIT FLOOR

SINGLES-ELDERLY (50+)





PRIVATE SPACE

SHARED LIVING SPACE

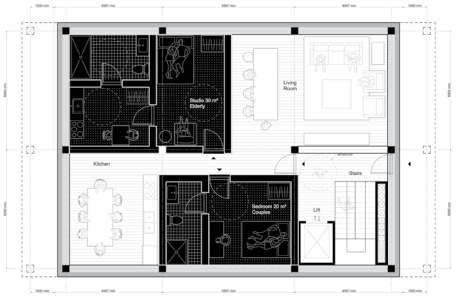
COMMUNAL BASEMENT

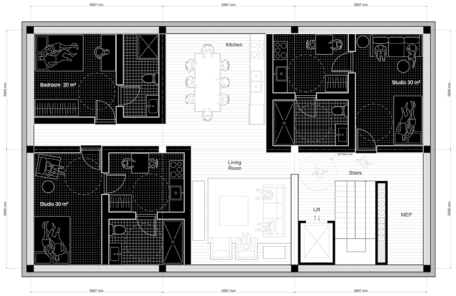
STUDIOS: 30 M2

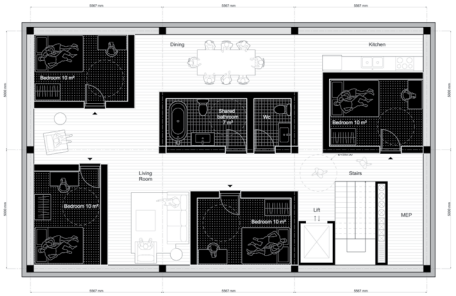
ROOMS: 20 M2

ROOMS: 10 M2

COLLECTIVE HALLWAY

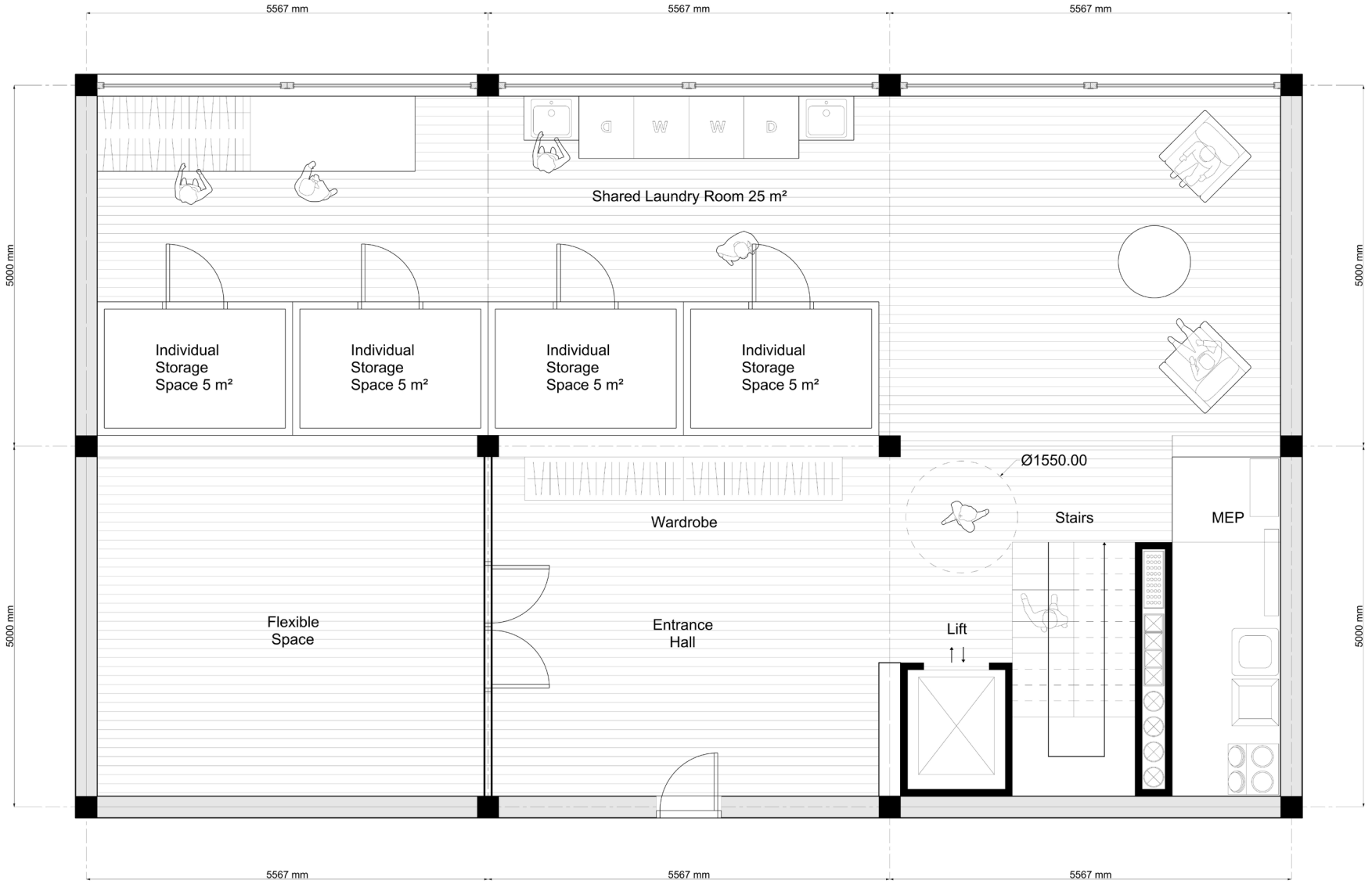






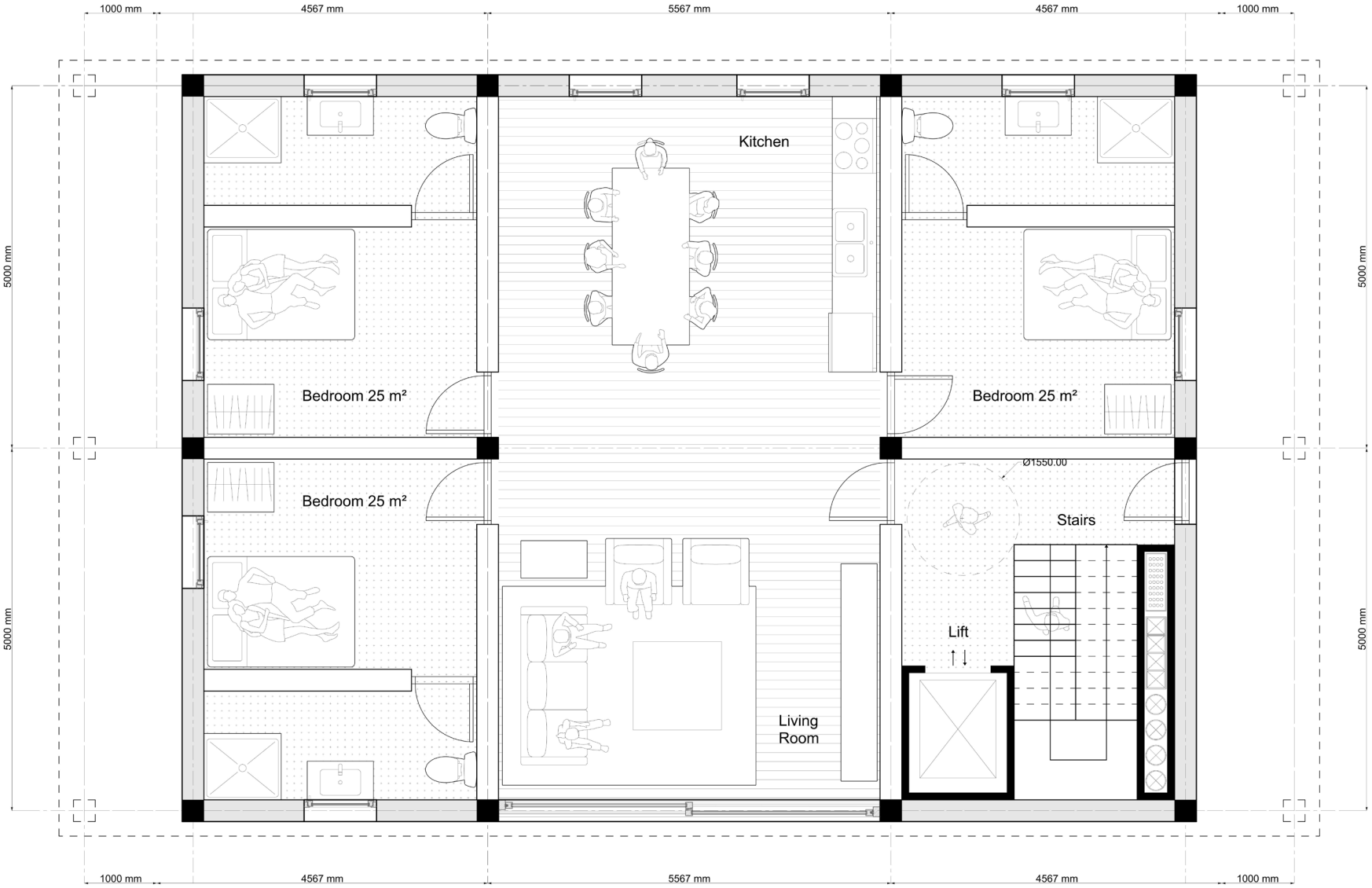
TYPE B: BASEMENT

SINGLES AND ELDERLY (50+)



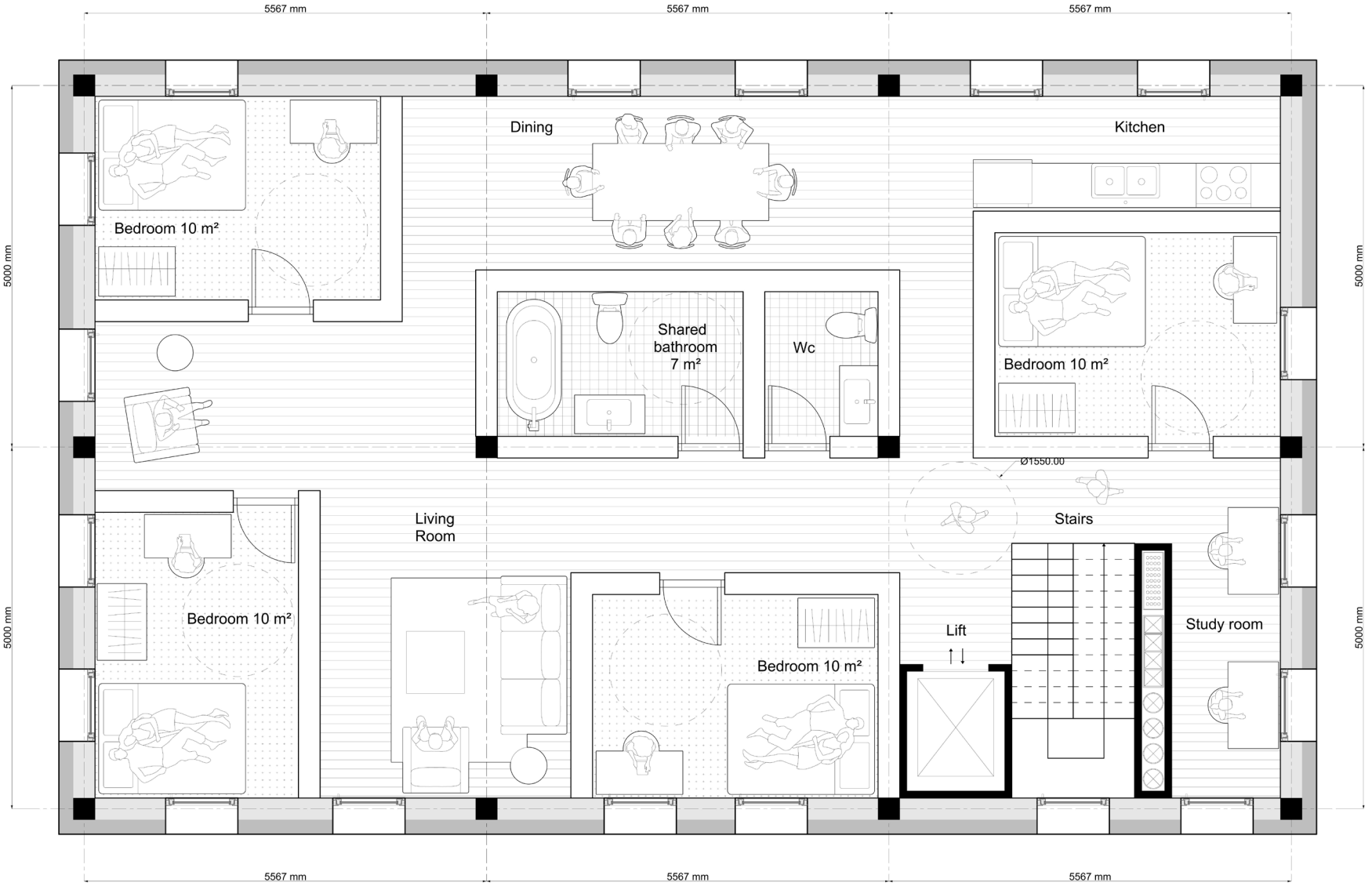
TYPE B: GROUND FLOOR

SINGLES AND ELDERLY (50+)



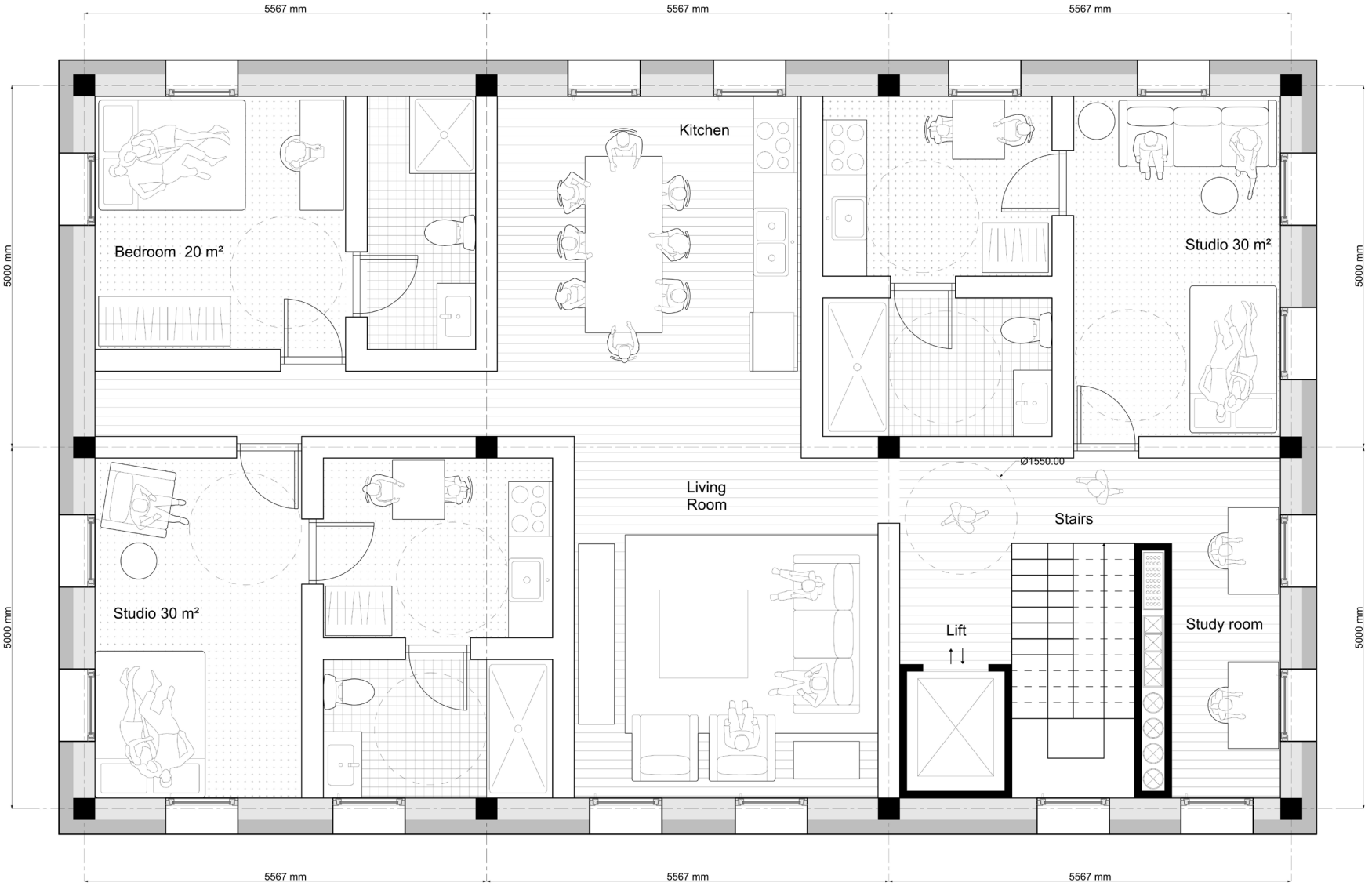
TYPE B: FIRST FLOOR

SINGLES AND ELDERLY (50+)



TYPE B: FIRST FLOOR (V)

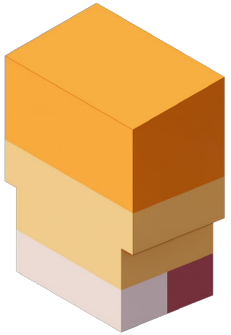
SINGLES AND ELDERLY (50+)



TYPE C & D: LOFTS & DUPLEX

MULTI-GENERATIONAL

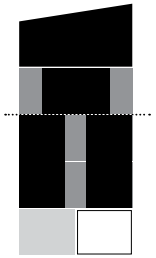
DIVORCED FAMILIES



PRIVATE SPACE

SHARED LIVING SPACE

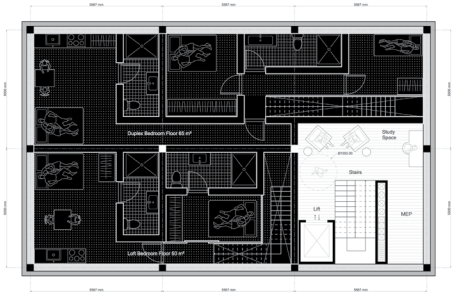
COMMUNAL BASEMENT

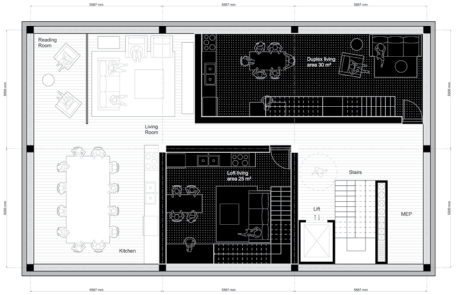


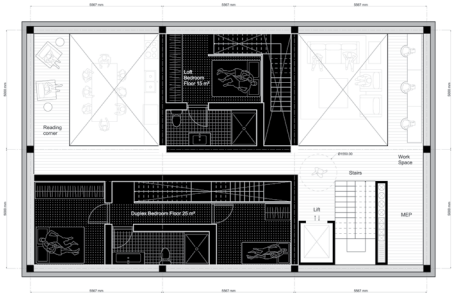
DUPLEX: 150 M2

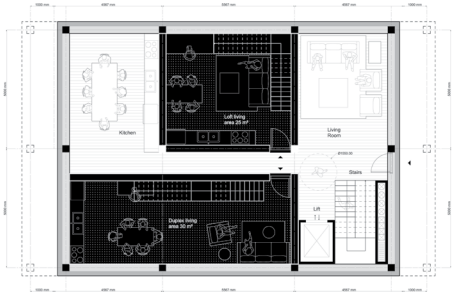
LOFTS: 50 M2 & 100M2

COLLECTIVE HALLWAY



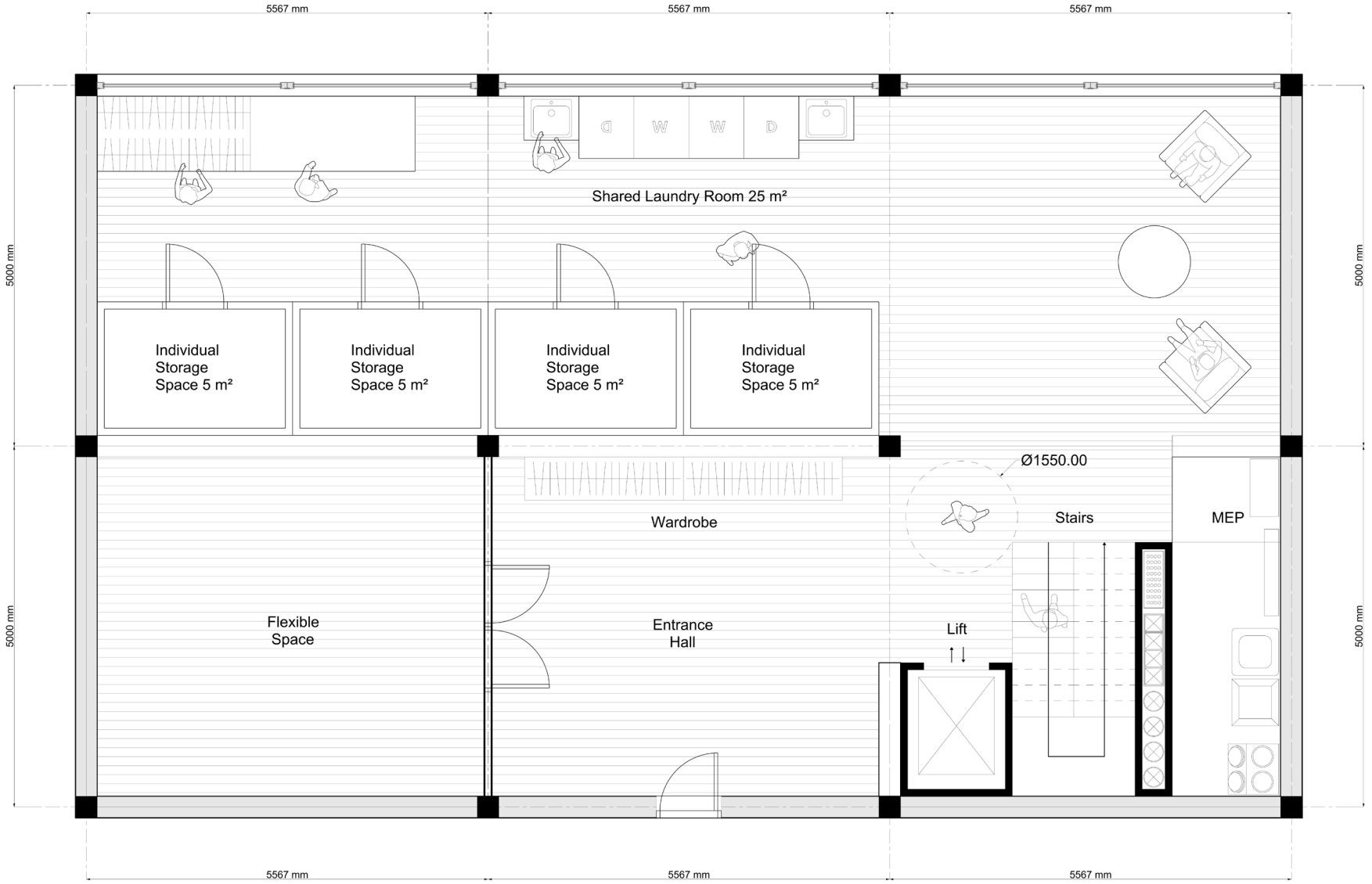






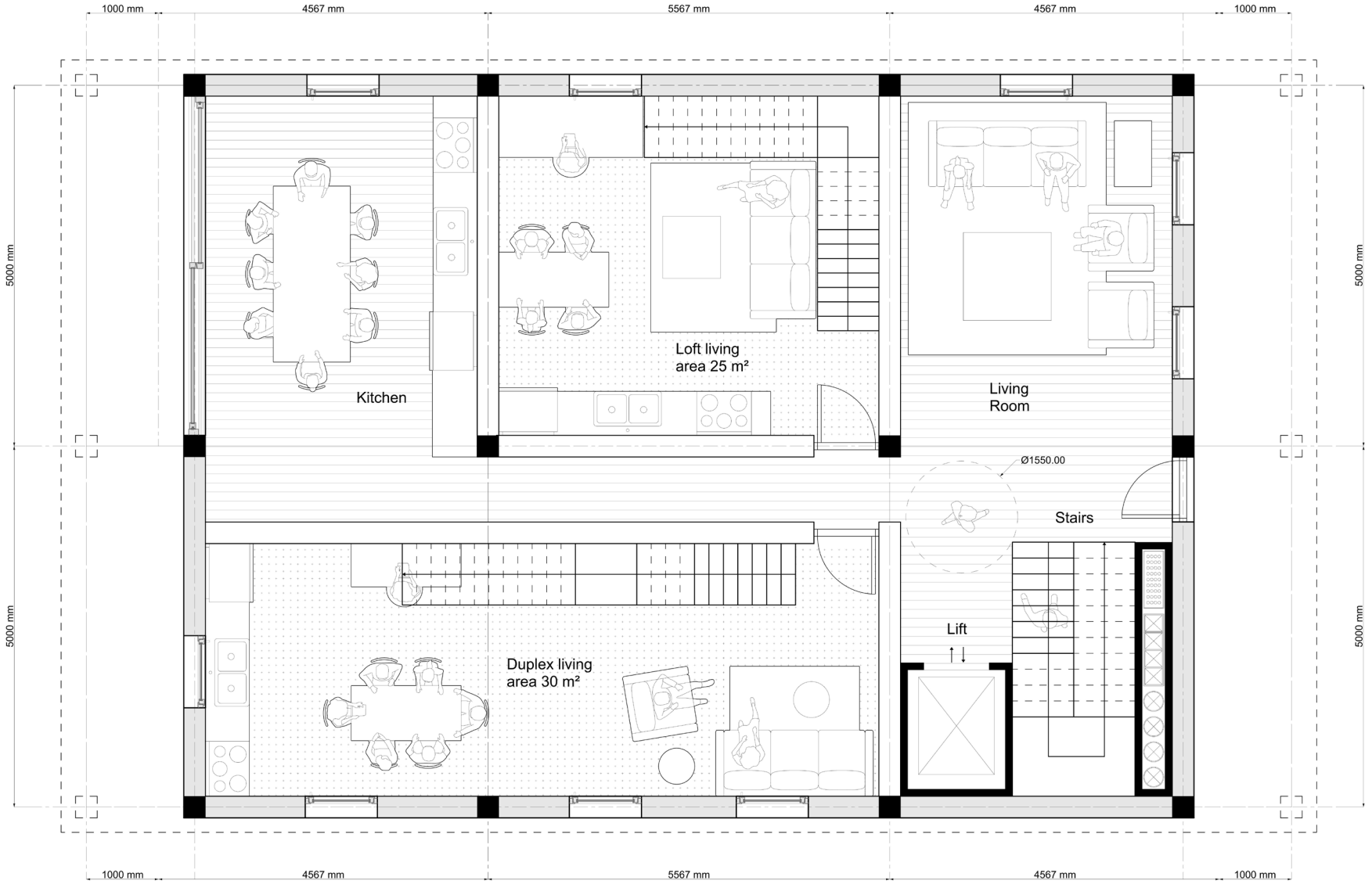
TYPE C: BASEMENT

MIXED CLUSTER



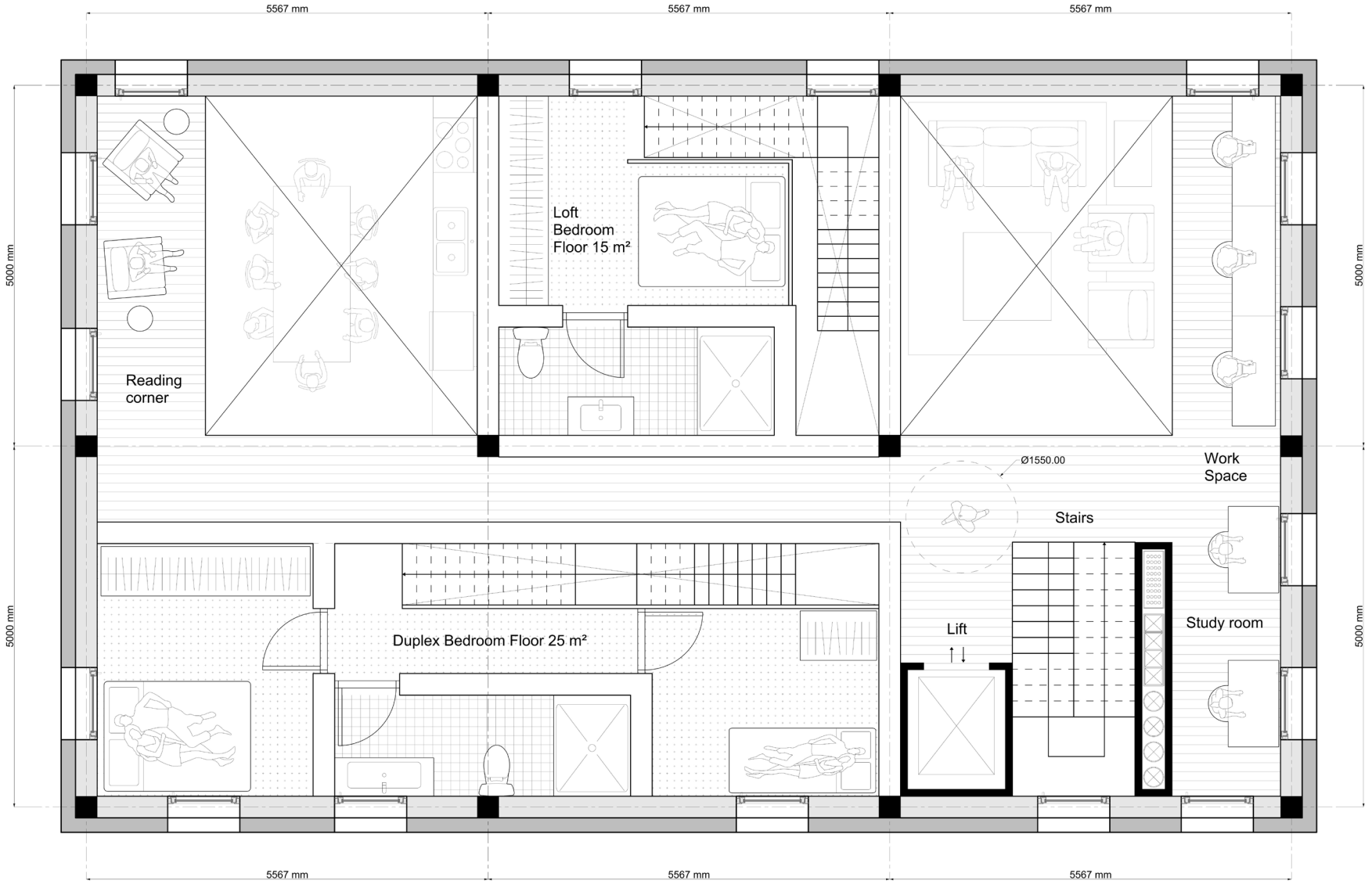
TYPE C: GROUND FLOOR

DIVORCED FAMILIES-COUPLES



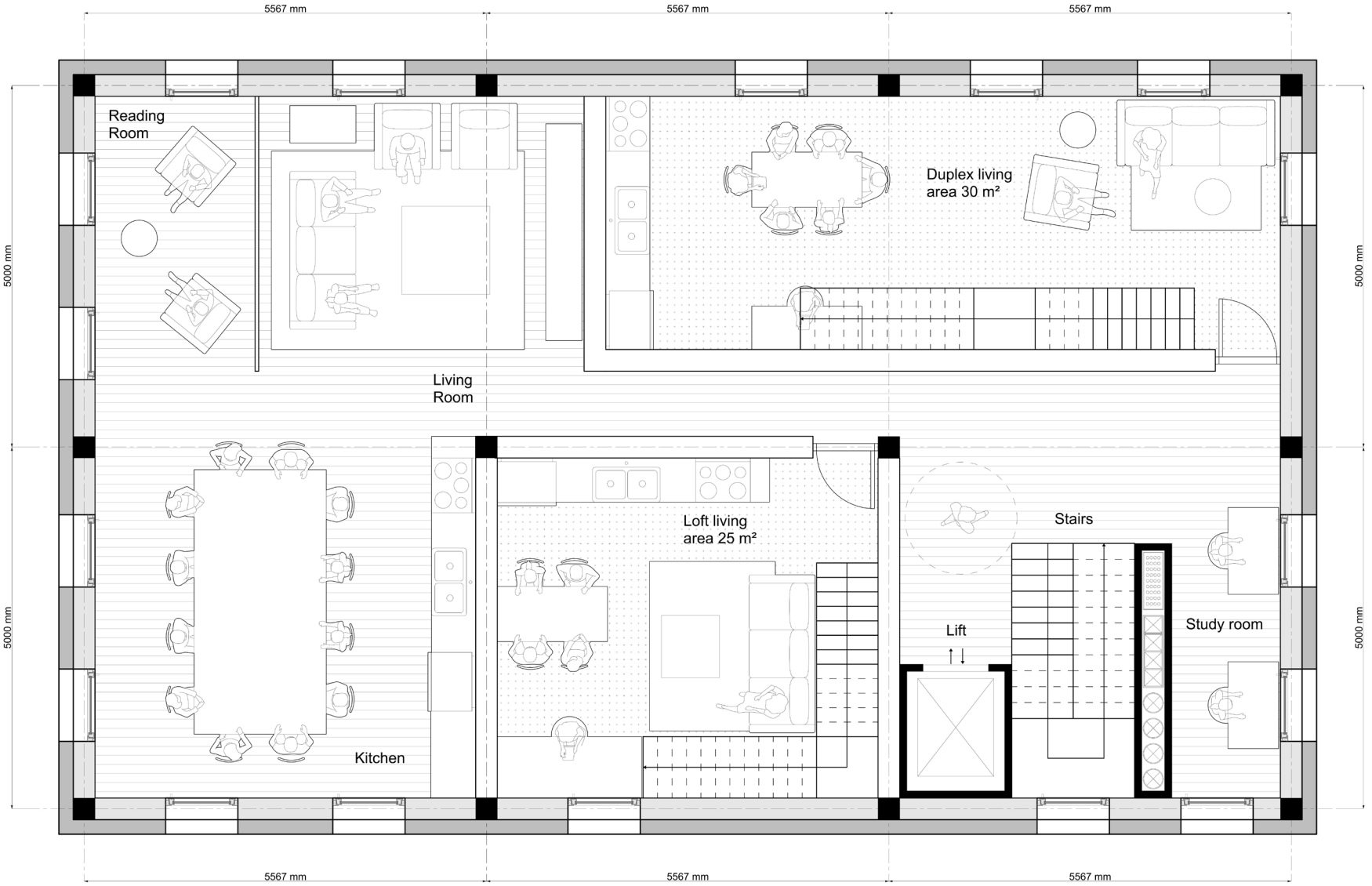
TYPE C: FIRST FLOOR

DIVORCED FAMILIES-COUPLES



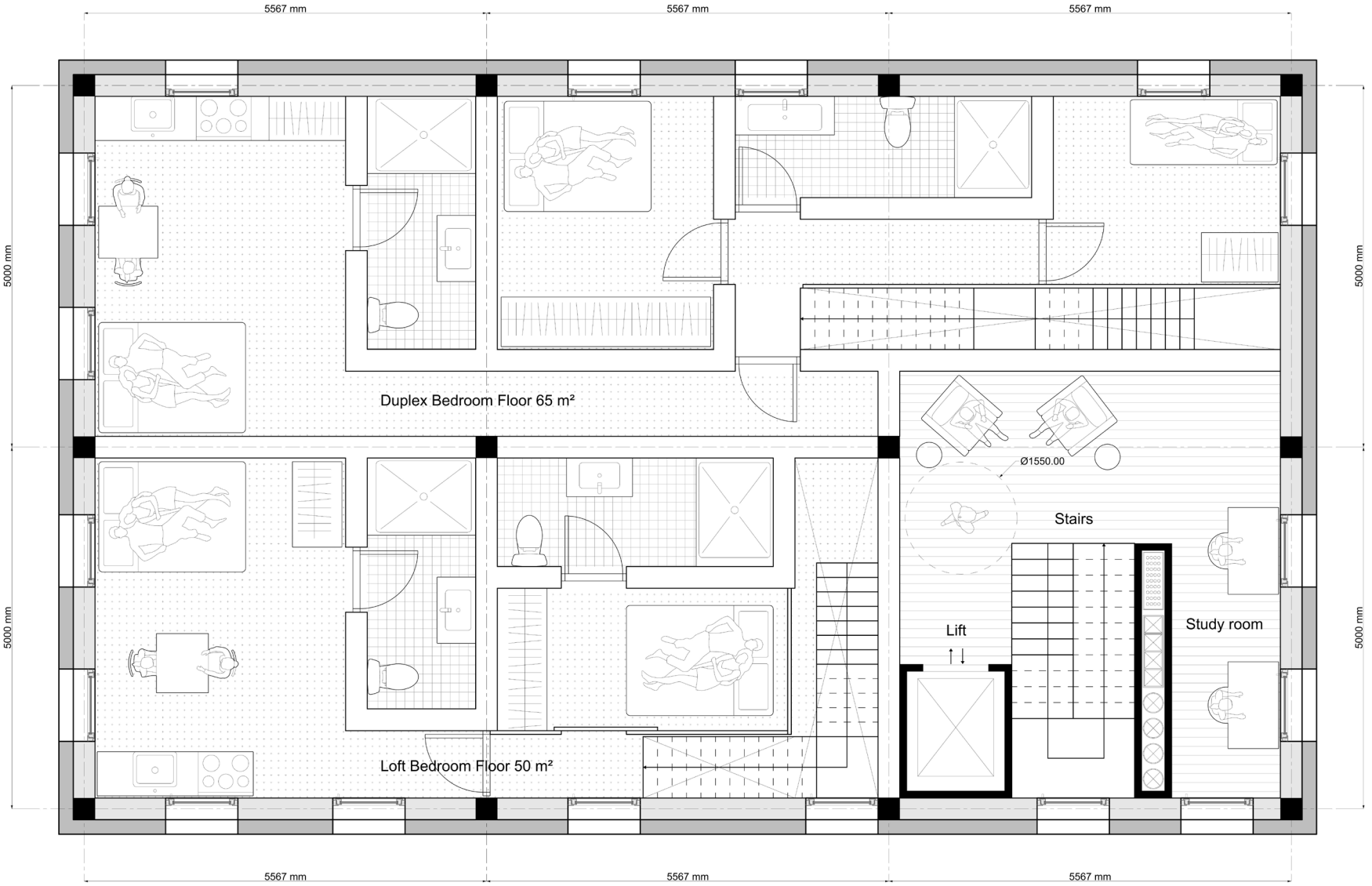
TYPE C: SECOND FLOOR

MULTI-GENERATIONAL



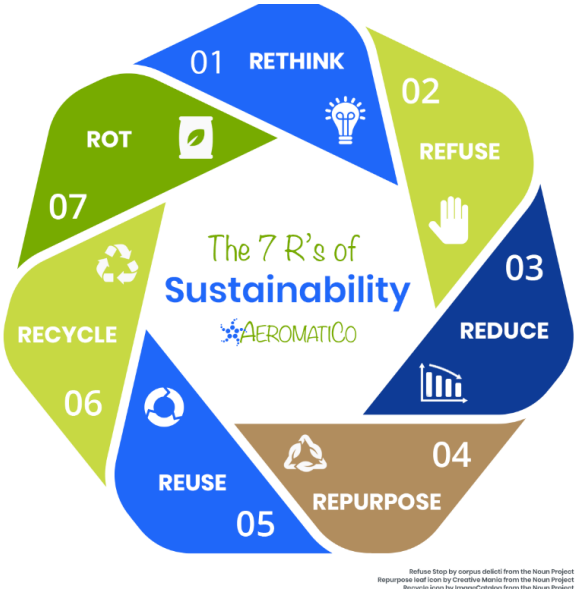
TYPE C: THIRD FLOOR

MULTI-GENERATIONAL



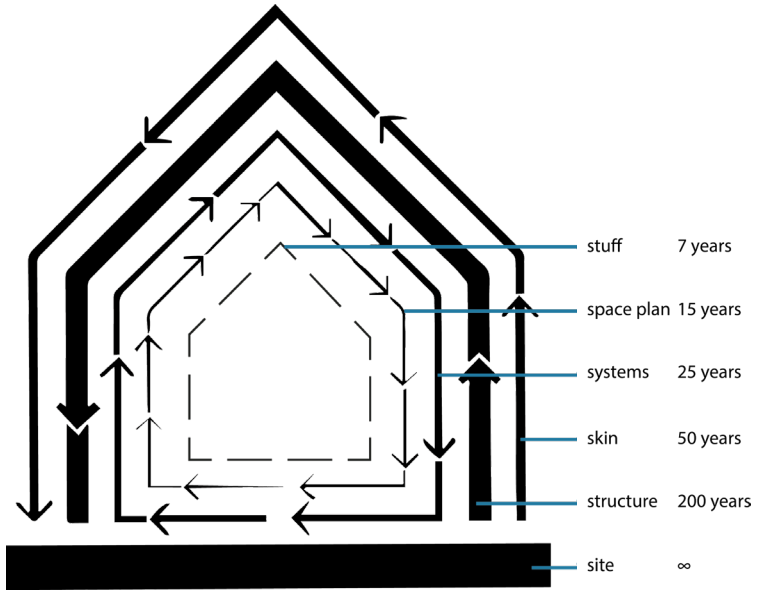
BUILDING TECHNOLOGY: SUSTAINABLE & CIRCULAR DESIGN PRINCIPLES

STRATEGIES



SUSTAINABILITY

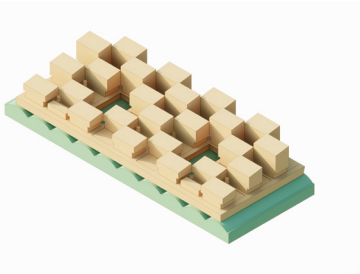
1. RETHINK: URBAN PLANNING
2. REFUSE: TO USE POLLUTING MATERIALS
3. REDUCE: CO2 EMISSIONS
4. REPURPOSE: EXISTING BUILDINGS
5. REUSE: EXISTING MATERIALS
6. RECYCLE: RESOURCES
7. ROT: RESIDUAL FLOWS



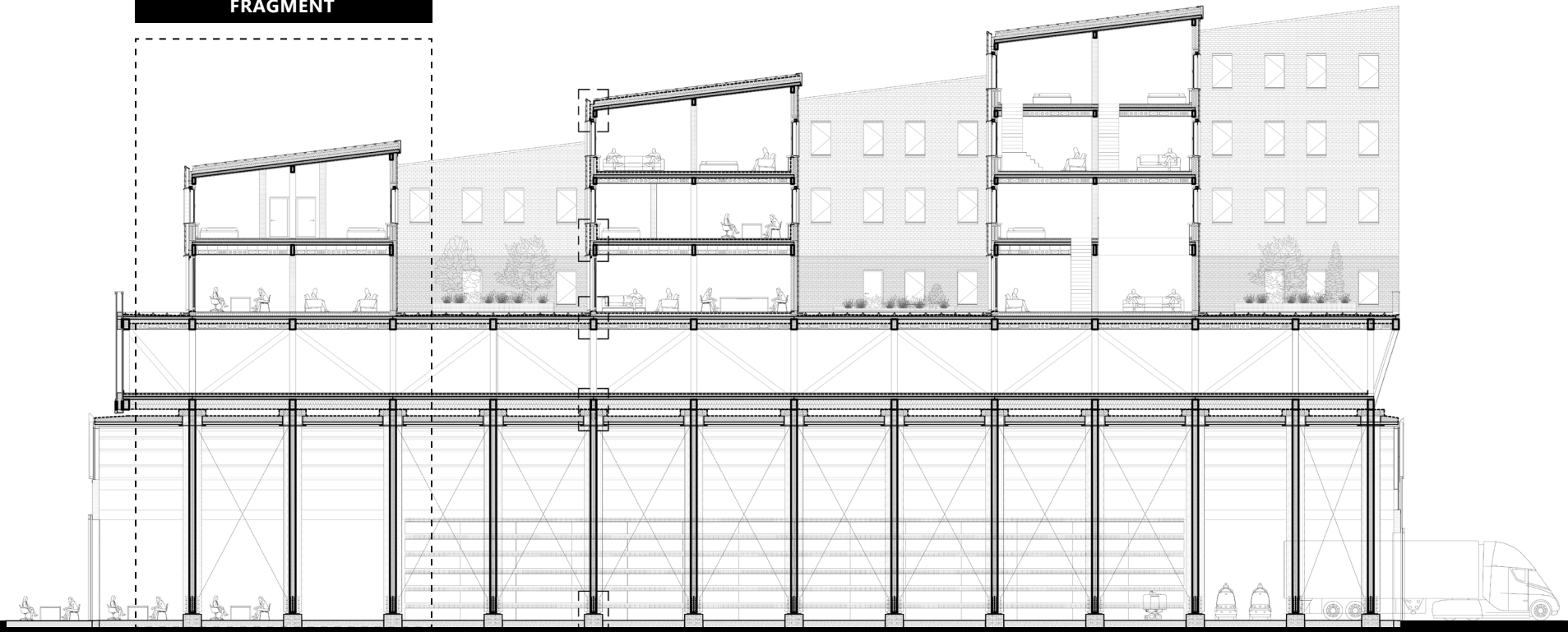
CIRCULARITY

1. SITE: BUILD ON EXISTING URBAN SITE
2. STRUCTURE: SEALING FOR DURABILITY
3. SKIN: DEMOUNTABLE SHINGLES
4. SYSTEMS: EFFICIENT & UPGRADABLE
5. SPACE PLAN: FLEXIBLE STRUCTUE
6. STUFF: SHARED SPACE & OBJECTS
7. * MAXIUMUM DEMOUNTABILITY

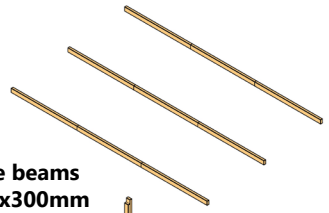
BUILDING CROSS SECTION



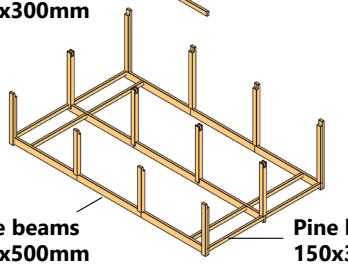
FRAGMENT



STRUCTURE & FLOORS

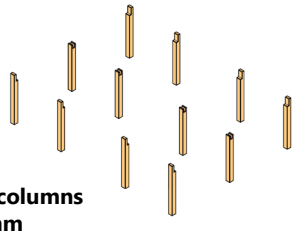


Pine beams
150x300mm

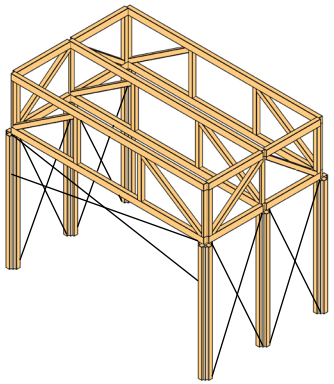


Pine beams
150x500mm

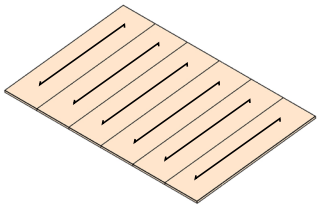
Pine beams
150x300mm



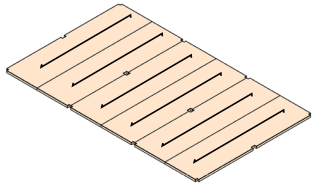
Pine columns
300mm



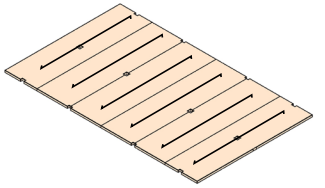
Gluelam Lattice Girder Horizontal Beam - 500x300mm
Gluelam Lattice Girder Vertical and Diagonal - 300x300mm
Gluelam Columns - 900x900mm



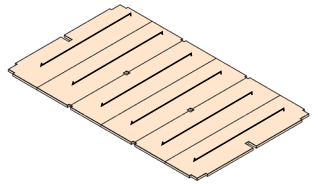
CLT 150mm - 5 layers



CLT 150mm - 5 layers



CLT 150mm - 5 layers

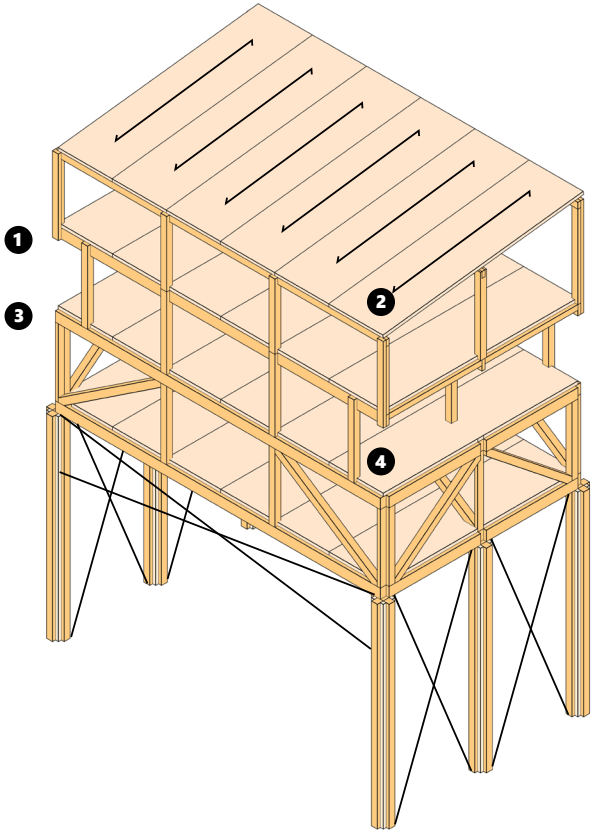


CLT 150mm - 5 layers

STRUCTURE & CONNECTIONS

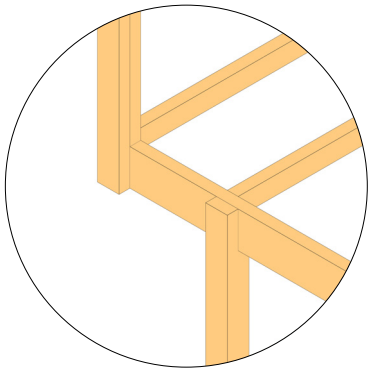
BIO-BASED LOCAL MATERIALS

DEMOUNTABILITY OF KNOTS

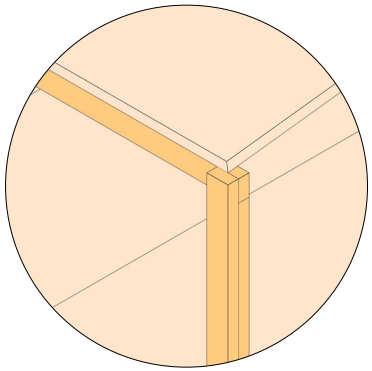


Diagonals for structural stiffness

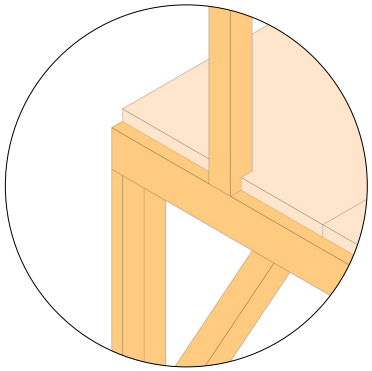
1 Imposition of the beams



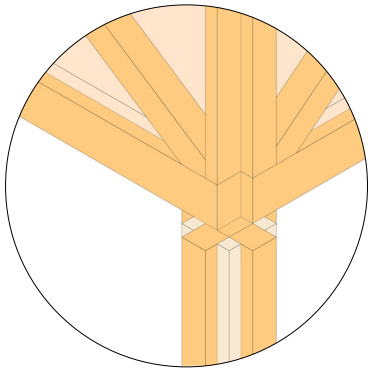
2 Imposition of the CLT panels



3 Lattice girder-column connection

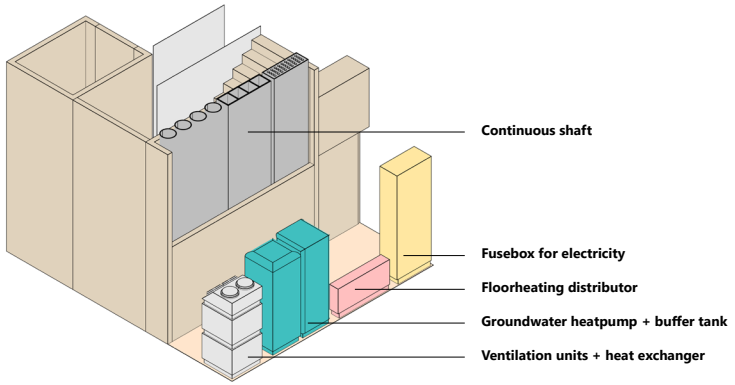


4 Column-lattice girder connection

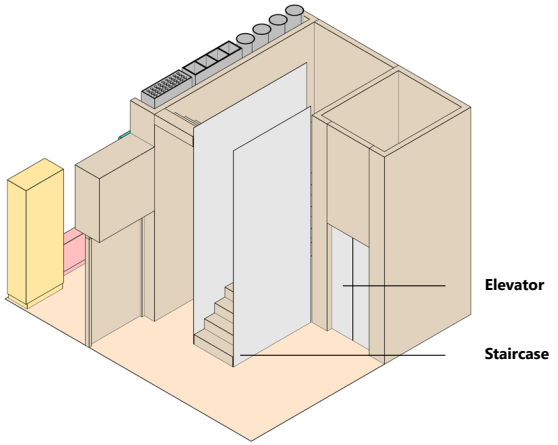


CLIMATE DIAGRAMS

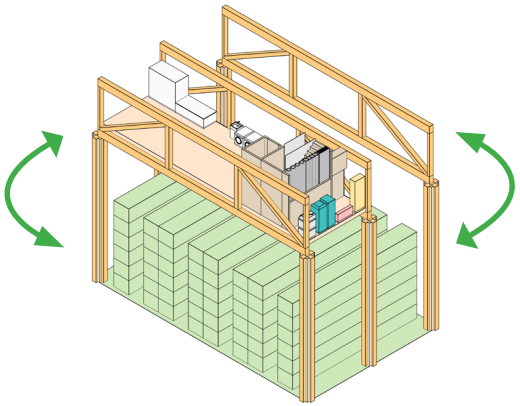
❶ Dedicated space for installation technique



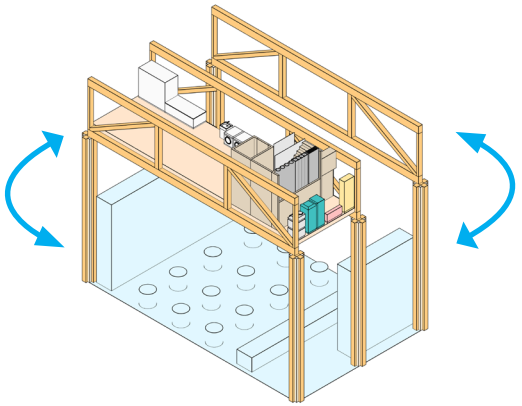
❷ Continuous core for optimal accessibility



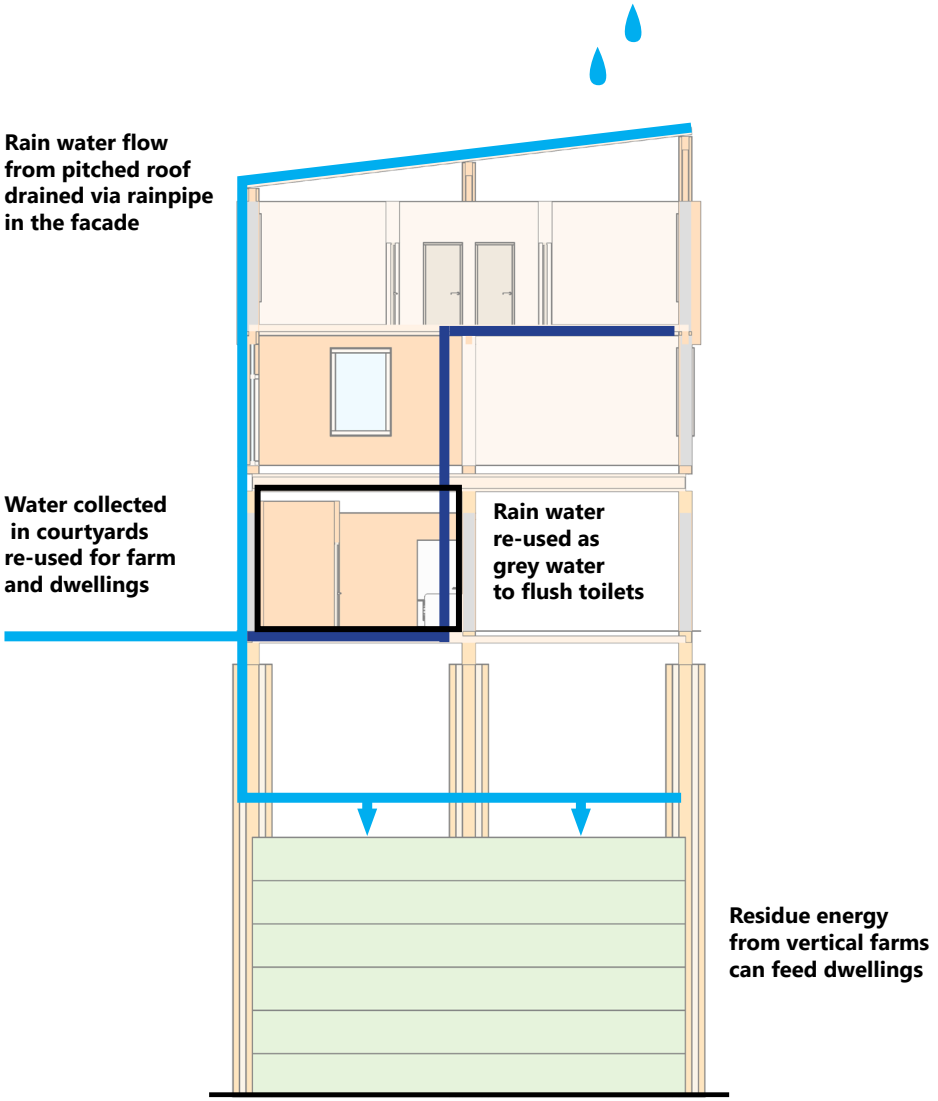
❸ Exchange of water/energy (vertical farming)

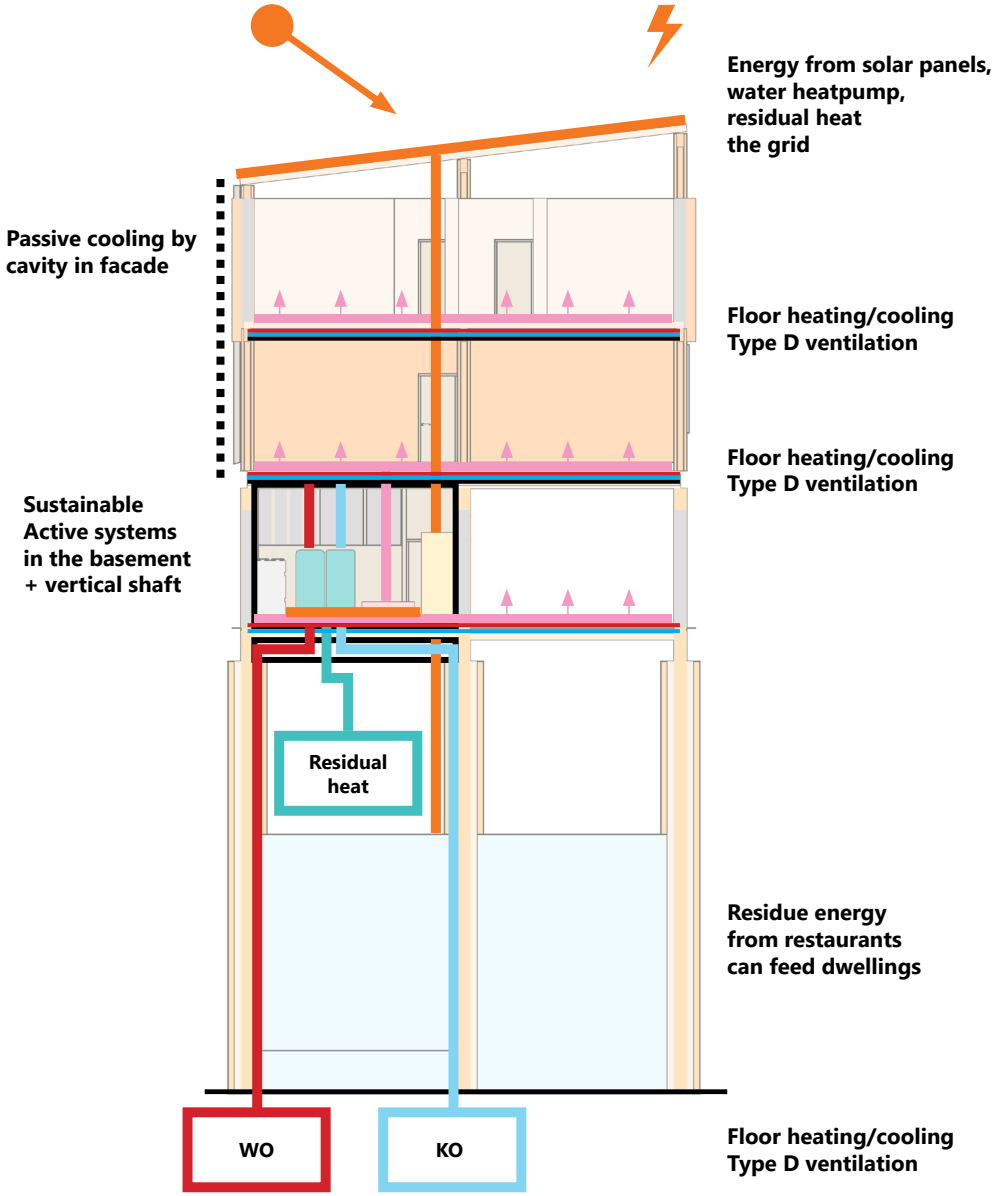


❹ Exchange of water/energy (shops/restaurants)



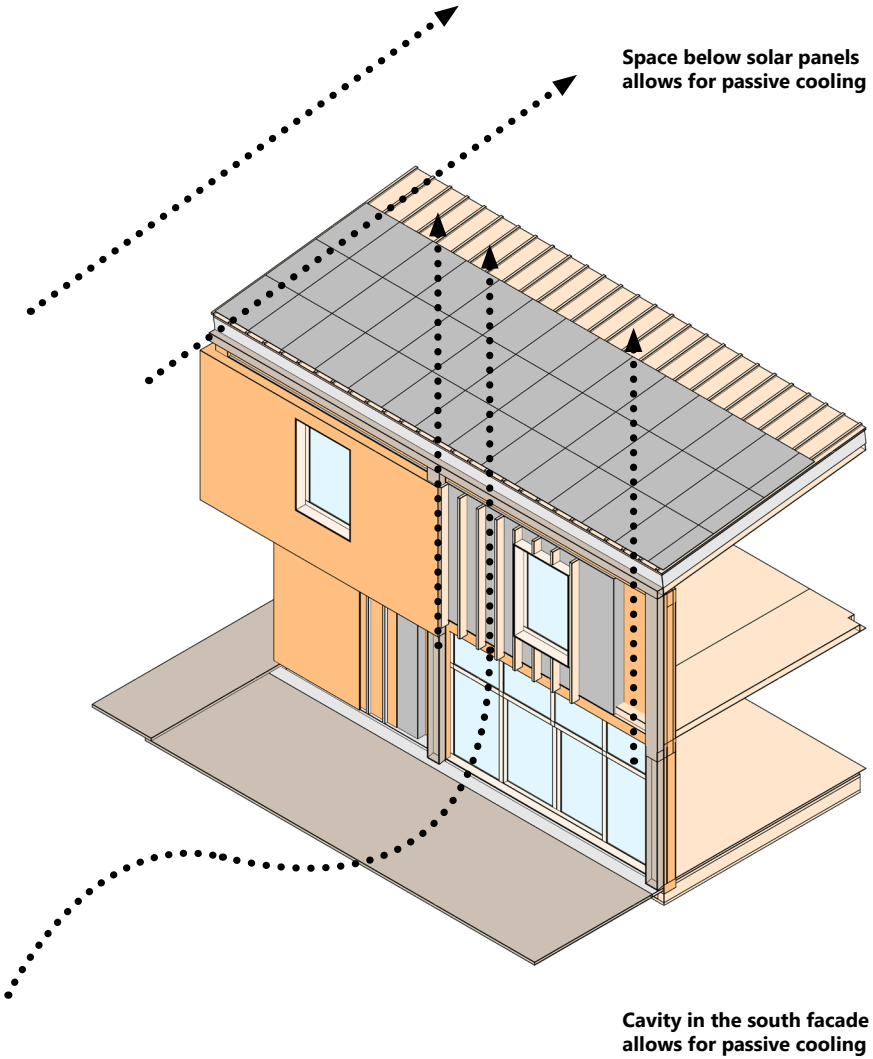
CLIMATE DIAGRAMS





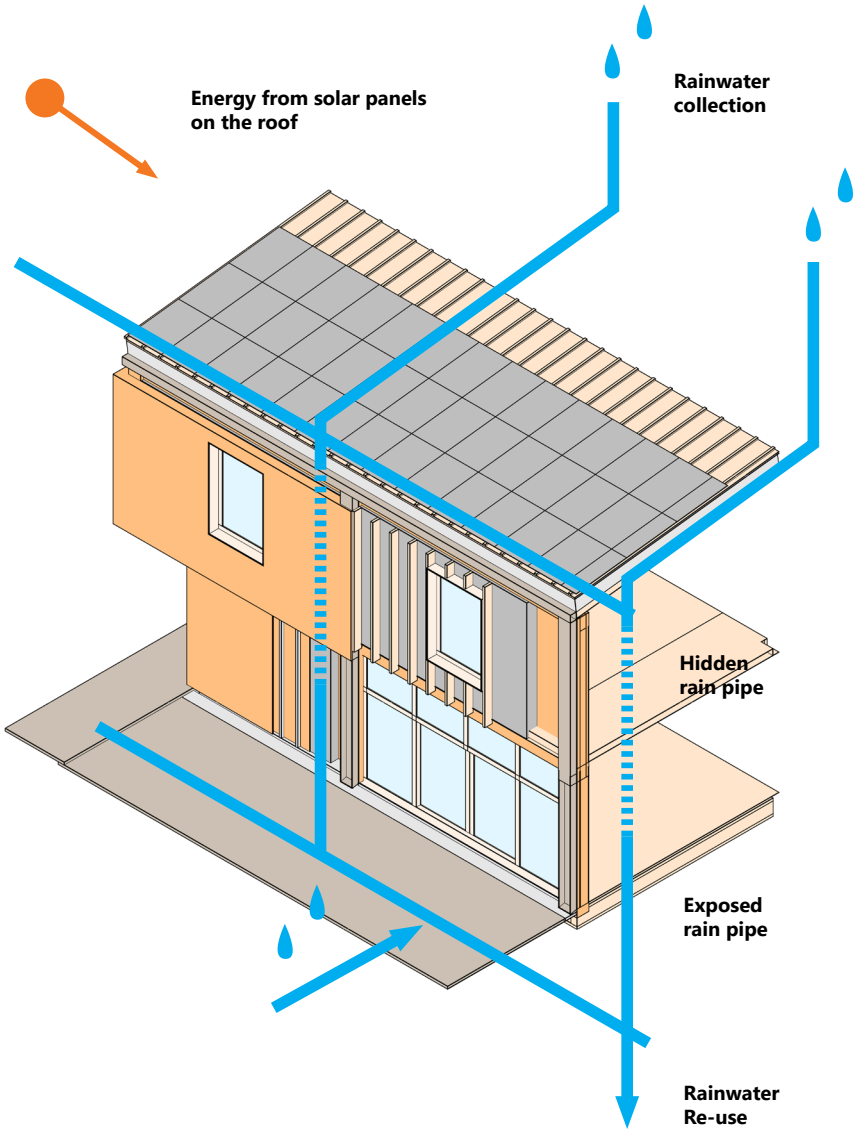
FACADE DIAGRAM

PASSIVE COOLING STRATEGY



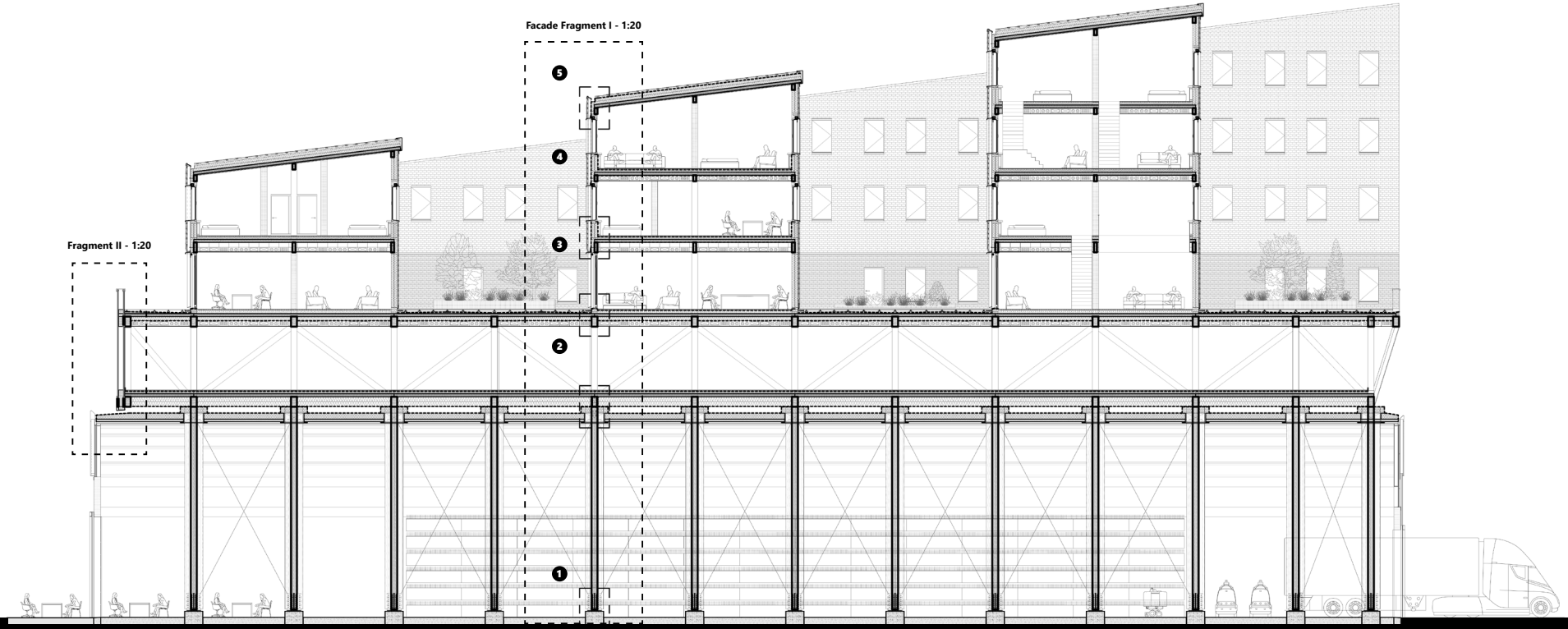
FACADE DIAGRAM

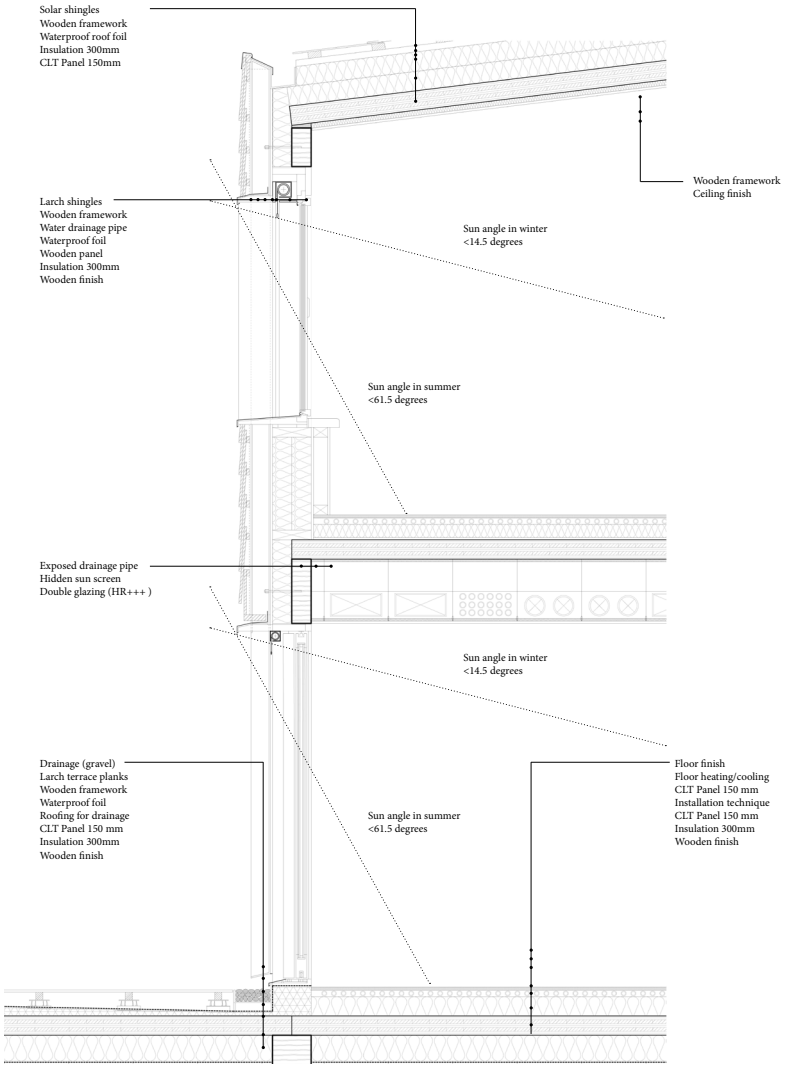
RESOURCE STRATEGY



TECHNICAL SECTION

FRAGMENT & DETAILS

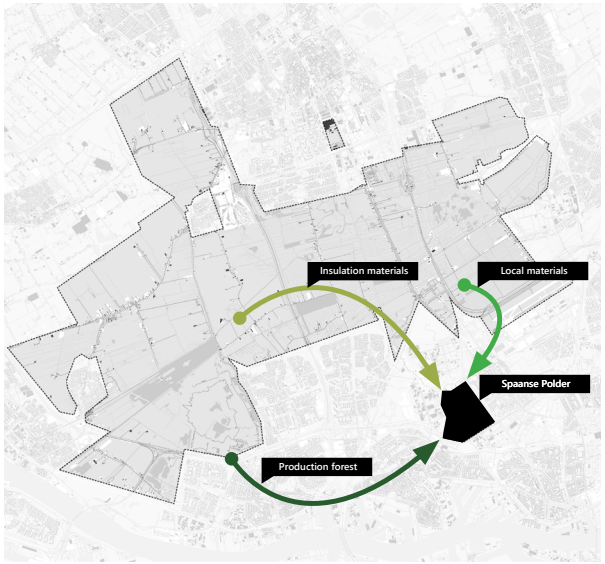




FACADE FRAGMENT

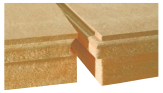
ELEVATION & SECTIONS

LOCAL MATERIALS



Material ambitions: Re-use existing (building) & use local bio-based resources *

Light structural beams/columns: Pine or poplar trees that can grow locally.
Heavy beams & floors: CLT & Glulam from locally sourced pine/spruce trees.
Facade: Durable larch spacers, frames and shingles, locally grown/sourced.
Insulation: Flax insulation , woodfibre insulation, hemp & cattail (optional).
Interior: Multiplex (made from pine/spruce/fir) or pine wood finishes.

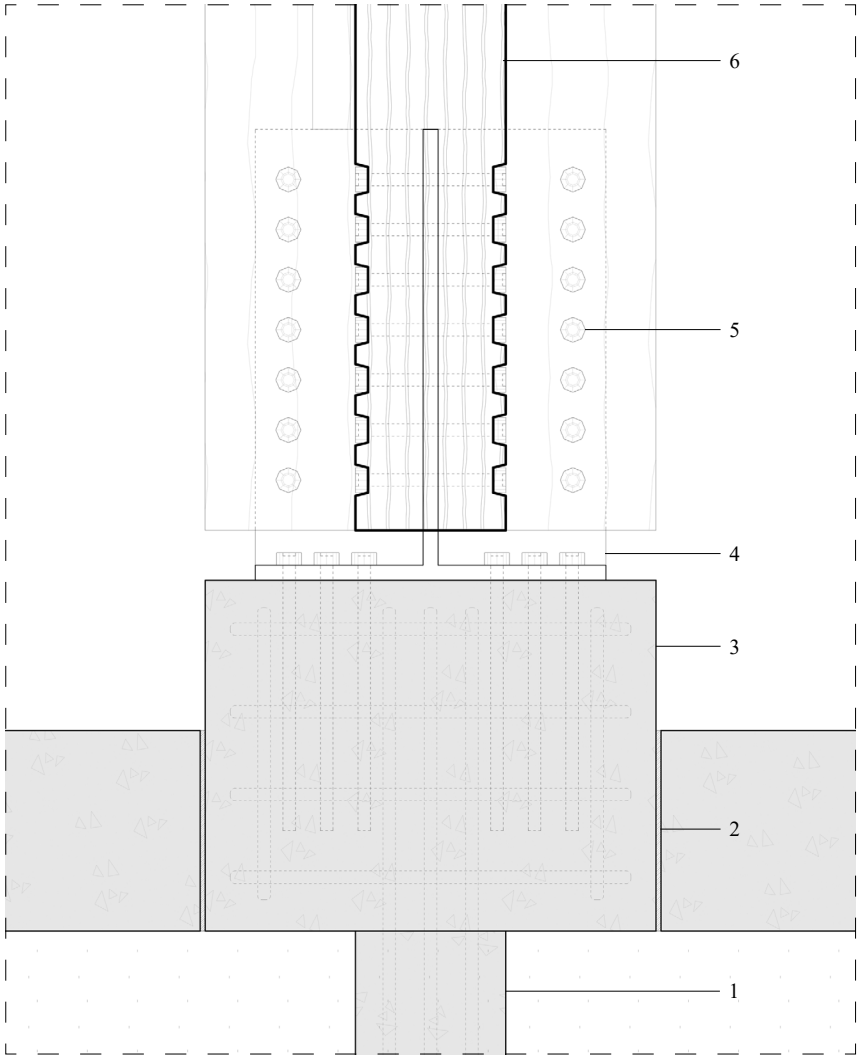
Light structural beams/columns	1.  2.  3. 	*1. Spruce or poplar wooden beams (Gadero)* *2. Galvanized steel connection points/insert leafs (when needed)* *3. Wooden connections with minal use and visibility of steel*
Heavy beams & floorsystems	1.  2.  3. 	*1. Glue Laminated beams (Stora Enso - various sizes)* *2. Cross Laminated timber (Stora Enso - 150mm 5 layers)* *3. Galvanized steel connection points/insert leafs*
Facade exterior materials	1.  2.  3. 	*1. Larch wood for exterior use: Spacers, windowframes, plating* *2. Larch shingles with cavity behind it for passive cooling* *3. Glavanized metal (exposed) rainpipe, zinc windowsill*
Insulation material products	1.  2.  3. 	*1. Woodfibre insulation boards (Pavatherm - pressure resistant)* *2. Flax insulation material in the walls (Isovlas)* *3. Hemp insulation material (Isohemp) - optional*
Interior finises products	1.  2.  	*1. Multiplex materials as a wall finish or* *2. Pine wood for wall/floor/ceiling finish*

** These materials could all be grown and locally harvested in Midden-Delfland*

DETAILING FOR SUSTAINABILITY AND DEMOUNTABILITY

The details are engineered to allow for demountability so that the materials can be re-used in a circular way during their life cycle. The selection of materials to build with are local materials that could be grown and harvest close by to reduce transportation cost and emissions. For the exterior, a more durable wood is used; larch wood, which can withstand the elements better. For the inside, mainly birch wood is considered as it grows fast and locally. The structure can also be made with a birch or pine wood because it will be enveloped completely by the insulation layers and skin of the building. This will guarantee the longevity of the structure. Towards the south side, the facade is extra thick because an open cavity is present between the skin (larch shingles) and the insulation layer of the facade. This will provide the building with passive cooling/ventilation and prevents the south facade from overheating during the summer. Due to this thickness, the window openings are also very deep and can block a lot of summer sun but allows for the winter sun to enter the building. Hidden sun blinds are installed externally for sun shading. The roof is covered with crystalline solar panels that can be integrated architecturally. The roof scape of the building will be able to generate energy, while aesthetically being part of the architecture. The dwellings are situated around small green courtyards for visual comfort and social interactions. The courtyards also play their part in the management of water, which can be collected and re-used in the building.

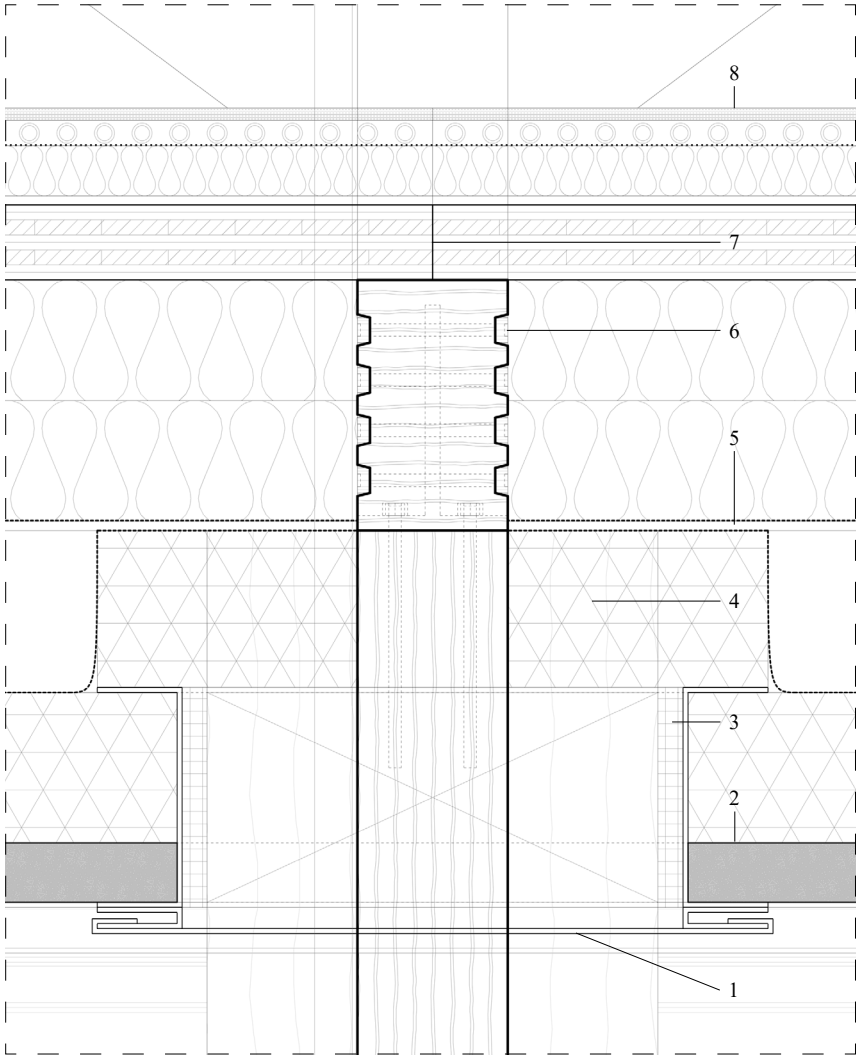
DETAIL FOUNDATION



Detail Foundation - Scale 1:10

1. Vroom prefab reinforced concrete foundation 26 meters, 290x290mm, C55 XC2.
2. Existing concrete floors 400mm, Peridam Tempex incision separation strip 5mm.
3. Insitu concrete connection with foundation head, interwoven reinforced steel connection.
4. Adjustable galvanized stainless steel column base with insert leaf 700x900mm.
5. Galvanized steel class 4.8 Bolts 300mm, same bolts at the concrete base 500mm.
6. Glue laminated timber column, 900x900mm, 300mm in width, 10 meters in height.

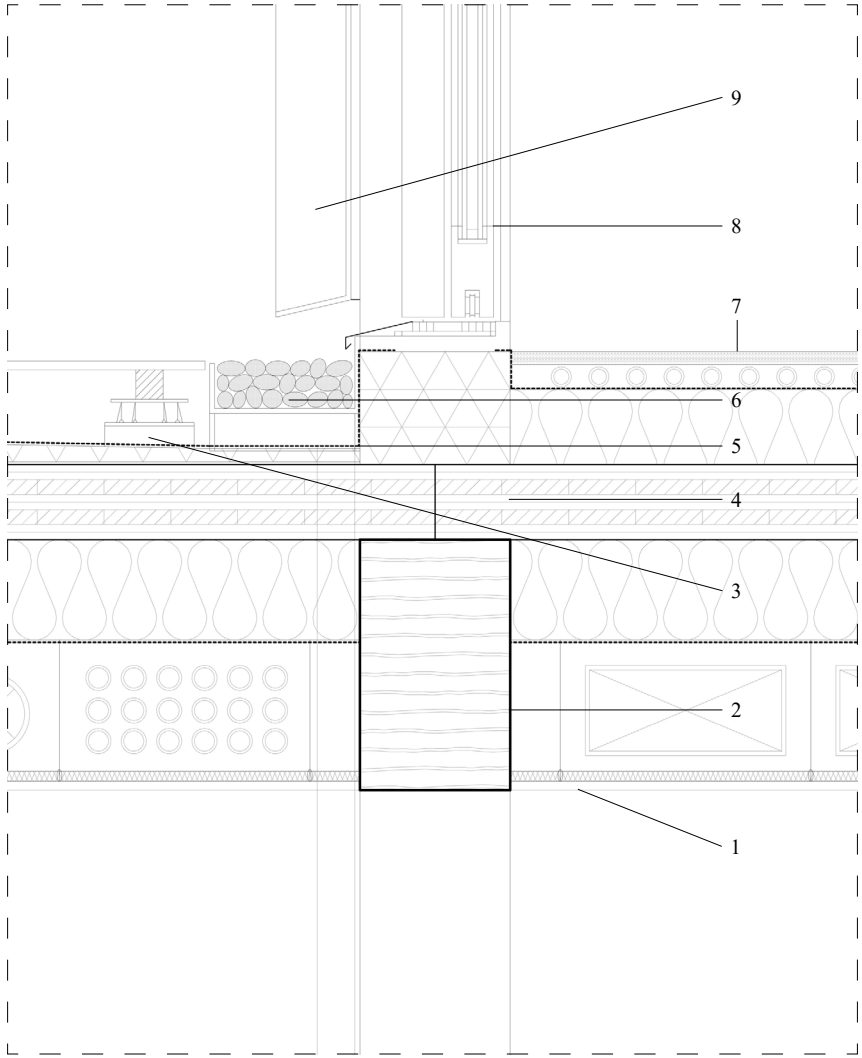
DETAIL COLUMN



Detail Column - Scale 1:10

1. Folded steel 2mm, attatched to perforated concrete roof, central cut out for column intersection.
2. Existing concrete roof, waffle panels 150mm, situated on existing galvanized steel beams IPE 180.
3. Tempex EPS incision separation strip 50mm, for cpolumn positioning and concealment of the side cavities.
4. Pavatherm pressure-resistant insulation 300mm (Rd – 7,86 m2K/W), water resistant foil, bitumen roof covering
5. WBP wooden plate 18mm, Isovlas, water resistant foil, flax insulation 500mm (Rd – 13,12 m2K/W).
6. Adjustable galvanized stainless steel column base with insert leaf 300x450mm. galvanized steel class 4.8 Bolts 300mm.
7. Stora Enso CLT flooring system (5 layers)150mm, width 2,75m and lengtht 10m, non-visual quality (NVI), fire protection board 18mm
8. Flooring finish, floor heating in 100mm concrete screed, PE damp proof membrane,Thermoflex wood fiber insulation 100mm

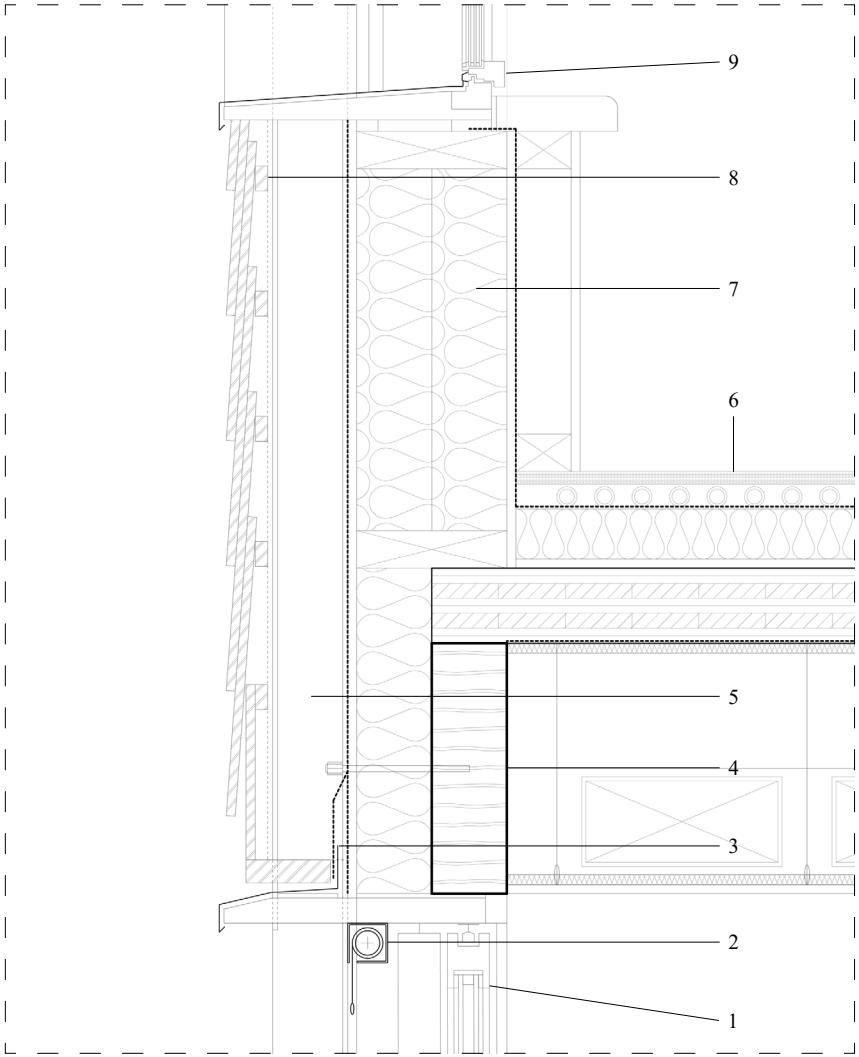
DETAIL FLOOR



Detail Floor - Scale 1:10

1. Climate ceiling 300mm, perforated fir 18mm, 50mm felt acoustic layer
2. Glue laminated beam 500mm, width 300mm
3. Dural patio support system, larch beam 50mm, larch terrace planks 18mm
4. Stora Enso CLT flooring system (5 layers)150mm, width 2,75m and lengtht 10m, non-visual quality (NVI)
5. Pavatherm pressure-resistant insulation 300mm (Rd – 7,86 m2K/W), water resistant foil, bitumen roof covering
6. Drain stone lineair element for gravel finishing; stainless steel drainage system with pebbles for water filtration
7. Flooring finish, floor heating in 100mm concrete screed, PE damp proof membrane,Thermoflex wood fiber insulation 100mm
8. Sliding door:insulation glazing in larch frame: 2× 4 mm lam. safety glass + 16 mm cavity + 2× 4 mm lam. safety glass, Ug = 1.0 W/m2K
9. Exposed galvanized steel rain pipe, depth 150mm and width 300mm, attached to structural column

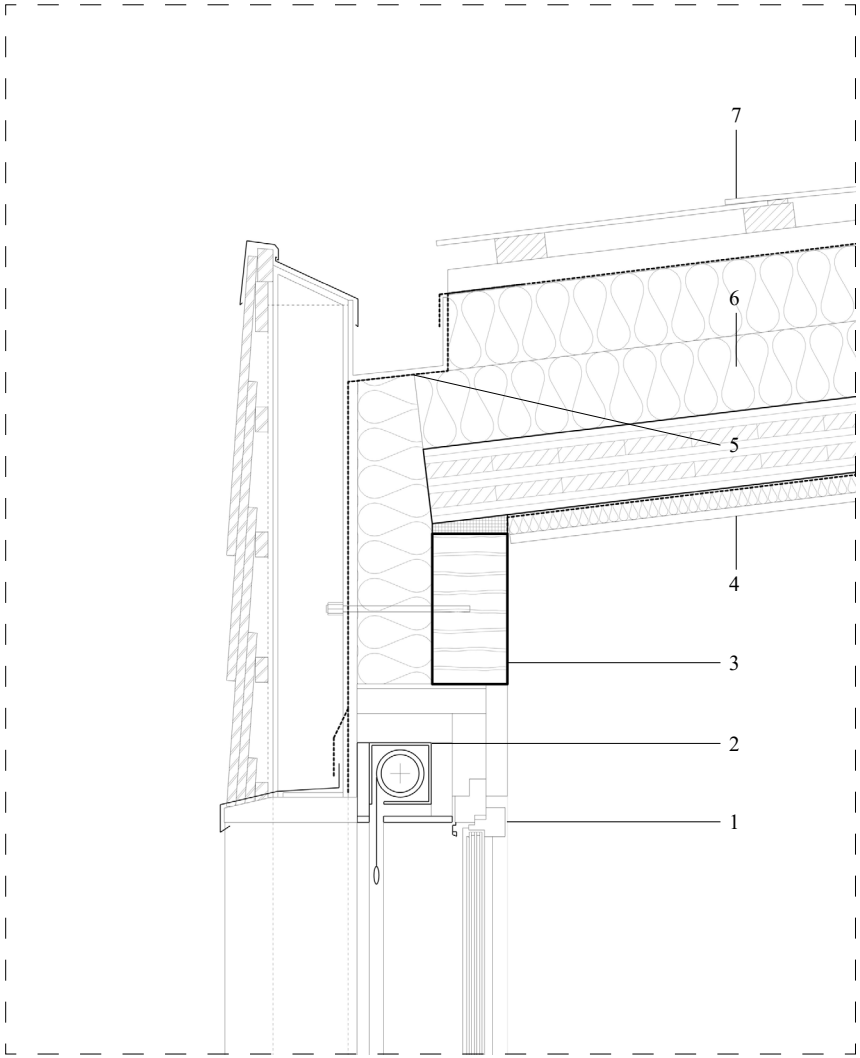
DETAIL WINDOWS



Detail Windows - Scale 1:10

1. Sliding door:insulation glazing in larch frame: 2× 4 mm lam. safety glass + 16 mm cavity + 2× 4 mm lam. safety glass, Ug = 1.0 W/m2K
2. Ritscreen, electric retractable exterior window screening to mitigate solar gain in summer
3. Sheet zinc cornice, pre-weathered for water drainage, water resistant PE membrane covering
4. Glue laminated beam, height 500mm and width 150mm, rainpipe locally bolted to structure
5. Facade cavity for passive airflow and cooling, hidden galvanized steel rain pipe, depth 150mm and width 300mm, attached to structural beam
6. Flooring finish, floor heating in 100mm concrete screed, PE damp proof membrane,Thermoflex wood fiber insulation 100mm
7. Water resistant PE membrane, WBP wooden plate 18mm, Isovlas natural biobased flax insulation 300mm (Rd – 7,86 m2K/W), multiplex 18mm
8. Larch shingles split 2-layer length 600 mm, Support battens 25 mm, vertical spacer battens 160 mm, PE membrane, WBP wooden plate 18mm
9. Insulation glazing in larch frame: 2× 4 mm laminated safety glass + 16 mm cavity + 2× 4 mm laminated safety glass, Ug = 1.0 W/m2K

DETAIL ROOF



Detail Roof - Scale 1:10

1. Insulation glazing in larch frame: 2× 4 mm laminated safety glass + 16 mm cavity + 2× 4 mm laminated safety glass, Ug = 1.0 W/m2K
2. Ritscreen, electric retractable exterior window screening to mitigate solar gain in summer
3. Glue laminated beam, height 500mm and width 150mm, rainpipe locally bolted to structure, CLT roof panel bolted to beam
4. Ceiling panels perforated fir 18mm , 50mm felt acoustic layer, PE damp proof membrane.
5. Water resistant PE membrane, galvanized steel, hidden gutter 300mm connected to vertical rainpipe
6. Stora Enso CLT 150mm, Pavatherm pressure-resistant insulation 300mm (Rd – 7,86 m2K/W)
7. Glass monocrystalline 7.5 mm, battens 50 mm, counter battens 50 mm, bitumen roof finish, water resistant PE membrane

SYNTHESIS

While theoretical research allows for the formulation of problem statements, the research by design engages the author to re-think the status quo. Instead of describing precedents, design research commands visionary thinking. The built environment is a very slow field, very much depended on outdated production technology and commercial business models. Envisioning alternative ways of developing, building and living requires some courage. The case study as a whole is therefore not a very conventional project, it rather questions the status quo of developing and living. Although it might not be the solution, it perhaps can be one of the solutions that can alleviate some of the tensions on the housing market. With the agrarian transition and the housing crisis, a lot of space is needed to accommodate this. The research has shown that industrial urban areas, nearby city centers, are indeed interesting and potent places to pay attention to. In a time where space is a scarce commodity, we need to re-evaluate how we use the space we have available. The research shows that, by re-organizing space, a lot of room can be allocated to other functions such as living and leisure. By redeveloping urban areas, the public space can also be upgraded with more greenery, activities and facilities. The transformation of an existing building has proven to be a complex challenge. Although building something from scratch might be easier, it is definitely important to understand how we can re-purpose and re-use our existing building stock. The existing building will outnumber the newly constructed buildings for a very long time. This means that there is a lot of space available, but we need to re-imagine how we can live. The broad range of floor plans for the dwellings are a good example of re-imagining the way we live. Due to the collective nature of the clusters, the floor plans are far from conventional and have resulted in interesting configurations that can add a degree of complexity and charm to the dwellings. The challenging part is the engineering of the building, therefore this chapter contains a broad range of products that explain how such a transformation could take place. The structure is elaborated on, the climate design, and the facade engineering. The mix of functions could allow for a symbiosis between functions. The production hall and dwellings could interchange energy and resources which would otherwise be lost. There can be an interesting contrast between the old (steel, concrete hall) and the new (light, wooden, bio-based dwellings). Building with bio based materials such as wood allow for more circular (demountable) and sustainable (low carbon emissions) building methods. Building with these materials also allows for a sense of aesthetics as the palette and textures of the materials are more present.

Keywords: housing crisis, agricultural transition, industrial urban areas, transformation, local ecologies, inclusive neighborhoods, affordable housing.

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