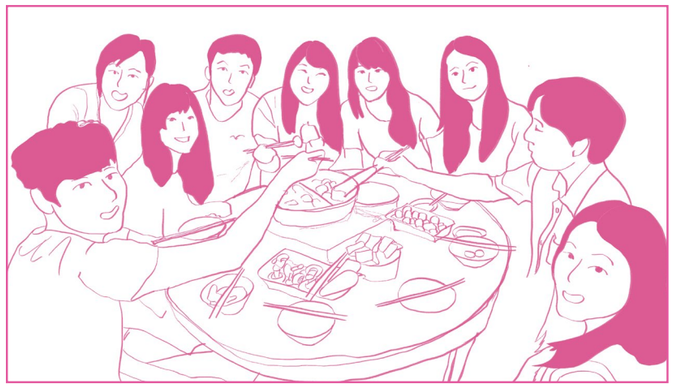
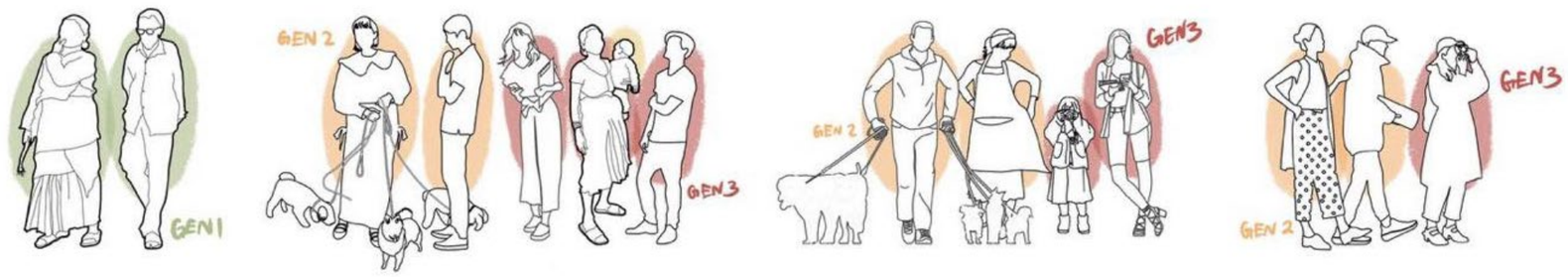
TIMBER FOR ITERATIVE LIVING

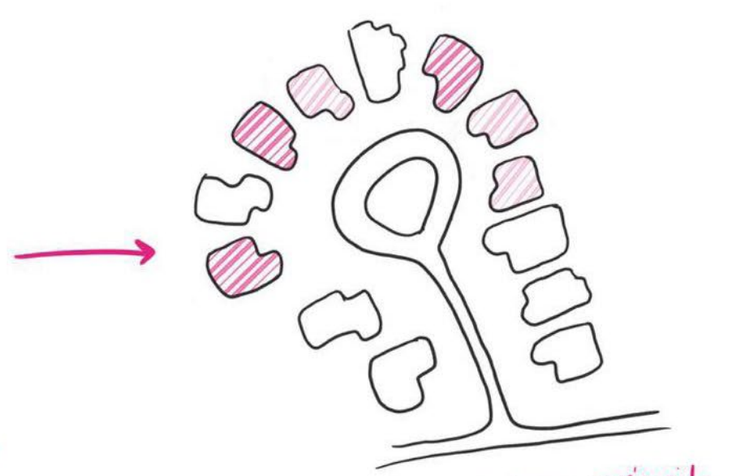
A PLAYBOOK FOR ADAPTABLE INTERGENERATIONAL HOMES

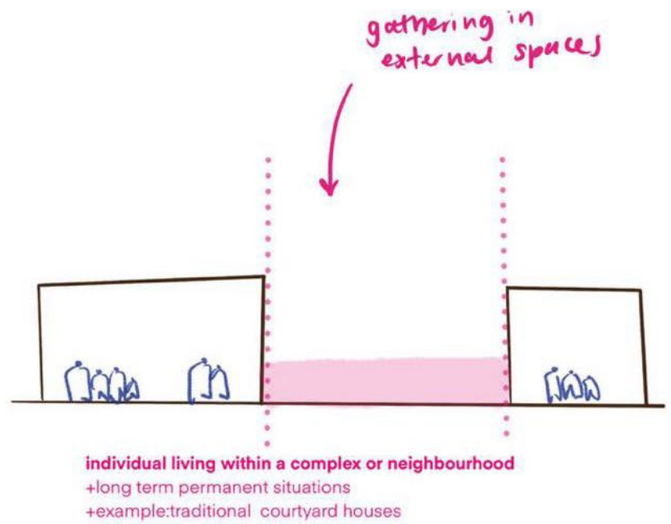
EMILEE Z CHEN



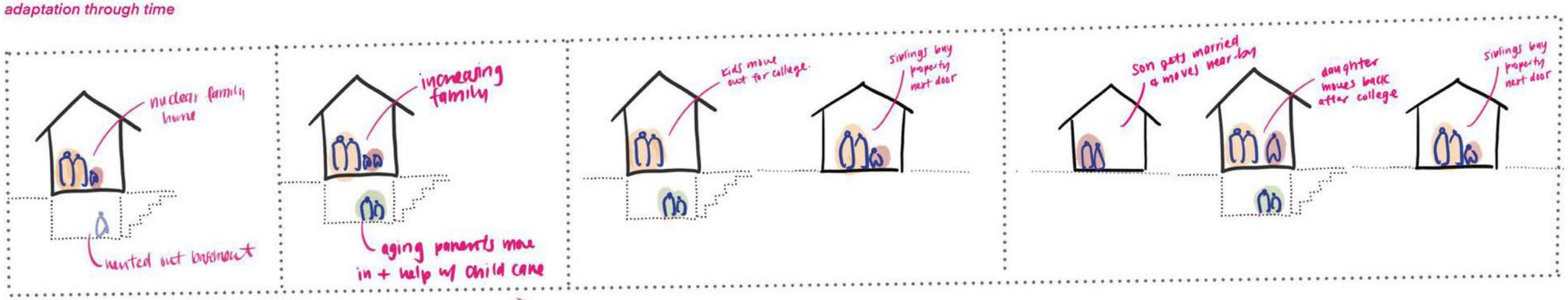


methods of adaptation

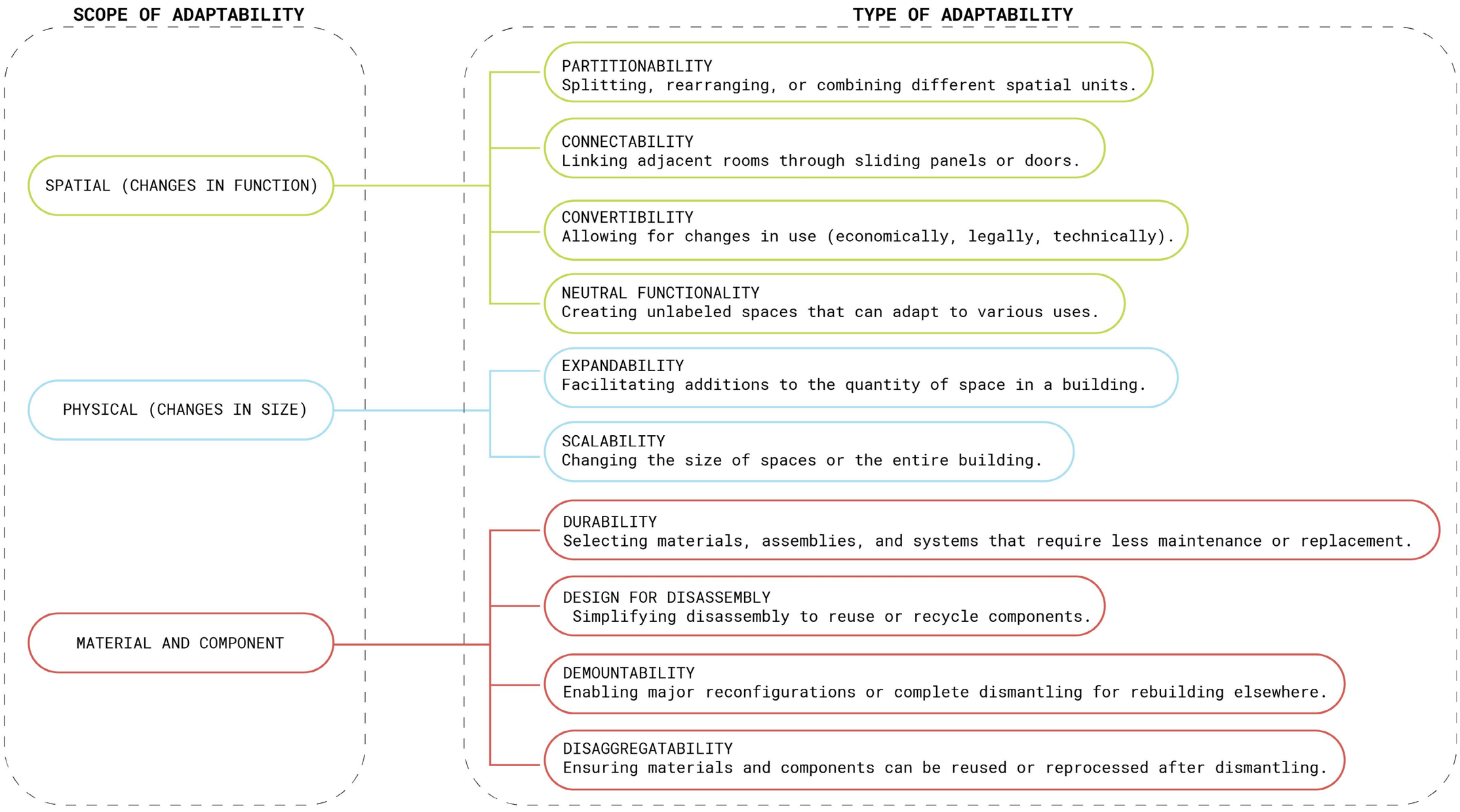




adaptation through time

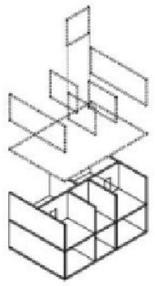


ADAPTABILITY_ SOCIAL LEVEL

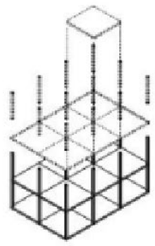


ADAPTABILITY_ BUILDING LEVEL

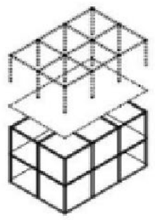
STRUCTURAL BUILDING SYSTEMS



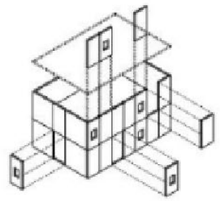
1. Load-bearing partition wall system – mostly transverse walls placed in dwelling divisions but also supplemented by stabilising longitudinal walls.



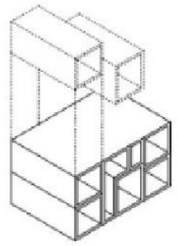
2. Pillar/slab system – typically circular or square columns in a grid combined with a floor structure (slabs).



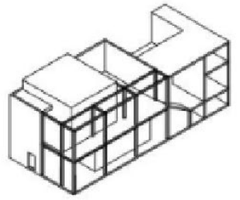
3. Frame system (pillar/beam) – system of columns and beams often with structurally fixed columns or as rigid frames.



4. Load-bearing facade system – System with bearing parts in the facades thus clearing interior floors.

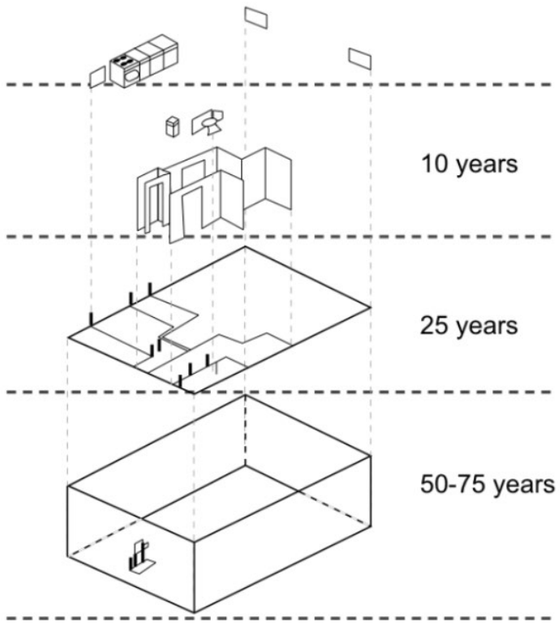


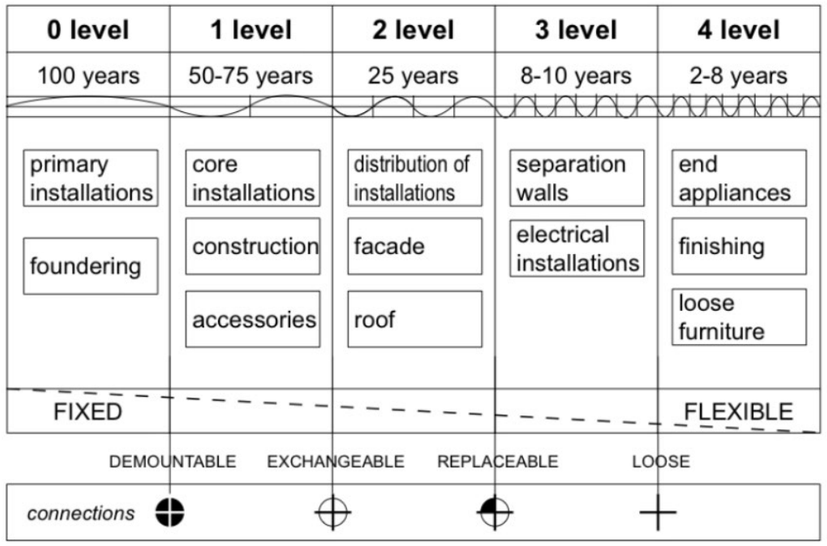
5. Volumetric system – in its clear state characterised by a double bearing structure where volumes meet.



6. Hybrid system – different systems combined in the same building.

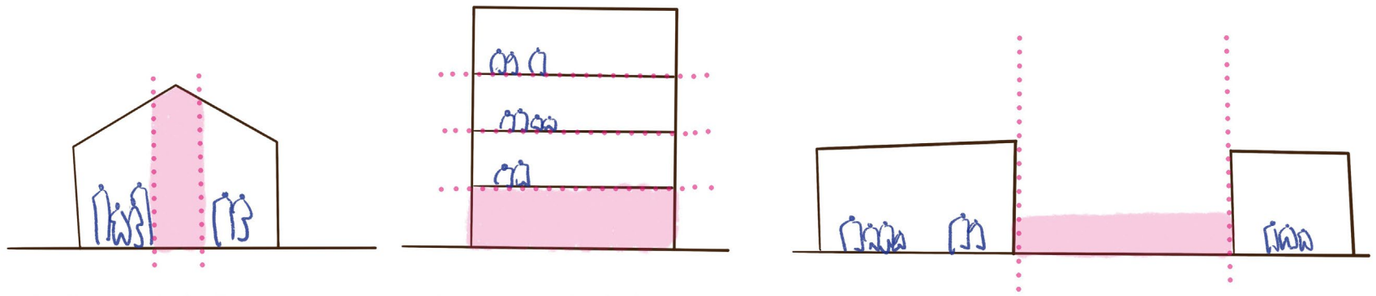
DEMONSTRATION OF BUILDING SHEARING LAYERS IN A DUTCH HOUSE





SOURCE: DURMISEVIC AND BROUWER, 2002)

ADAPTABILITY_ BUILDING COMPONENT LEVEL



shared spaces under 1 roof
+often temporary or unplanned situations
+commonly 3 generations
+often adapted basement units

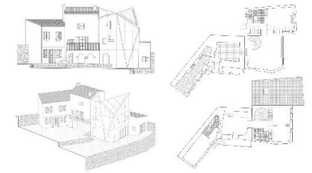
individual levels or units with shared spaces
+often seen with larger families with multiple adult children
+more personalized situations and designs

individual living within a complex or neighbourhood
+long term permanent situations
+example:traditional courtyard houses

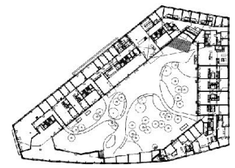
COMMON UNDERSTANDINGS OF THE MULTIGENERATIONAL/ INTERGENERATIONAL HOME

RESIDENCE OF THREE GENERATIONS

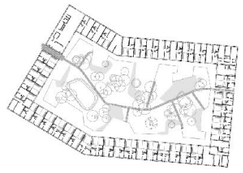
BENOIT&ROSELYNE



KALKBREITE



LANGE ENG

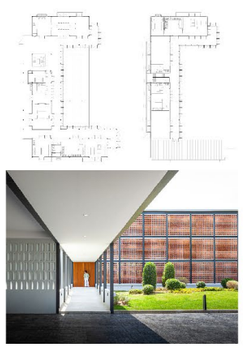


KAS & CO

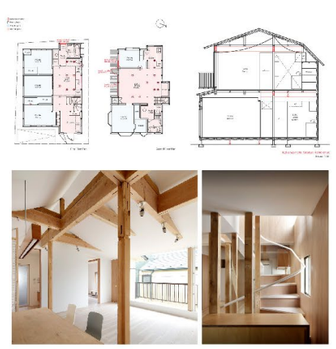
SAN RIEMO

FRIESENBERG

HOUSE BT



HOUSE FOR 4 GENERATIONS



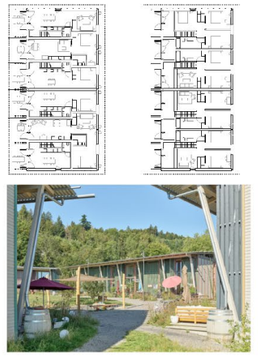
BETA GENERATIEHUIS

CARING WOOD

HAGMANN AREAL

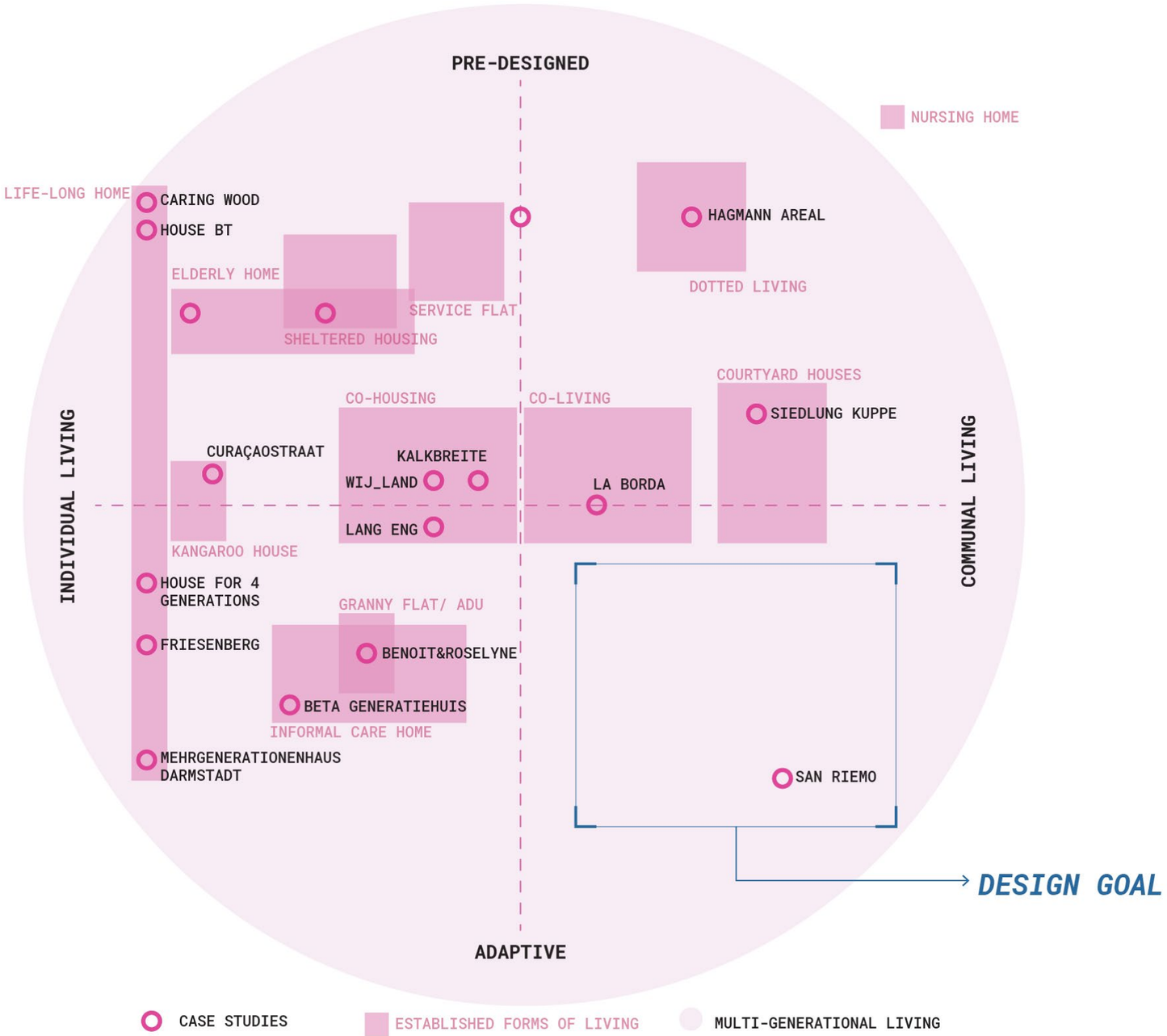
MEHRGENERATIONENHAUS DARMSTADT

SIEDLUNG KUPPE



EXPANDED UNDERSTANDING OF INTERGENERATIONAL LIVING

INTERGENERATIONAL LIVING



LIFE-LONG HOME
A HOME DESIGNED TO ADAPT TO CHANGING NEEDS OVER A PERSON'S LIFETIME, ENSURING ACCESSIBILITY AND COMFORT AT EVERY STAGE.

CO-HOUSING
NTENTIONAL COMMUNITIES WHERE RESIDENTS OWN PRIVATE HOMES AND SHARE COMMUNAL SPACES AND RESPONSIBILITIES IN A COLLABORATIVE LIVING ENVIRONMENT.

CO-LIVING
A MODERN SHARED LIVING ARRANGEMENT, OFTEN RENTAL-BASED, WHERE INDIVIDUALS LIVE IN PRIVATE ROOMS WITH ACCESS TO SHARED FACILITIES AND CURATED COMMUNITY ACTIVITIES.

INFORMAL CARE HOME
A LIVING SETUP WHERE FAMILY MEMBERS OR CLOSE COMMUNITY MEMBERS PROVIDE CARE AND SUPPORT TO AN INDIVIDUAL IN A NON-PROFESSIONAL CAPACITY.

KANGAROO HOUSE
A COMBINED LIVING ARRANGEMENT WHERE A LARGER FAMILY HOME INCLUDES A SEPARATE, SMALLER UNIT FOR ELDERLY RELATIVES OR CAREGIVERS.

"KNARRENHOF" COURTYARD HOUSING
A COMMUNITY-ORIENTED HOUSING MODEL WHERE RESIDENTS LIVE IN PRIVATE HOMES AROUND A SHARED COURTYARD, EMPHASIZING MUTUAL SUPPORT AND SOCIAL CONNECTION.

ELDERLY HOME
A RESIDENCE PROVIDING ACCOMMODATION AND CARE SPECIFICALLY FOR OLDER ADULTS, OFTEN WITH SHARED FACILITIES AND SOCIAL PROGRAMS.

SHELTERED HOUSING
HOUSING WITH PRIVATE UNITS FOR INDEPENDENT LIVING, SUPPLEMENTED BY COMMUNAL AREAS AND MINIMAL ON-SITE CARE OR SUPPORT SERVICES.

SERVICE FLAT
A PRIVATE APARTMENT FOR SENIORS, OFFERING ADDITIONAL SERVICES LIKE MEALS, CLEANING, AND EMERGENCY SUPPORT.

DOTTED LIVING
A DECENTRALIZED LIVING ARRANGEMENT WITH SMALLER UNITS OR CARE SERVICES SPREAD ACROSS A NEIGHBORHOOD TO INTEGRATE SUPPORT INTO COMMUNITY LIFE.

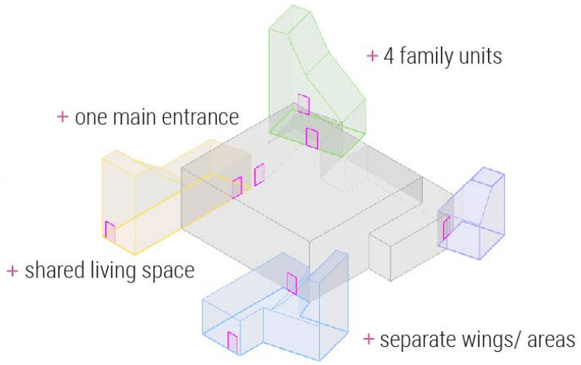
INTERGENERATIONAL LIVING

PRE-DESIGNED

ADAPTIVE

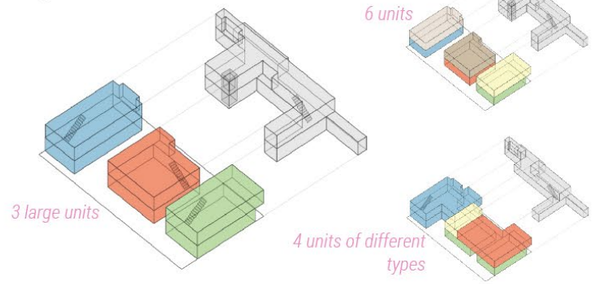
SINGLE FAMILY

CARING WOOD



MEHRGENERATIONENHAUS DARMSTADT

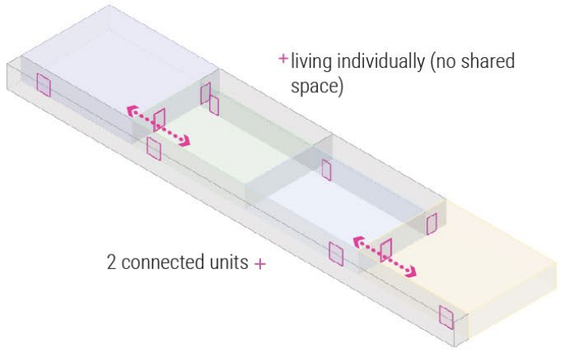
method of adaptation:
SPLIT, OPEN



+ partitionability -- splitting/ combining spatial units
+ neutral functionality -- shared space can be converted to living units
+ access -- separate access points to each space through shared space allowing it to become independent

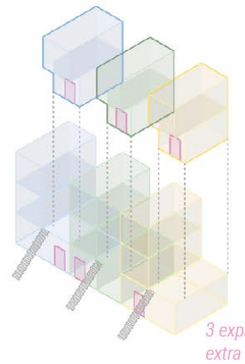
MULTI FAMILY

CURAÇAOSTRAAT GRONINGEN



QUINTA MONROY

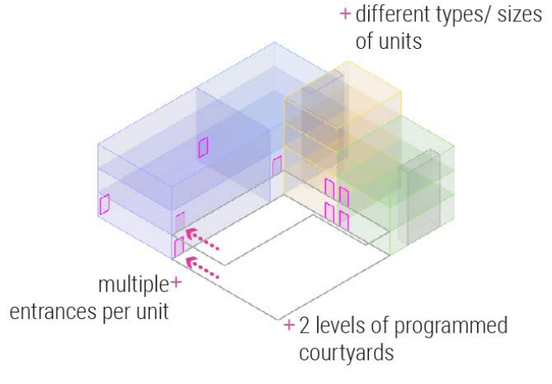
method of adaptation:
ADD



+ expandability -- porosity allows for space to grow
+ connectability -- pre-planned access routes

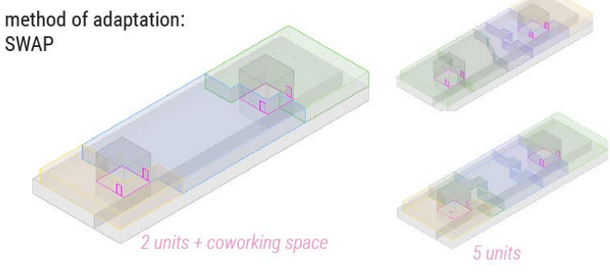
COMMUNAL LIVING

KAS & CO



SAN RIEMO

method of adaptation:
SWAP



+ connectability -- existing openings between units allow for entire rooms to be swapped
+ neutral functionality -- large areas of shared space that can be for socializing or closed into a unit
+ access -- rearranging units depends on the circulation cores

INTERGENERATIONAL LIVING_ SPATIAL REQUIREMENTS

PUBLIC AMENITIES FOR INTERGENERATIONAL LIVING

MARKET HALL ------> *podium*

COMMUNITY KITCHEN ------> *pocket*

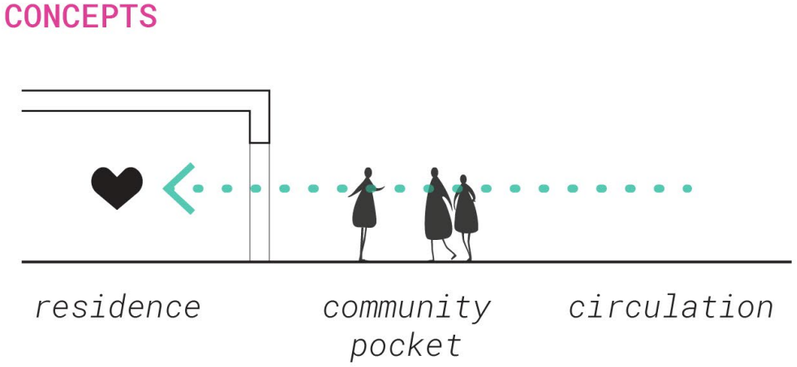
CO-WORKING SPACE ------> *pocket*

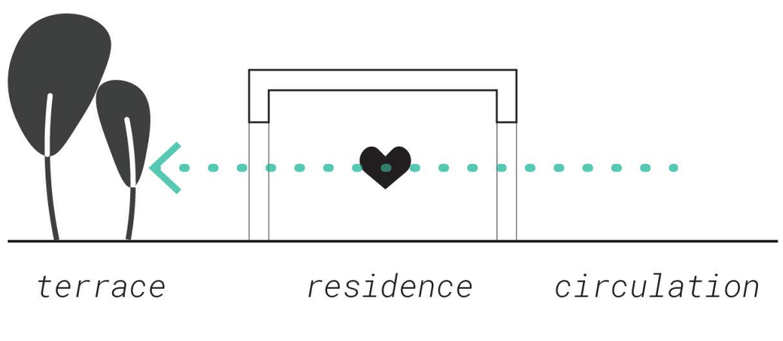
COMMUNITY GARDEN ------> *pocket*

SHARED DINING AREA ------> *pocket*

LITERACY CENTER ------> *podium*

ACCESS CONCEPTS





INTERGENERATIONAL LIVING_ COMMUNITY REQUIREMENTS

TIME SPAN

SCENARIOS OF SPATIAL NEEDS

METHODS OF ADAPTATION

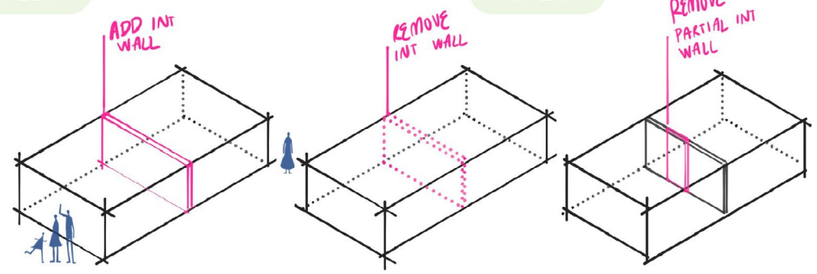
INVOLVED BUILDING SHEARING LAYERS

SHORT TERM
< 1 year

- Temporary Room Conversions
- Seasonal Modifications
- Workspace Addition
- Childcare Adjustments

SPLIT

OPEN



- STUFF
- SPACE PLAN

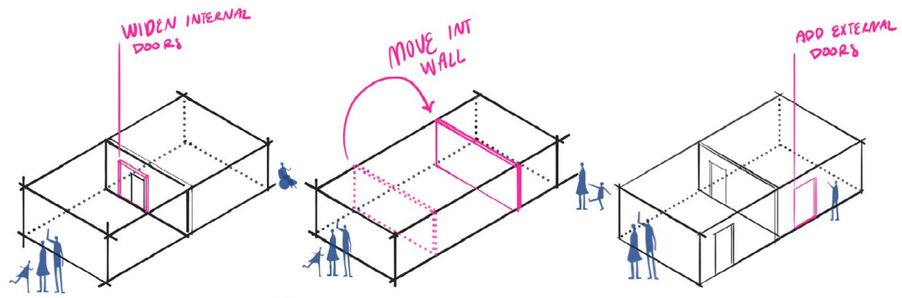
MEDIUM TERM
1-5 years

- Accessibility Modifications
- Home Sharing/ Renting
- Family Expansion

EXPAND

SWAP

ACCESS



- SPACE PLAN
- SERVICES

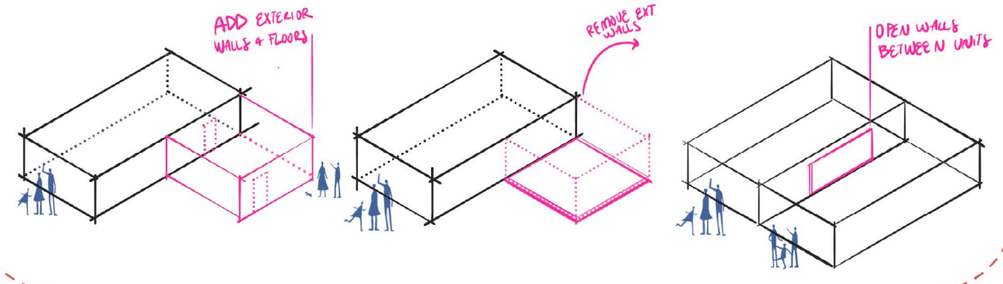
LONG TERM
> 5 years

- Aging in Place
- Family Evolution
- Cohabitation Adjustments

ADD

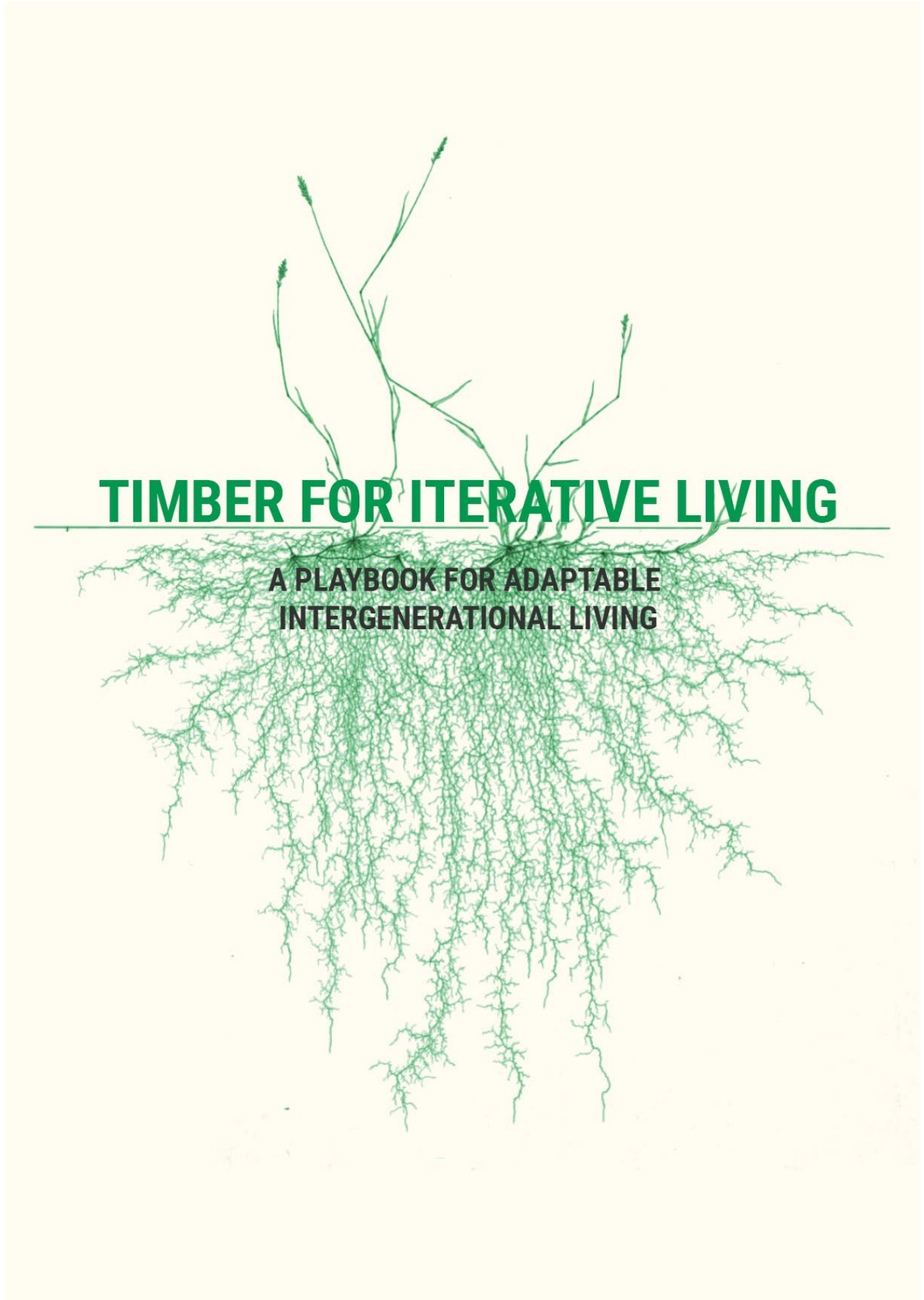
REMOVE

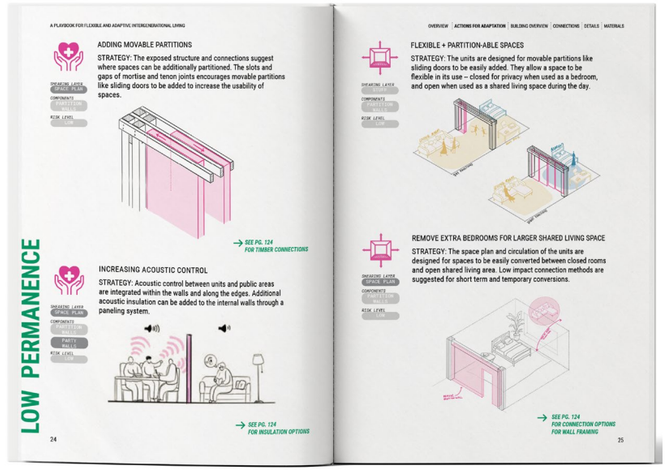
OPEN

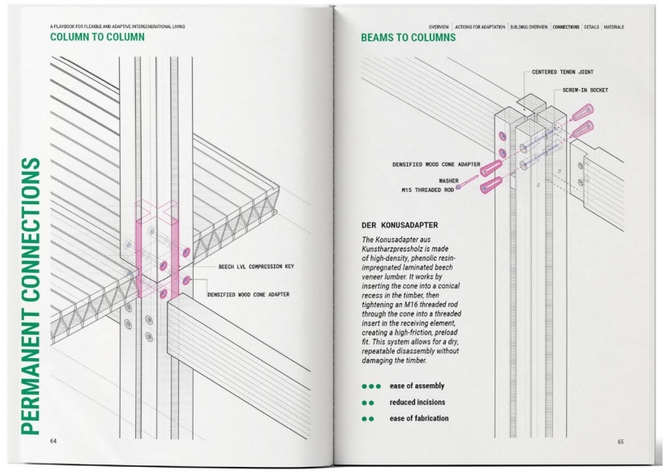


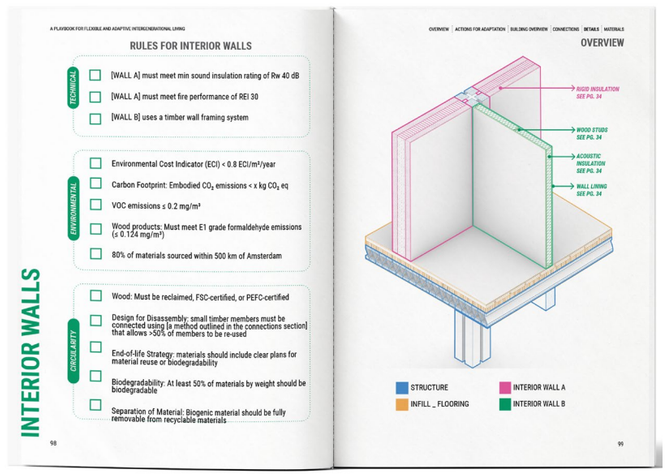
- SERVICES
- SKIN
- STRUCTURE

ADAPTABLE INTERGENERATIONAL LIVING





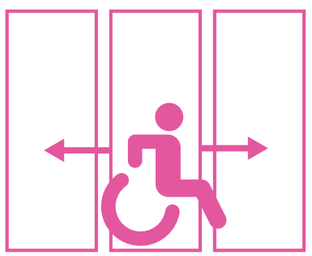




ADAPTIVE INTERGENERATIONAL LIVING_ THE PLAYBOOK

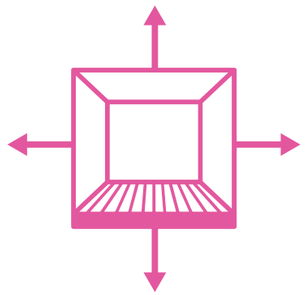
ADAPTING FOR CARE + PRIVACY

In intergenerational homes, privacy is essential for dignity and autonomy, while proximity enables caregiving when needed. Adaptable partitions, soundproof zones, and shared-but-separate suites allow households to shift between independence and intimacy—supporting different rhythms of life and care needs across generations.



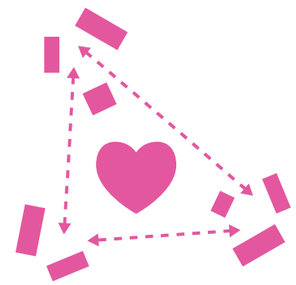
ADAPTING FOR ACCESSIBILITY

Universal design ensures every generation can navigate and enjoy the home. Step-free entrances, wide doorways, adjustable counters, and smart home technologies create a responsive environment. As mobility needs evolve, spaces must seamlessly adapt—making accessibility an integrated and unobtrusive part of everyday living.



ADAPTING FOR SPACE

Flexible space planning supports evolving family structures and changing functions over time. Sliding walls, convertible rooms, and modular furnishings allow spaces to grow, shrink, or switch use—transforming a playroom into a guest suite or a living area into a work hub, without rebuilding.



ADAPTING FOR COMMUNITY

Shared spaces foster intergenerational bonds, collaboration, and a sense of belonging. Common kitchens, gardens, and gathering areas offer opportunities for connection, while retreat spaces respect the need for solitude. Adaptable layouts can shift between communal and private modes as household dynamics change.

THE PLAYBOOK_ DESIGN ACTIONS FOR ADAPTABILITY

LOW PERMANENCE

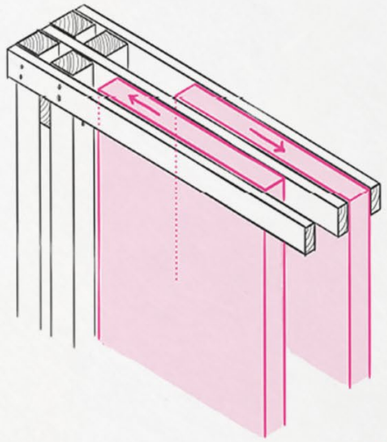
ADDING MOVABLE PARTITIONS

SHEARING LAYER
SPACE PLAN

COMPONENTS
PARTITION WALLS

RISK LEVEL
LOW

STRATEGY: The exposed structure and connections suggest where spaces can be additionally partitioned. The slots and gaps of mortise and tenon joints encourages movable partitions like sliding doors to be added to increase the usability of spaces.



→ SEE PG. 124
FOR TIMBER CONNECTIONS

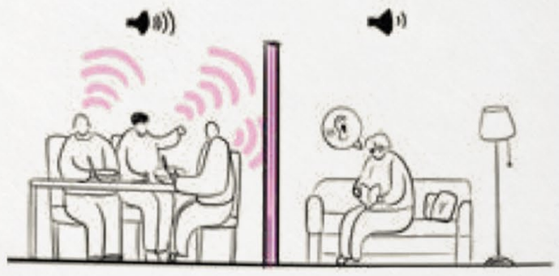
INCREASING ACOUSTIC CONTROL

SHEARING LAYER
SPACE PLAN

COMPONENTS
PARTITION WALLS
PARTY WALLS

RISK LEVEL
LOW

STRATEGY: Acoustic control between units and public areas are integrated within the walls and along the edges. Additional acoustic insulation can be added to the internal walls through a paneling system.



→ SEE PG. 124
FOR INSULATION OPTIONS

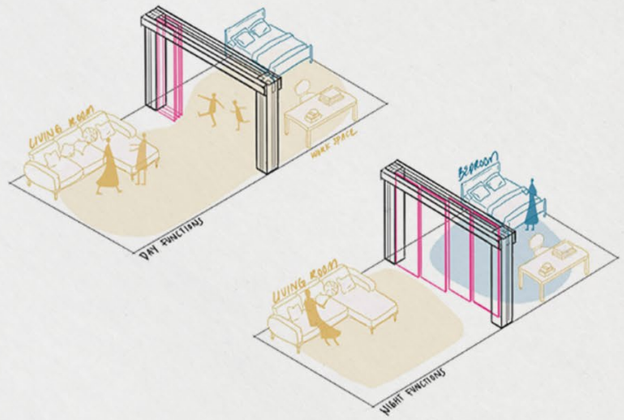
FLEXIBLE + PARTITION-ABLE SPACES

SHEARING LAYER
STUFF

COMPONENTS
PARTITION WALLS

RISK LEVEL
LOW

STRATEGY: The units are designed for movable partitions like sliding doors to be easily added. They allow a space to be flexible in its use -- closed for privacy when used as a bedroom, and open when used as a shared living space during the day.



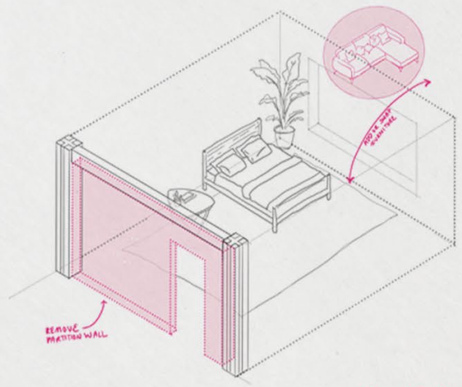
REMOVE EXTRA BEDROOMS FOR LARGER SHARED LIVING SPACE

SHEARING LAYER
SPACE PLAN

COMPONENTS
PARTITION WALLS

RISK LEVEL
LOW

STRATEGY: The space plan and circulation of the units are designed for spaces to be easily converted between closed rooms and open shared living area. Low impact connection methods are suggested for short term and temporary conversions.



→ SEE PG. 124
FOR CONNECTION OPTIONS
FOR WALL FRAMING

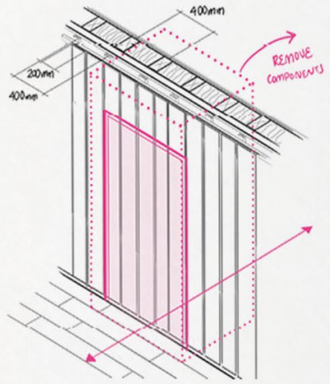
DESIGN ACTIONS FOR ADAPTABILITY_ SHORT TERM

MODERATE PERMANENCE

ADDING EXTERIOR DOOR IN INNER COURTYARD

SHEARING LAYER: SKIN
COMPONENTS: EXTERIOR WALLS
RISK LEVEL: MODERATE

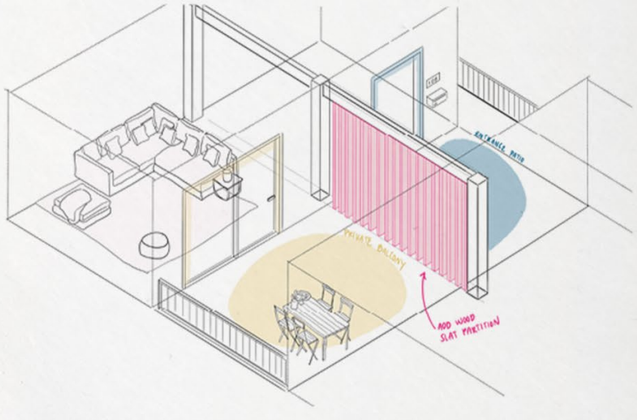
STRATEGY: Phase 1 construction uses modular sized building components that are sized to accommodate additional fenestration. Vertical cladding is used in the inner courtyard and aligns with the wall framing to minimize cuts required for the intervention.



SPLIT OPEN PATIO FOR PRIVATE BALCONY

SHEARING LAYER: SPACE PLAN
COMPONENTS: PARTITION WALLS
RISK LEVEL: LOW

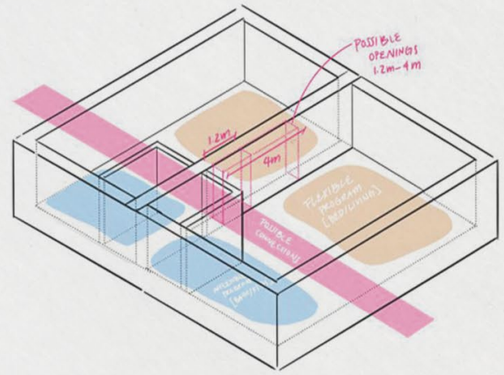
STRATEGY: The open space dedicated to each unit for possible future expansion doubles as the entry patio to the unit in the meantime, accessed from the shared corridor. A separation wall can also be added to split the 8m deep patio to add a private balcony accessed from inside the unit.



CONNECT UNITS FOR KANGAROO CARE HOMES

SHEARING LAYER: SPACE PLAN
COMPONENTS: PARTY WALLS
RISK LEVEL: MODERATE

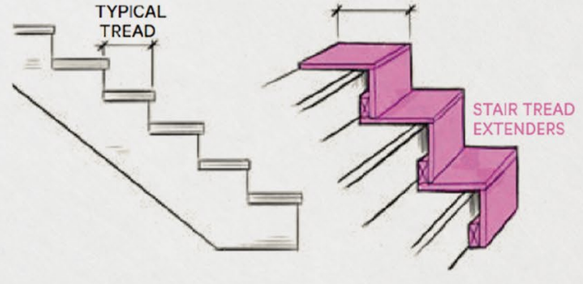
STRATEGY: The space plan of the units are designed with areas where the partition walls between 2 adjacent units can be removed to connect the units, either through a simple door or a larger opening for a joint living space. Note: these then become one fire compartment.



EXTEND STAIR TREADS

SHEARING LAYER: SPACE PLAN
COMPONENTS: IN-UNIT STAIRS
RISK LEVEL: MODERATE

As individuals age, a major concern is the risk of falling as this can have many major health implications for seniors. One of the reasons that seniors often slip and fall on stairs is because of the tread length; however, this can be abated simply by increasing the tread length of stairs.



DESIGN ACTIONS FOR ADAPTABILITY_ MEDIUM TERM

HIGH PERMANENCE

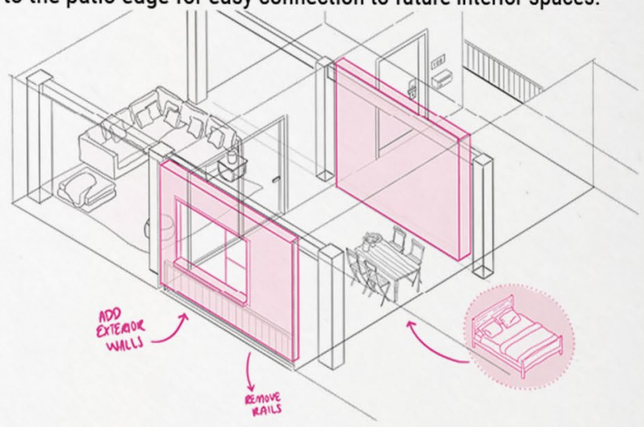
CONVERT PATIO TO EXTRA ROOMS

SHEARING LAYER: SKIN

COMPONENTS: EXTERIOR WALLS

RISK LEVEL: HIGH

STRATEGY: The structural grid and foundation are pre-dimensioned to support enclosure of patio spaces, allowing infill walls and roof extension without altering the primary structure. Services such as ventilation and electrical conduits are pre-routed to the patio edge for easy connection to future interior spaces.



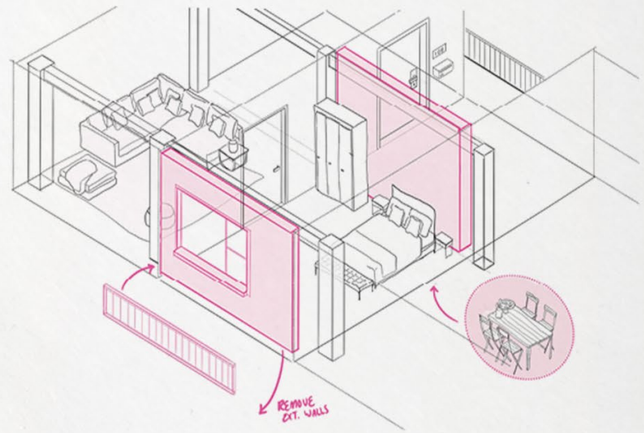
REMOVE EXTRA BEDROOMS FOR MORE PATIO SPACE

SHEARING LAYER: SKIN

COMPONENTS: EXTERIOR WALLS

RISK LEVEL: HIGH

STRATEGY: Non-load-bearing partition walls allow for easy removal to open the floor plate toward the exterior. Modular facade elements can be disassembled and relocated to redefine the building envelope, transforming interior space into an open or semi-open patio.



→ SEE PG. X FOR EXTERIOR WALL DETAILS

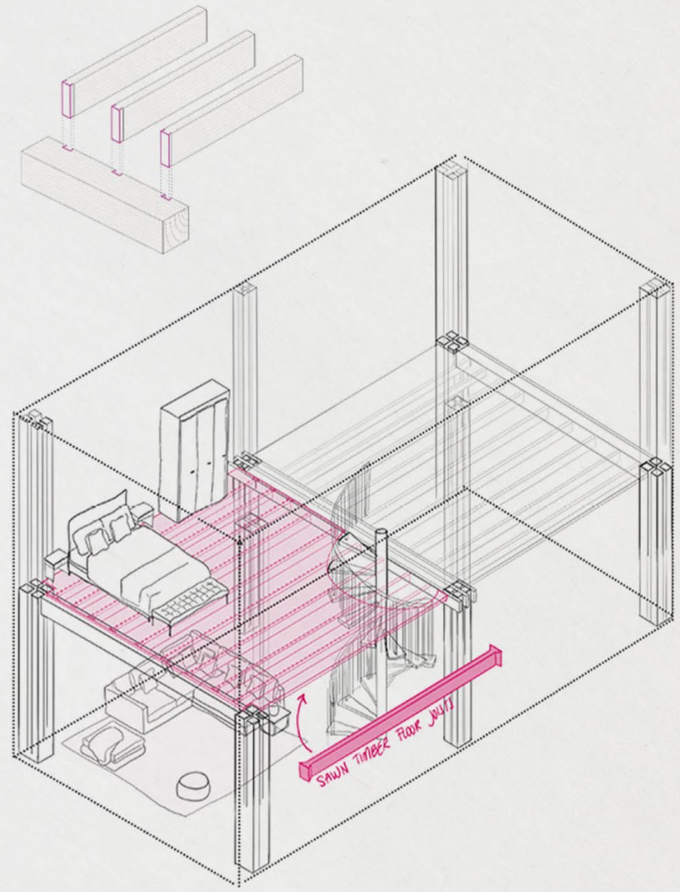
TURN LOFT INTO DUPLEX FOR ADDITIONAL FLOOR SPACE

SHEARING LAYER: STRUCTURE

COMPONENTS: PARTITION FLOORS

RISK LEVEL: MODERATE

STRATEGY: The ceiling height and structural spans are designed to allow insertion of a mezzanine or partial second floor with minimal reinforcement. Floor openings for stair access are pre-designated within the structural grid to enable vertical circulation without major demolition.



→ SEE PG. X FOR FLOOR ASSEMBLIES

DESIGN ACTIONS FOR ADAPTABILITY_ LONG TERM

SCORING CRITERIA OF CONNECTIONS:

ease of assembly/ disassembly

5: Simple to assemble without specialized tools or skills.
1: Requires skilled labor or advanced tools.

low-impact

5: No damage to timber; fully reversible.
1: Significant damage or waste during disassembly.

scalability

5: Easily adaptable to different material sizes and types.
1: Limited flexibility, specific to one size/material.

CONNECTIONS ASSESSMENT

CATEGORIES OF REVERSIBLE TIMBER CONNECTIONS

STRAPPING

In order to better understand how to address the issue of social isolation, a literature review was performed to generate a list of evidence-based design features that can be used when retrofitting existing high-rises.

\+ **ease of assembly**

requires some knowledge or previous experience

\+ **number of incisions**

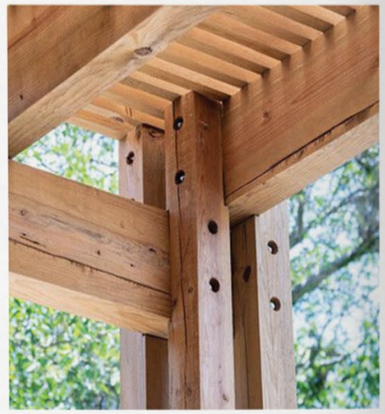
no incisions made to the timber members unless combined with carpentry joinery

\+ **ease of fabrication**

only simple cuts required

\- **applicability**

limited by structural capacity



SIMPLE FASTENERS

In order to better understand how to address the issue of social isolation, a literature review was performed to generate a list of evidence-based design features that can be used when retrofitting existing high-rises.

\+ **ease of assembly**

\- **number of incisions**

results in damage accumulation; this often leads to smaller members not being reused

\+ **ease of fabrication**

\+ **applicability**

PROPRIETARY STEEL CONNECTORS

In order to better understand how to address the issue of social isolation, a literature review was performed to generate a list of evidence-based design features that can be used when retrofitting existing high-rises.

\+ **ease of assembly**

\- **number of incisions**

usually multiple incisions for knife plates or fasteners

\= **ease of fabrication**

\- **applicability**

each connector designed for specific members and connection

CARPENTRY JOINERY + WOOD CONNECTORS

In order to better understand how to address the issue of social isolation, a literature review was performed to generate a list of evidence-based design features that can be used when retrofitting existing high-rises.

\+ **ease of assembly**

joints like tongue and groove allow for self-aligning and require minimal tools

\+ **number of incisions**

specific incisions made by CNC; may limit type of future reuse to same function

\= **ease of fabrication**

CNC fabrication

\- **applicability**

x-fix connectors currently mostly designed for connecting mass timber panels

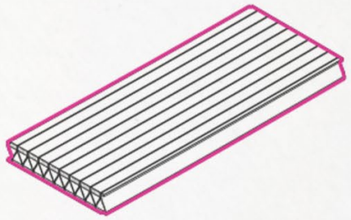
CONNECTIONS ASSESSMENT

A PLAYBOOK FOR FLEXIBLE AND ADAPTIVE INTERGENERATIONAL LIVING

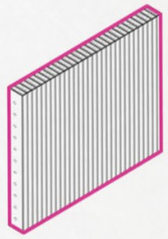
CONNECTION MATRIX

elements

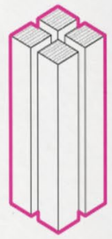
floors_ kielstag cassette system



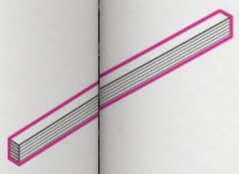
solid walls_ DLT



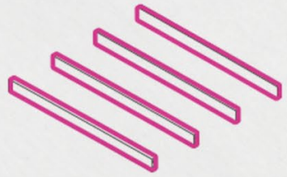
columns_ glulam



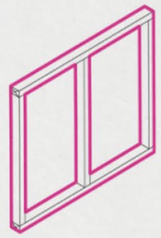
beam_ glulam



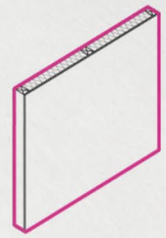
joists_ sawn timber



infill_ wood framing

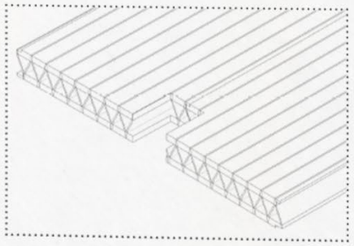


infill_ wall panels



connections [structural]

floor slab - floor slab

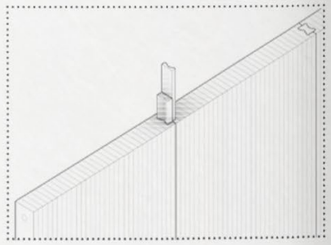


permanent

SIMPLE FASTENERS

STEEL CONNECTORS

wall panel - wall panel

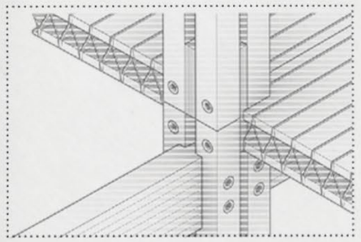


permanent

WOOD CONNECTORS

STEEL CONNECTORS

column - column

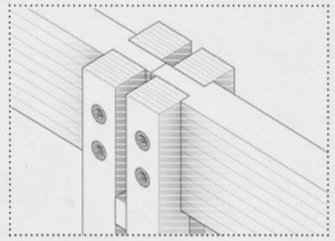


permanent

WOOD CONNECTORS

SIMPLE FASTENERS

column - beam



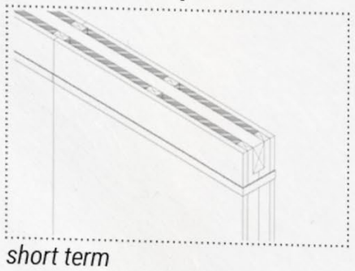
permanent

WOOD CONNECTORS

SIMPLE FASTENERS

connections [infill]

wall panel - wall panel



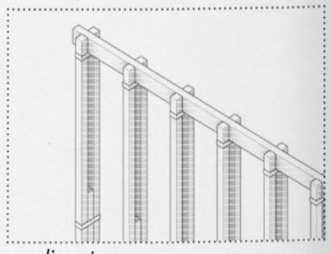
short term

STRAPPING

SIMPLE FASTENERS

CARPENTRY JOINERY

framing - framing



medium term

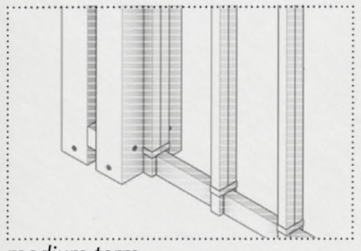
STRAPPING

SIMPLE FASTENERS

CARPENTRY JOINERY

connections [structural - infill]

column - wall framing

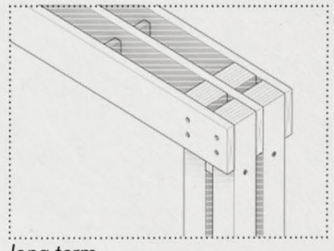


medium term

STRAPPING

SIMPLE FASTENERS

column - ceiling joists



long term

CARPENTRY JOINERY

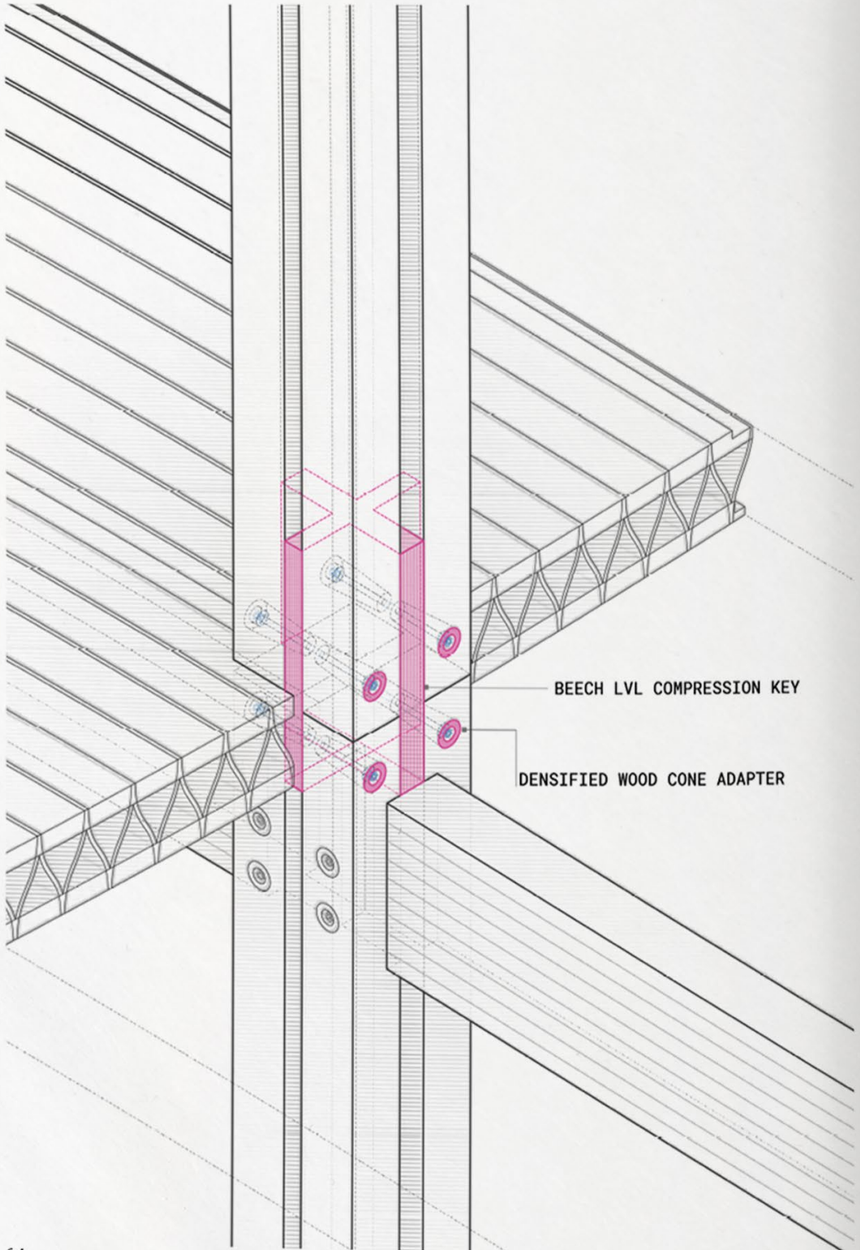
SIMPLE FASTENERS

CONNECTIONS ASSESSMENT

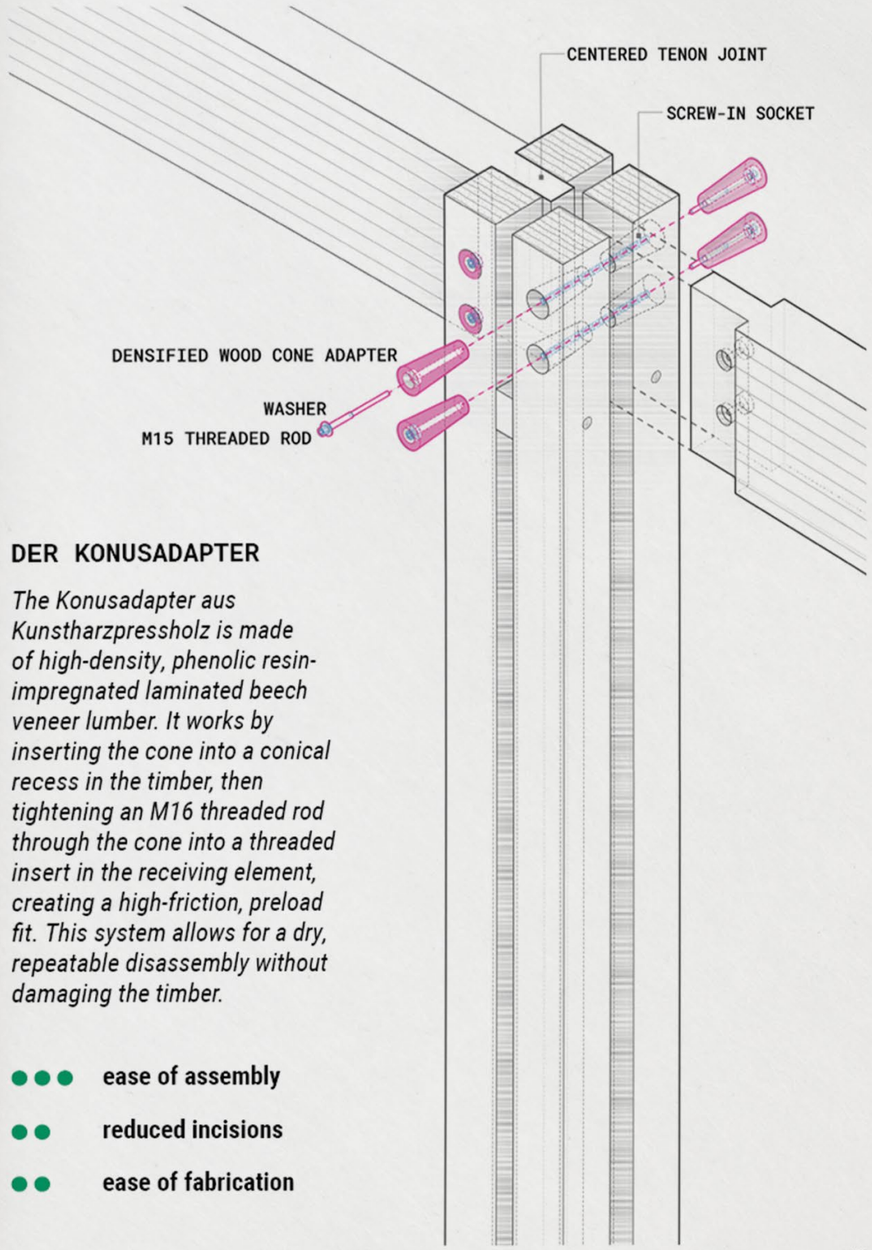
A PLAYBOOK FOR FLEXIBLE AND ADAPTIVE INTERGENERATIONAL LIVING

COLUMN TO COLUMN

PERMANENT CONNECTIONS



BEAMS TO COLUMNS



DER KONUSADAPTER

The Konusadapter aus Kunstharzpressholz is made of high-density, phenolic resin-impregnated laminated beech veneer lumber. It works by inserting the cone into a conical recess in the timber, then tightening an M16 threaded rod through the cone into a threaded insert in the receiving element, creating a high-friction, preload fit. This system allows for a dry, repeatable disassembly without damaging the timber.

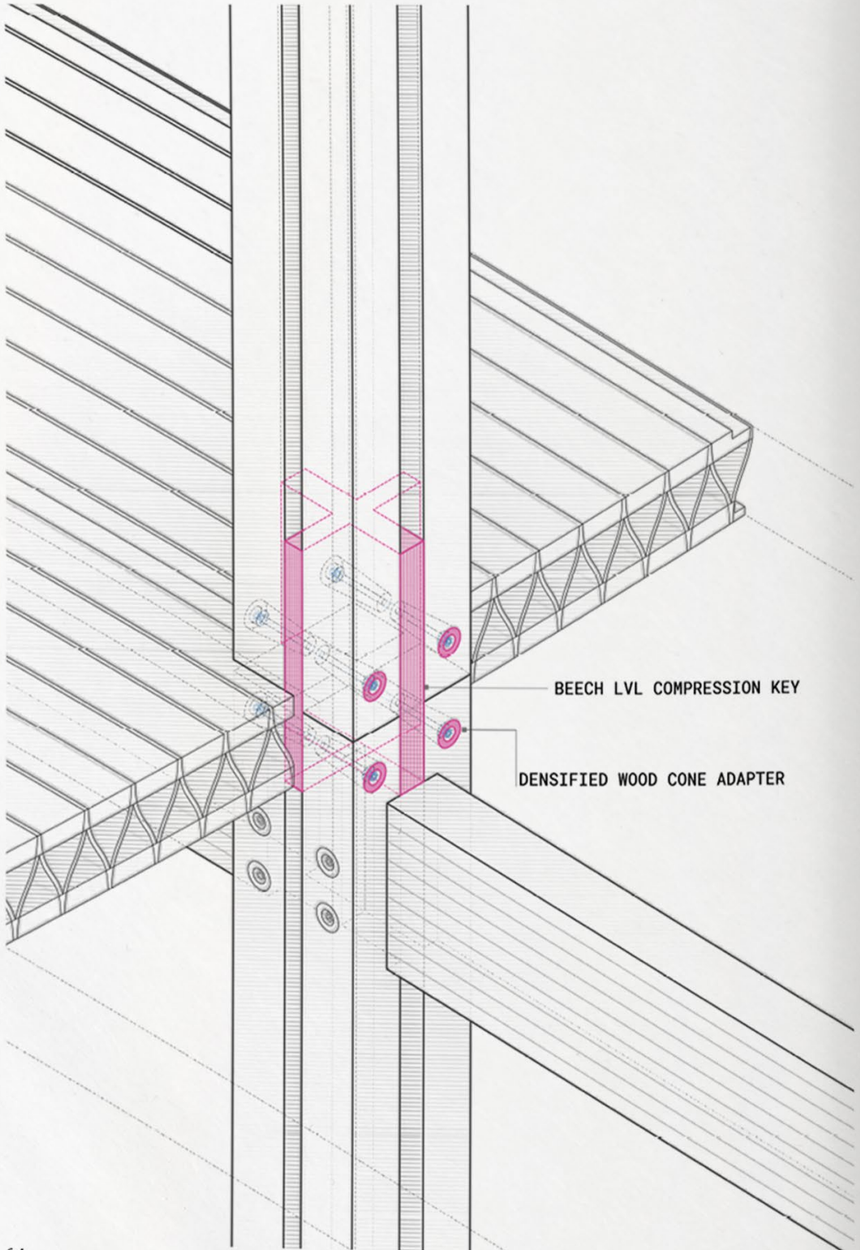
- ●●● **ease of assembly**
- ●● **reduced incisions**
- ●● **ease of fabrication**

CONNECTIONS ASSESSMENT

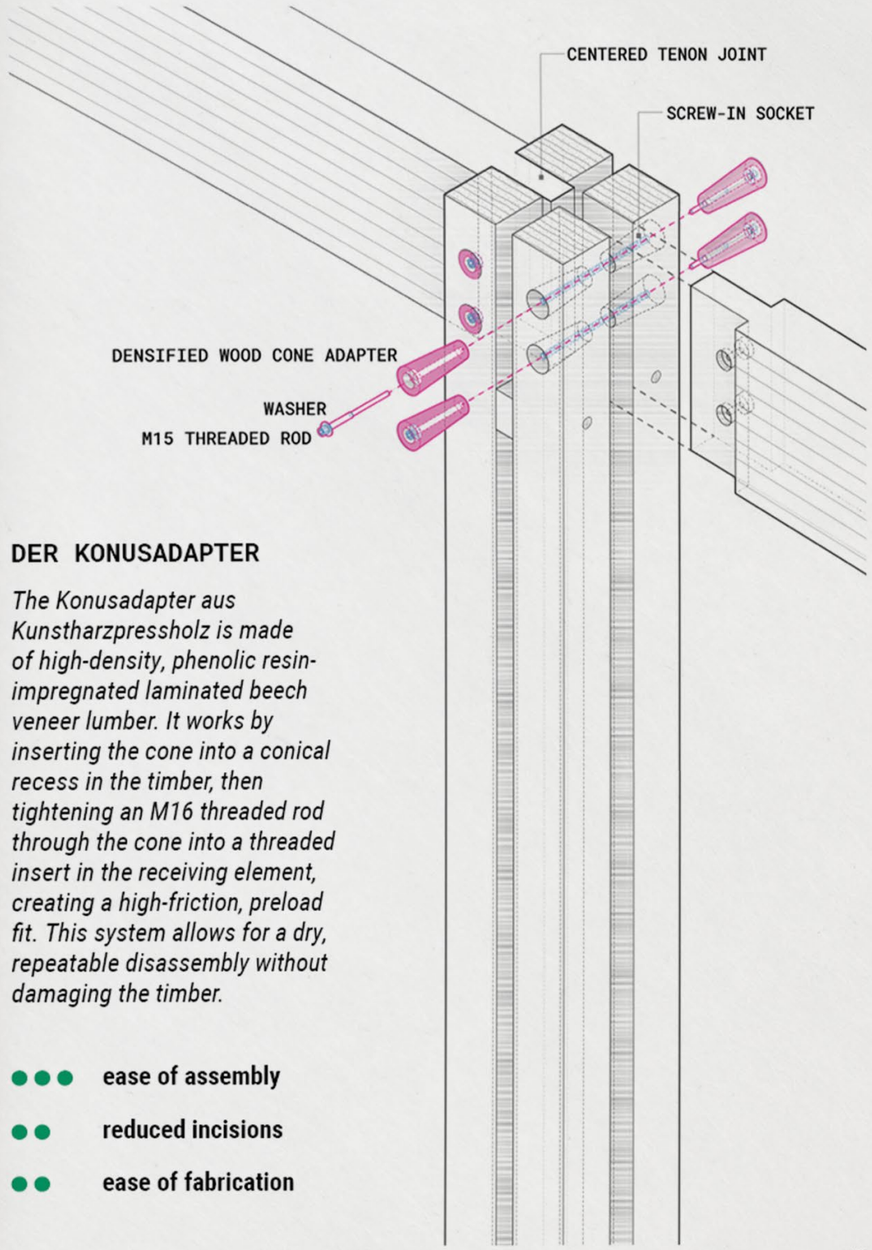
A PLAYBOOK FOR FLEXIBLE AND ADAPTIVE INTERGENERATIONAL LIVING

COLUMN TO COLUMN

PERMANENT CONNECTIONS



BEAMS TO COLUMNS



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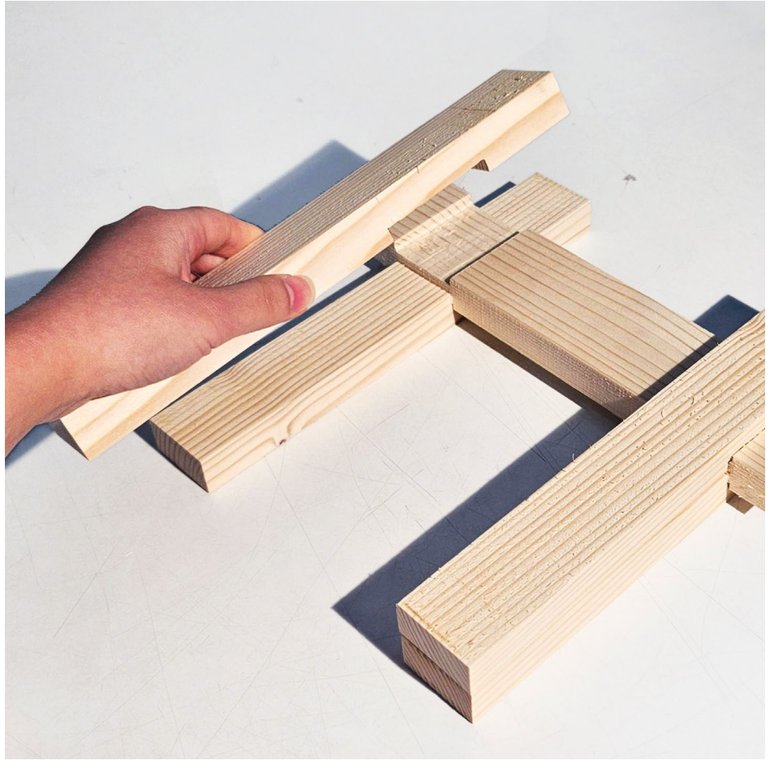
CONNECTIONS ASSESSMENT



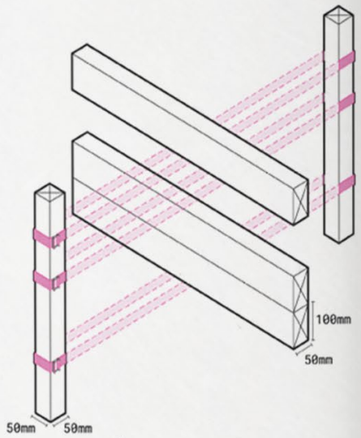
CONNECTIONS ASSESSMENT_ STRAPPED FRAMING

WALL FRAMING

STRAPPING METHOD

No incisions are made to the wood, allowing for maximum possible re-use. Straps are tied above and below horizontal members. Lateral stability is provided through sheathing. This build up uses smaller vertical members and results in a thicker wall assembly and more space in between for acoustic insulation.

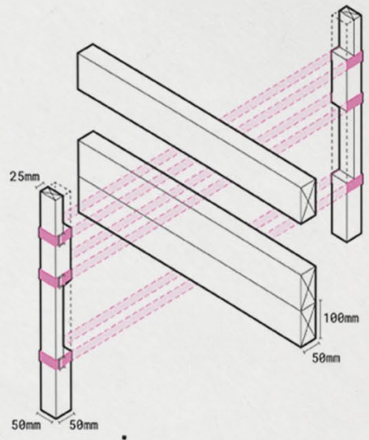
- ●● **ease of assembly**
- ●●● **reduced incisions**
- ●●● **ease of fabrication**



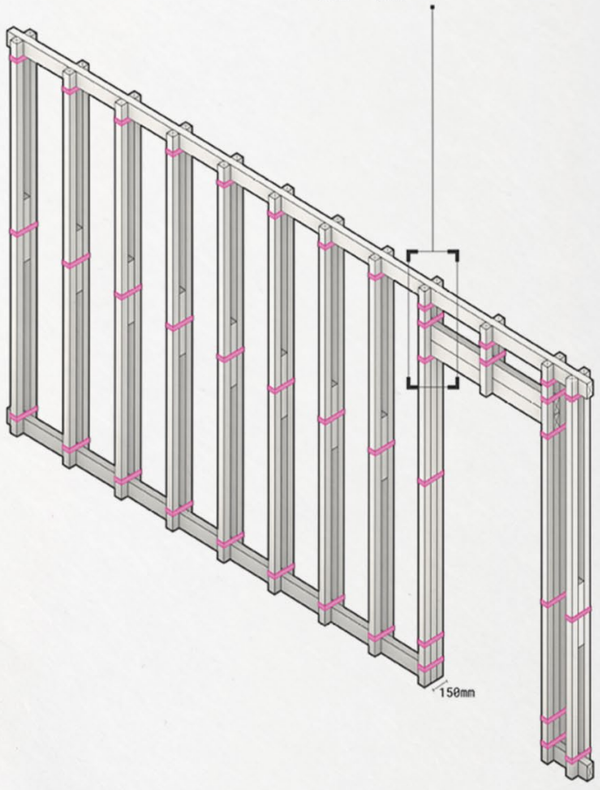
MODIFIED STRAPPING METHOD

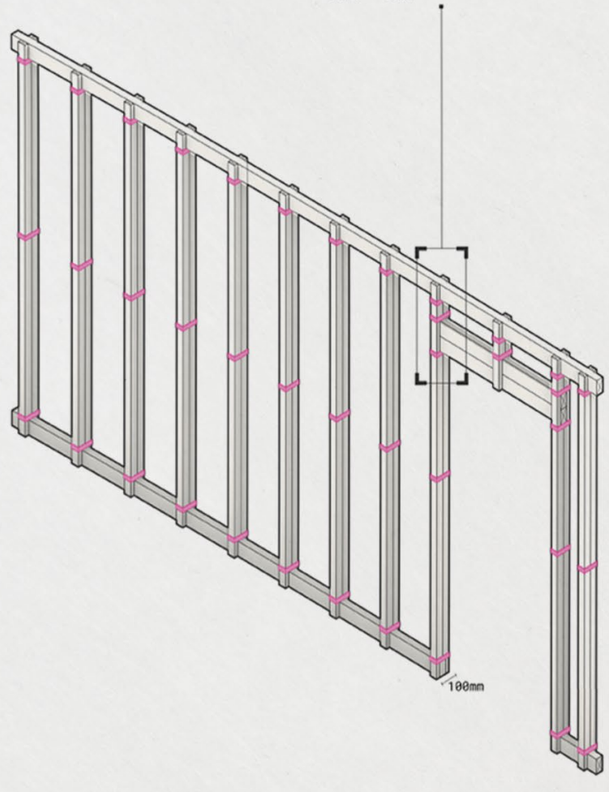
Half-laps are CNC milled in the vertical studs for easy placement and assembly with crossing elements, adding extra stability. Vertical members are tied together directly, eliminating the need for blocking pieces in between, and results in a thinner wall compared to the simple strapping method.

- ●●● **ease of assembly**
- ●● **reduced incisions**
- ●● **ease of fabrication**



INFILL CONNECTIONS





CONNECTIONS ASSESSMENT_ STRAPPED FRAMING

REFERENCE GUIDELINES

BOUWBESLUIT

NATIONALE MILIEUDATABASE

LIVING BUILDING CHALLENGE

FSC&PEFC CERTIFICATION

NIBS LIFECYCLE GUIDELINES

ELLEN MACARTHUR FOUNDATION

TECHNICAL PERFORMANCE

Fire Resistance Rating:

>30 min (EI 30) (interior walls)

>60 min (EI 60) (exterior walls)

Materials with a Euroclass fire rating of B-s1, d0, or better.

Acoustics: Minimum sound insulation rating of Rw = 40 dB

Thermal (exterior walls): U-Value ≤ 0.2 W/m²·K

Maximum air permeability qv10 ≤ 0.15 dm³/s·m²

ENVIRONMENTAL PERFORMANCE

Environmental Cost Indicator (ECI) < 0.8 ECI/m²/year

Carbon Footprint: Embodied CO2 emissions < x kg CO2 eq

VOC emissions ≤ 0.2 mg/m³

Wood products: Must meet E1 grade formaldehyde emissions (≤ 0.124 mg/m³)

RESPONSIBLE SOURCING

80% of materials sourced within 500 km of Amsterdam

Wood: Must be reclaimed, FSC-certified, or PEFC-certified

LIFESPAN AND CIRCULARITY

DfD: Materials must be removable without damaging adjacent components

Functional Lifespan Alignment: Materials should match the lifespan of surrounding components.

Structural elements: 50+ years

Interior finishes: 10-20 years

Exterior cladding: 30+ years

Flooring: (Abrasion-resistant for high-traffic areas) 15+ years

End-of-life Strategy: materials should include clear plans for material reuse or biodegradability

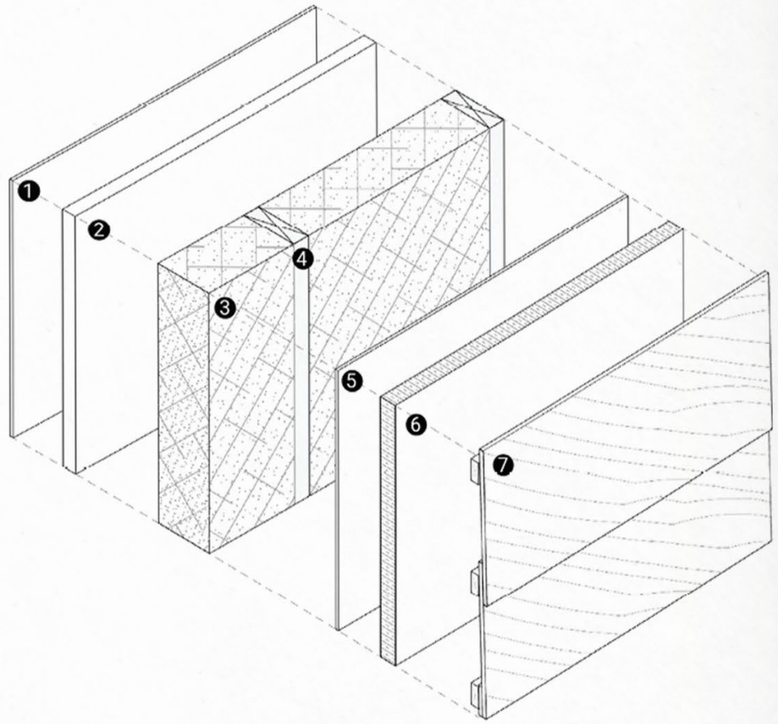
Biodegradability: At least 50% of materials by weight should be biodegradable

Separation of Material: Biogenic material should be fully removable from recyclable materials, so they can be returned to the earth

CRITERIA FOR BIOGENIC MATERIAL SPECIFICATION

ASSEMBLY EXAMPLES

LIGHT TIMBER FRAME/HEMPBATT INSULATION/HEMP-LIME BOARD



(Based on Material Cultures, Circular Biobased Construction Report, 2021)

Materials:
1.Clay Plaster
2.Hemp-Lime Board (Celenit Isohemp, Nl): 25 mm
3.Hempbatt Insulation (Thermo-Hemp, De): 145 mm
4.Timber Frame (FSC-Certified Spruce):45 mm x 145 mm
5. Wood Fiber Board (Gutex Thermosafe, De): 16 mm
6.Woodfibre Insulation (Glutex, De): 60 mm
7.Exterior Cladding (Reclaimed Timber): 25 mm

TECHNICAL

- ☑ Use a ventilated rain-screen cladding system
- ☑ Use a non-load-bearing framing system supported from the top of the floor slab
- ☑ Material composition of assembly must function without the use of a vapour membrane to allow for breathable walls
  - → *All materials used are vapour open*
- ☑ Complete wall build-up must meet fire performance of REI60
  - → *REI60 with lime plaster, Euroclass B-s1, d0*
- ☑ Complete wall build-up must meet Rc Value of 4.5 m²·K/W
  - → *achieved with 2 types of insulation*
- ☑ Install water control layer as specified in details

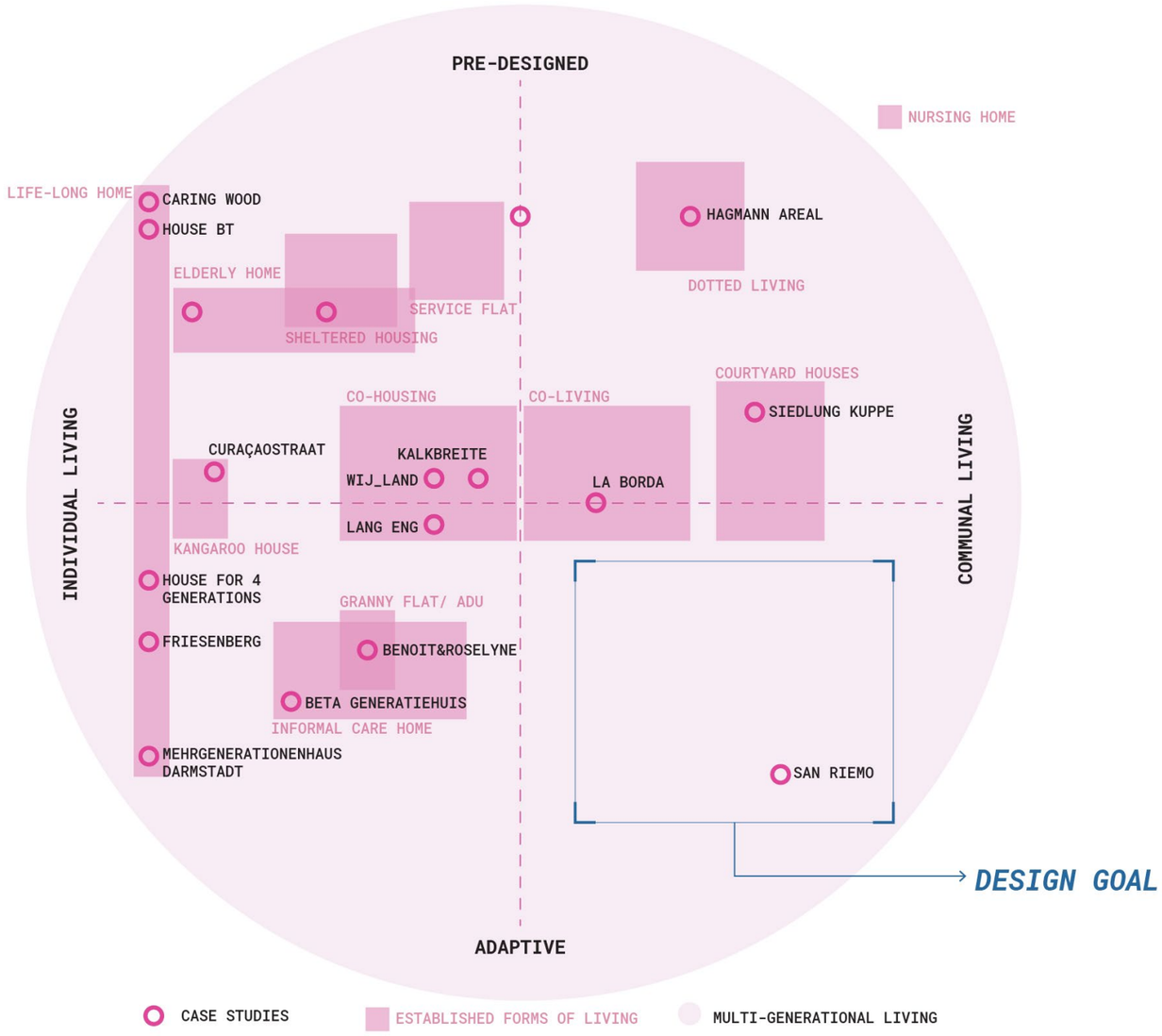
ENVIRONMENTAL

- ☑ Environmental Cost Indicator (ECI) < 0.8 ECI/m²/year
  - → *<0.5 ECI/m²/ year*
- ☑ Carbon Footprint: Embodied CO_2 emissions < x kg CO_2 eq
  - → *carbon negative*
- ☑ VOC emissions ≤ 0.2 mg/m³
- ☑ Wood products: Must meet E1 grade formaldehyde emissions (≤ 0.124 mg/m³)
- ☑ 80% of materials sourced within 500 km of Amsterdam
  - → *most materials sourced within NL and DE*

CIRCULARITY

- ☑ Wood: Must be reclaimed, FSC-certified, or PEFC-certified
  - → *reclaimed wood and FSC-certified spruce*
- ☑ Design for Disassembly: Materials must be removable without damaging adjacent components
- ☑ End-of-life Strategy: materials should include clear plans for material reuse or biodegradability
  - → *80% bio-degradable straw, hemp, timber*
- ☑ At least 50% of materials by weight should be biodegradable
- ☑ Separation of Material: Biogenic material should be fully removable from recyclable materials

CRITERIA FOR BIOGENIC MATERIAL SPECIFICATION



WHAT?

ADAPTABLE LIVING

HIGH DENSITY (MULTI-FAMILY)

INTERGENERATIONAL LIVING

COMMUNITY CENTERED LIVING

FOR WHOM?

NON-NUCLEAR FAMILIES, IMMIGRANT FAMILIES, PEOPLE IN DIFFERENT STAGES OF LIFE

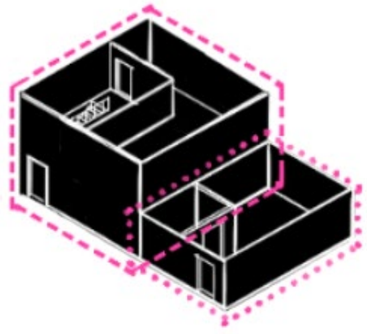
WHERE?

HOUTHAVEN, AMSTERDAM

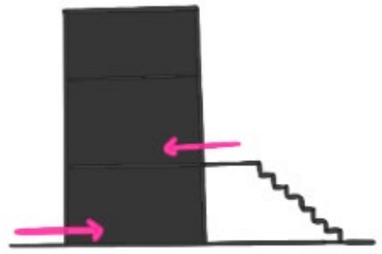
DESIGN_ TYPOLOGY

ADAPTABLE LIVING | **HIGH DENSITY (MULTI-FAMILY)** | **INTERGENERATIONAL LIVING** | **COMMUNITY CENTERED LIVING**

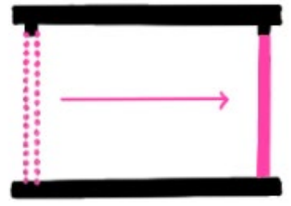
FORMALLY DEFINE FRAMEWORK FOR GROWING AND MOVING



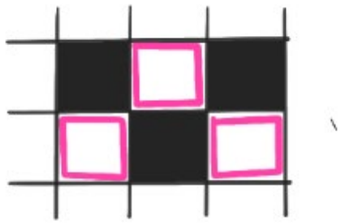
VARIETY OF DIFFERENT HOUSING TYPES



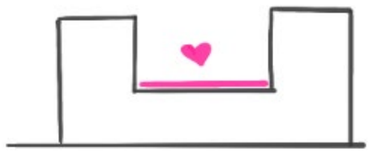
MULTIPLE POINTS OF ACCESS AND ENTRY



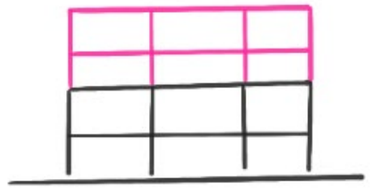
USE OF TEMPORAL BUILDING LAYERS TO ALLOW FOR RECONFIGURATION



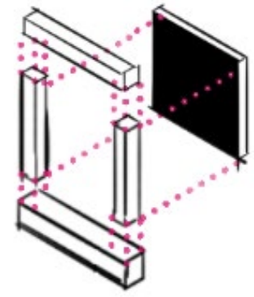
POROUS ARCHITECTURE (SPACE TO GROW)



COMMUNAL SPACES FOR INTERGENERATIONAL KNOWLEDGE SHARING

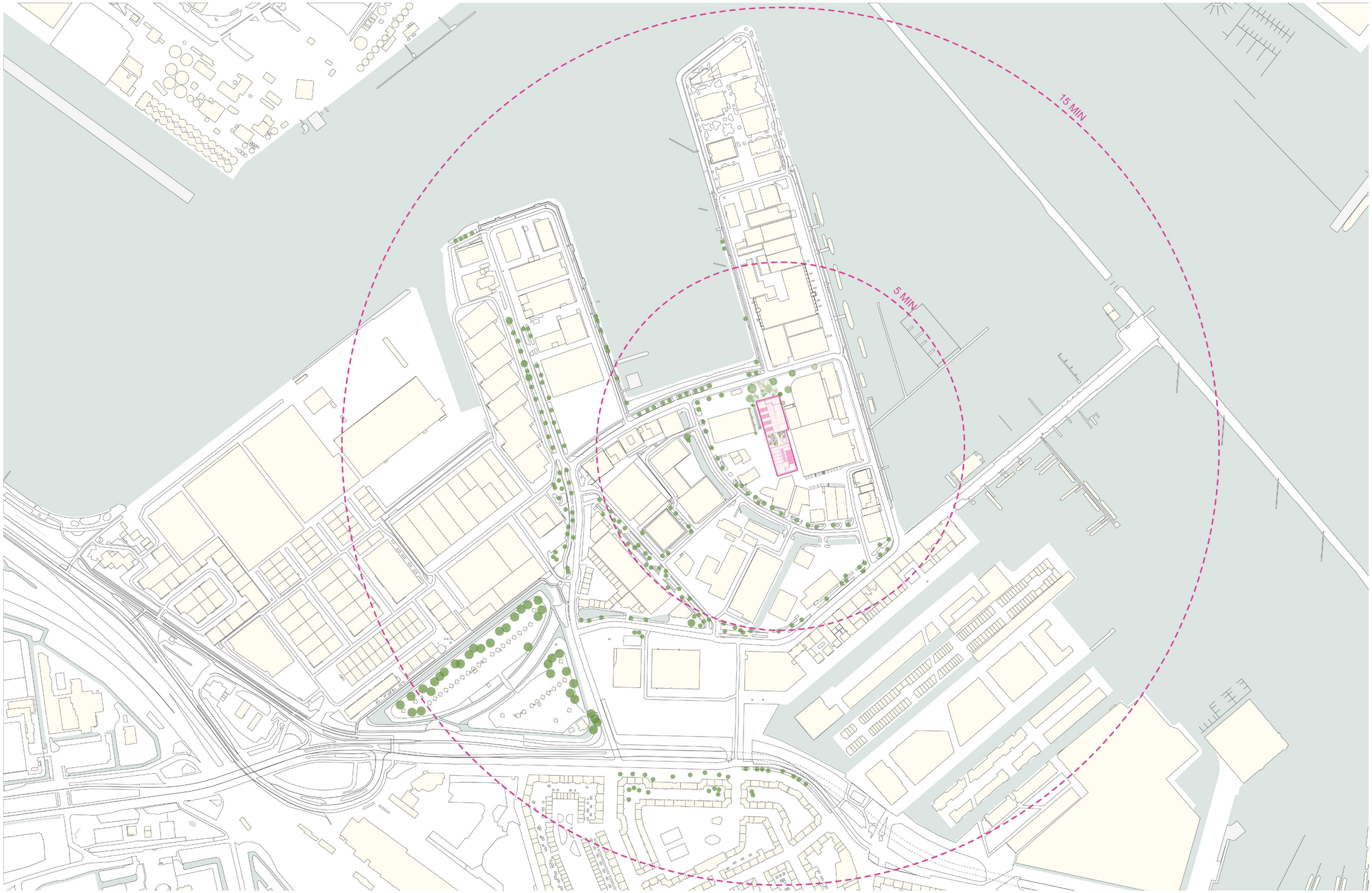


USING AND EXPANDING STRUCTURE OF EXISTING BUILDINGS



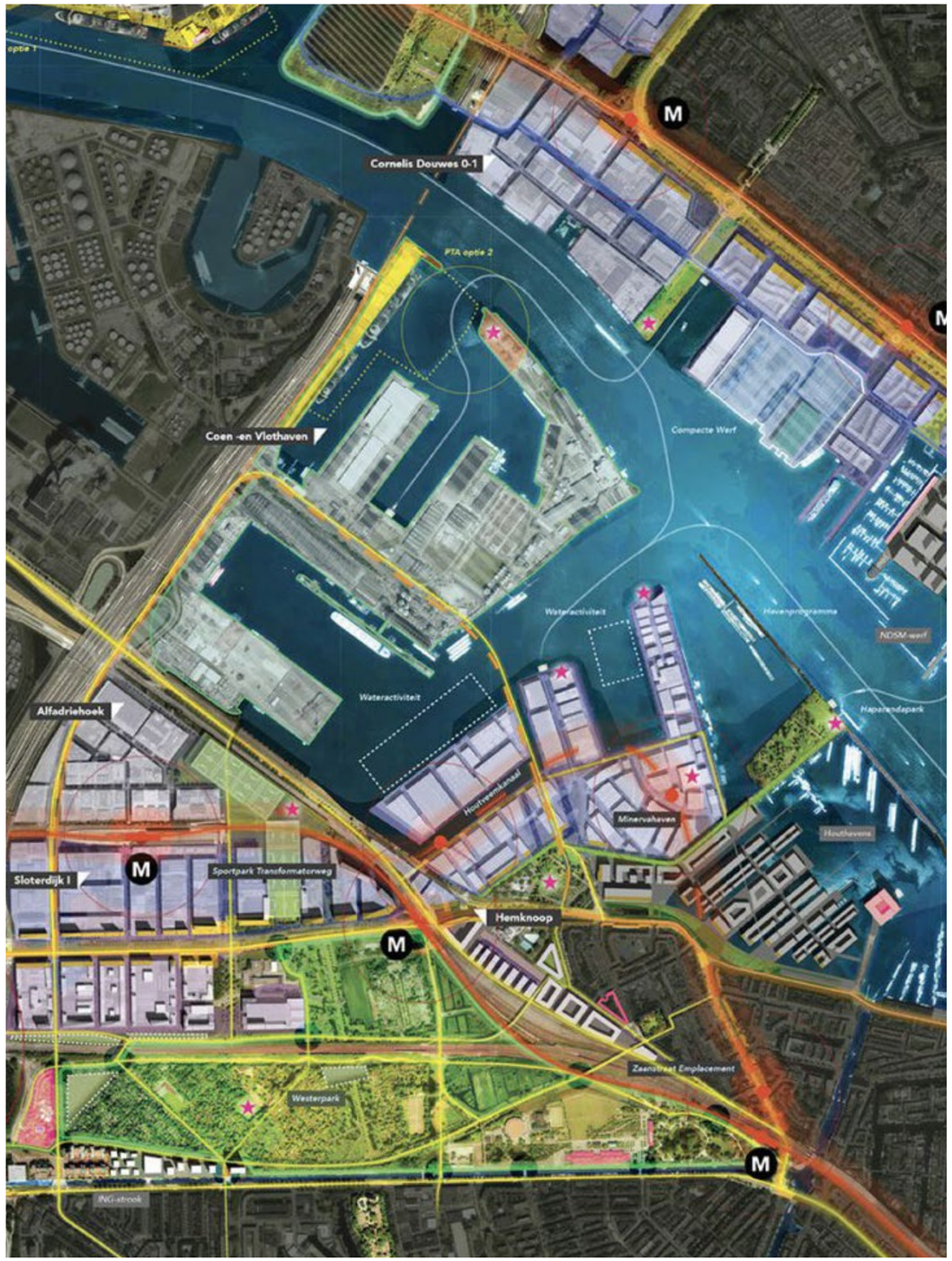
DESIGN FOR DISASSEMBLY TO ALLOW FOR CHANGE AND SWAPPING OF ELEMENTS

DESIGN GUIDELINES



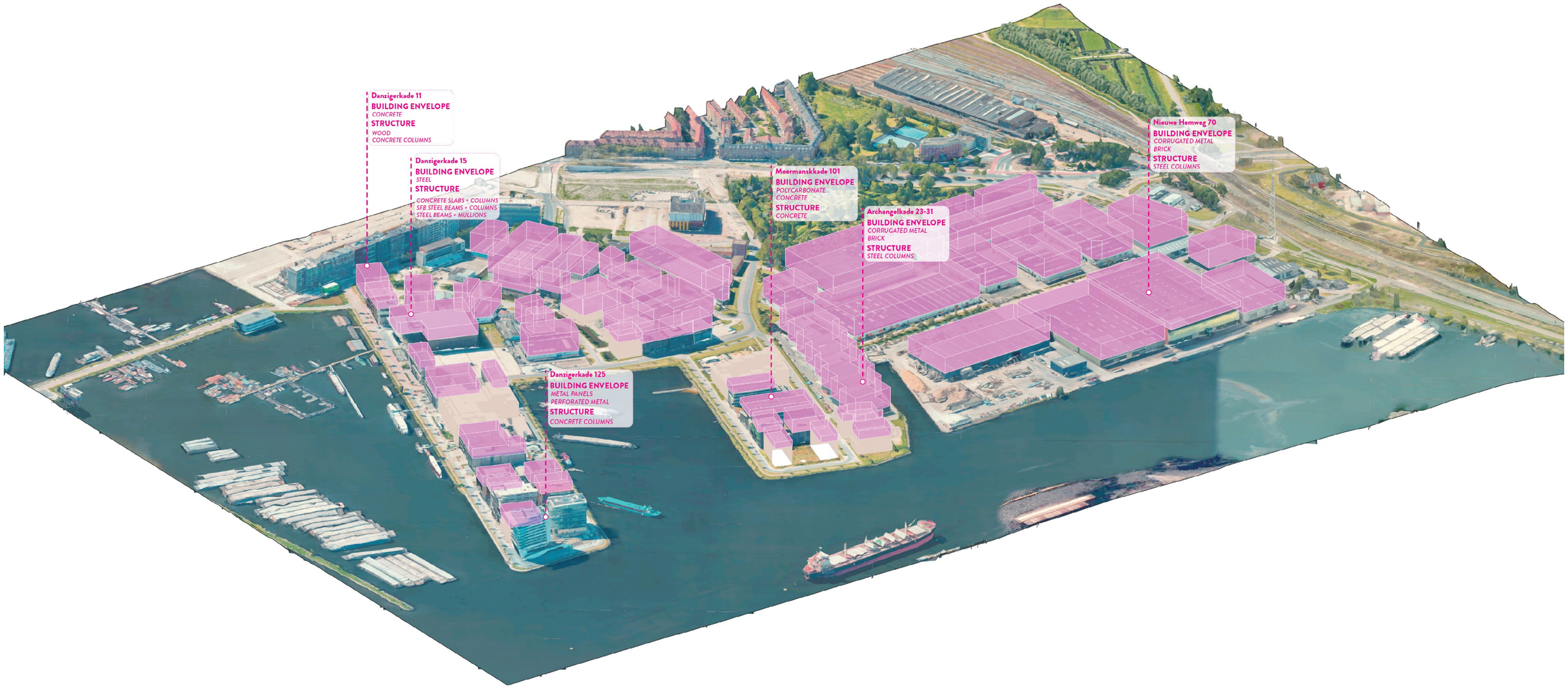
SITE SITUATION

MASTERPLAN_ FABRICATIONS

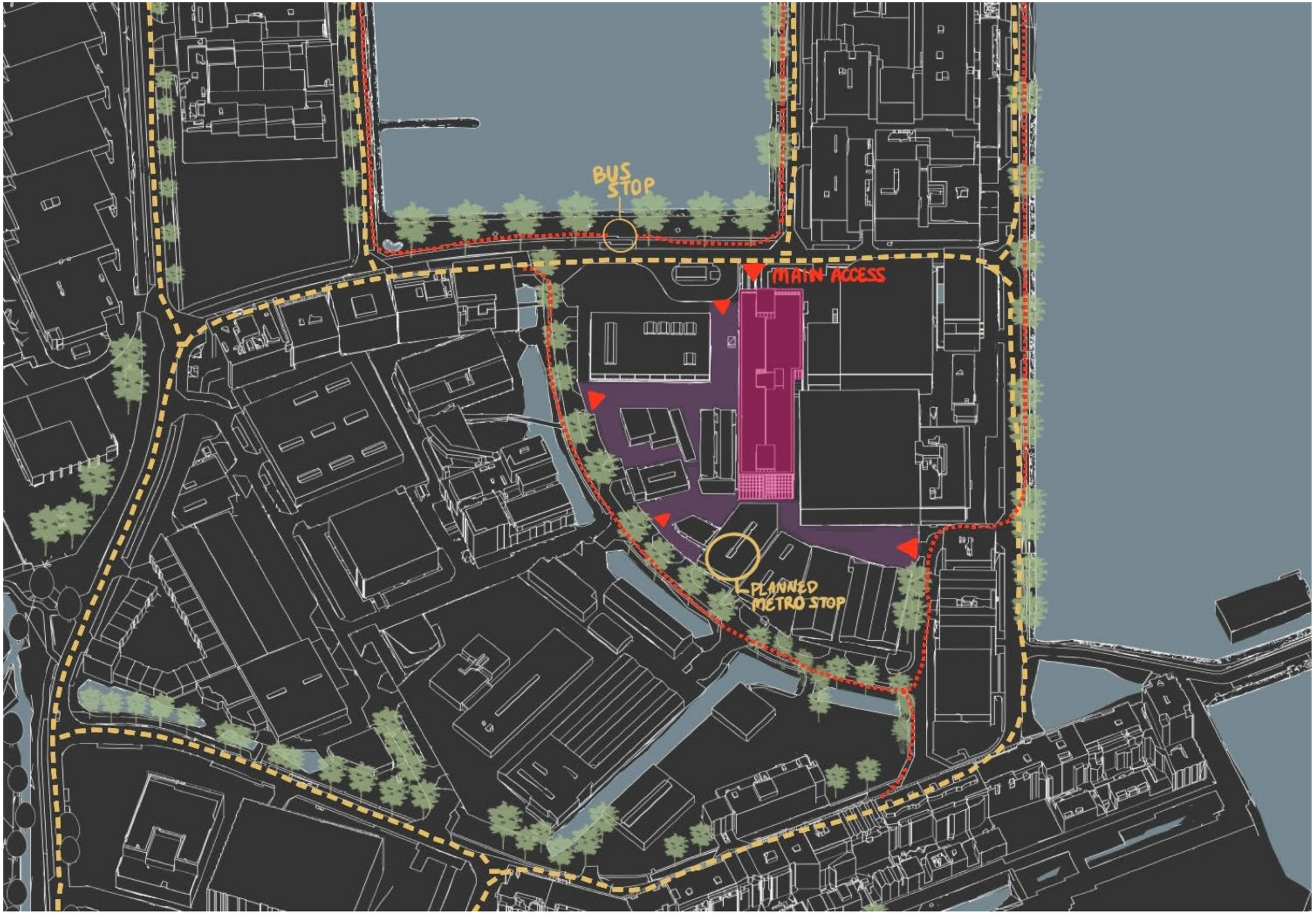


MASTERPLAN_ DE ZWARTE HOND

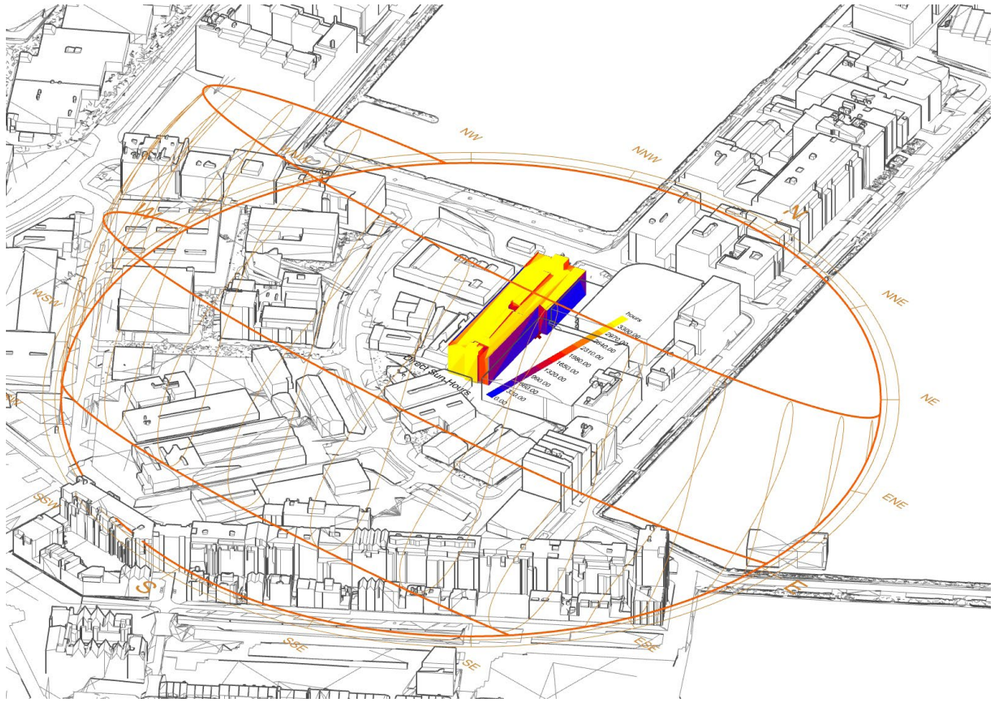
THE SITE_MASTERPLAN DENSITY

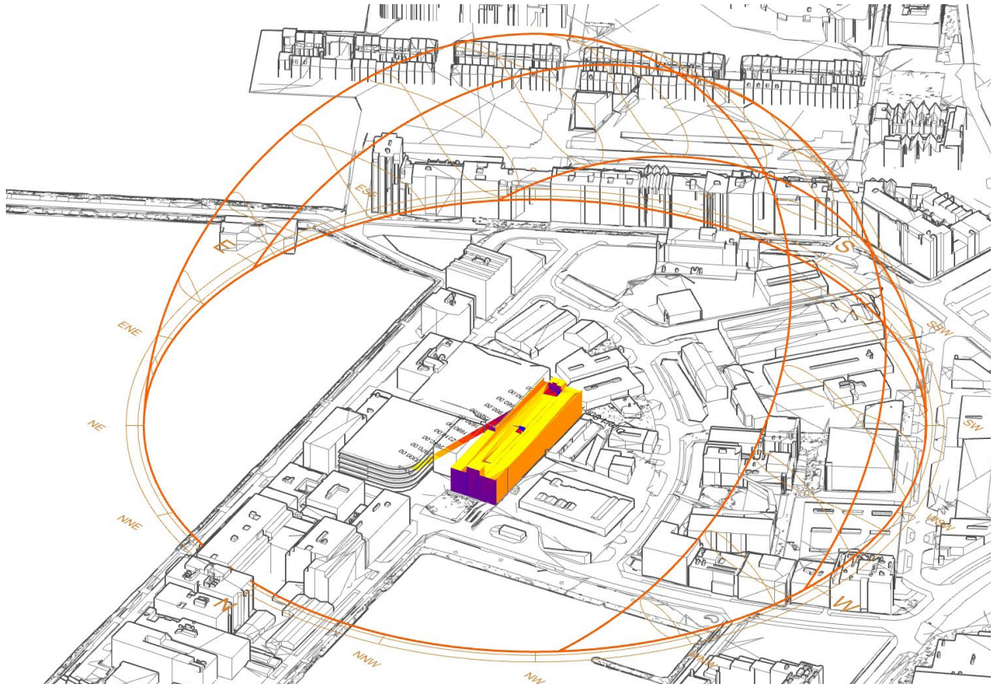


THE SITE_ POTENTIALS FOR OPTOPPEN



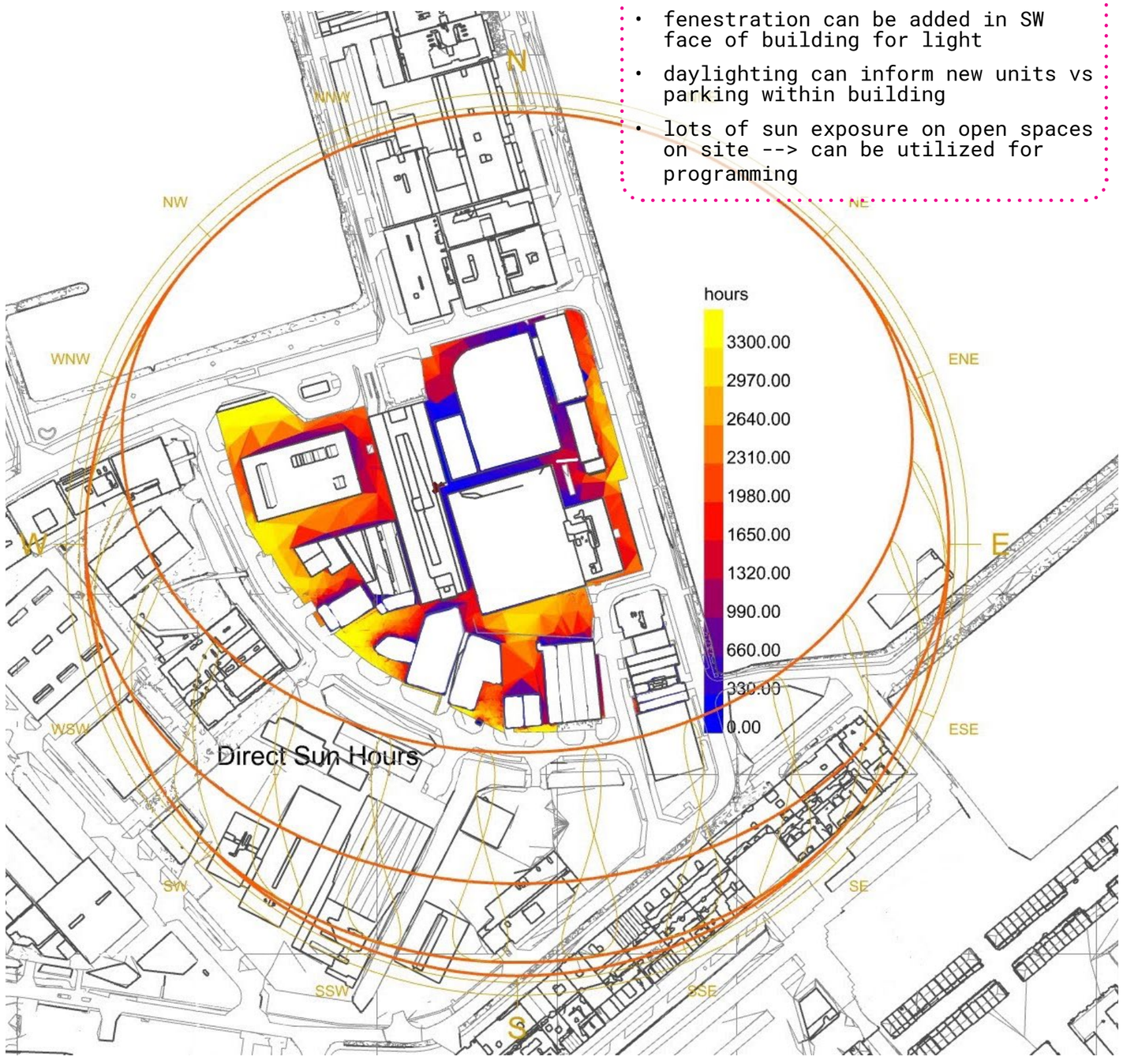
PRELIMINARY SITE ANALYSIS



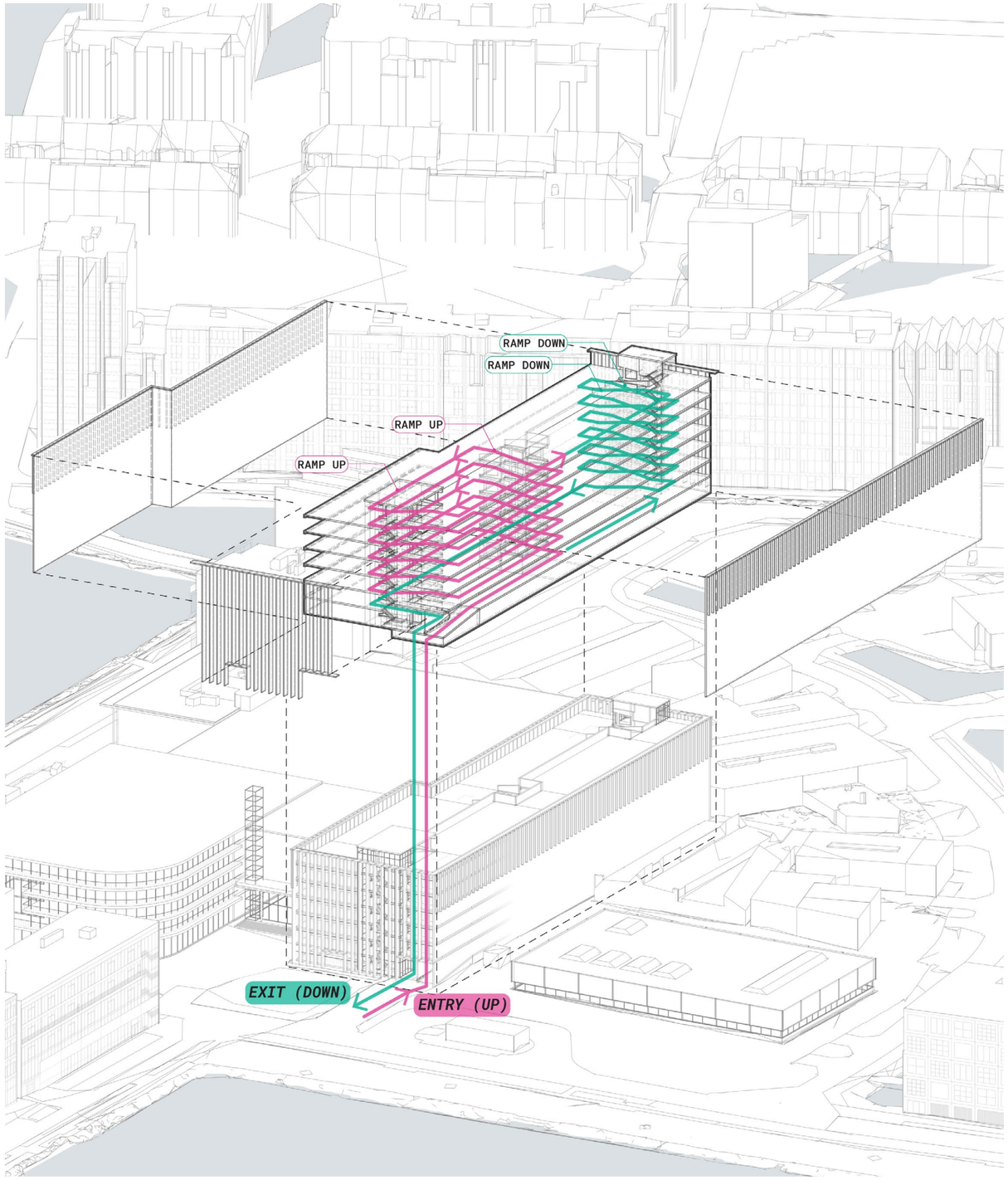


OPPORTUNITIES:

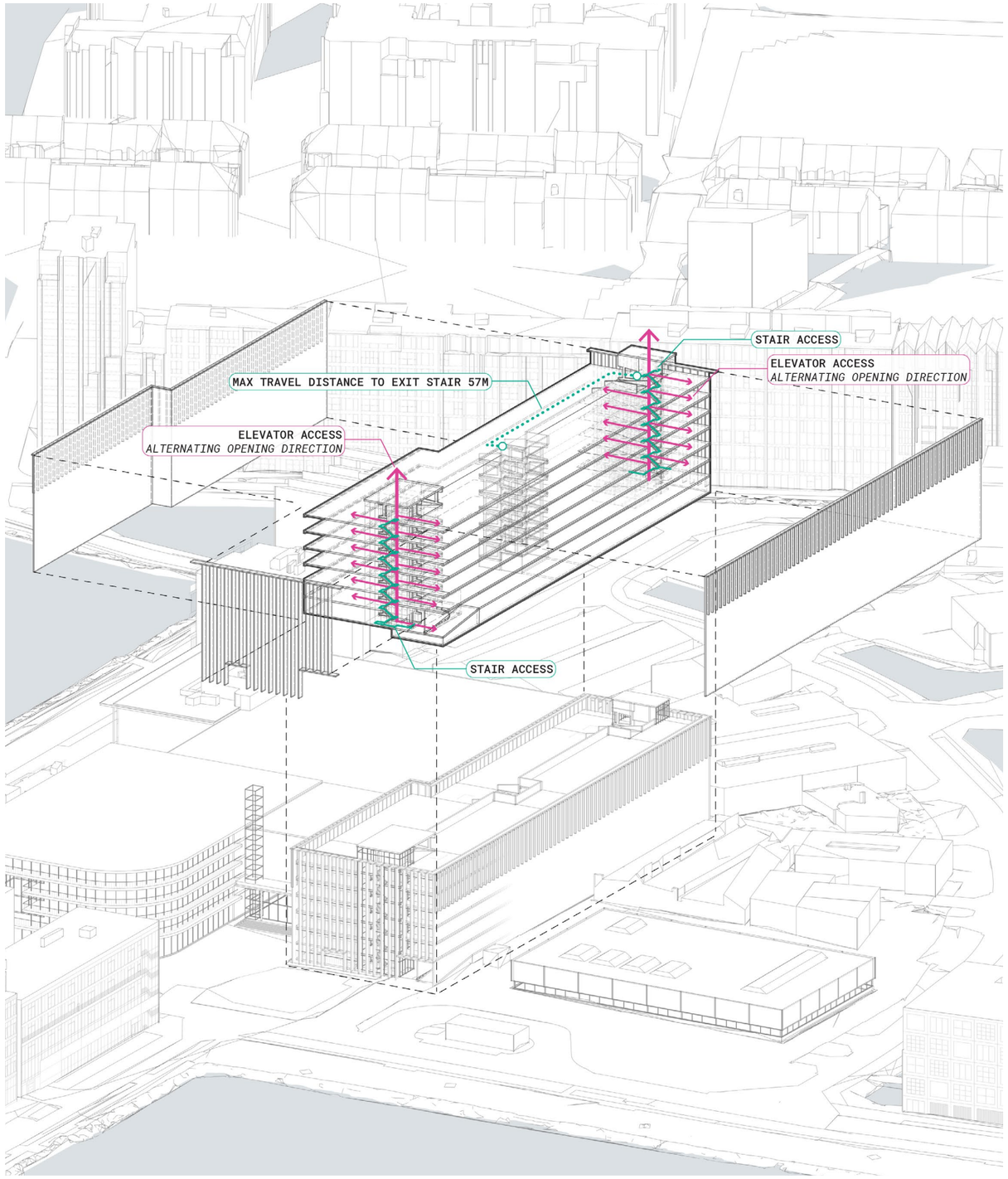
- fenestration can be added in SW face of building for light
- daylighting can inform new units vs parking within building
- lots of sun exposure on open spaces on site --> can be utilized for programming



BUILDING ANALYSIS_ DAYLIGHTING

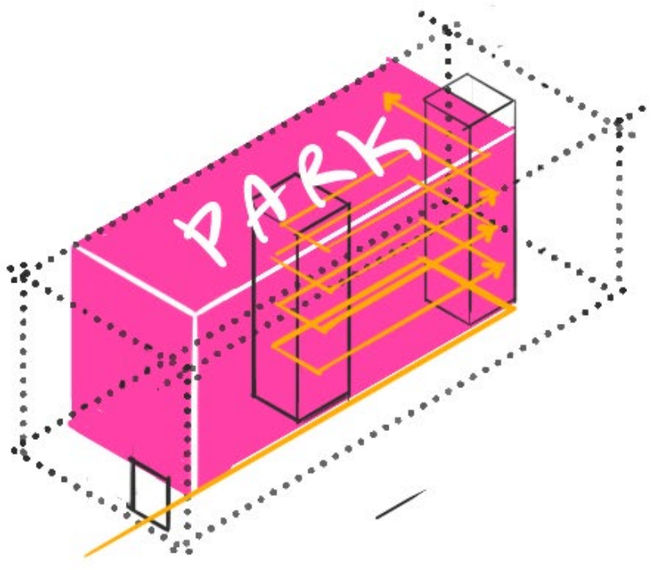


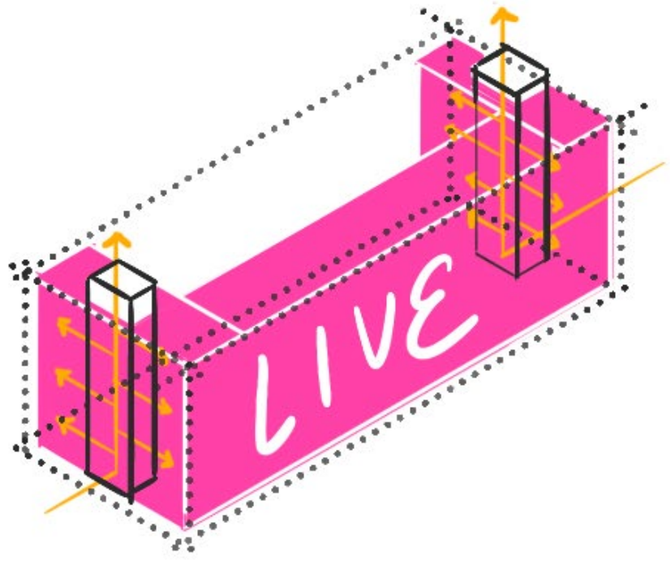
VEHICLE CIRCULATION



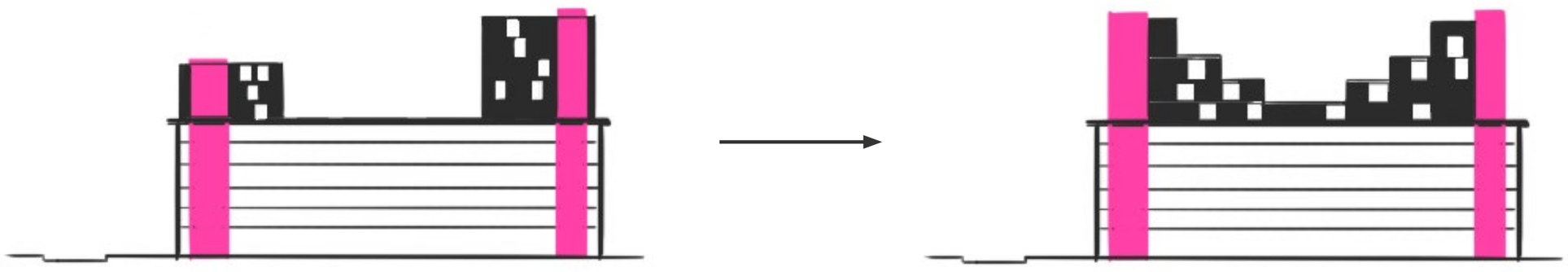
STAIRS + ELEVATORS

BUILDING ANALYSIS_ CIRCULATION



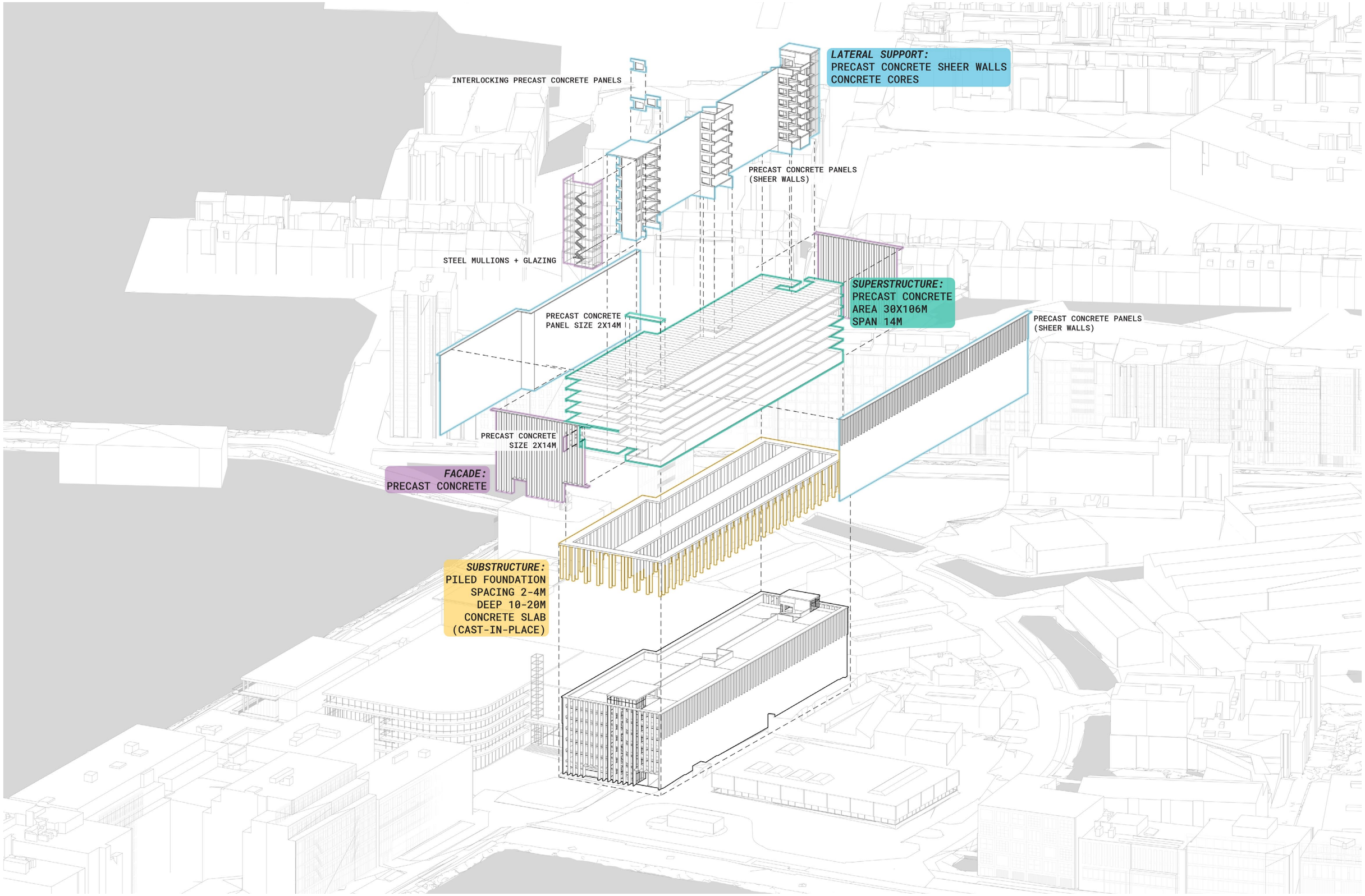


PROGRAM CONCEPT FOR RETROFIT INFILL

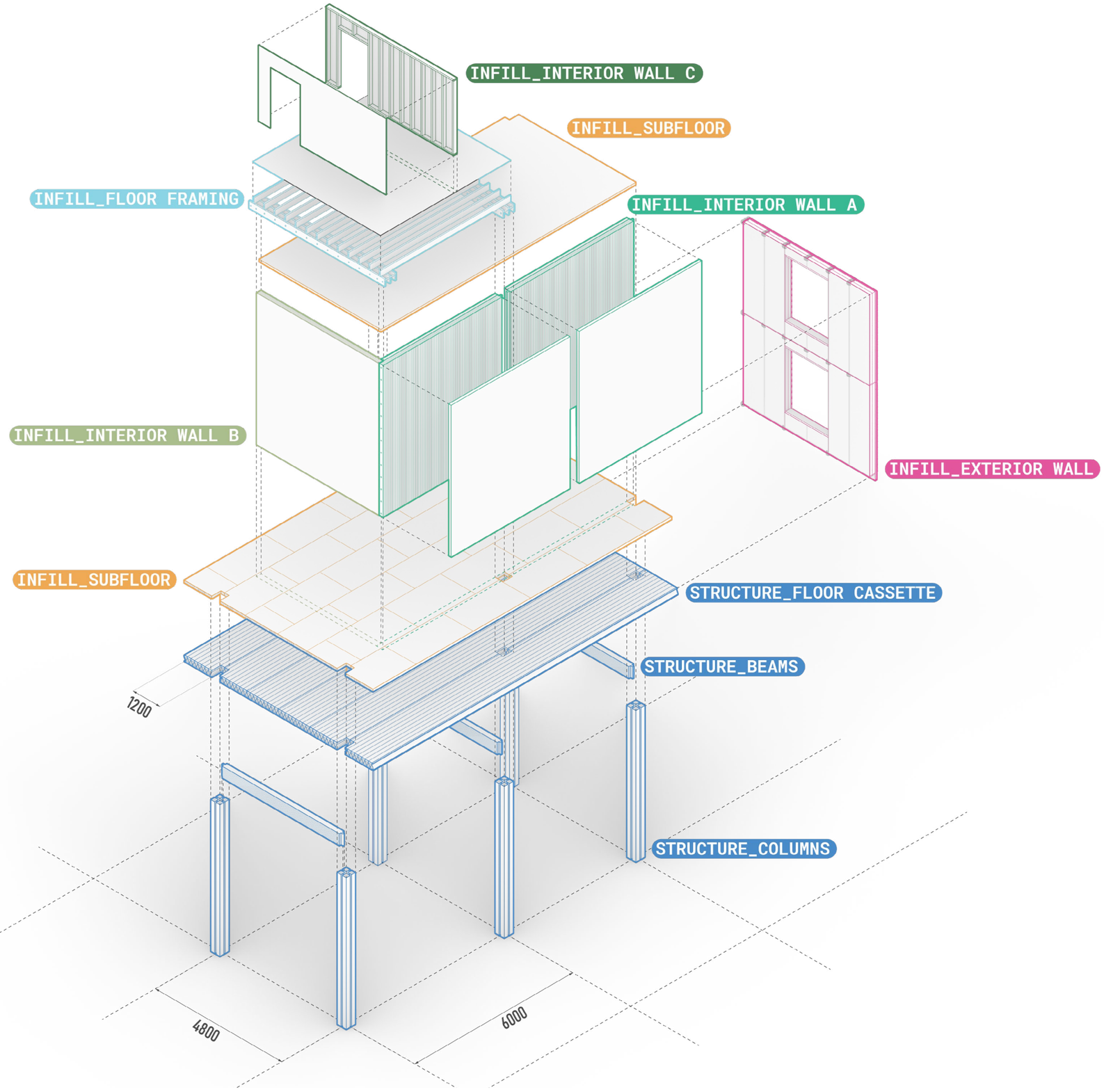


MASSING CONCEPT FOR OPTOPPEN

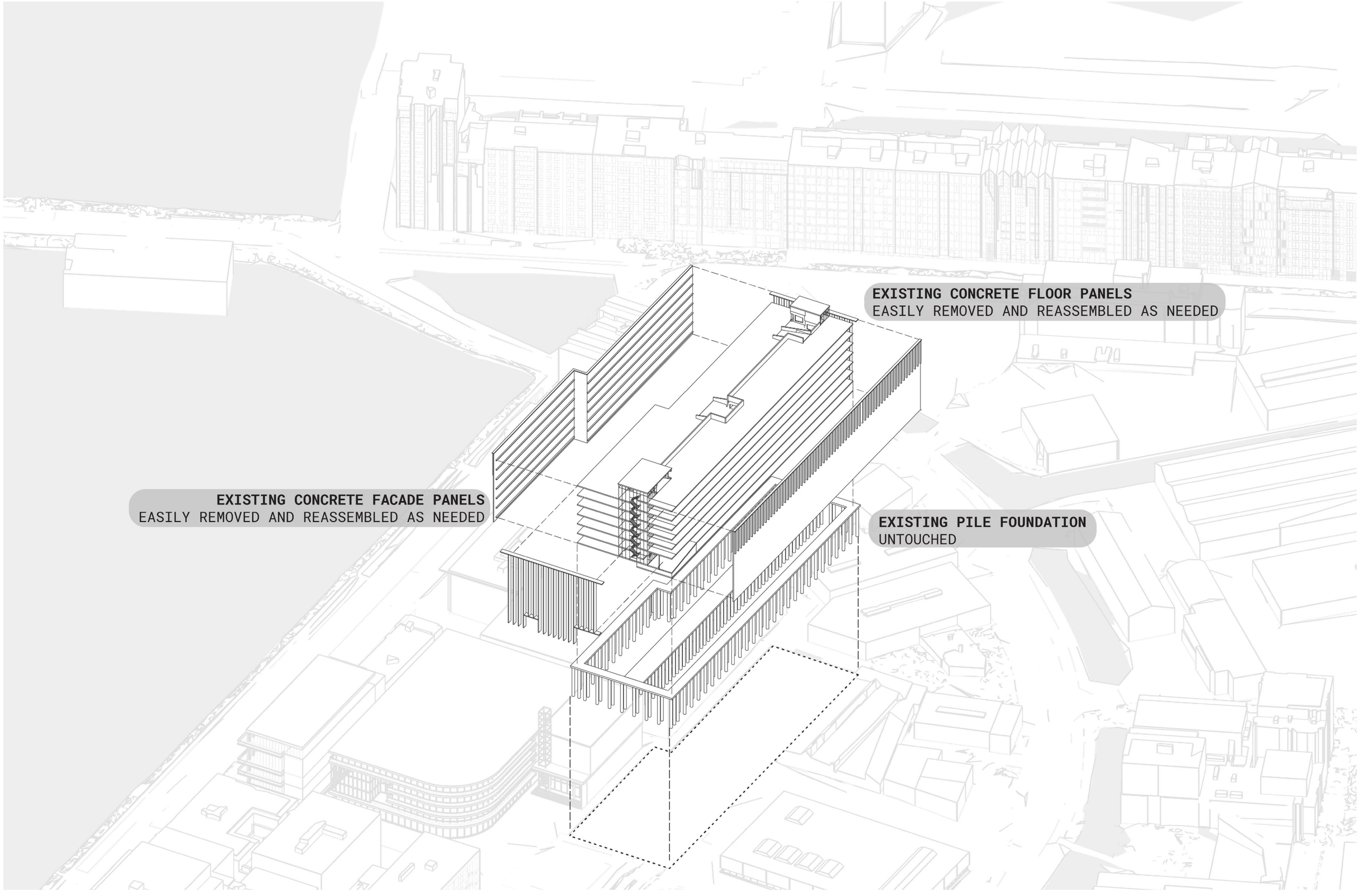
CONCEPT DIAGRAMS



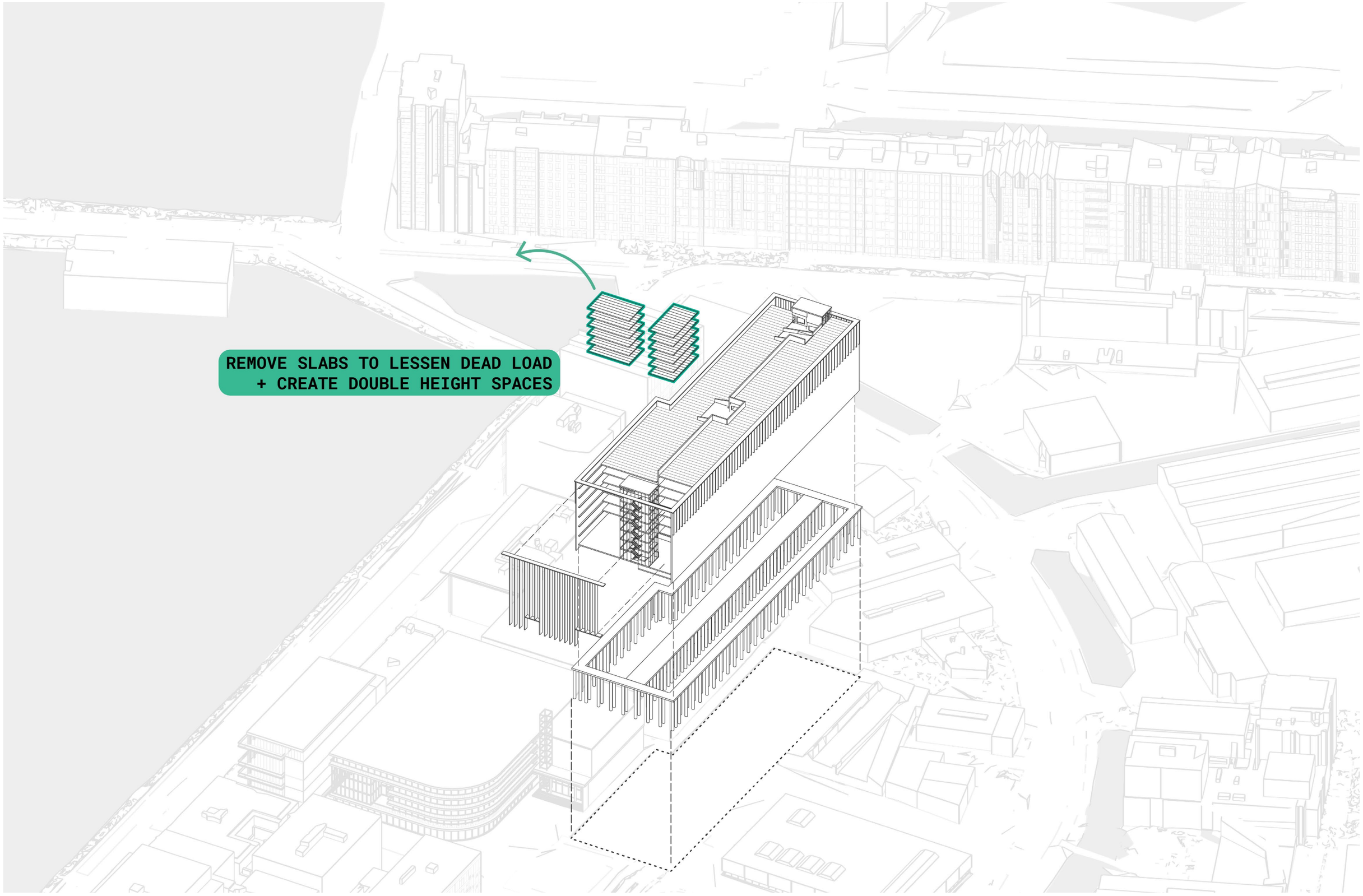
EXISTING STRUCTURAL ANALYSIS



UNIT ASSEMBLY



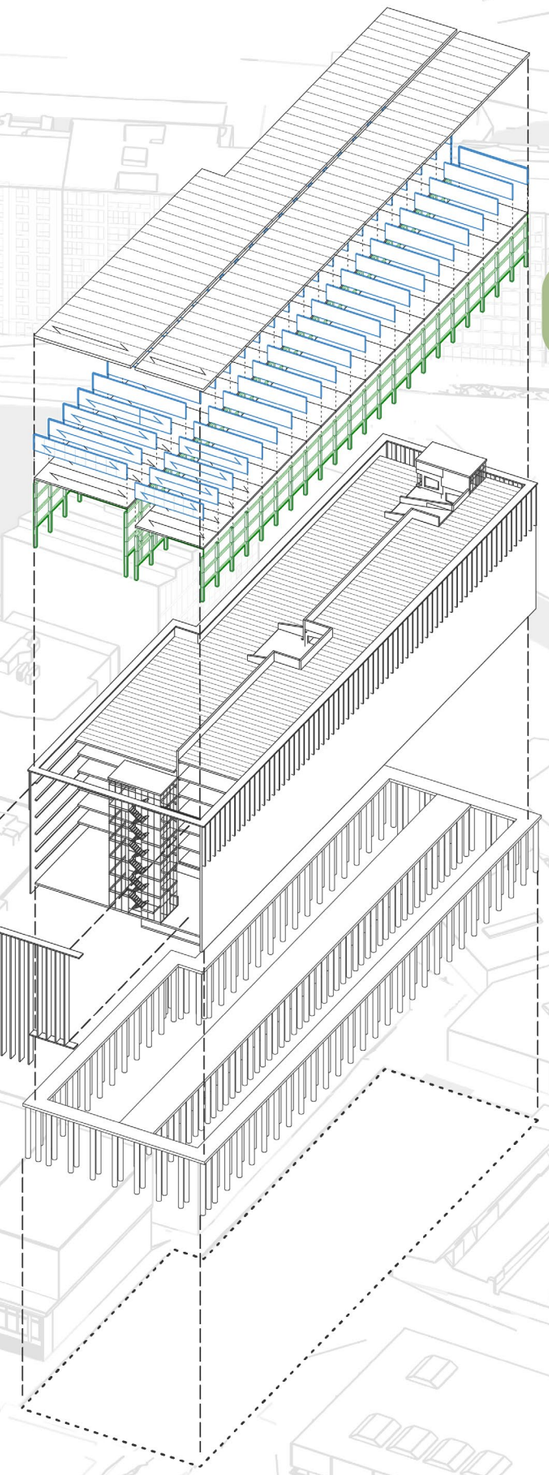
EXISTING CONSTRUCTION



REMOVE MATERIALS

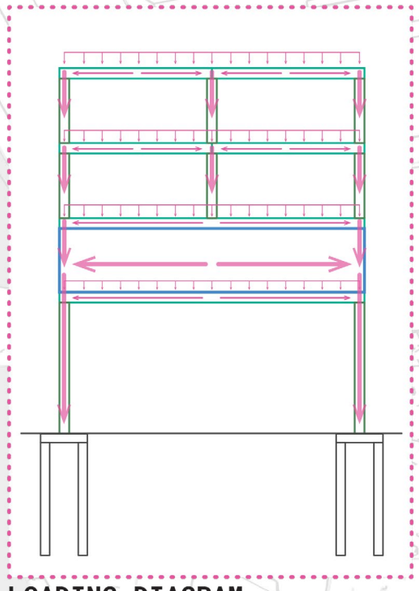
EXISTING CONCRETE FLOOR PANELS
CONNECTED TO VERTICAL PANELS AS DIAPHRAM

DLT VERTICAL PANELS 2.4x3.0m
CONNECTED AND SPANNING 15m
ACTING AS DEEP BEAM VIERENDEEL TRUSS



BUILT-UP GLULAM COLUMNS 400x400mm
LANDING ON EXISTING FOUNDATION
WITH ANCHORING BASE CONNECTORS

EXISTING PILE FOUNDATION



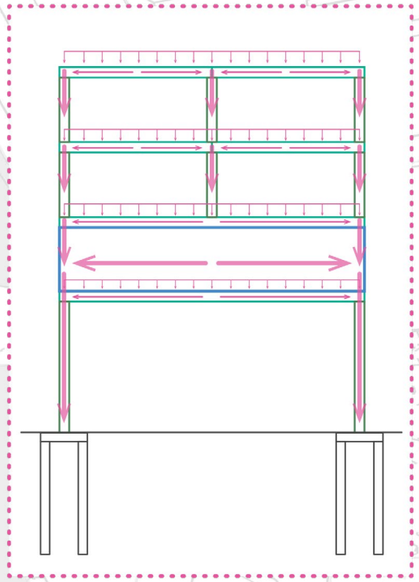
LOADING DIAGRAM

TABLE CONSTRUCTION USING VERTICAL PANELS AS DEEP BEAMS

KIELSTEG FLOOR CASSETTE PANELS 228mm
PANEL WIDTH 1.2m SPANNING 6m

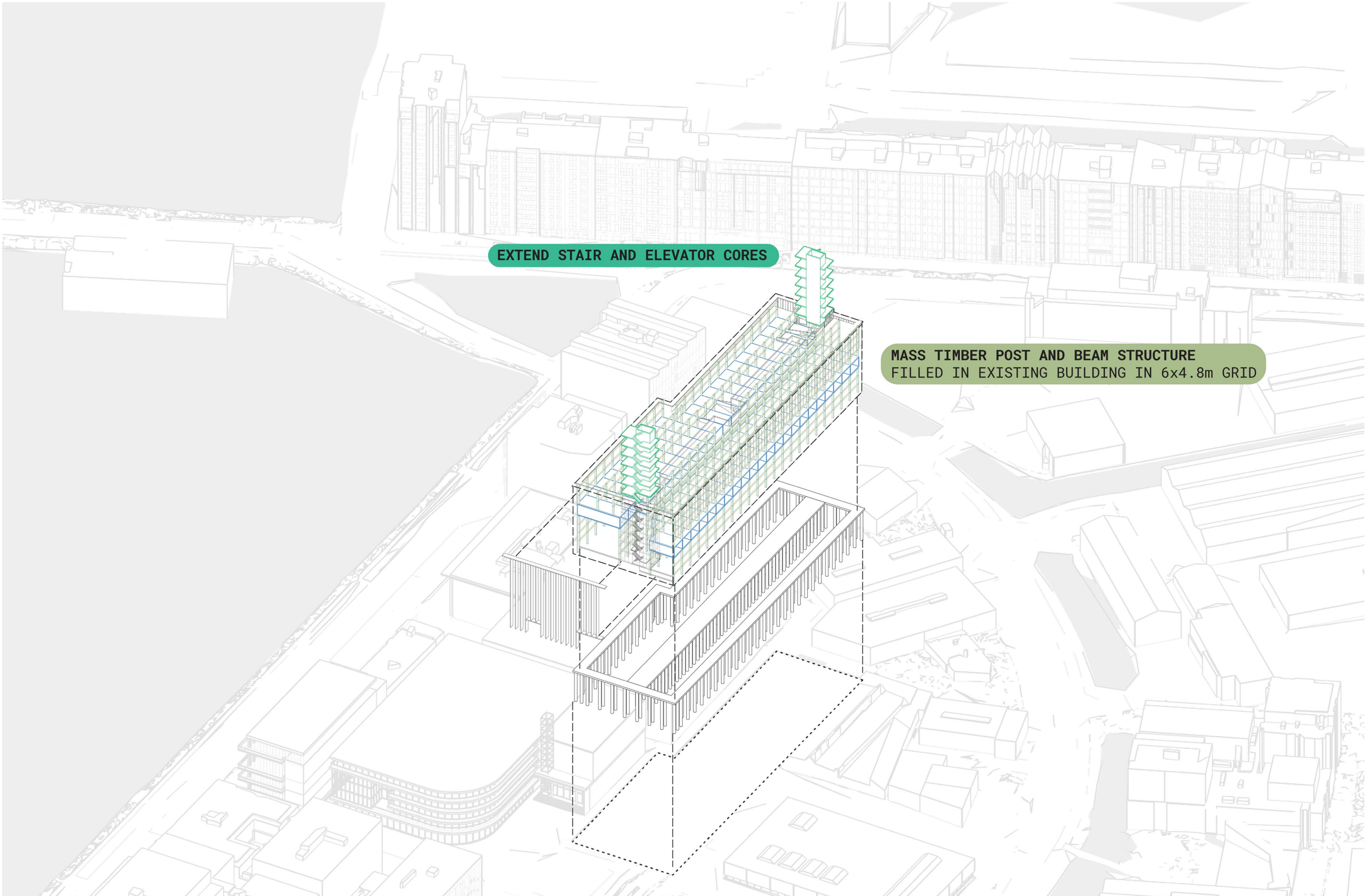
BUILT-UP GLULAM COLUMNS 400x400mm
SPACED ON 6x4.8m GRID

GLULAM BEAMS 190x410mm REI 30
SPANNING 4.8m

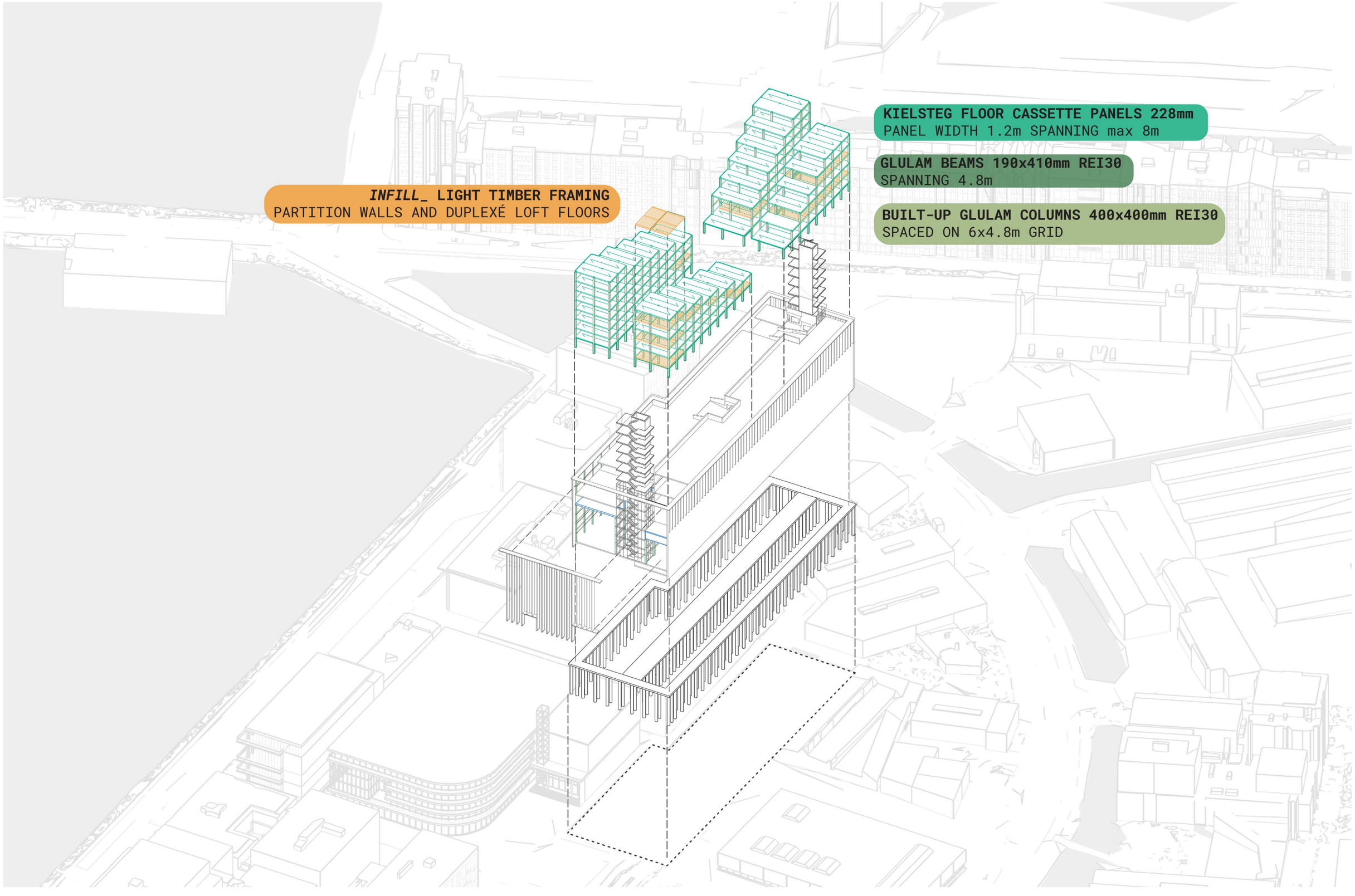


LOADING DIAGRAM

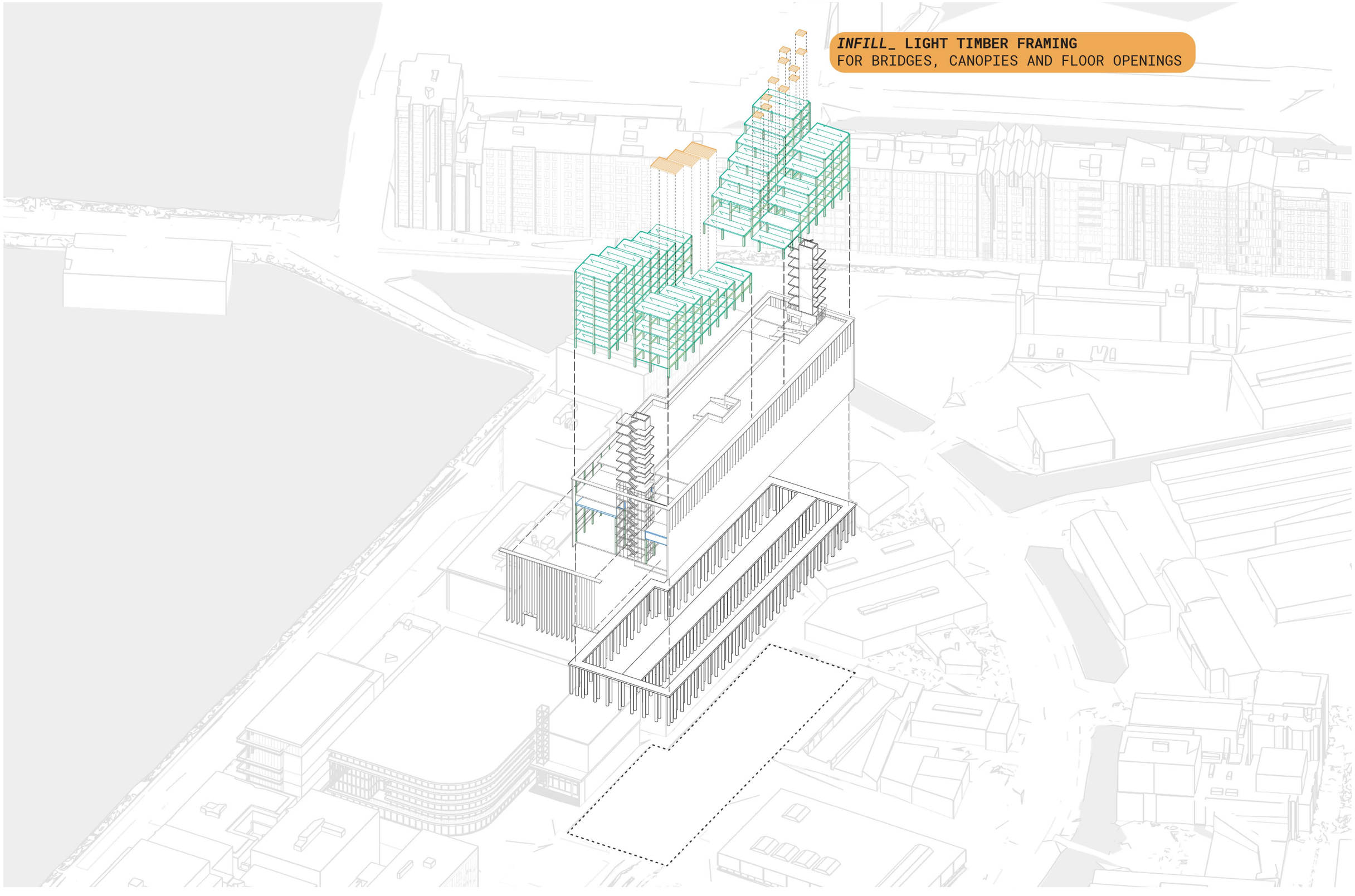
TABLE CONSTRUCTION USING VERTICAL PANELS AS DEEP BEAMS



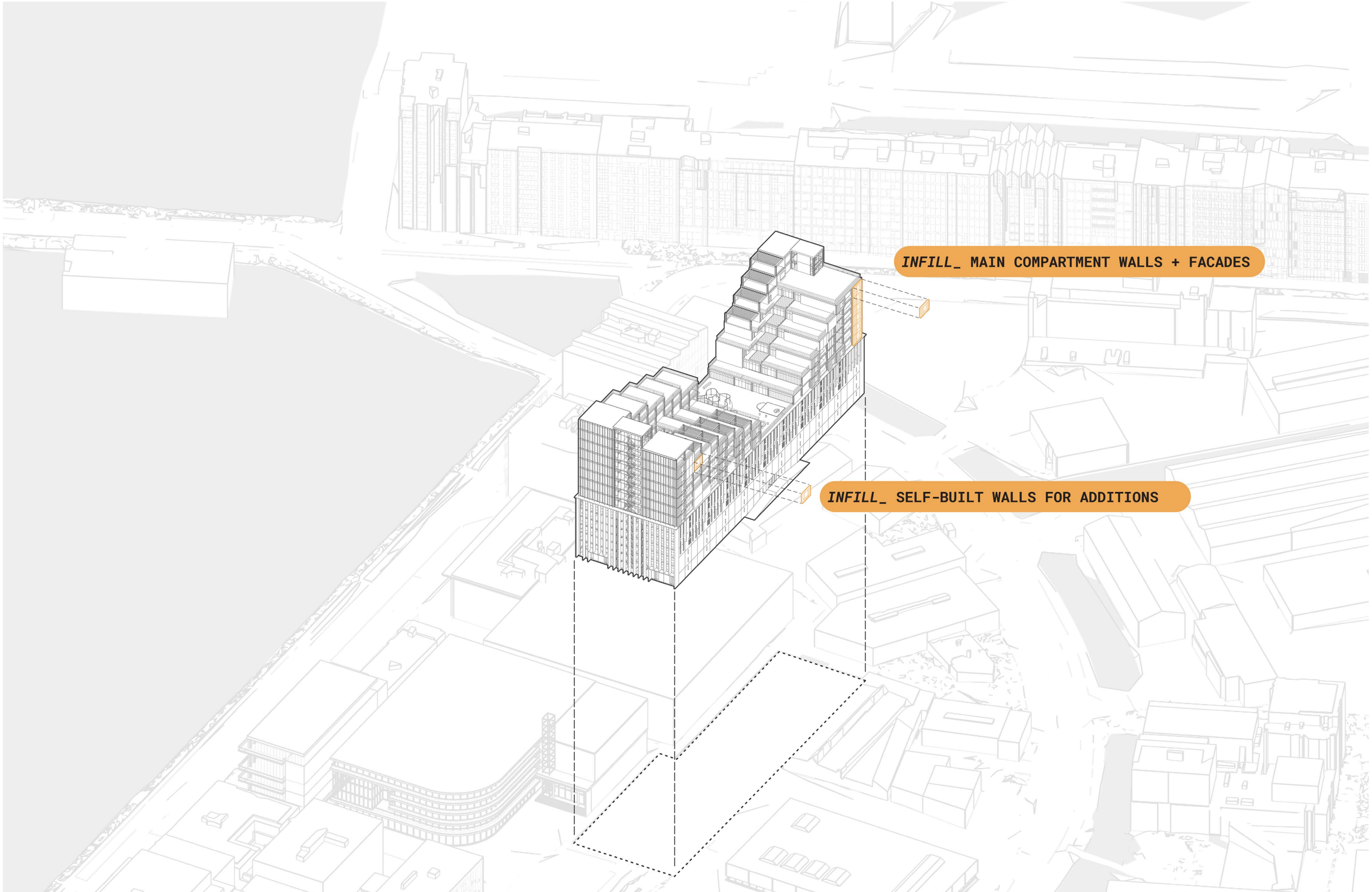
MASS TIMBER POST AND BEAM STRUCTURE



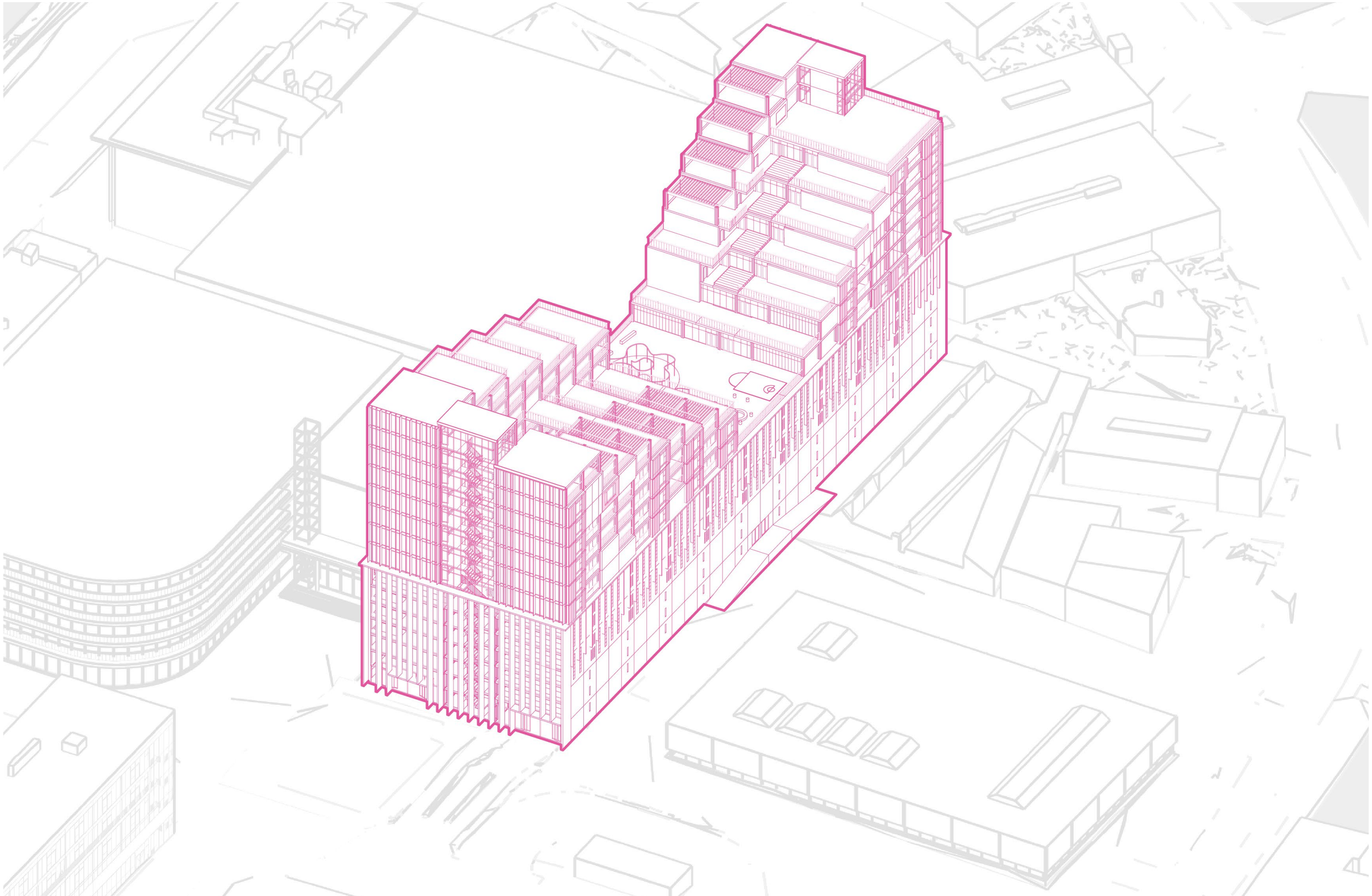
OPTOPPEN + INFILL STRUCTURE



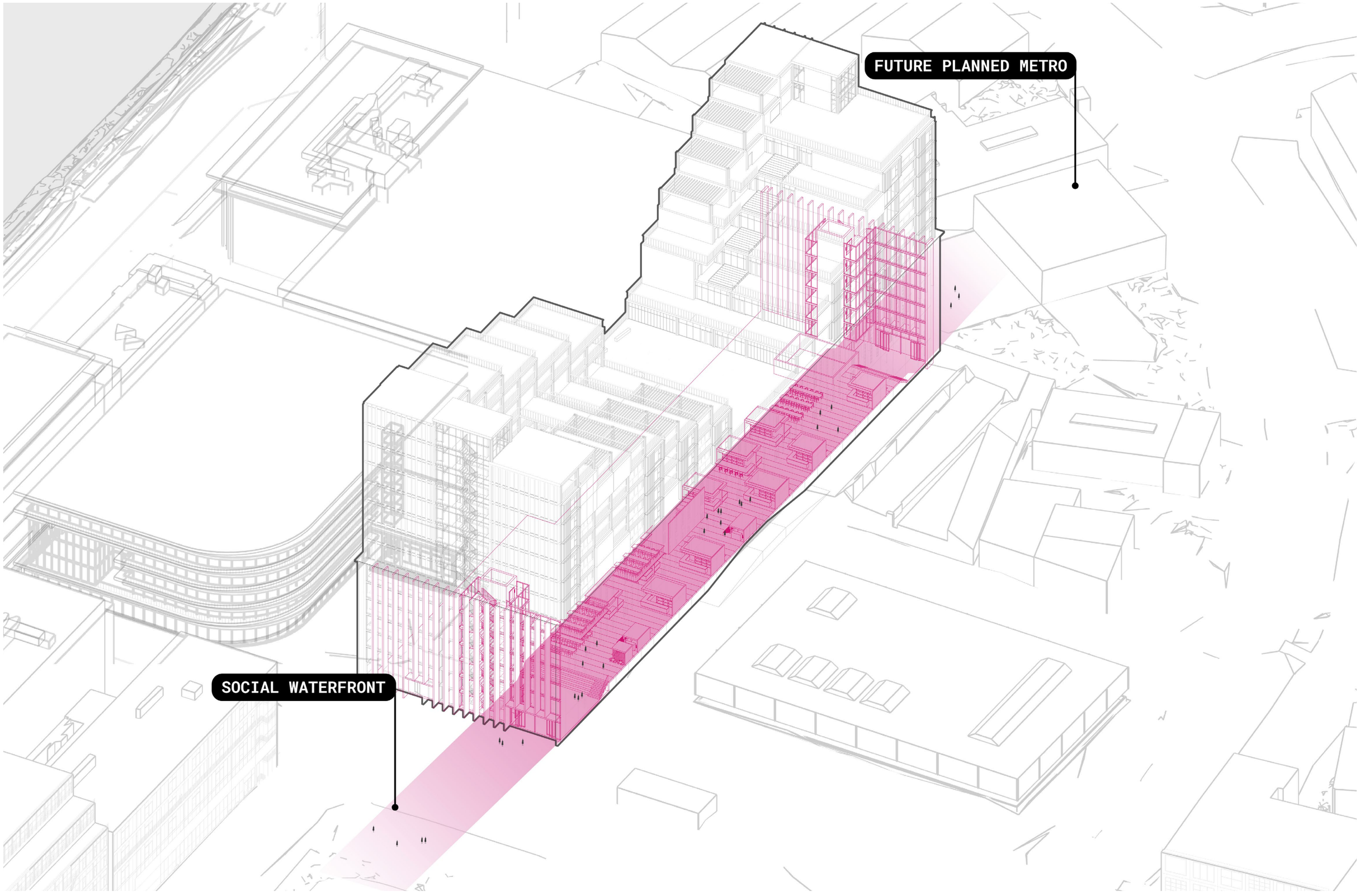
TIMBER FRAMING FOR BRIDGES AND OPENINGS



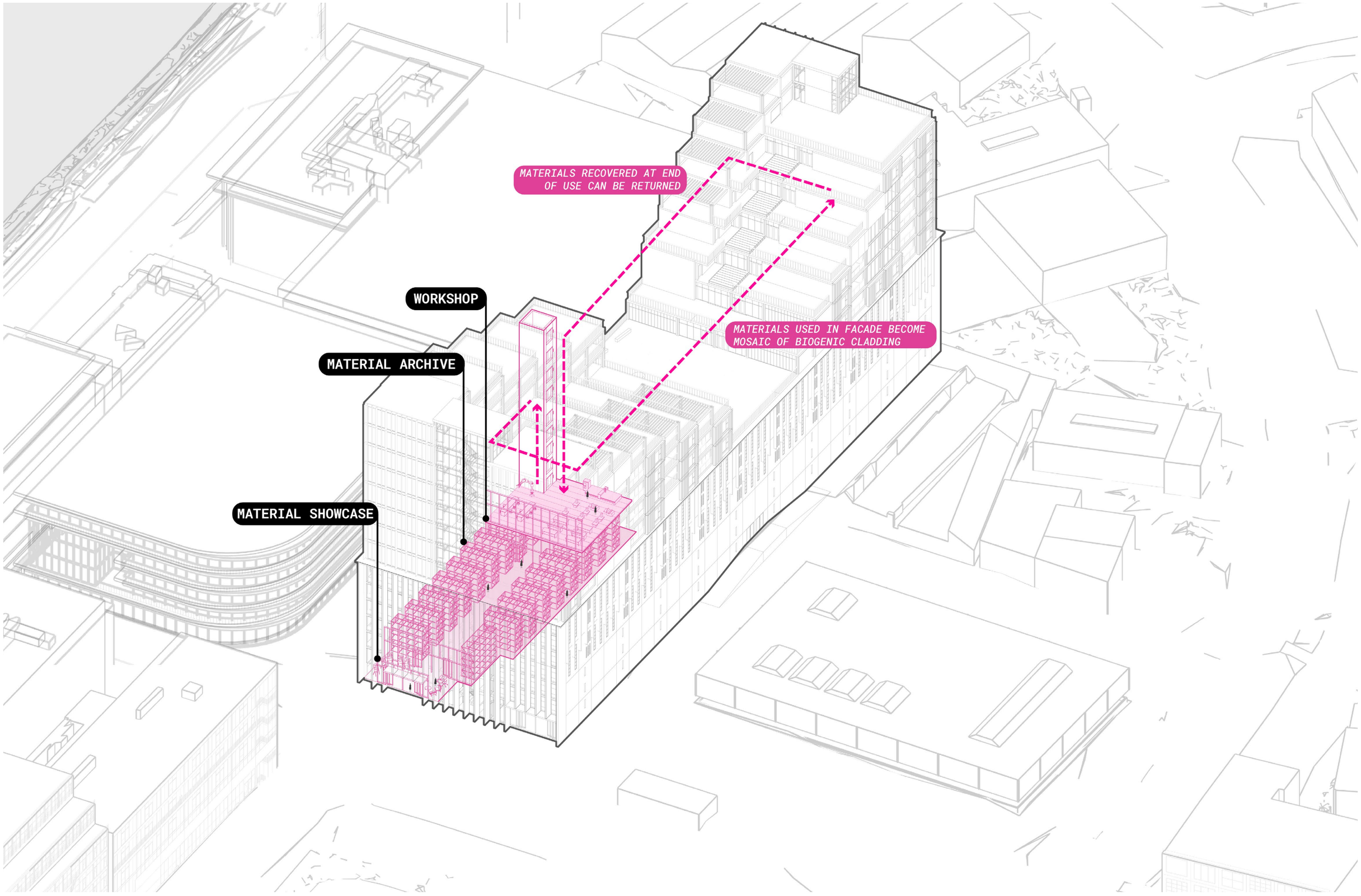
FACADE INFILL



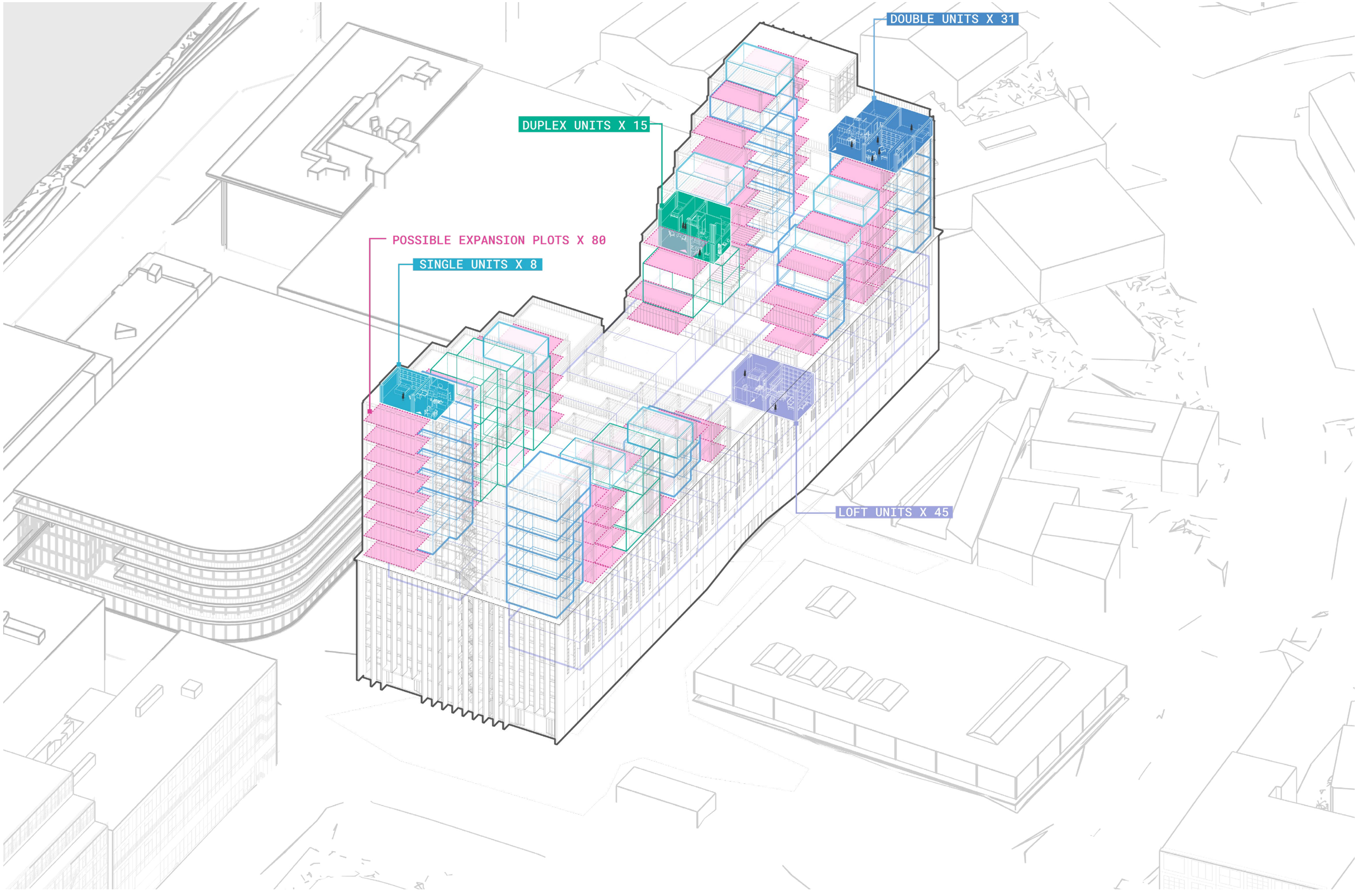
BUILDING ON SITE



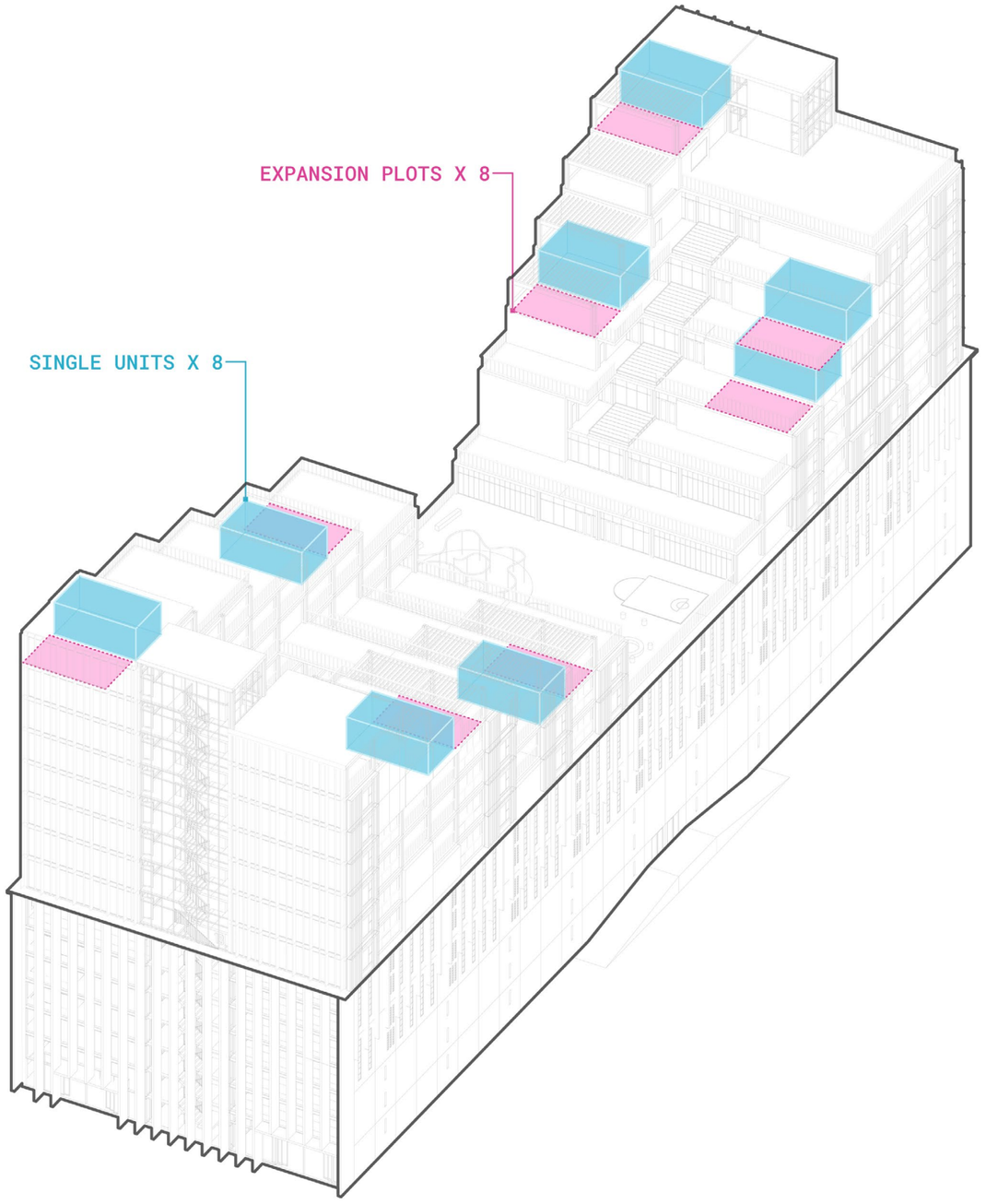
PUBLIC FUNCTION_ MARKET HALL



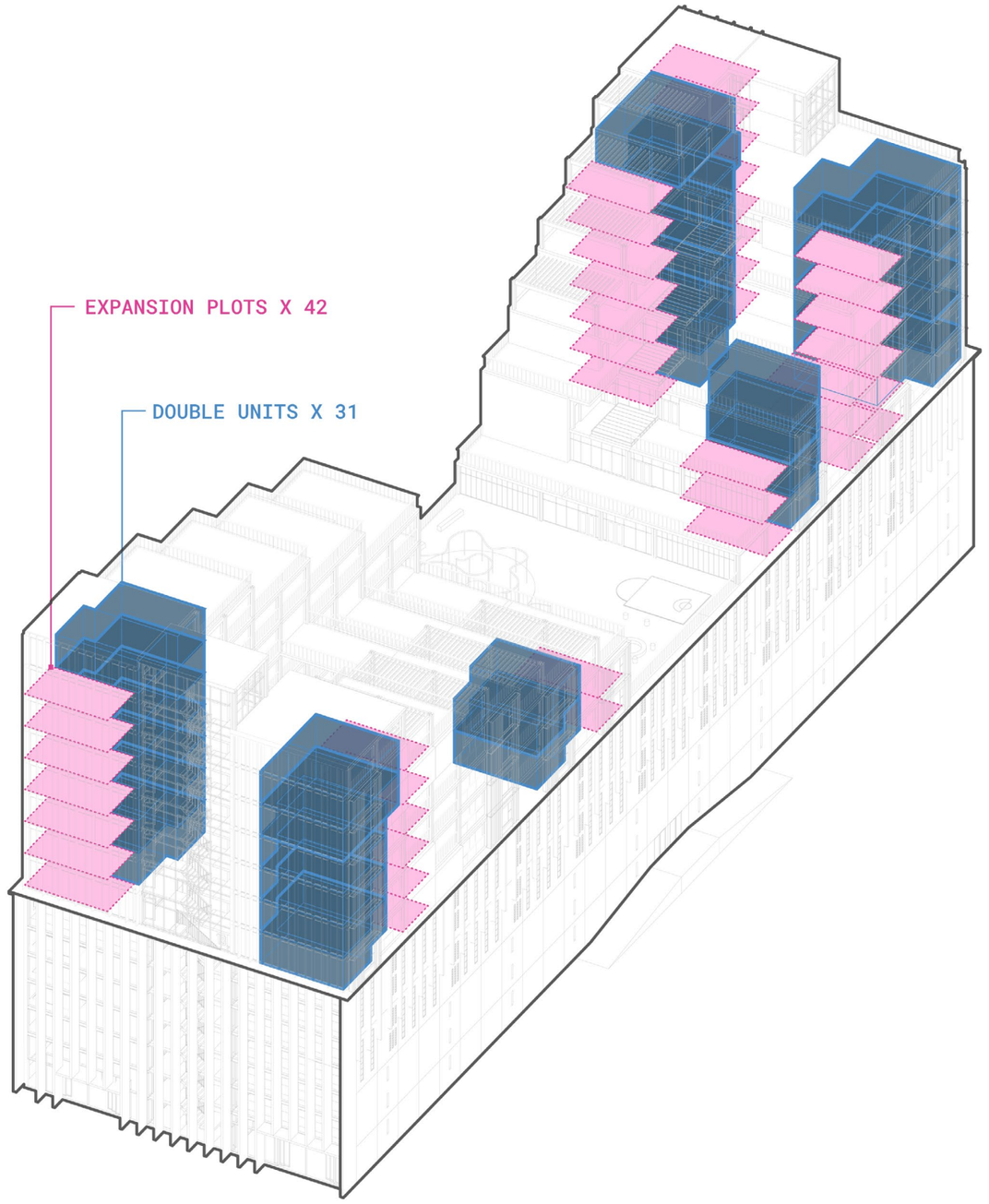
MATERIAL ARCHIVE CONCEPT



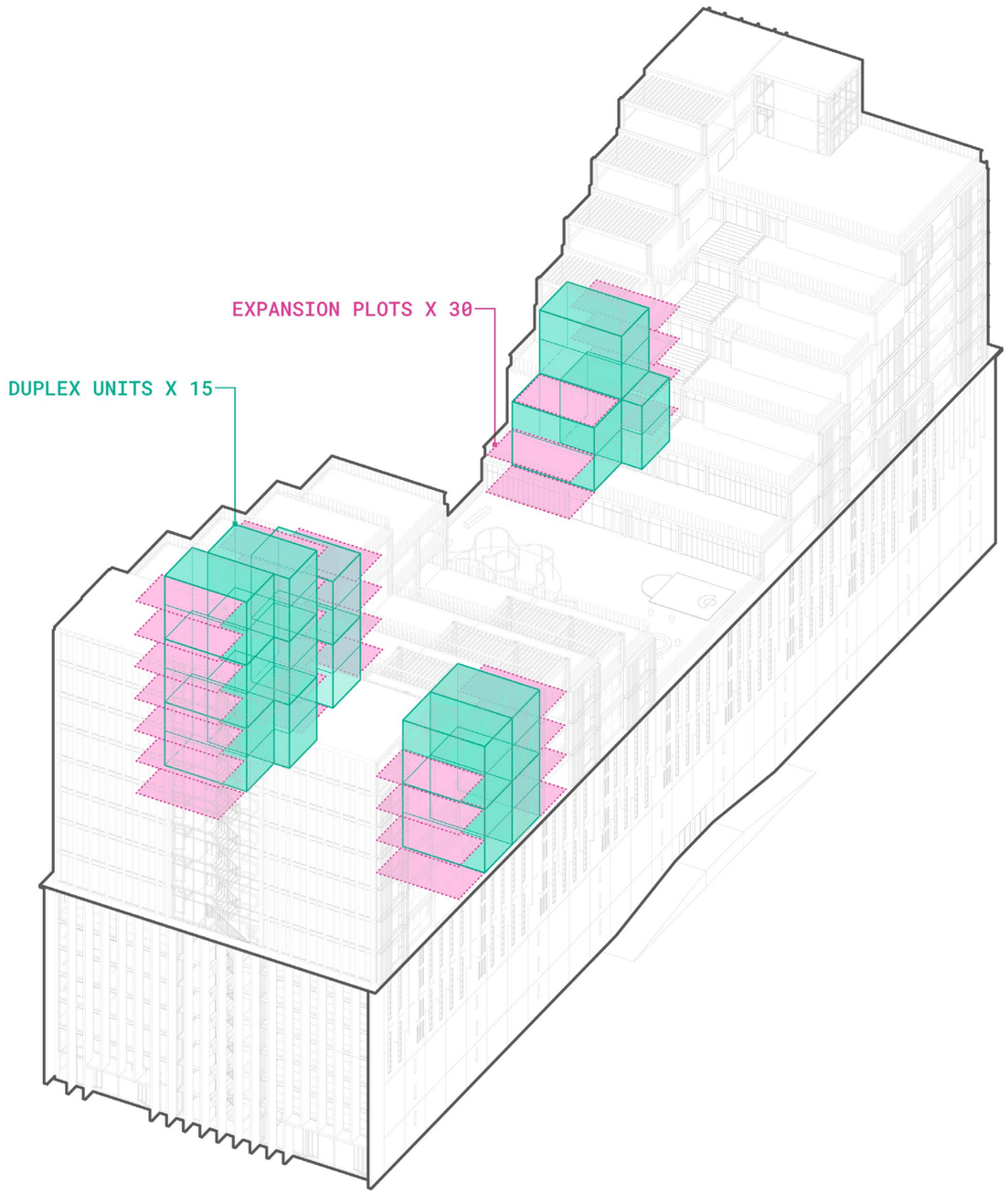
BUILDING ORGANIZATION_ UNITS



BUILDING ORGANIZATION_ UNITS



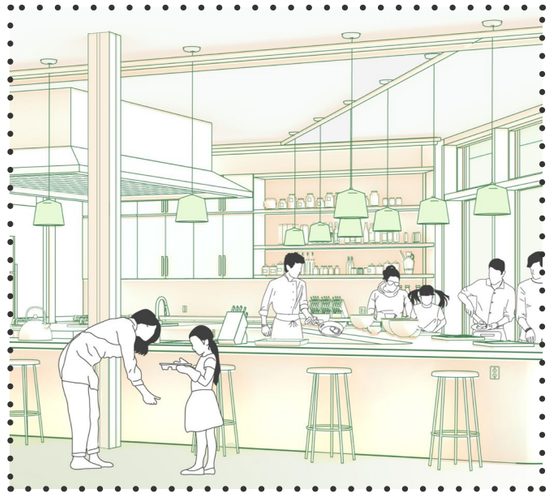
BUILDING ORGANIZATION_ UNITS



BUILDING ORGANIZATION_ UNITS

ENTRY PATIOS/ COMMUNITY SPACE

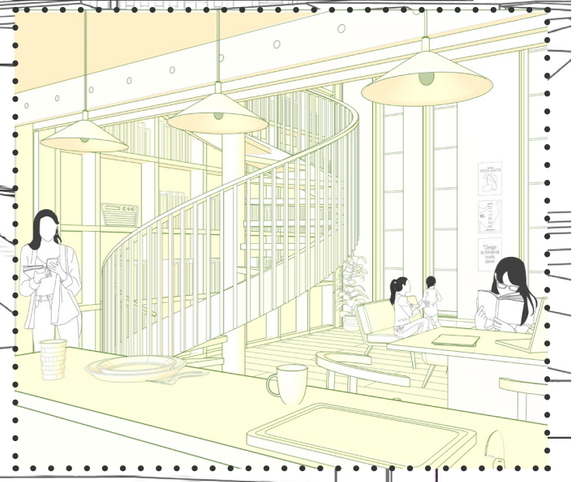
COMMUNITY KITCHEN [BEHIND]



DUPLEX UNITS

UNIT FLATS

LOFTS IN EXISTING STRUCTURE



PARKING

BUILDING MATERIAL LIBRARY

MARKET HALL

CROSS SECTION

phase 1 cladding

+

?

future growth cladding

ELEVATION

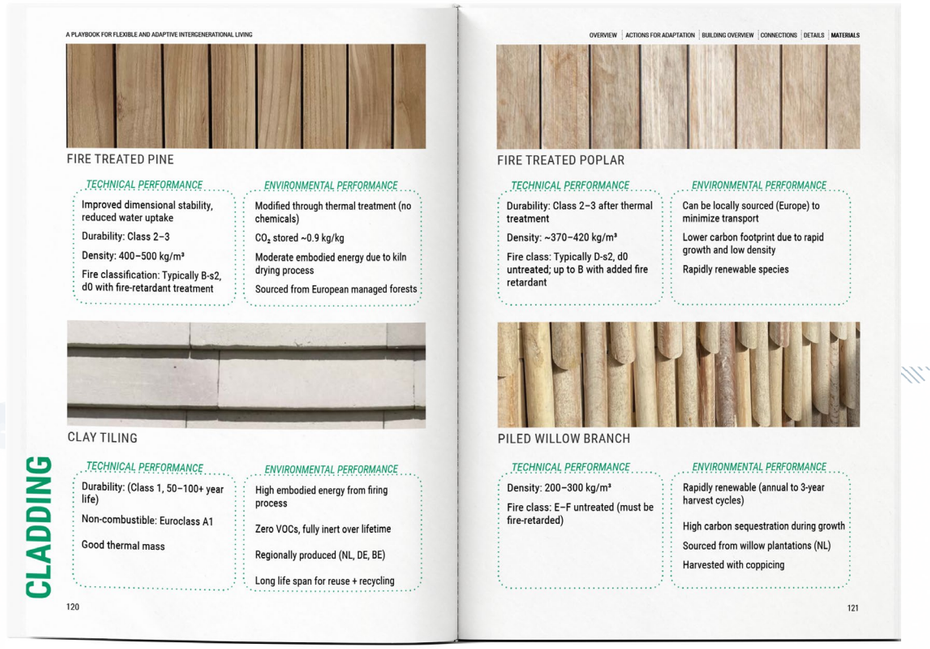
phase 1 cladding

+

?

future growth cladding

ELEVATION



A PLAYBOOK FOR FLEXIBLE AND ADAPTIVE INTERGENERATIONAL LIVING

OVERVIEW | ACTIONS FOR ADAPTATION | BUILDING OVERVIEW | CONNECTIONS | DETAILS | **MATERIALS**

CLADDING

FIRE TREATED PINE

TECHNICAL PERFORMANCE

Improved dimensional stability, reduced water uptake

Durability: Class 2–3

Density: 400–500 kg/m³

Fire classification: Typically B-s2, d0 with fire-retardant treatment

ENVIRONMENTAL PERFORMANCE

Modified through thermal treatment (no chemicals)

CO_2 stored ~0.9 kg/kg

Moderate embodied energy due to kiln drying process

Sourced from European managed forests

CLAY TILING

TECHNICAL PERFORMANCE

Durability: (Class 1, 50–100+ year life)

Non-combustible: Euroclass A1

Good thermal mass

ENVIRONMENTAL PERFORMANCE

High embodied energy from firing process

Zero VOCs, fully inert over lifetime

Regionally produced (NL, DE, BE)

Long life span for reuse + recycling

120

FIRE TREATED POPLAR

TECHNICAL PERFORMANCE

Durability: Class 2–3 after thermal treatment

Density: ~370–420 kg/m³

Fire class: Typically D-s2, d0 untreated; up to B with added fire retardant

ENVIRONMENTAL PERFORMANCE

Can be locally sourced (Europe) to minimize transport

Lower carbon footprint due to rapid growth and low density

Rapidly renewable species

PILED WILLOW BRANCH

TECHNICAL PERFORMANCE

Density: 200–300 kg/m³

Fire class: E–F untreated (must be fire-retarded)

ENVIRONMENTAL PERFORMANCE

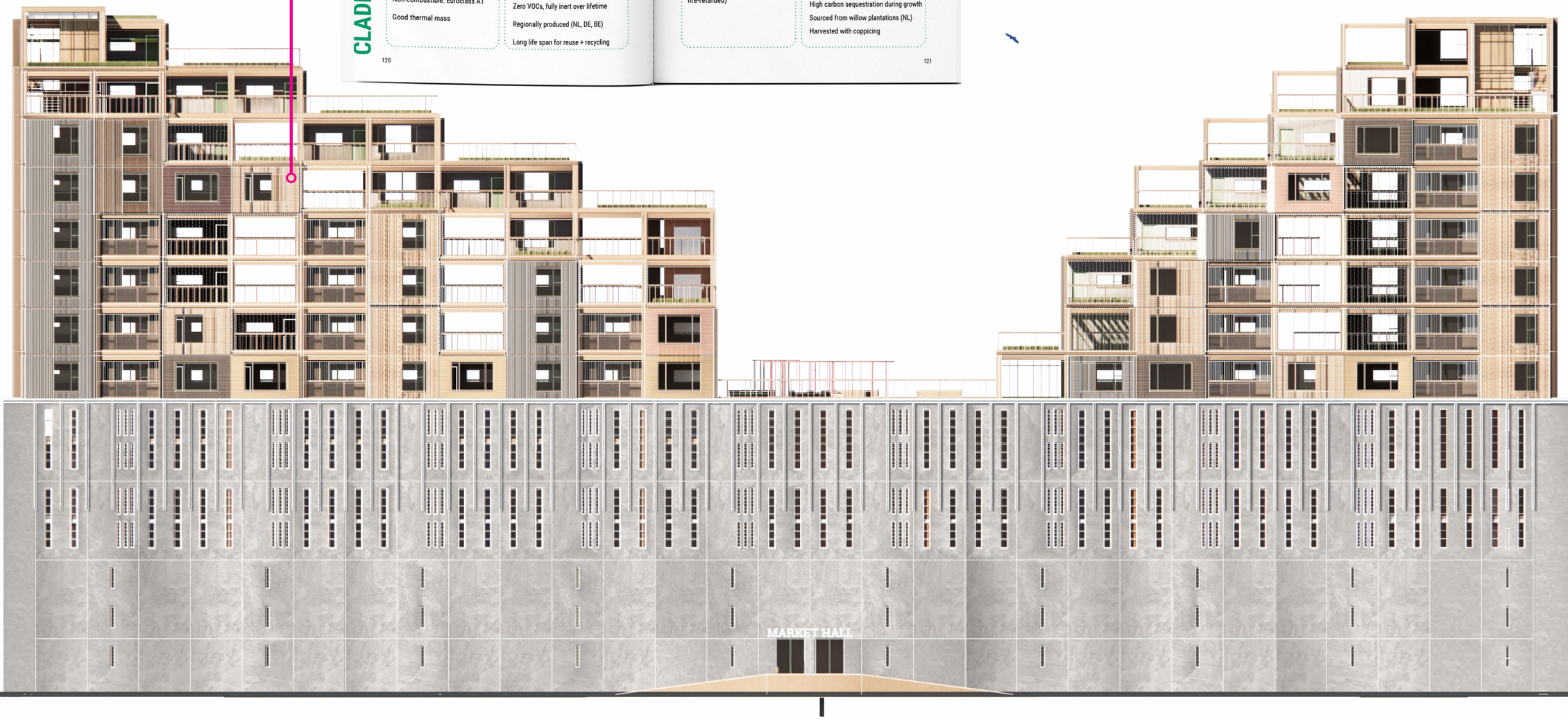
Rapidly renewable (annual to 3-year harvest cycles)

High carbon sequestration during growth

Sourced from willow plantations (NL)

Harvested with coppicing

121



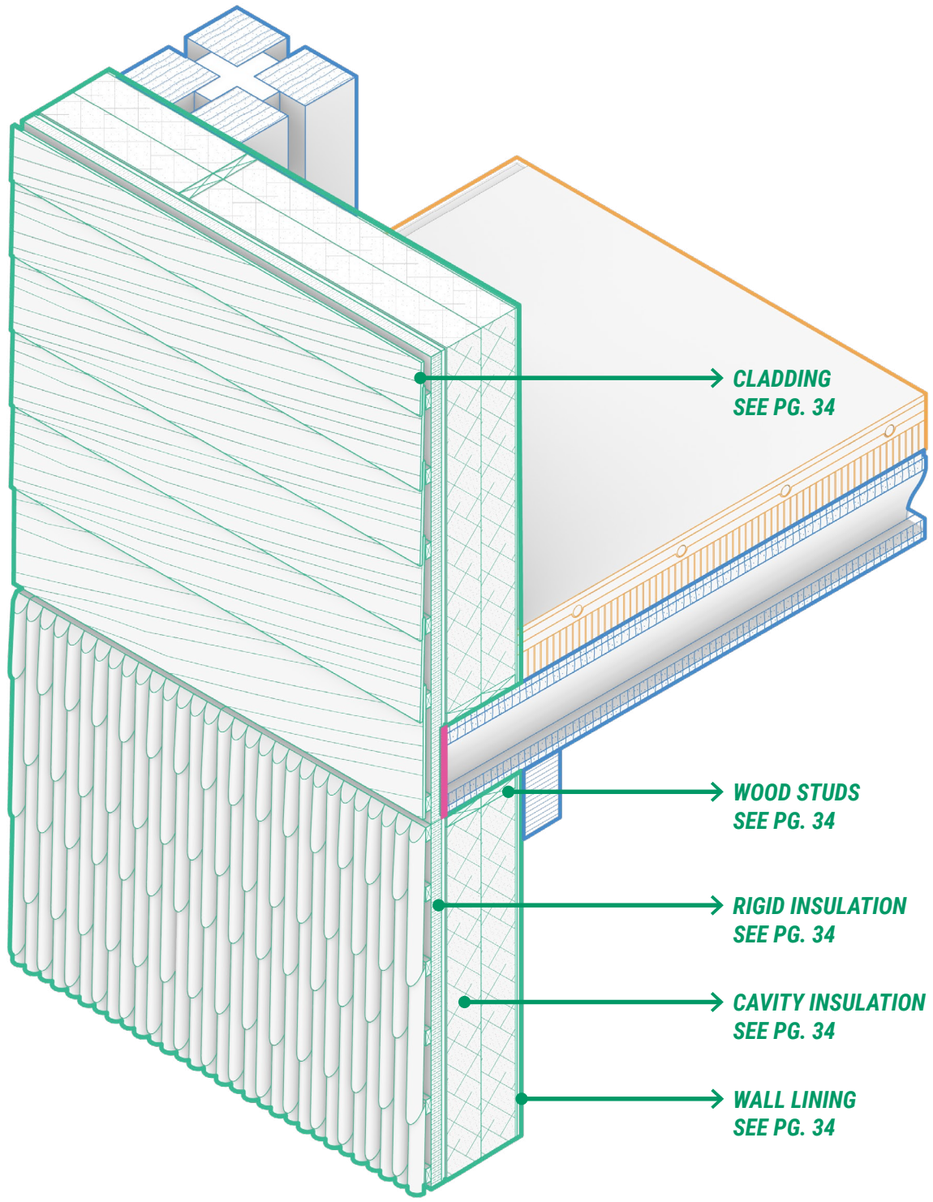
ELEVATION

VIEWS

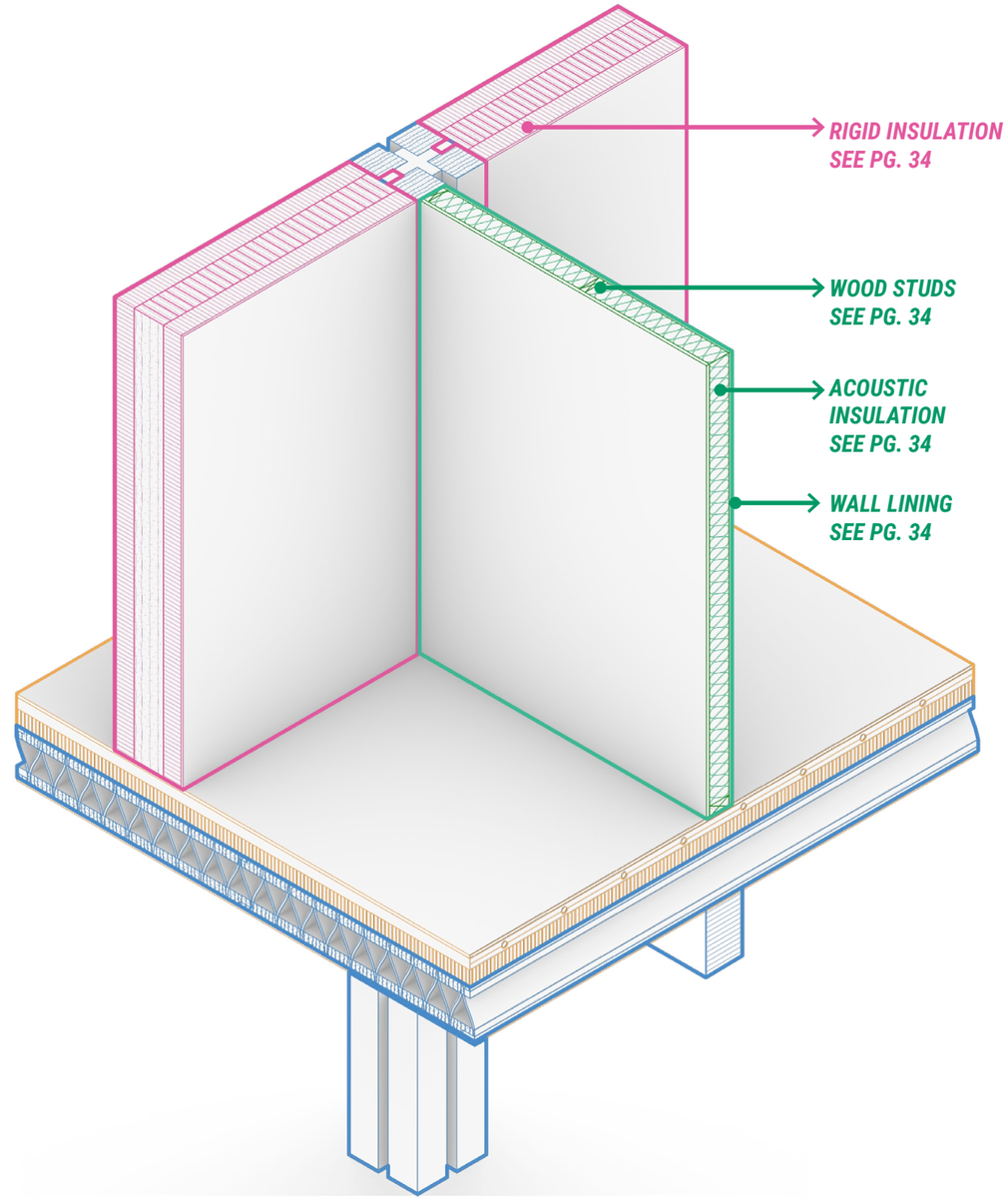
VIEWS_ COURTYARD

VIEWS_ CORRIDOR

VIEWS_ ROOFTOP

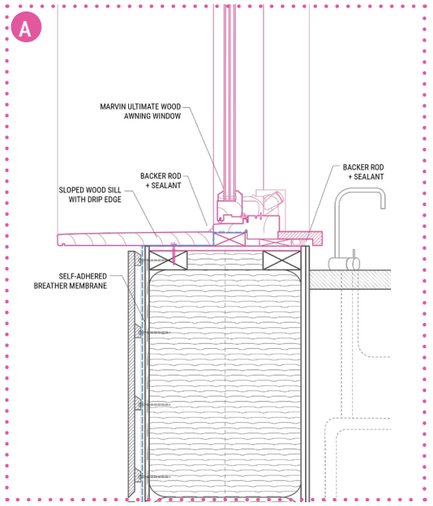


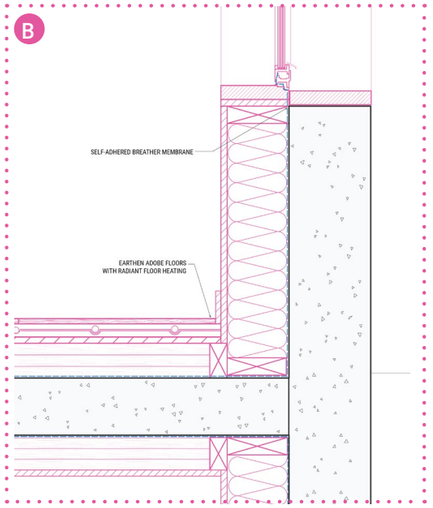
STRUCTURE
LINEAR FIRE STOP
INFILL _ EXTERIOR WALL
INFILL _ FLOORING

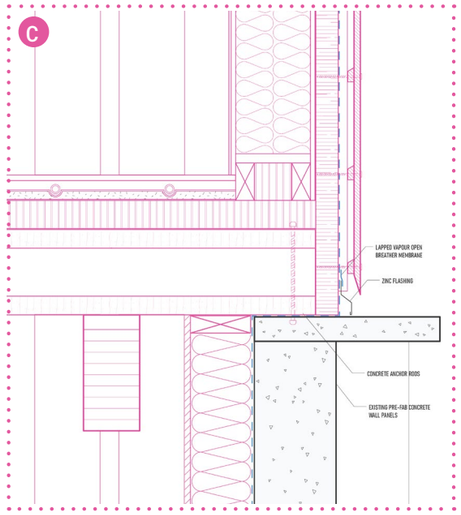


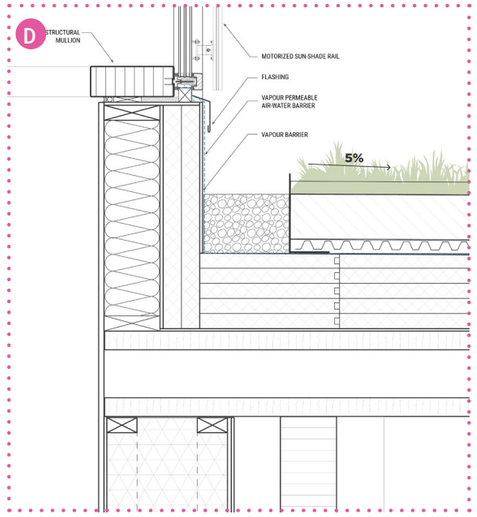
STRUCTURE
INFILL _ FLOORING
INTERIOR WALL 1
INTERIOR WALL 2

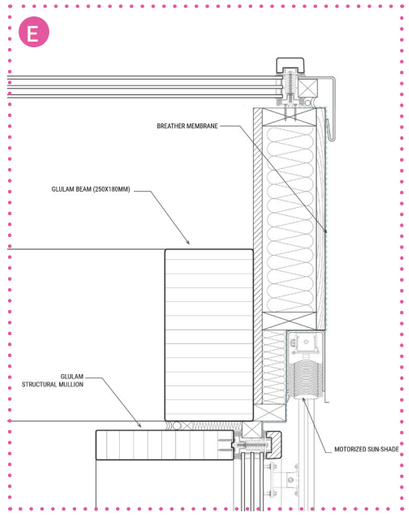
DETAIL CONCEPTS

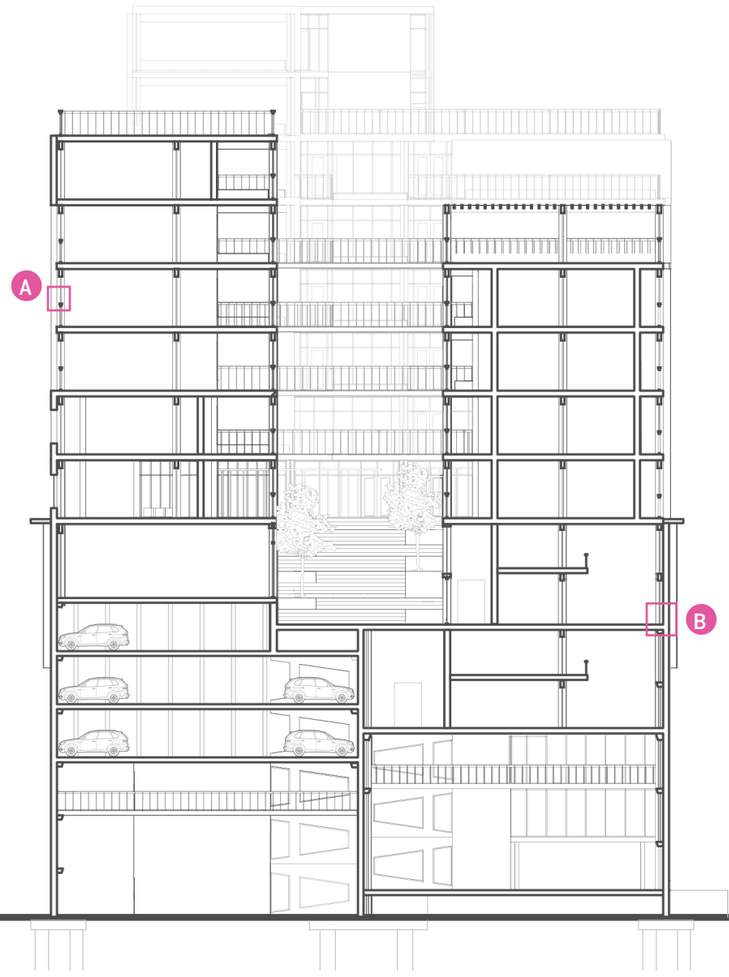


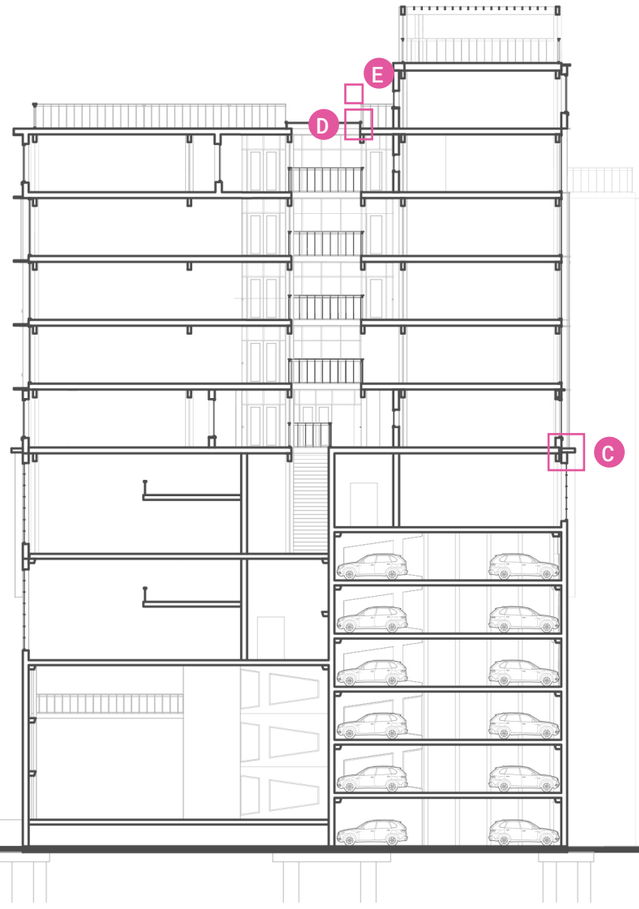




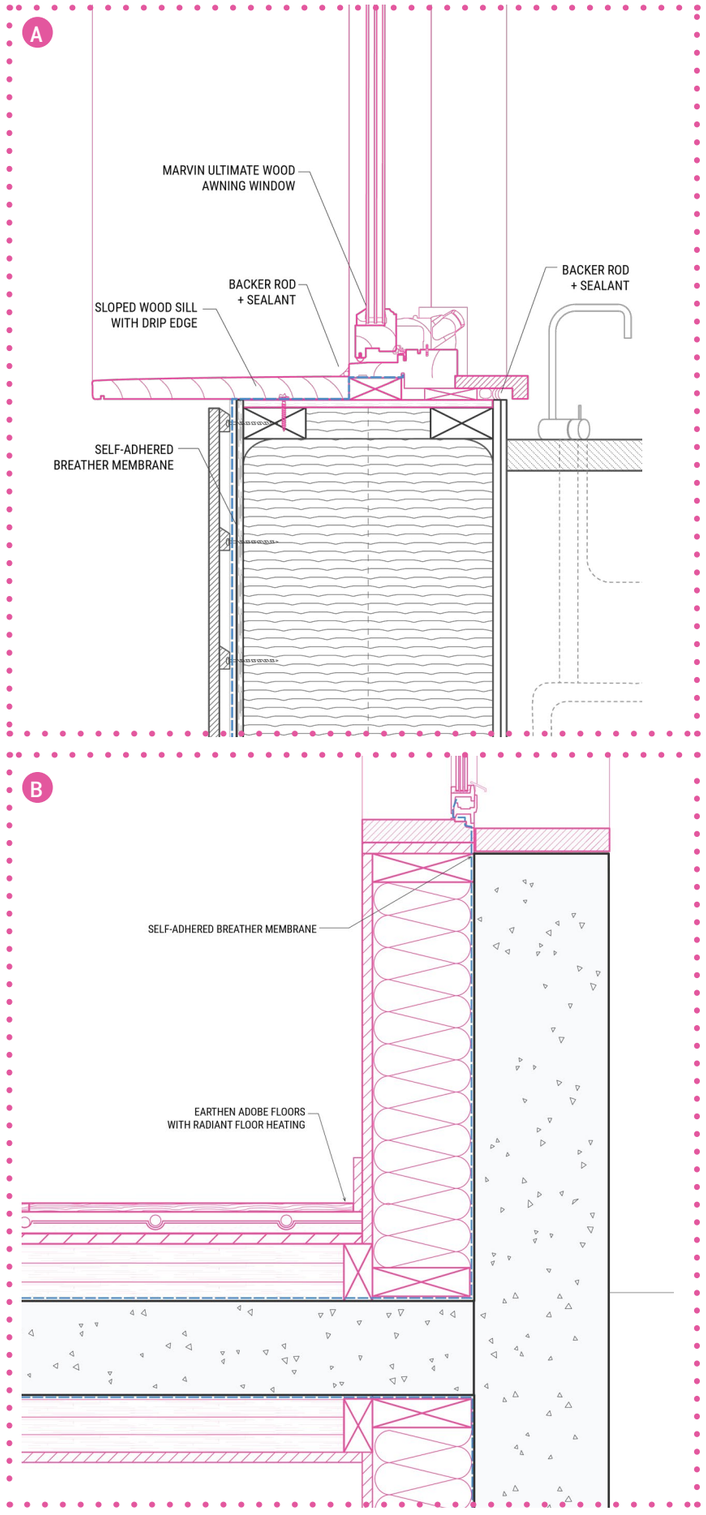


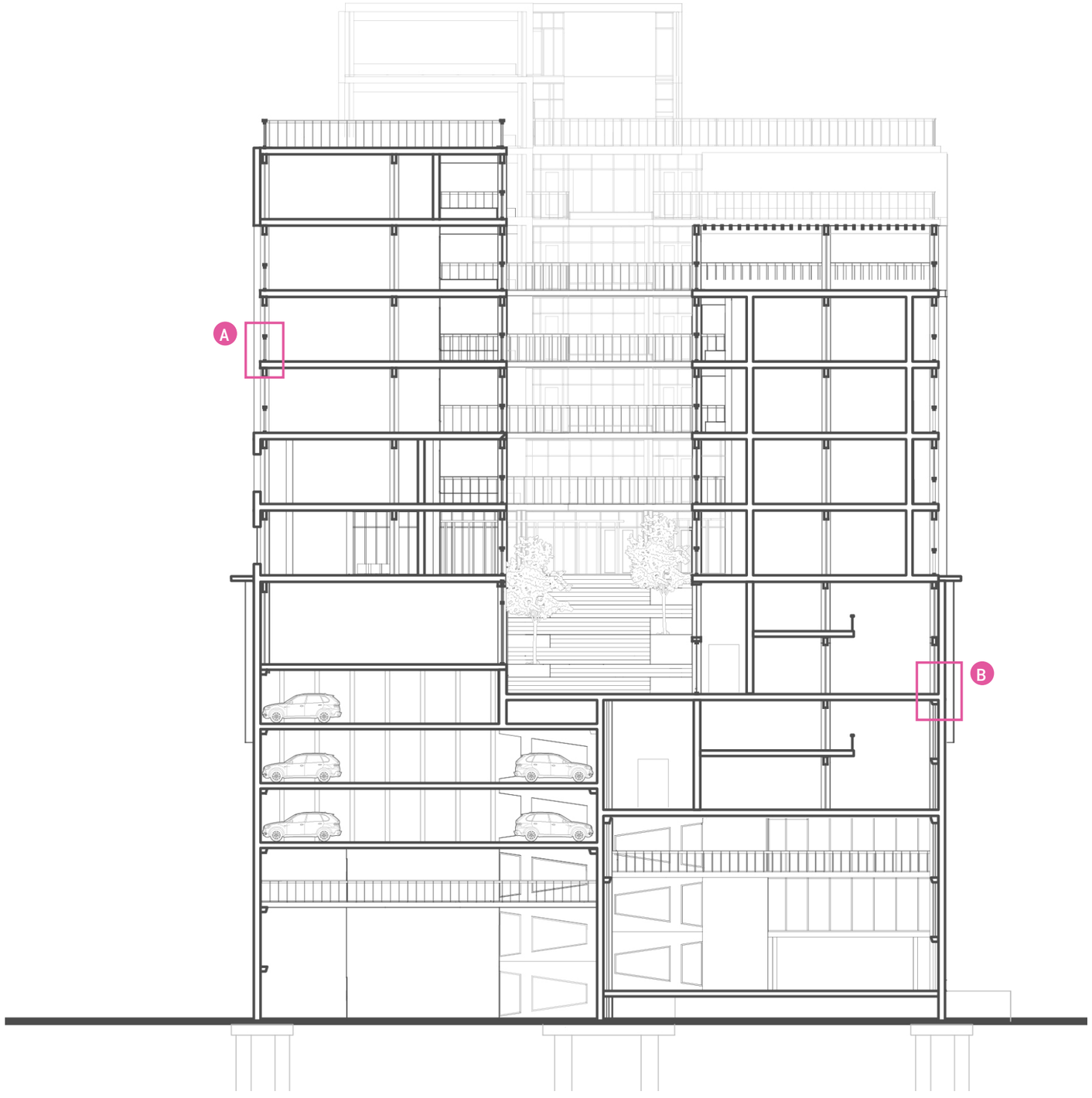




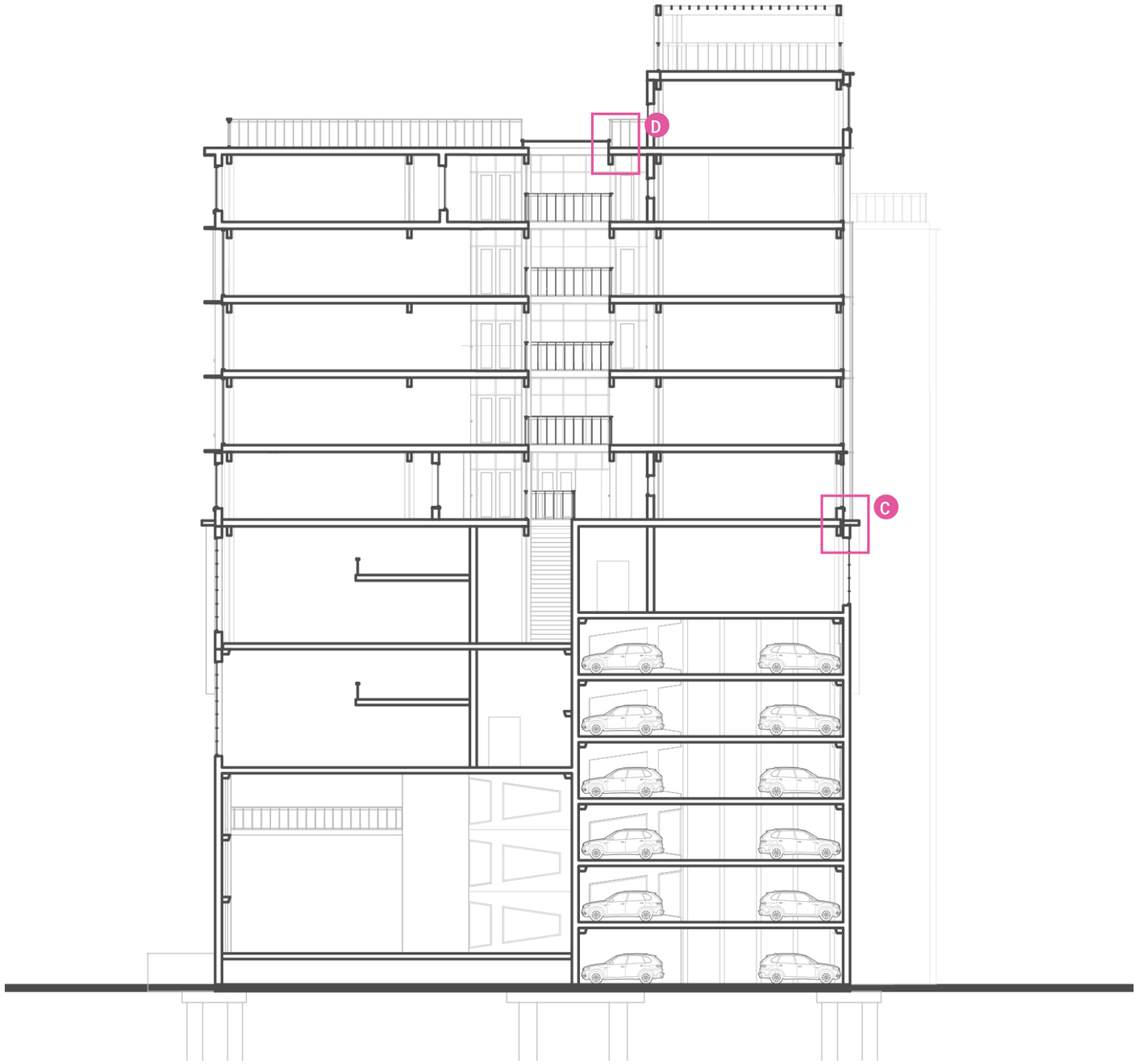


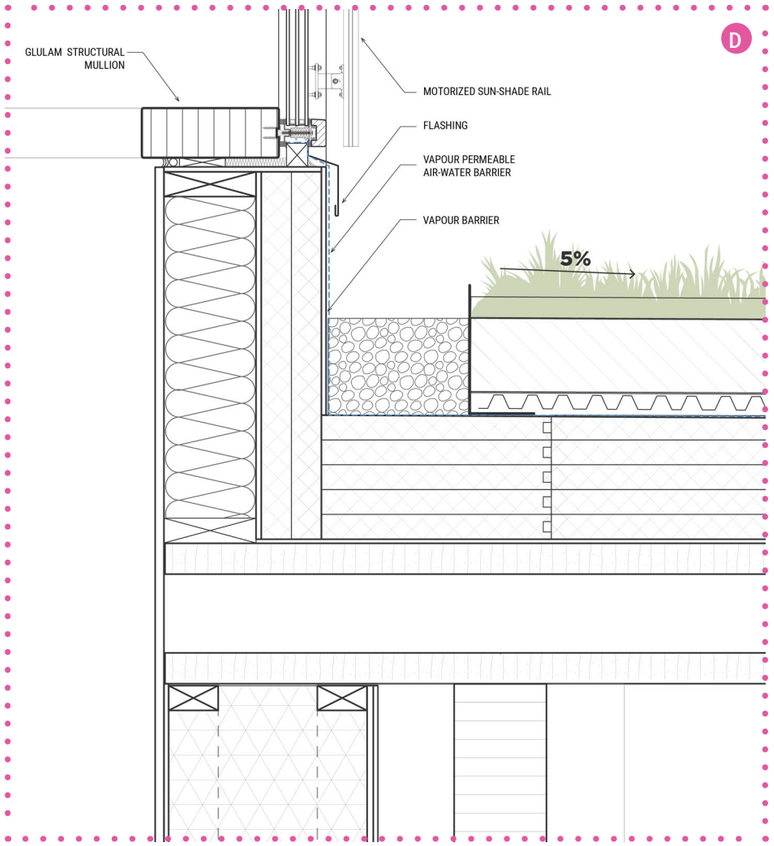
SECTION DETAILS

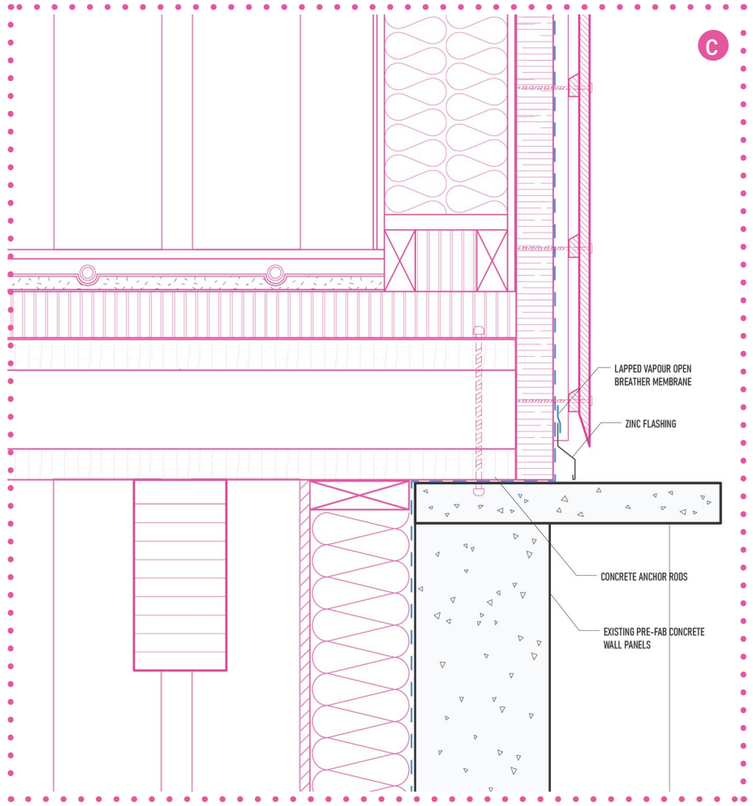




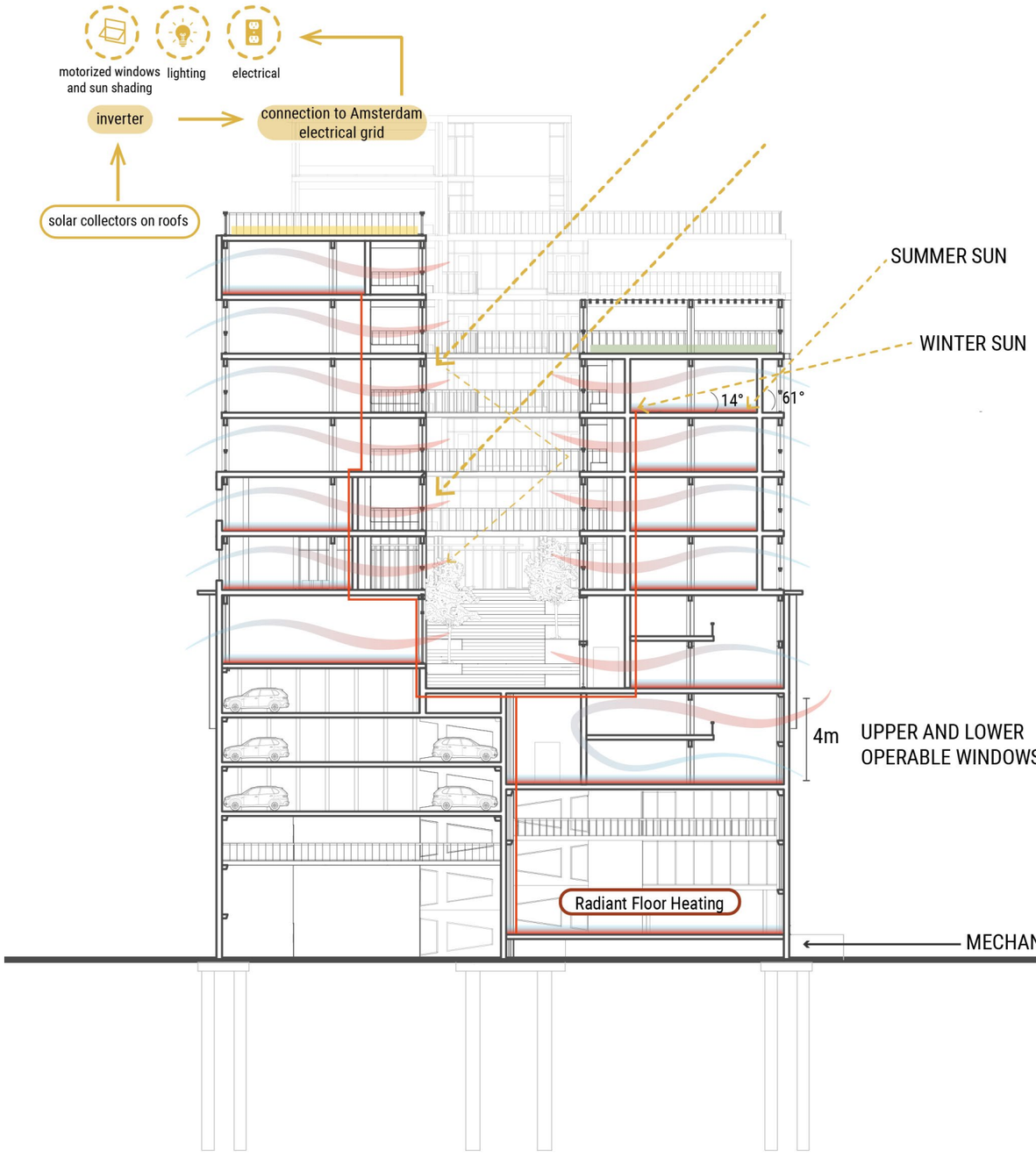
SECTION DETAILS

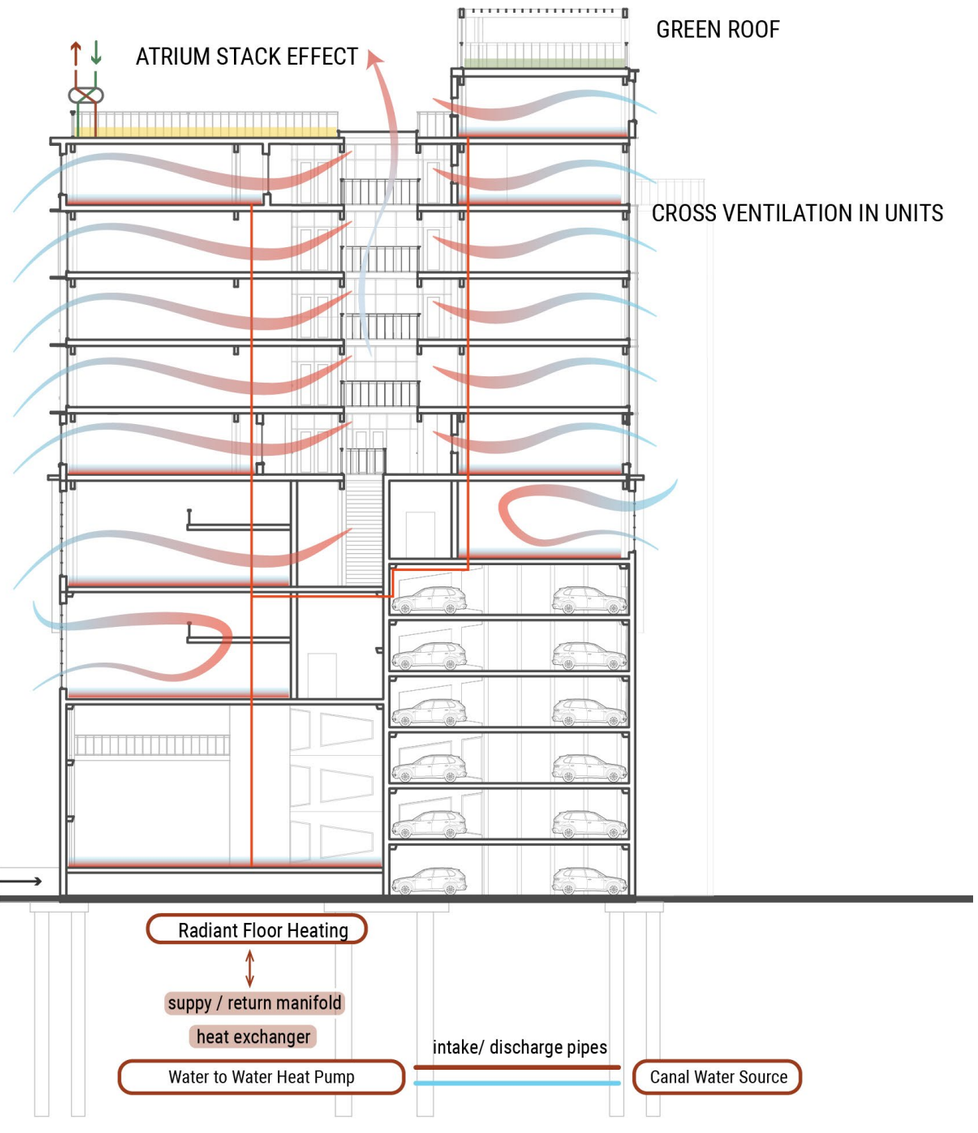




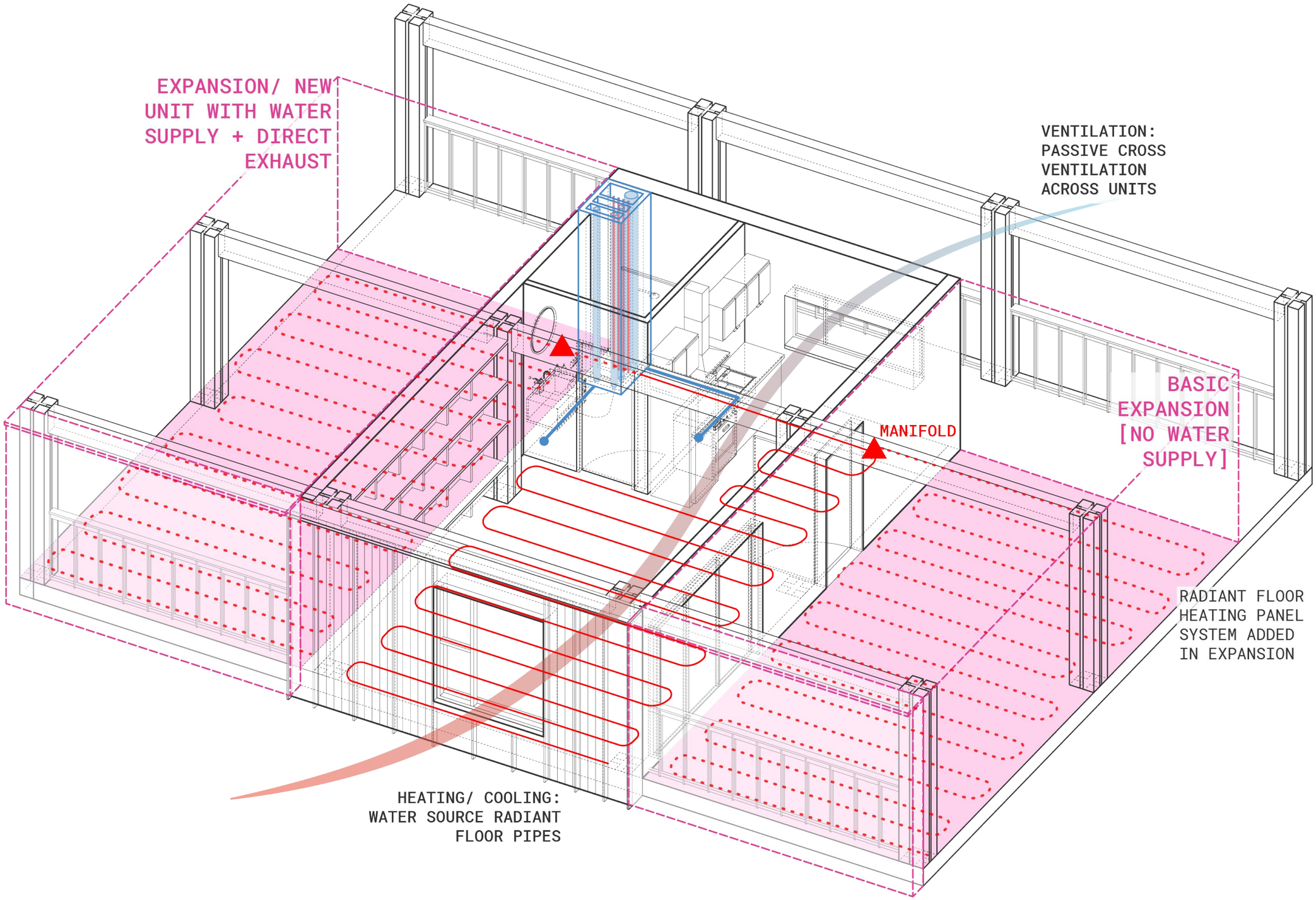


SECTION DETAILS



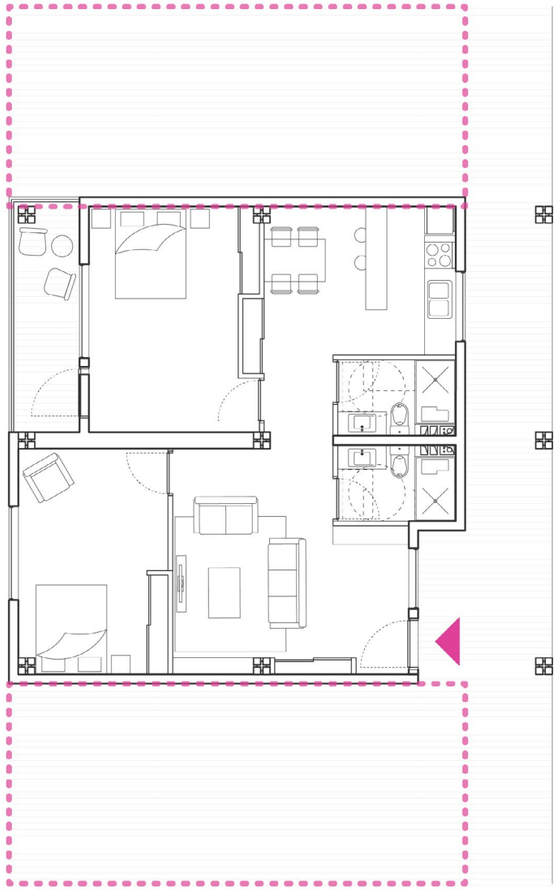


CLIMATE SYSTEMS



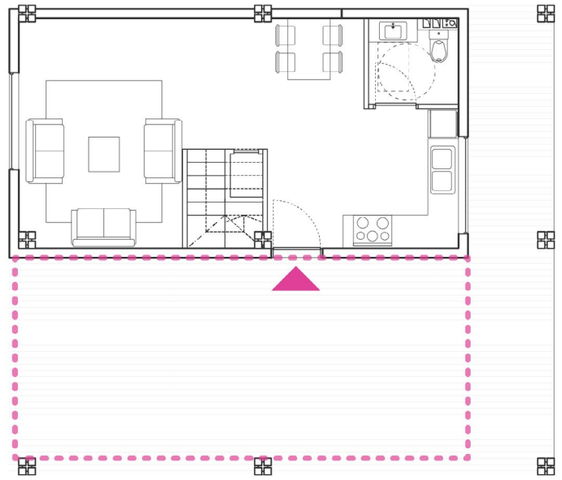
CLIMATE SYSTEMS_ UNITS

FLAT 1 BED 1BATH + 1X

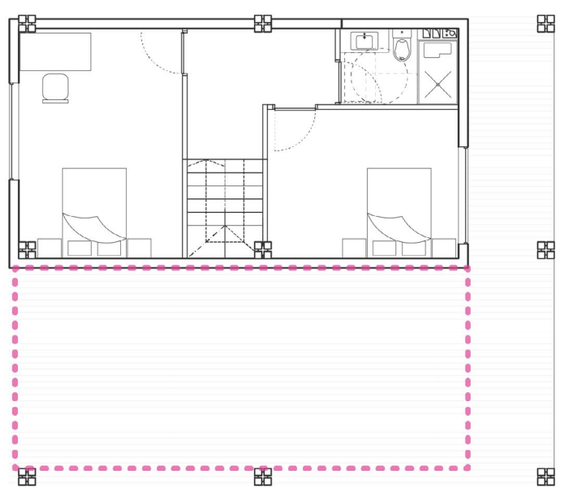


FLAT 2 BED 2BATH + 2X

LOWER LEVEL

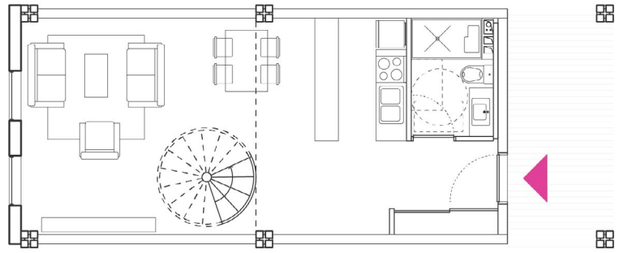


UPPER LEVEL

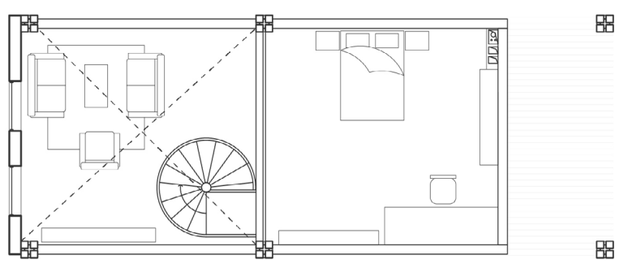


DUPLEX 2BED 2BATH + 2X

LOWER LEVEL

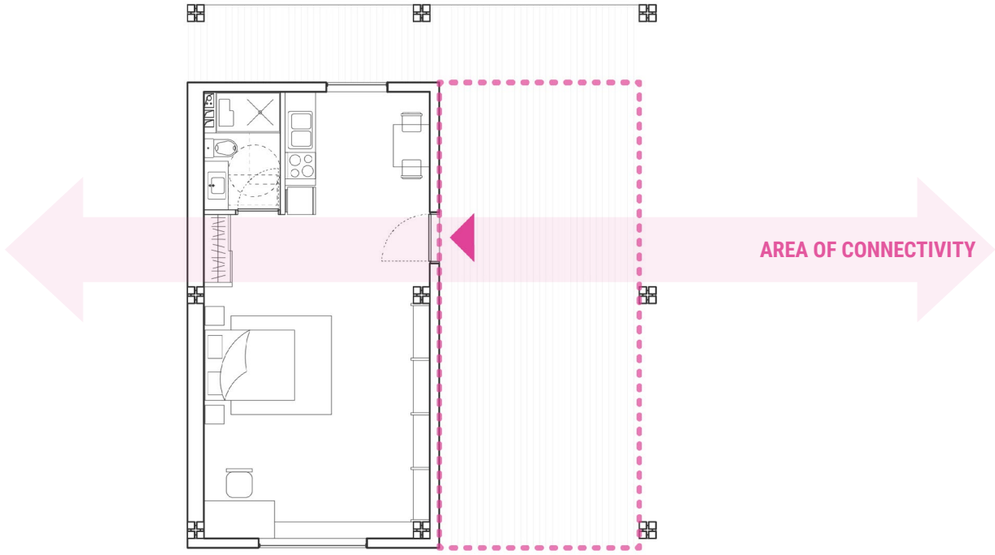


UPPER LEVEL

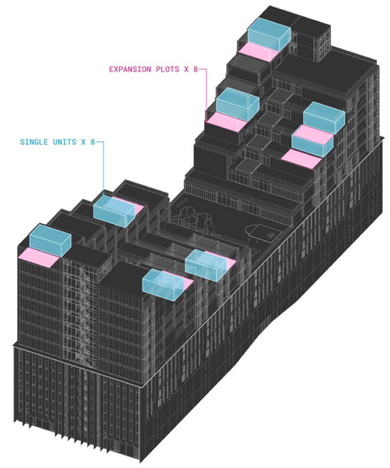


LOFT 1BED 1BATH + 2X

BASE UNIT TYPES

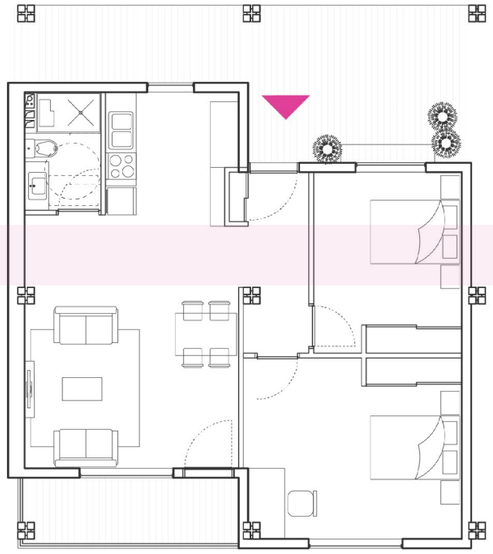


FLAT 1 BED 1BATH + 1X

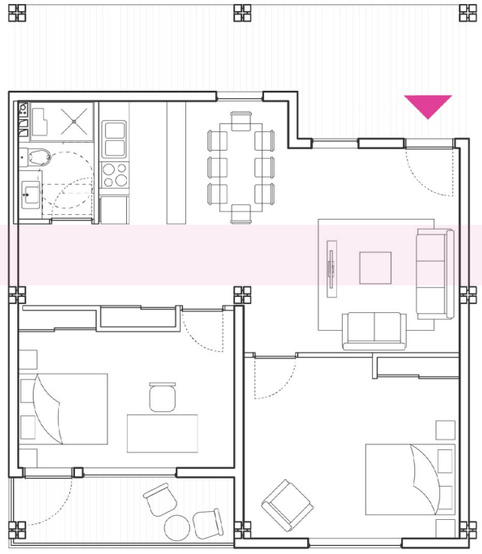


TOTAL 8 SINGLE UNITS IN BUILDING

EXPANDED UNIT VARIATIONS

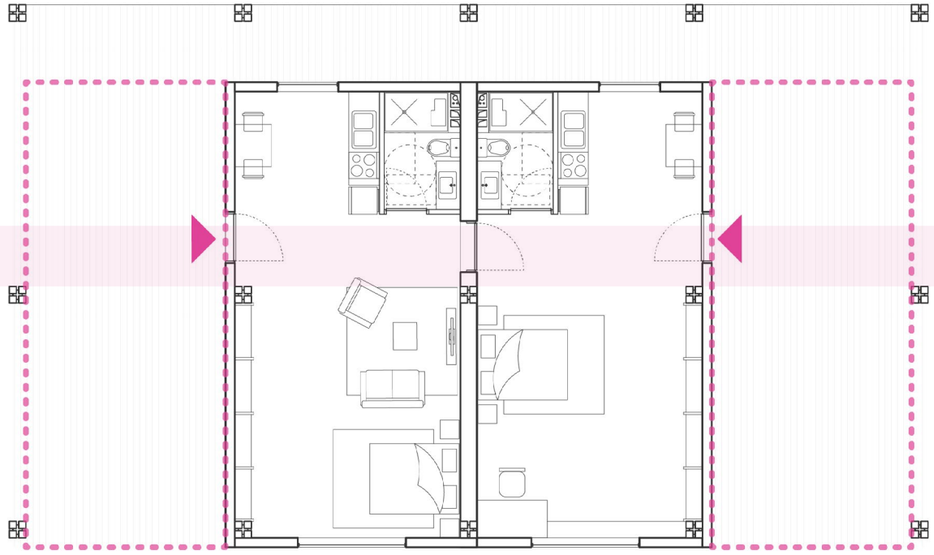


FLAT 2 BED 1BATH

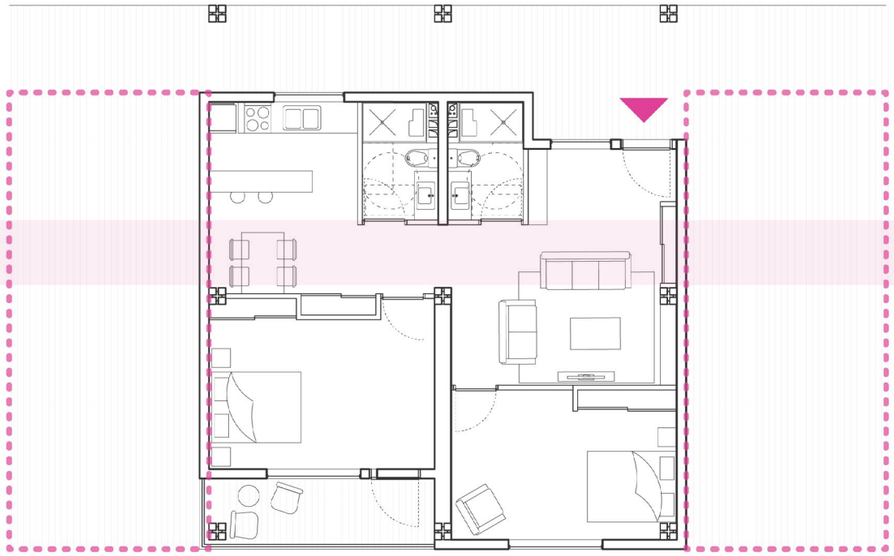


FLAT 2 BED 1BATH

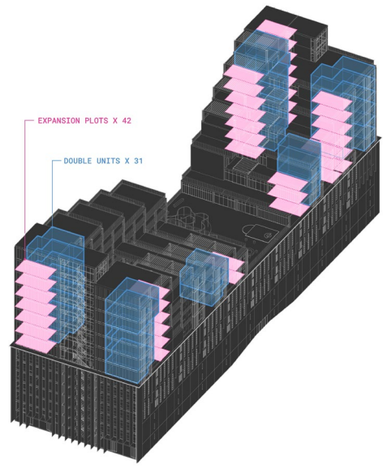
COMBINED UNITS



FLAT 1BED 1BATH + 1BED 1 BATH



AREA OF CONNECTIVITY



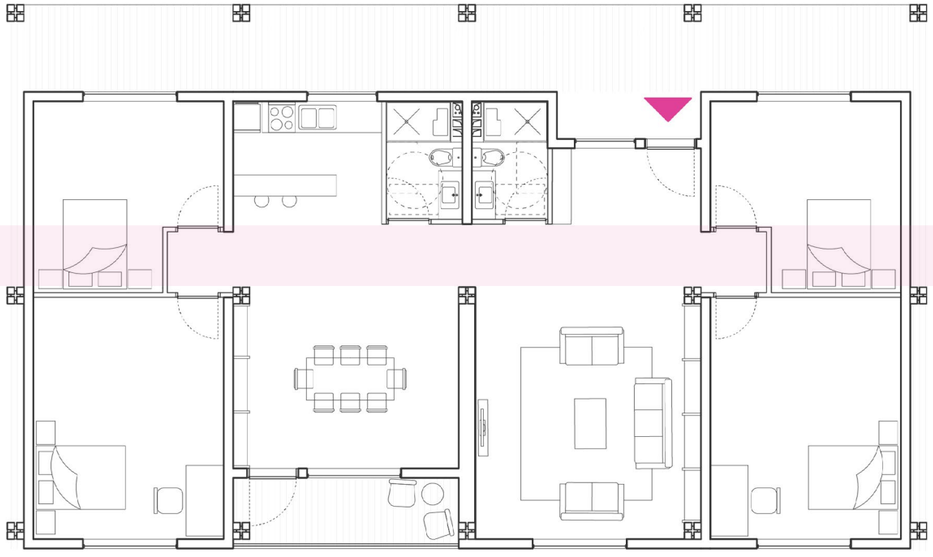
TOTAL 31 DOUBLE UNITS IN BUILDING

FLAT 2 BED 2BATH + 2X

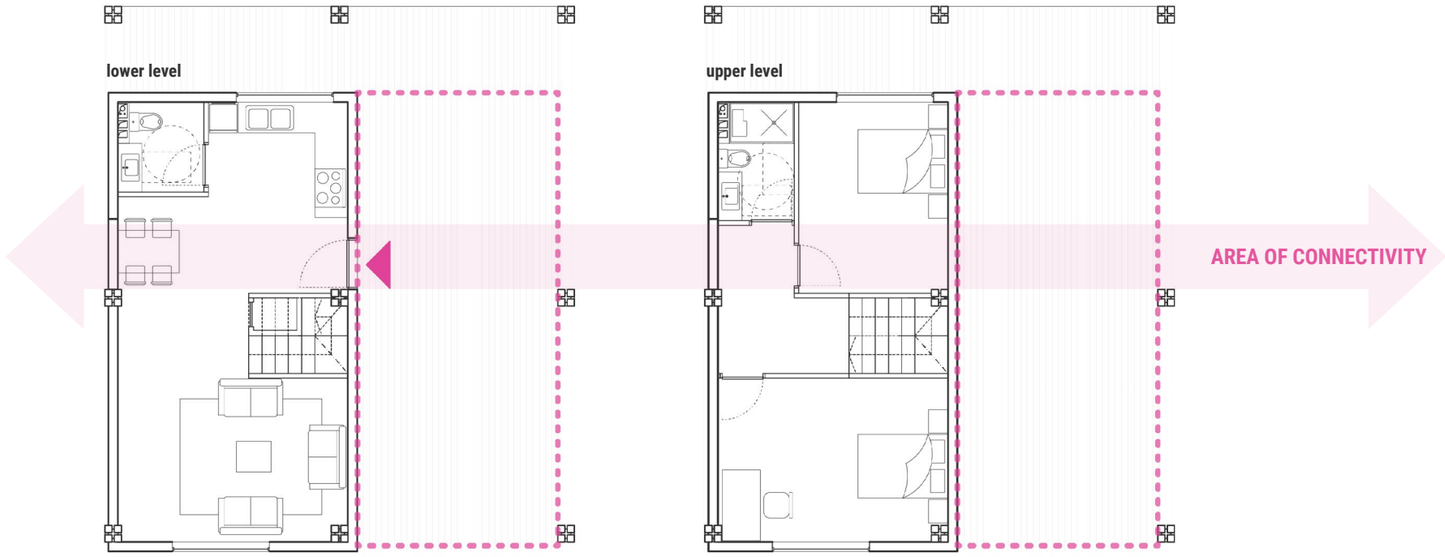
PARTIALLY EXPANDED

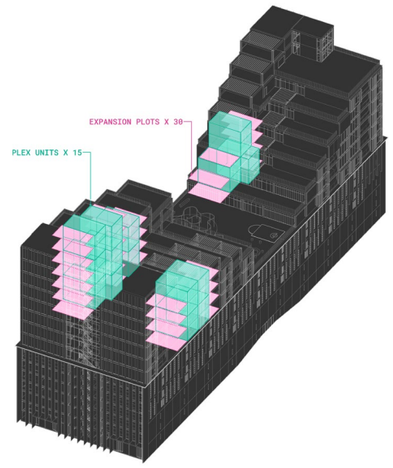
FLAT 3BED 2BATH

FULLY EXPANDED



FLAT 5BED 2BATH

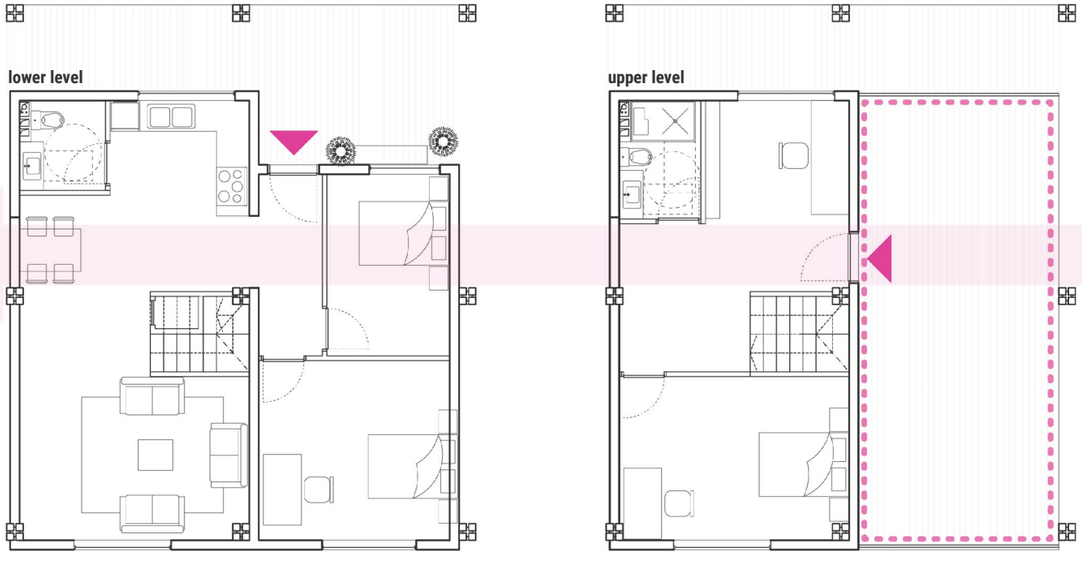




TOTAL 15 DUPLEX UNITS IN BUILDING

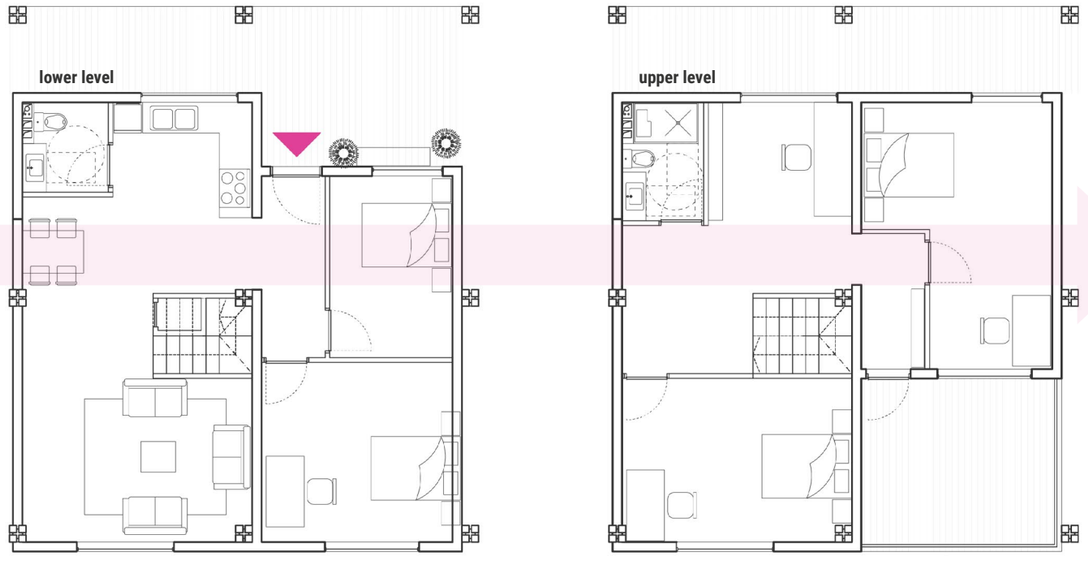
DUPLEX 2BED 2BATH + 2X

LOWER LEVEL EXPANSION

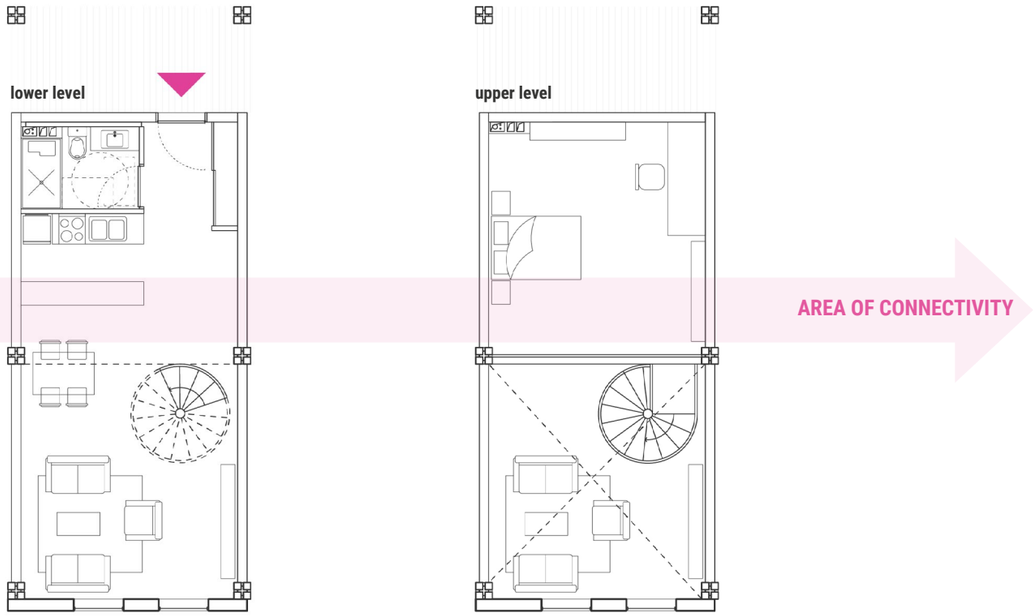


DUPLEX 3BED 2BATH

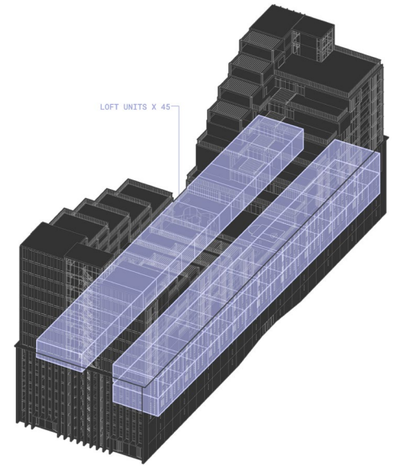
UPPER LEVEL EXPANSION



DUPLEX 4BED 2BATH

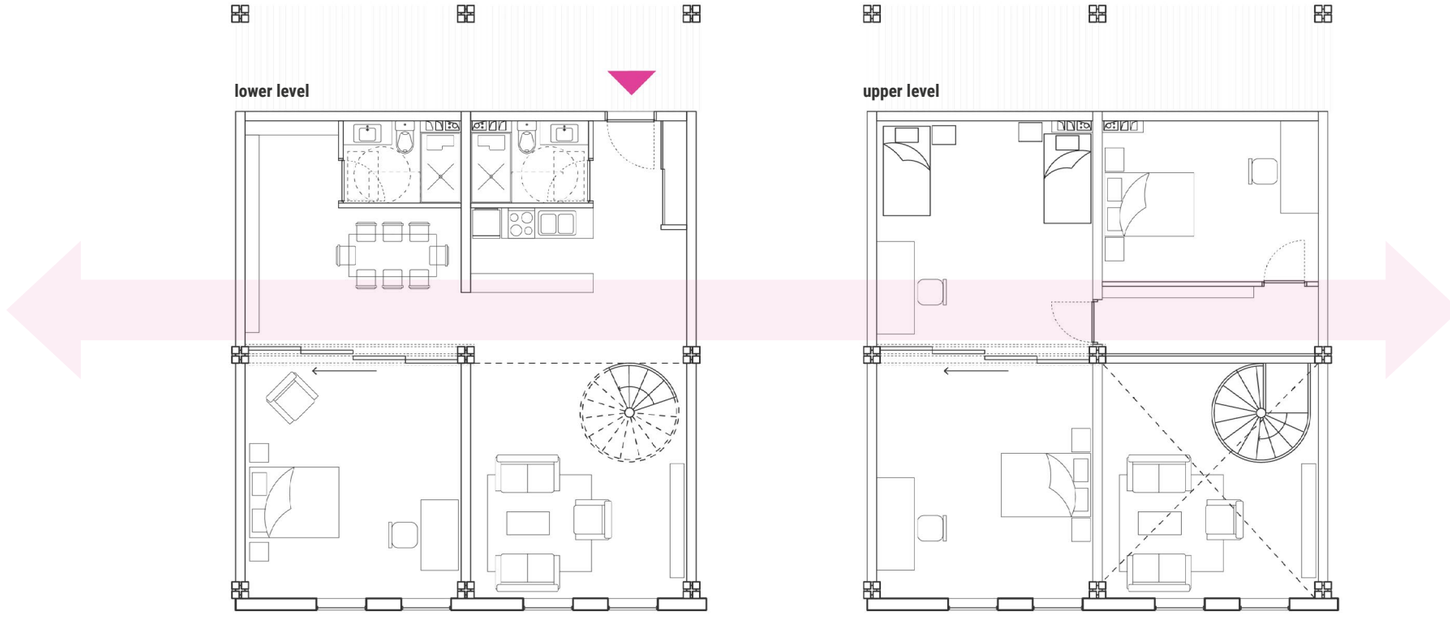


LOFT 1BED 1BATH + 2X



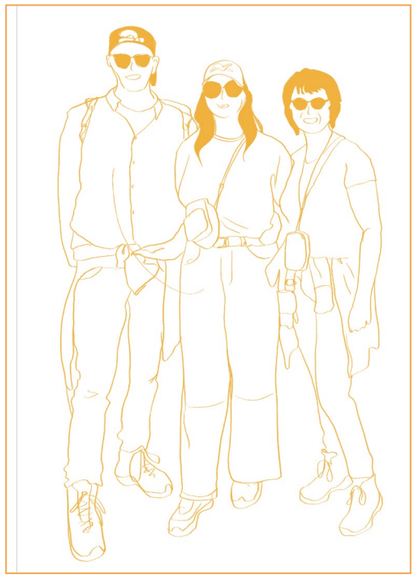
TOTAL 45 LOFT UNITS IN BUILDING

COMBINED LOFT

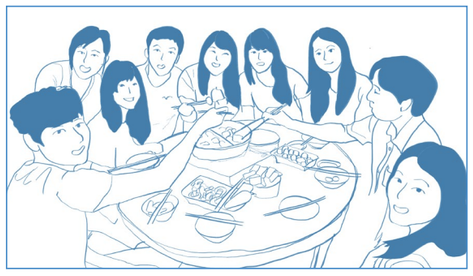


LOFT 4BED 2BATH

The Jouhal Family

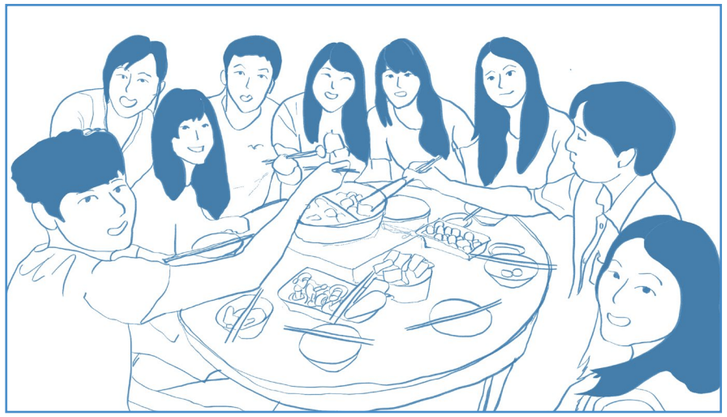


The Massen Family



The Cheuk Family

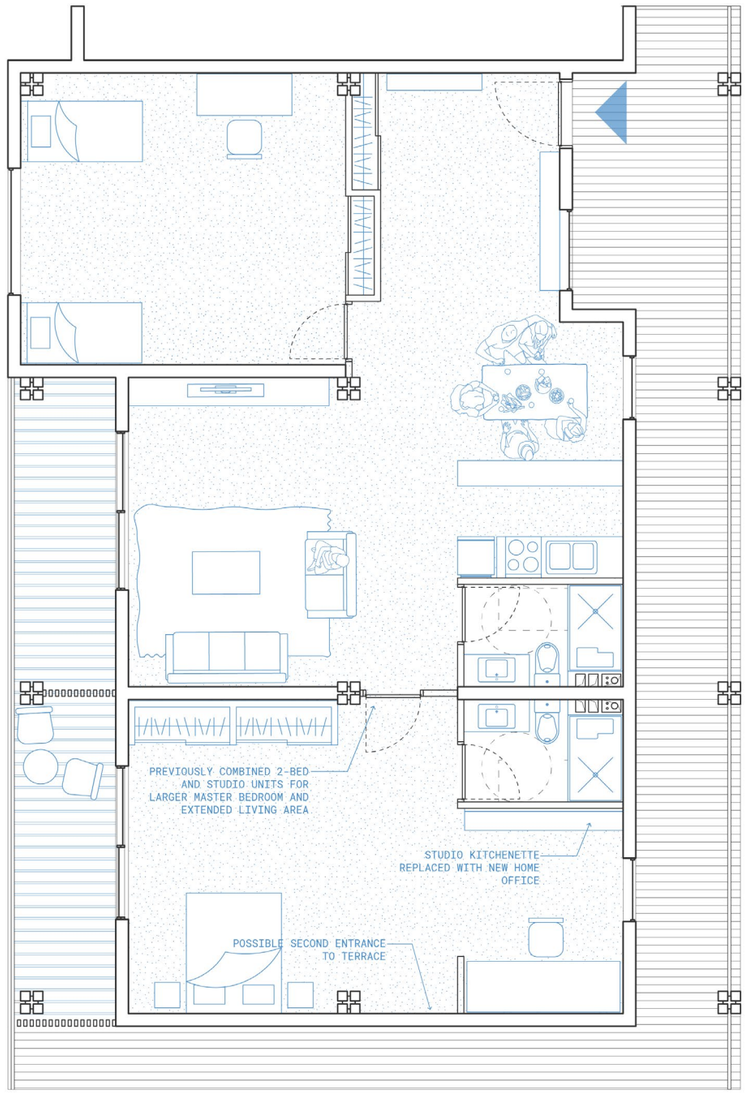
LETS PLAY THE PLAYBOOK !



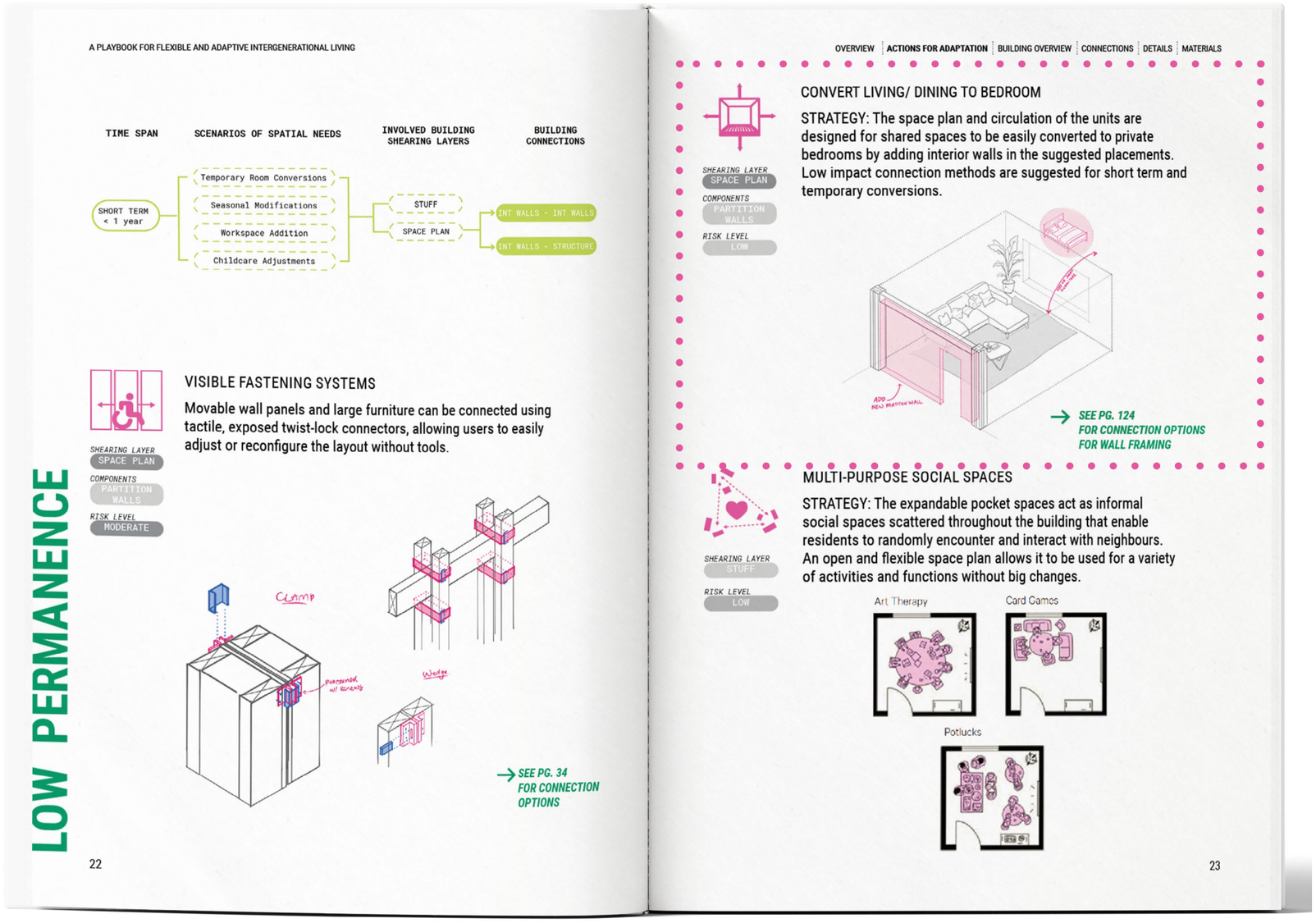
SHORT-TERM SCENARIO: The Cheuk Family [2-Bedroom Flat]

A cousin moves to the country on a 1-year exchange program, and stays with the family during her studies.

ACTION: add interior partition wall with easy disassembled connections since the wall is only needed for around a year



existing living situation



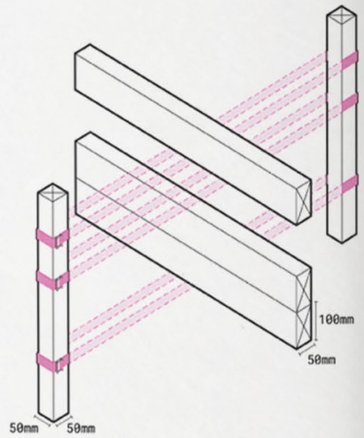
LETS PLAY THE PLAYBOOK ! (1)

WALL FRAMING

STRAPPING METHOD

No incisions are made to the wood, allowing for maximum possible re-use. Straps are tied above and below horizontal members. Lateral stability is provided through sheathing. This build up uses smaller vertical members and results in a thicker wall assembly and more space in between for acoustic insulation.

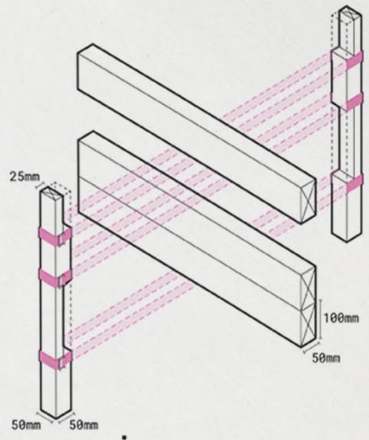
- ●● ease of assembly
- ●●● reduced incisions
- ●●● ease of fabrication



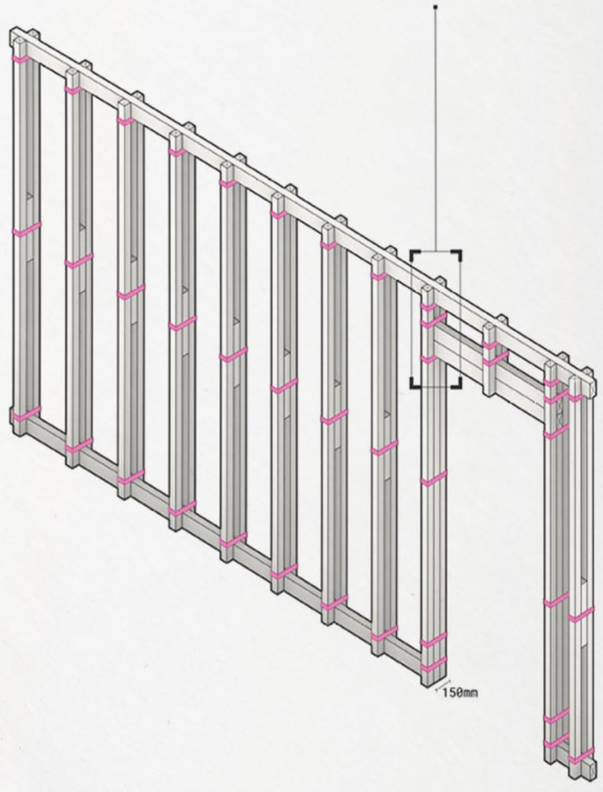
MODIFIED STRAPPING METHOD

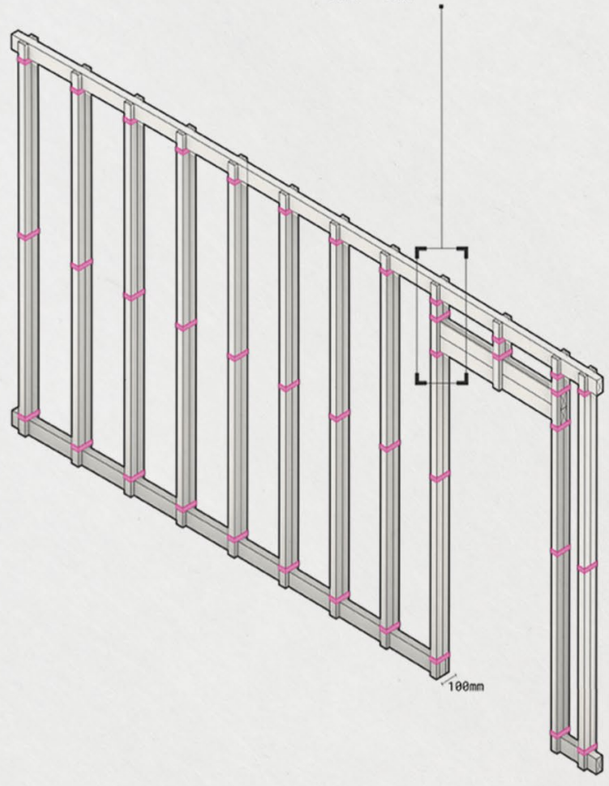
Half-laps are CNC milled in the vertical studs for easy placement and assembly with crossing elements, adding extra stability. Vertical members are tied together directly, eliminating the need for blocking pieces in between, and results in a thinner wall compared to the simple strapping method.

- ●●● ease of assembly
- ●● reduced incisions
- ●● ease of fabrication



INFILL CONNECTIONS





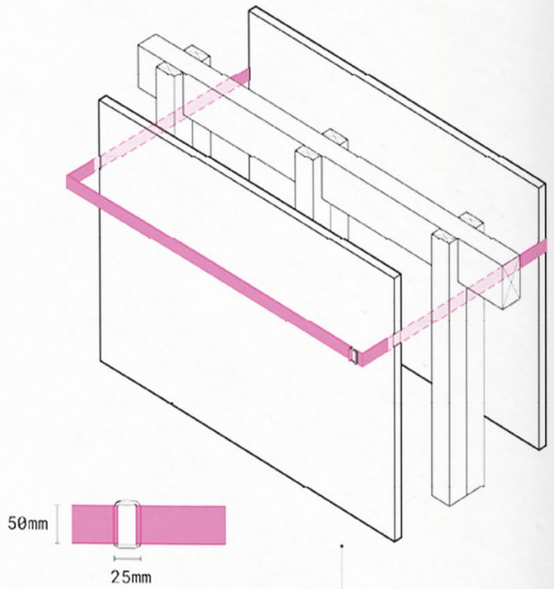
LETS PLAY THE PLAYBOOK ! (1)

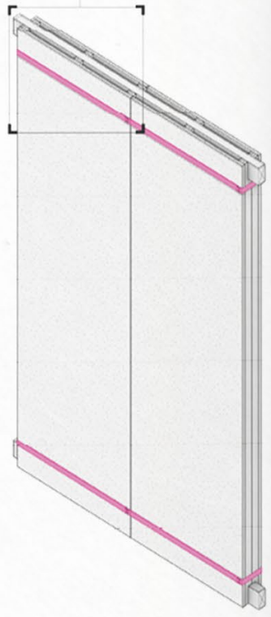
WALL PANELS

STRAPPING METHOD

Long straps wrap around the full 2 panels on either side of the timber framing. Each panel is 1.5x the spacing of the studs to act as lateral sheathing. A gap can be left between panels to leave space for the straps.

Alternatively, an incision can be made to the side of the panels to allow straps to pass through. This allows for easier assembly and reduces risk of slippage.





ease of assembly

●● *(if allowing gap between panels for straps)*

●●● *(if cutting indent for strap space)*

reduced incisions

●●● *(if allowing gap between panels for straps)*

●● *(if cutting indent for strap space)*

ease of fabrication

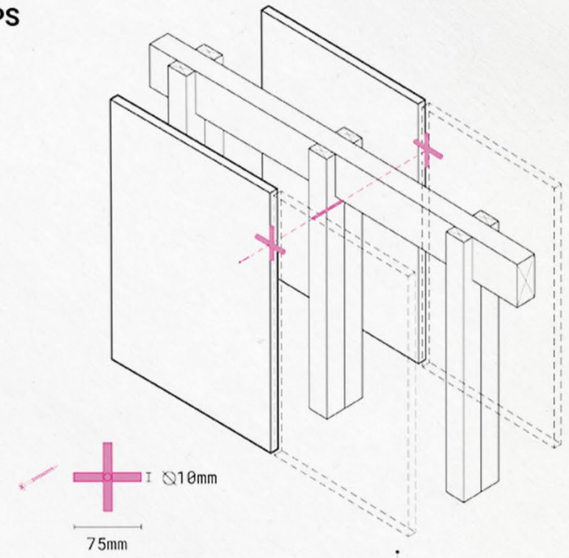
●●● *(if allowing gap between panels for straps)*

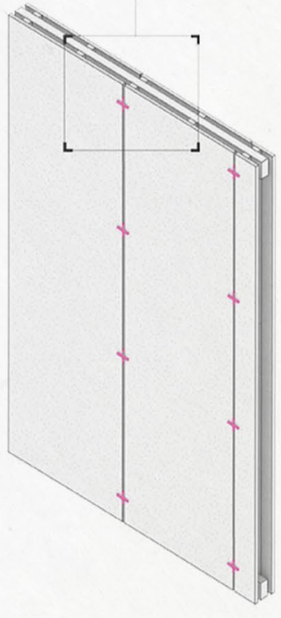
●● *(if cutting indent for strap space)*

WOODEN TOGGLE CLAMPS

A pair of toggle elements on both sides of the stud wall screwed to a dowel that runs through the wall. By tightening, the toggles compress the panels against the stud, holding them in place via friction and pressure. No punctures to the panels or timber frame.

Alternatively, the toggles can be screwed directly into the wood studs for easier assembly.





ease of assembly

●● *(if using connective dowel)*

●●● *(if screwing into wood stud)*

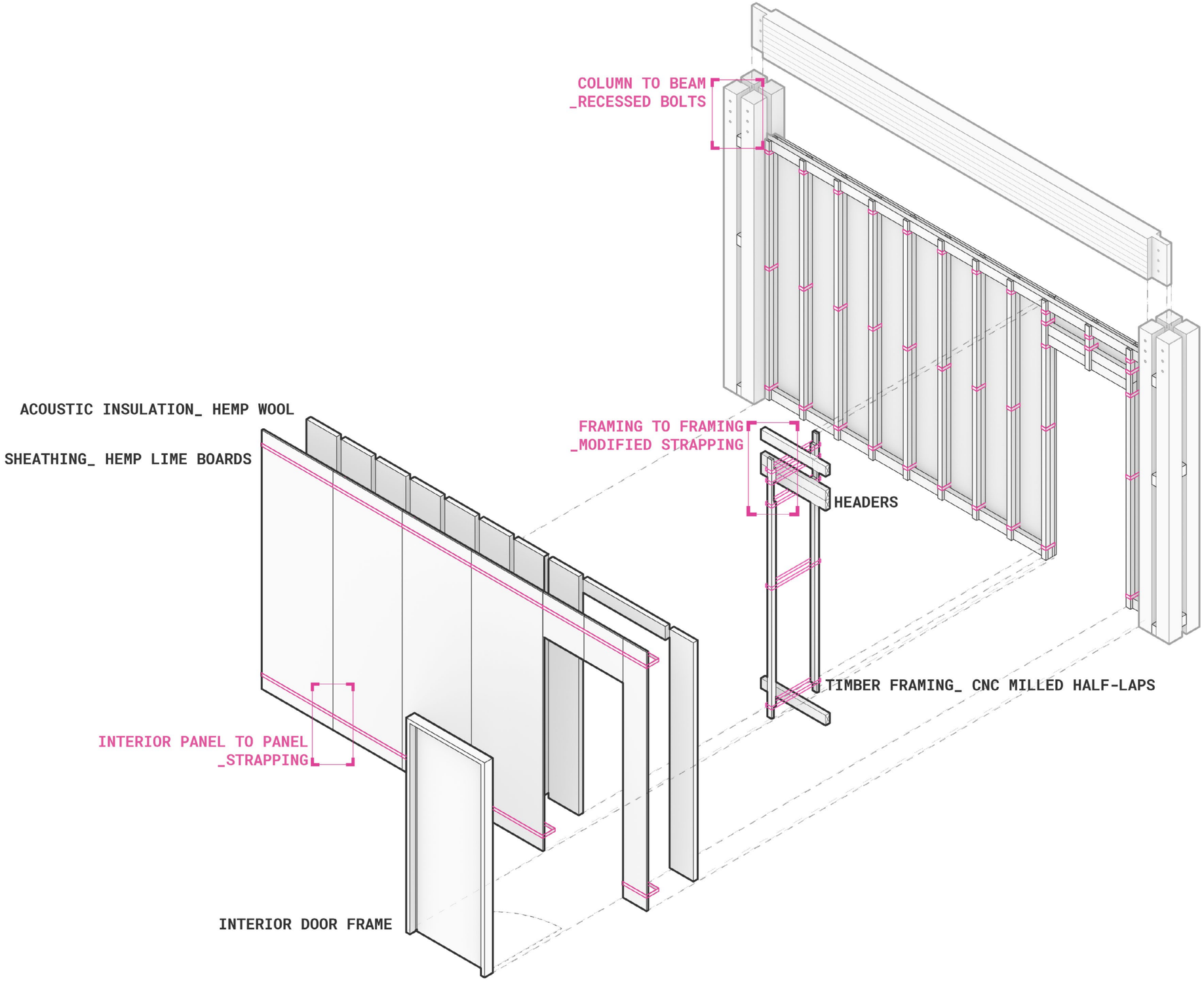
reduced incisions

●●● *(if using connective dowel)*

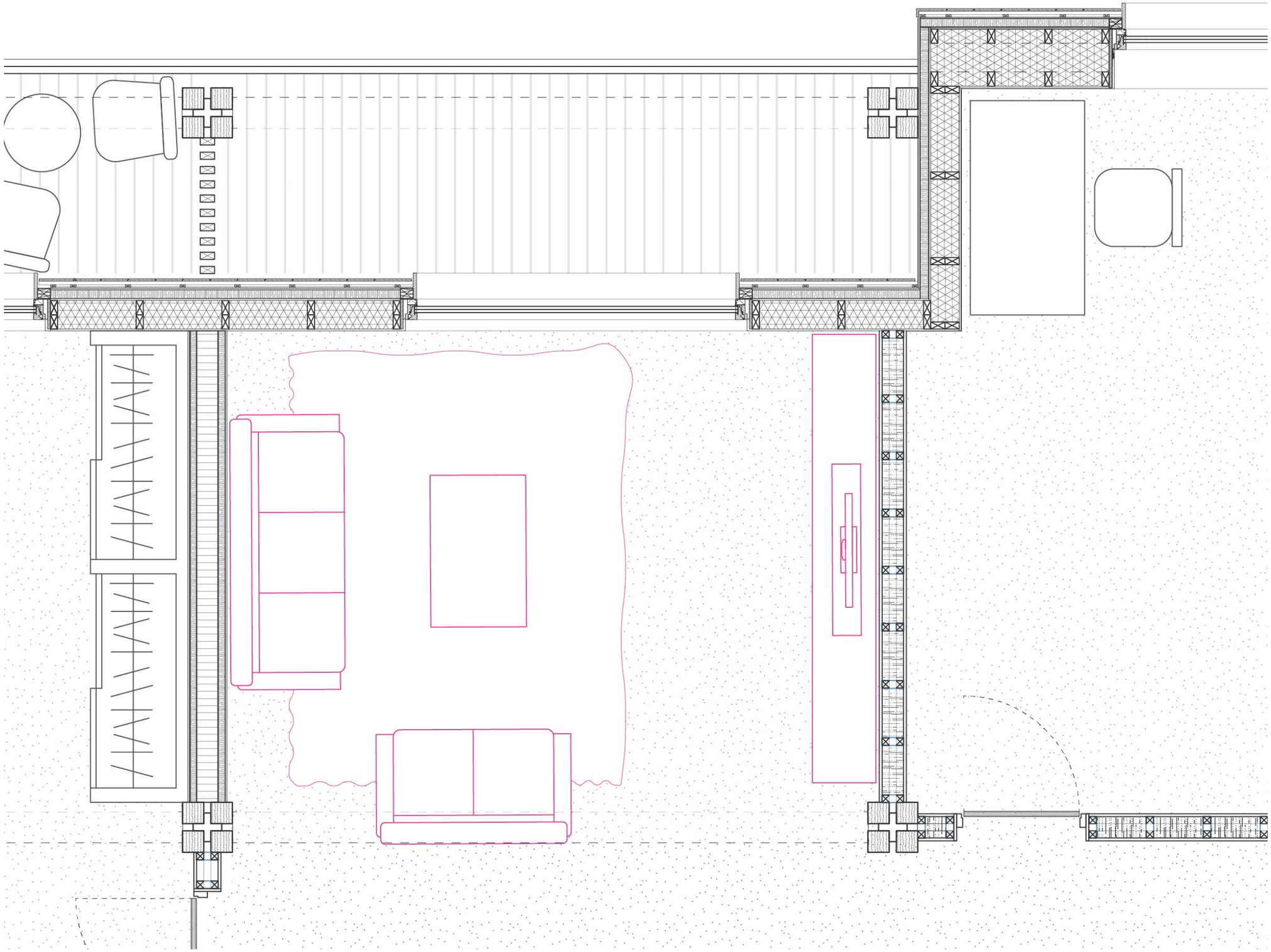
●● *(if screwing into wood stud)*

●●● **ease of fabrication**

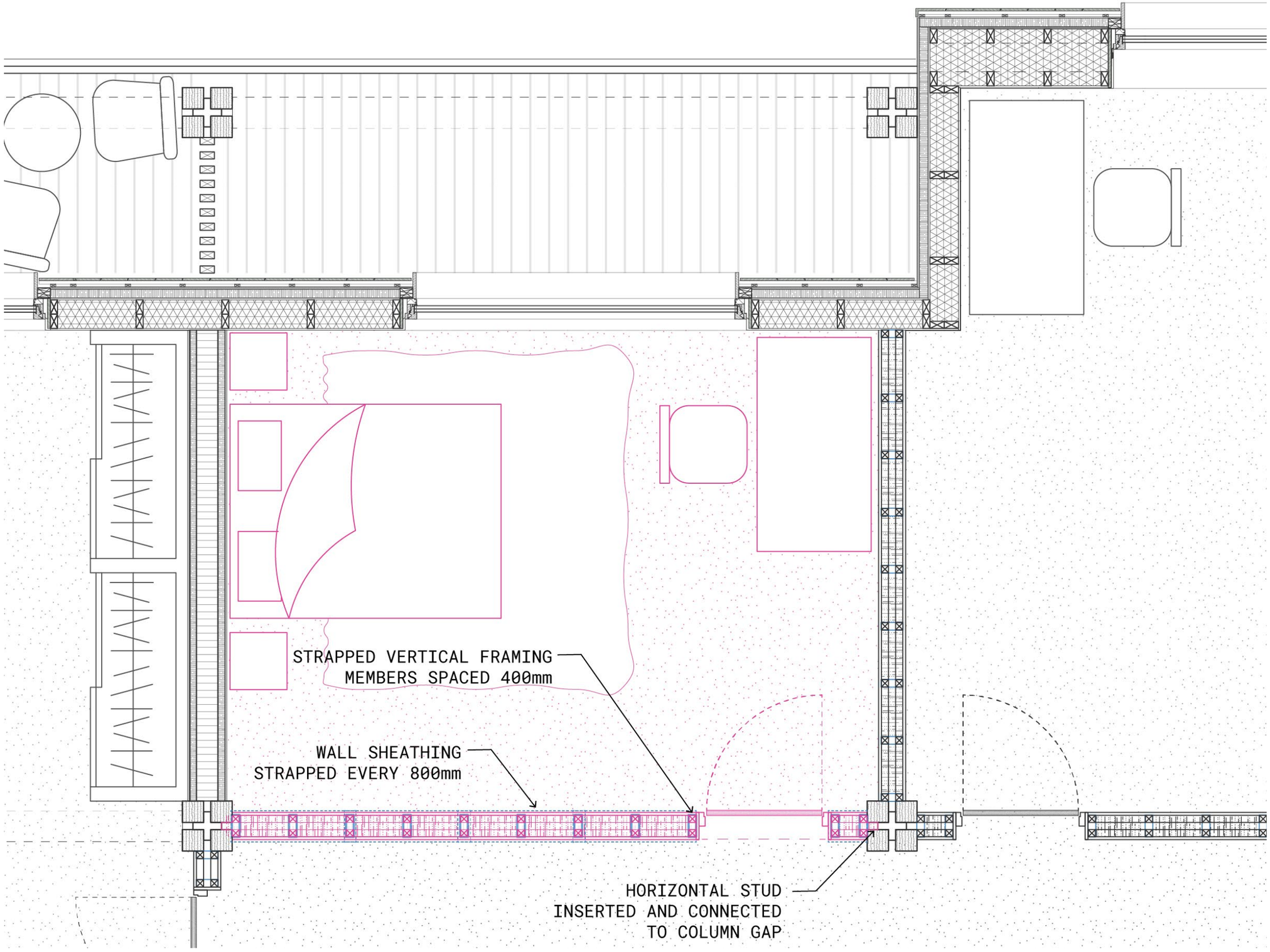
LETS PLAY THE PLAYBOOK ! (1)



LETS PLAY THE PLAYBOOK ! (1)

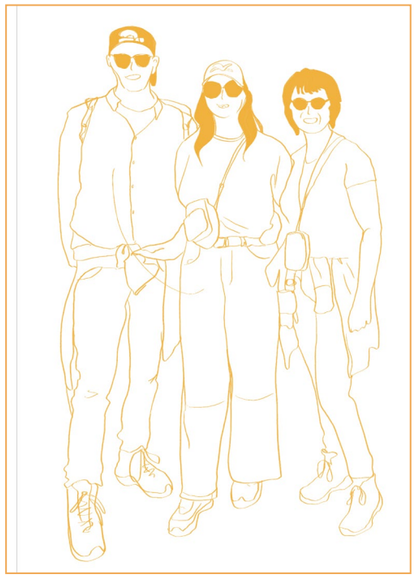


SCENARIO 1_ strapped interior wall framing [before]

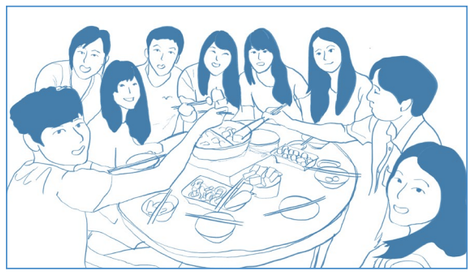


SCENARIO 1_ strapped interior wall framing [after]

The Jouhal Family

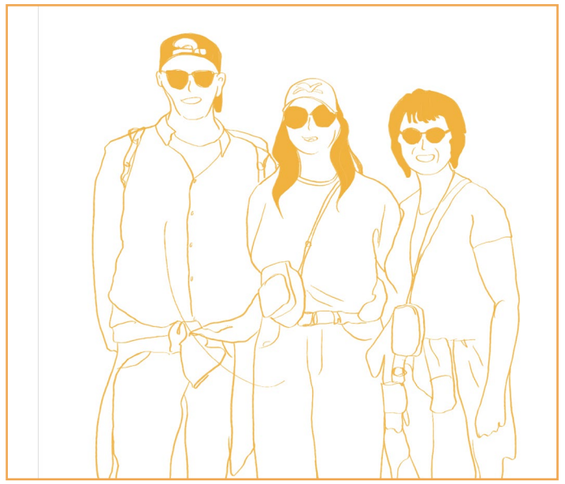


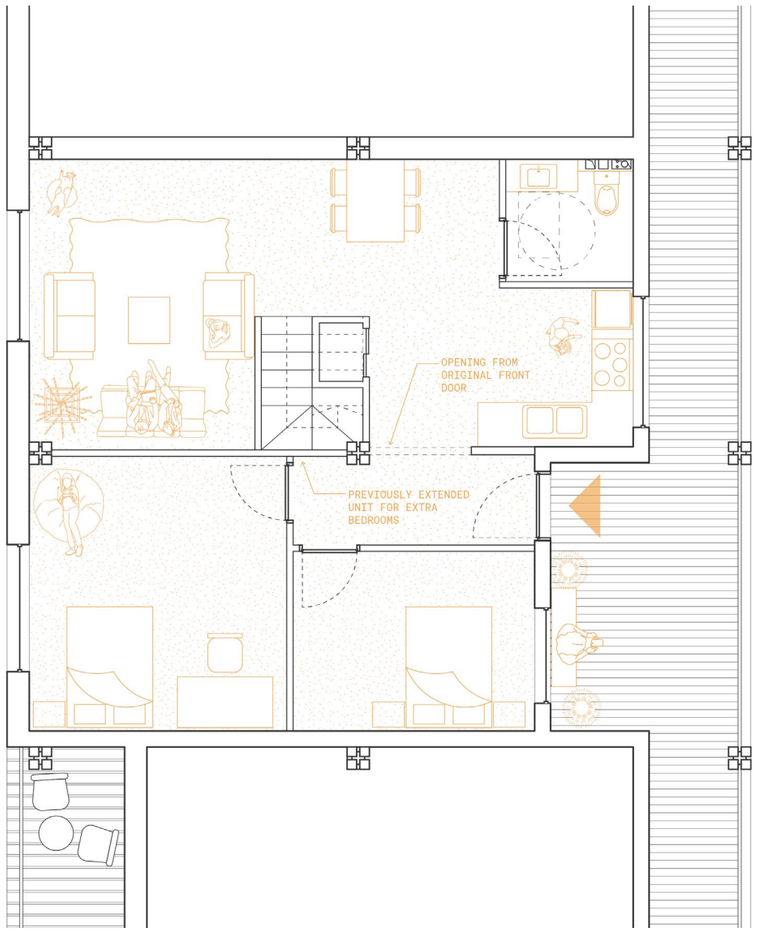
The Massen Family



The Cheuk Family

LETS PLAY THE PLAYBOOK !

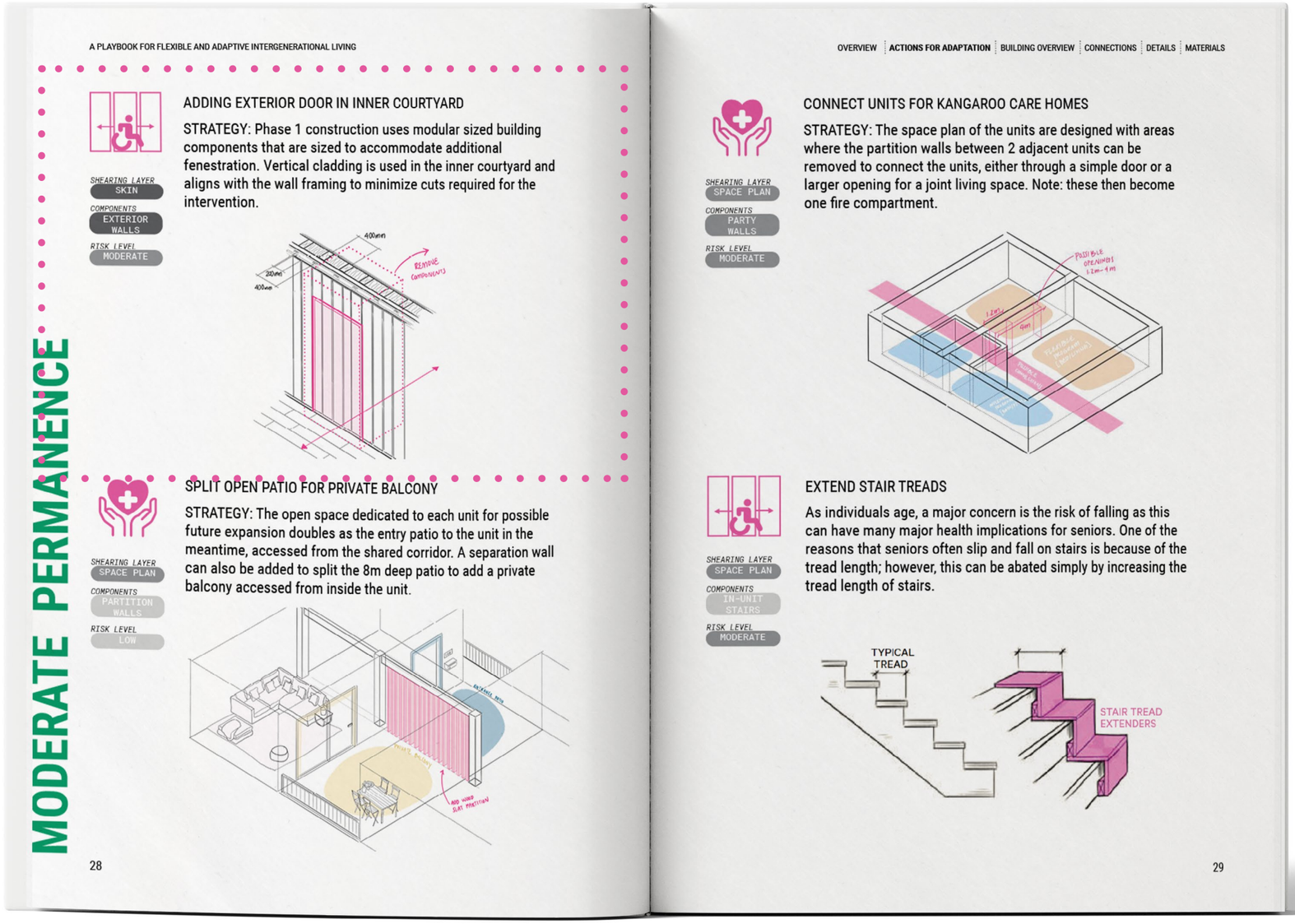




existing living situation

MEDIUM-TERM SCENARIO: The Massen Family [Duplex 4-Bedroom Unit]
Their adult daughter moves back in temporarily after collage

ACTION: she takes her upstairs bedroom but also wants privacy for when she comes and goes so the family decides to open up a secondary door to the courtyard, then when she eventually moves out, the upper unit can also be rented out



LETS PLAY THE PLAYBOOK ! (2)

ASSEMBLY CONCEPT

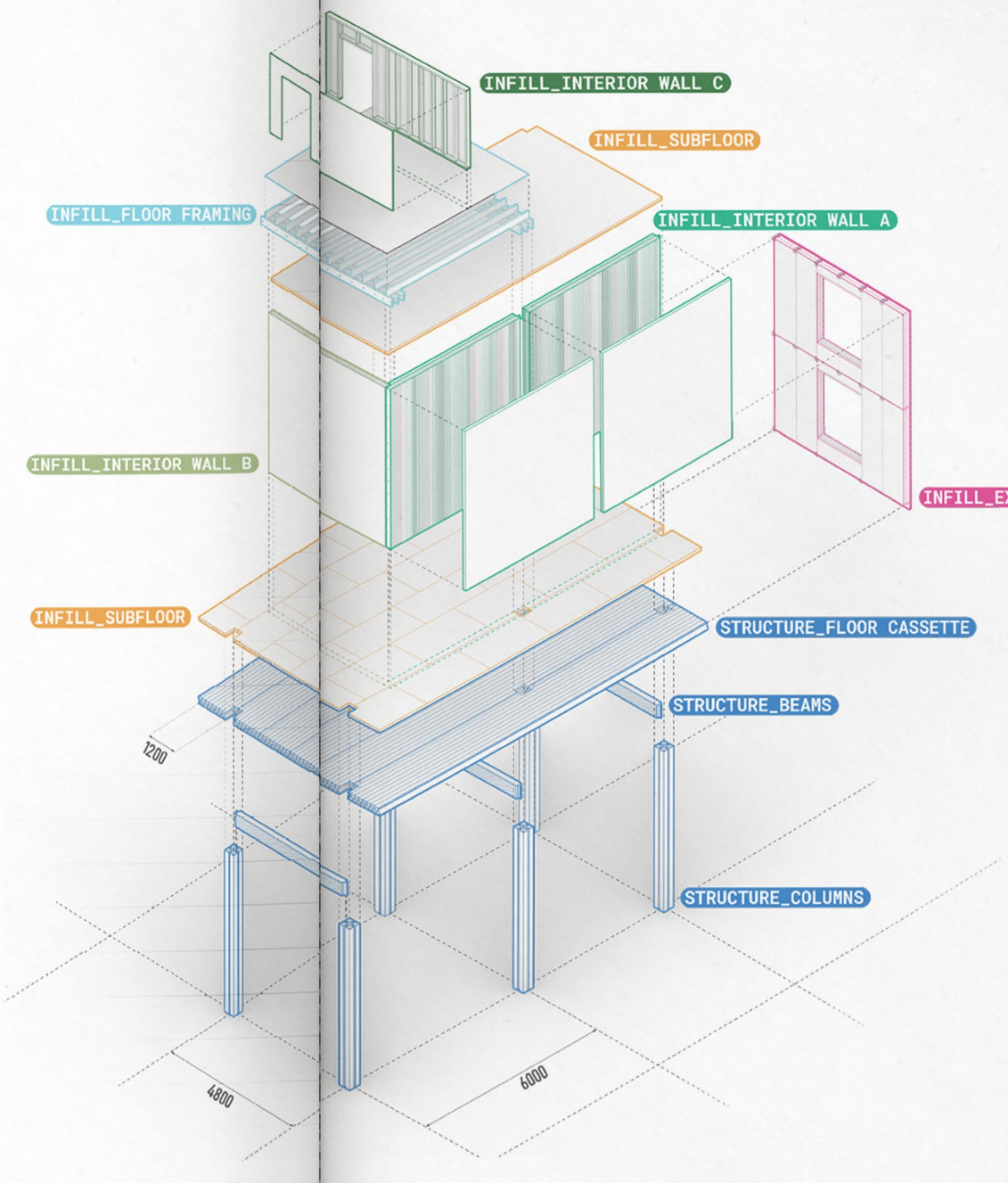
The assembly strategy is based on the principles of the Open Building concept, with the more permanent support structure and short-term, user-adaptable components -- the infill. The strategy follows a layered subsystem approach, where building systems are treated as independent, mono-functional layers. This enables components—such as load-bearing elements, installation zones, and spatial enclosures—to operate separately, allowing for individual adaptability, maintenance, and replacement over time.

The supporting structure acts as the permanent framework for the building. Structural floors are constructed with Kielsteg floor cassettes, which have a high strength-to-weight ratio. These span between beams that connect to stacked columns across each floor for efficient load transfer and structural continuity.

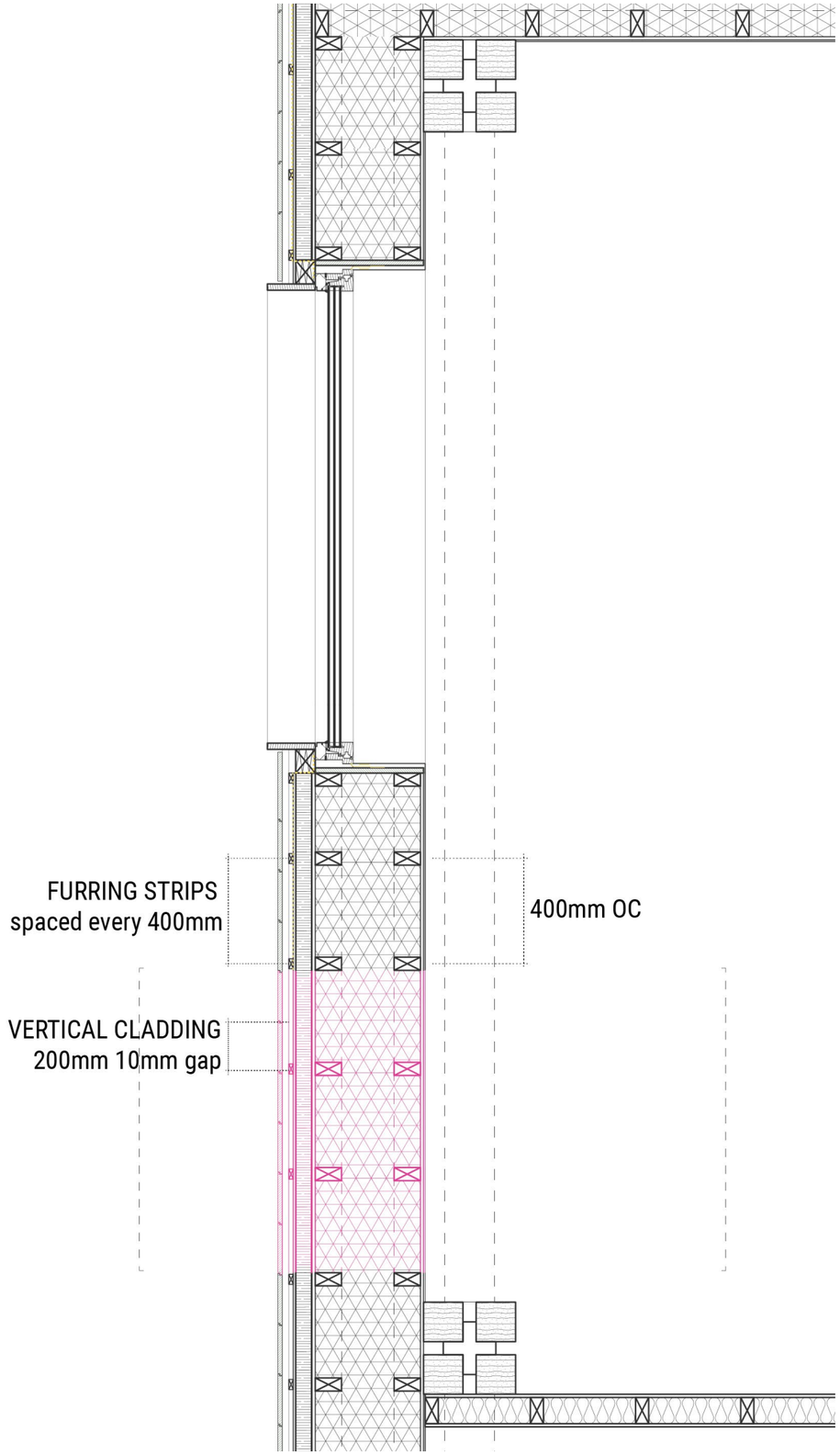
The design prioritizes fire safety through the integration of solid DLT partition walls with decoupled, double-leaf constructions. Fire compartments are defined by offset joints or interlocking panels at wall junctions.

Interior partition walls are flexible in layout but generally correspond to the structural grid, allowing for a degree of layout variability without compromising structural logic. The infill components—such as partition walls, facades, and installation layers—are conceived as replaceable and non-destructively demountable units.

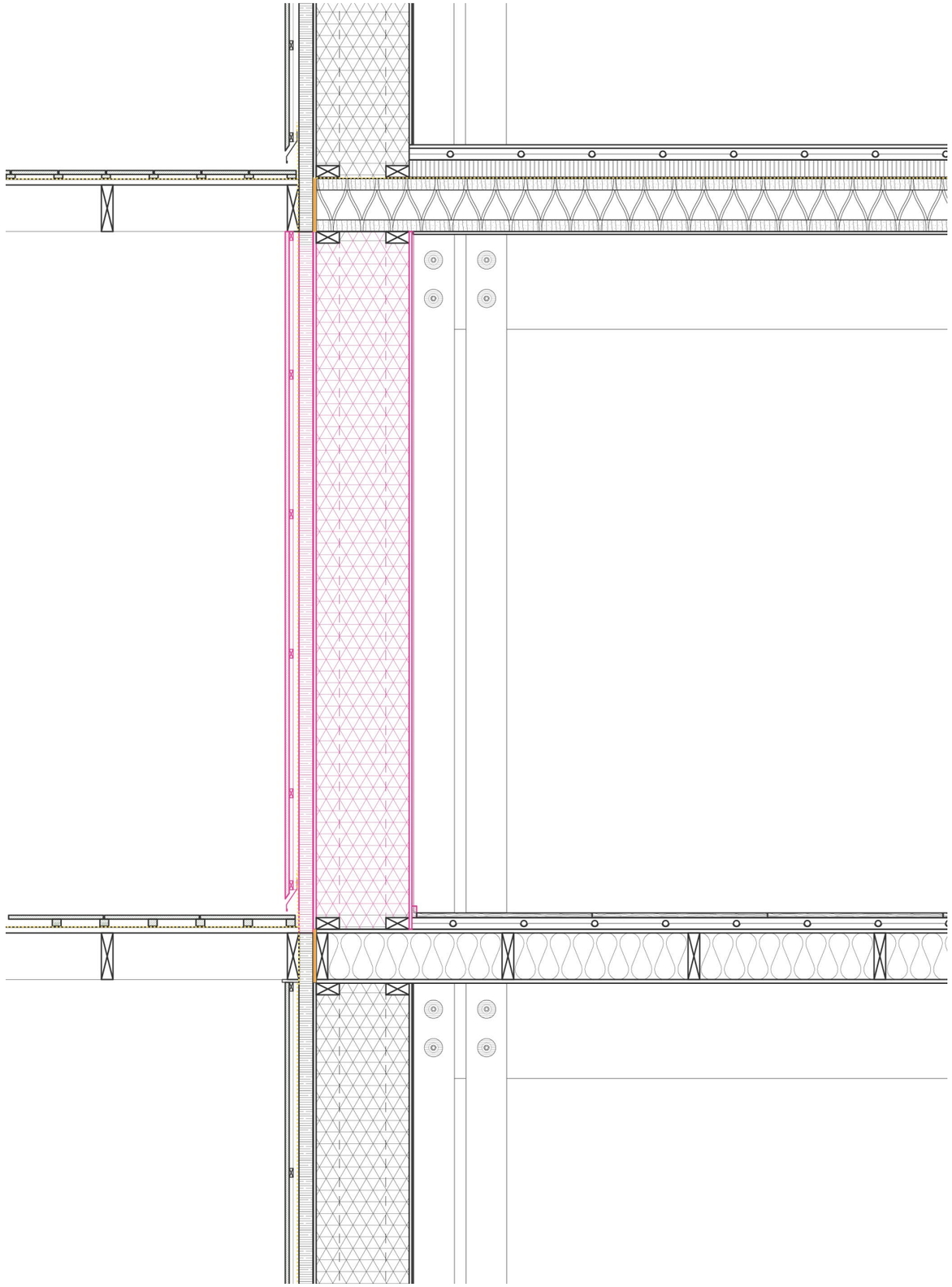
By minimizing fixed connections between layers, this strategy ensures a high degree of flexibility and adaptability throughout the building's lifecycle. It supports phased transformation and user-driven adaptations.



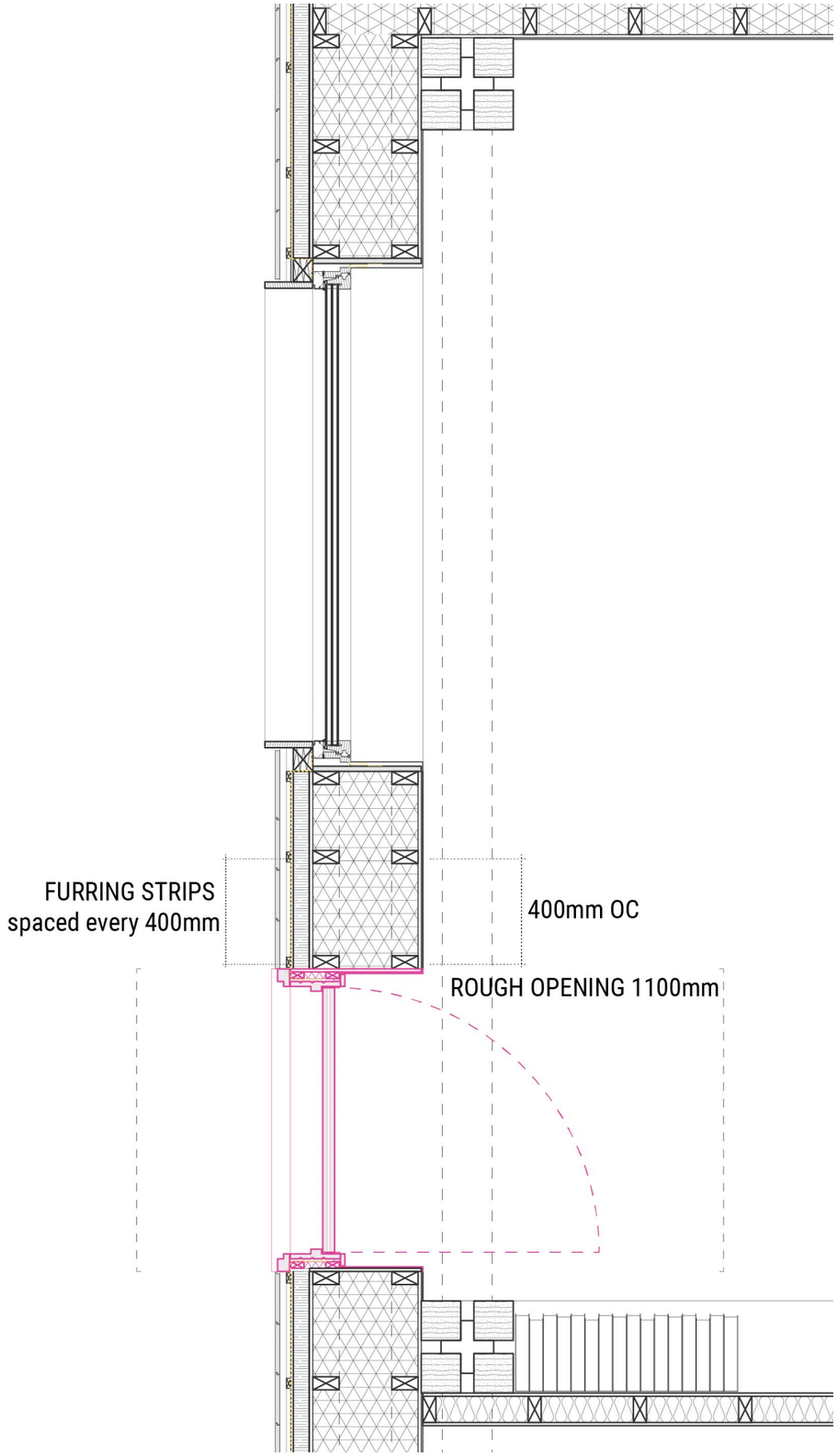
LETS PLAY THE PLAYBOOK ! (2)



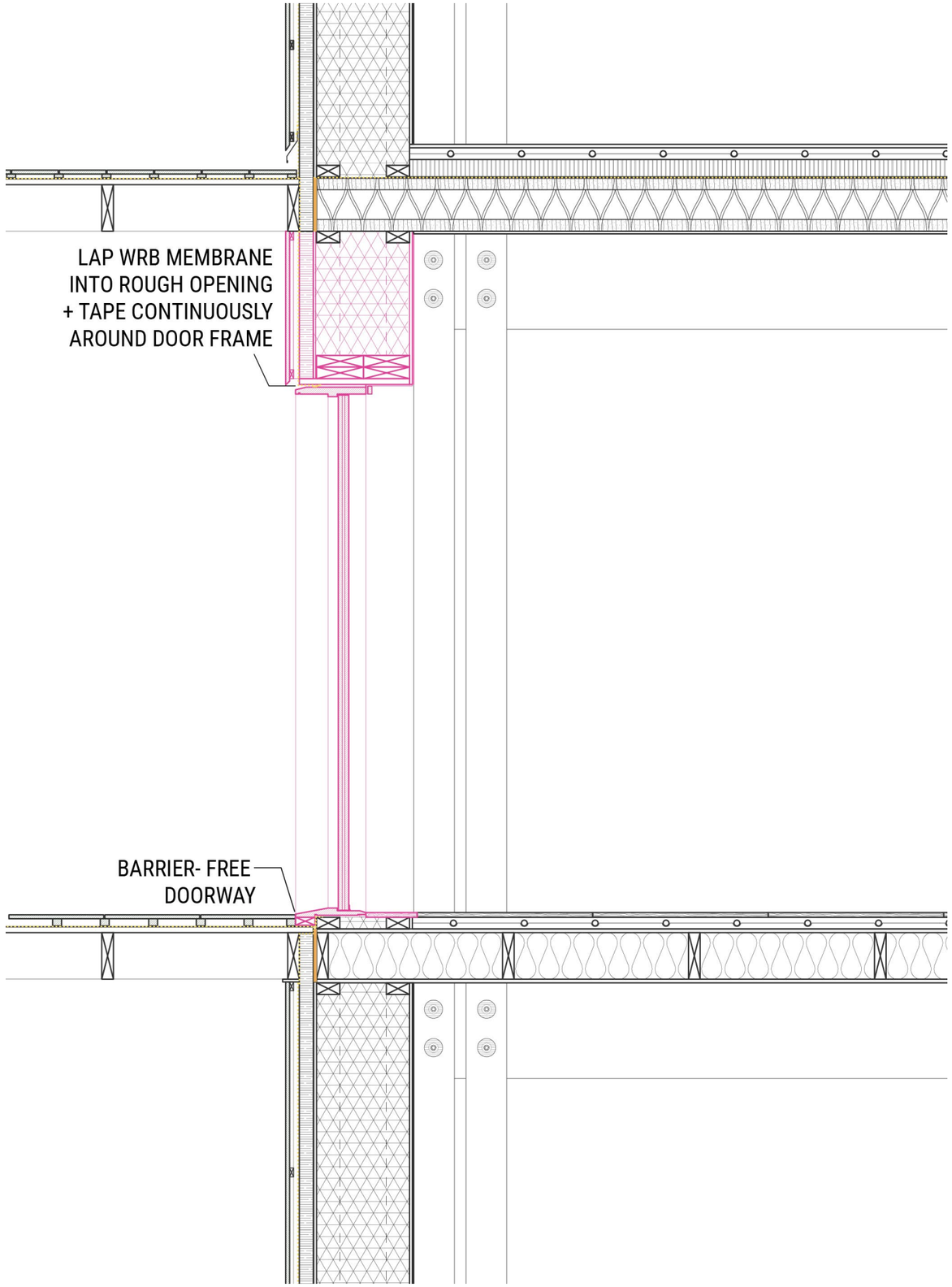
existing condition plan 1:20



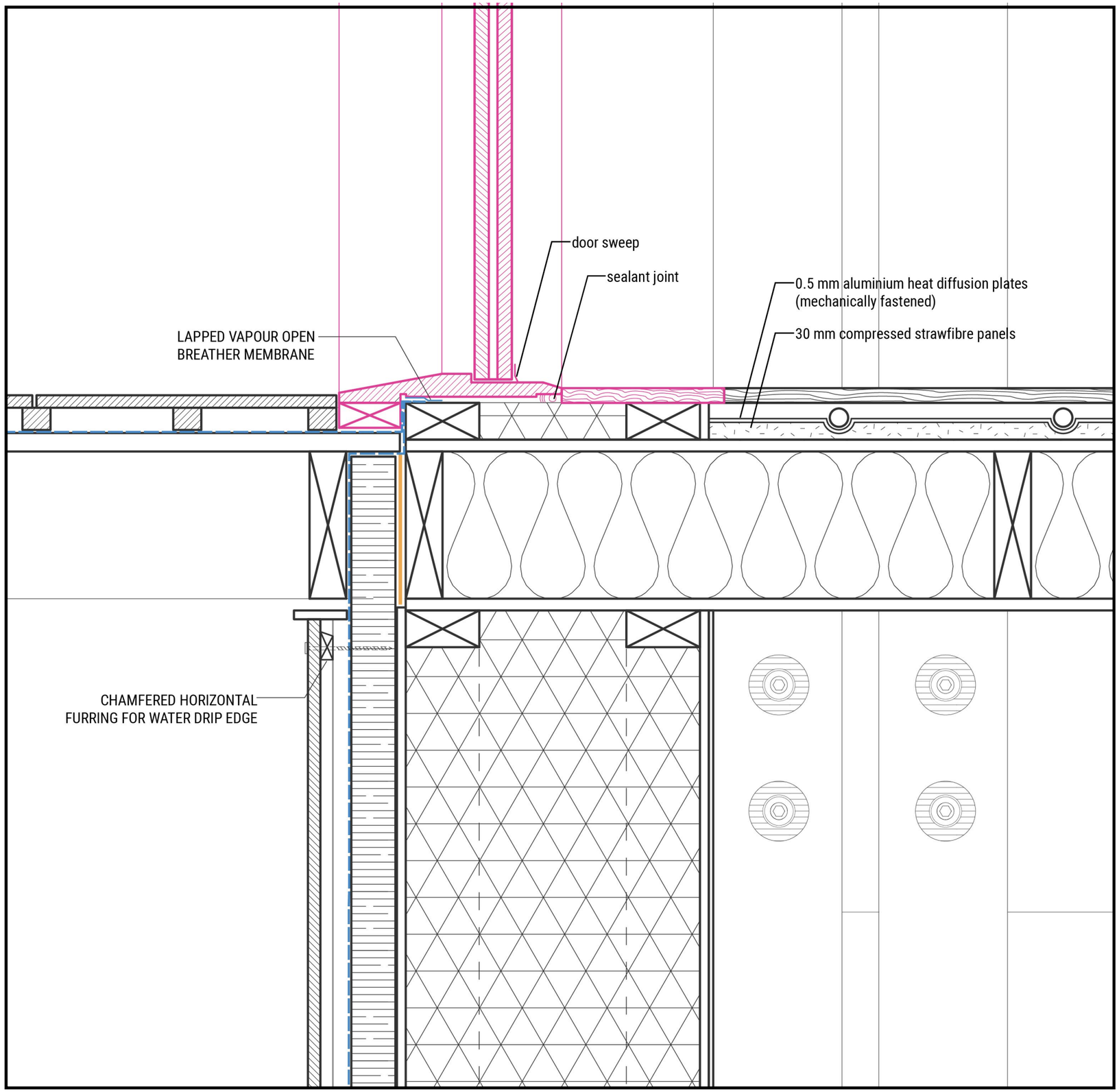
existing condition section 1:20

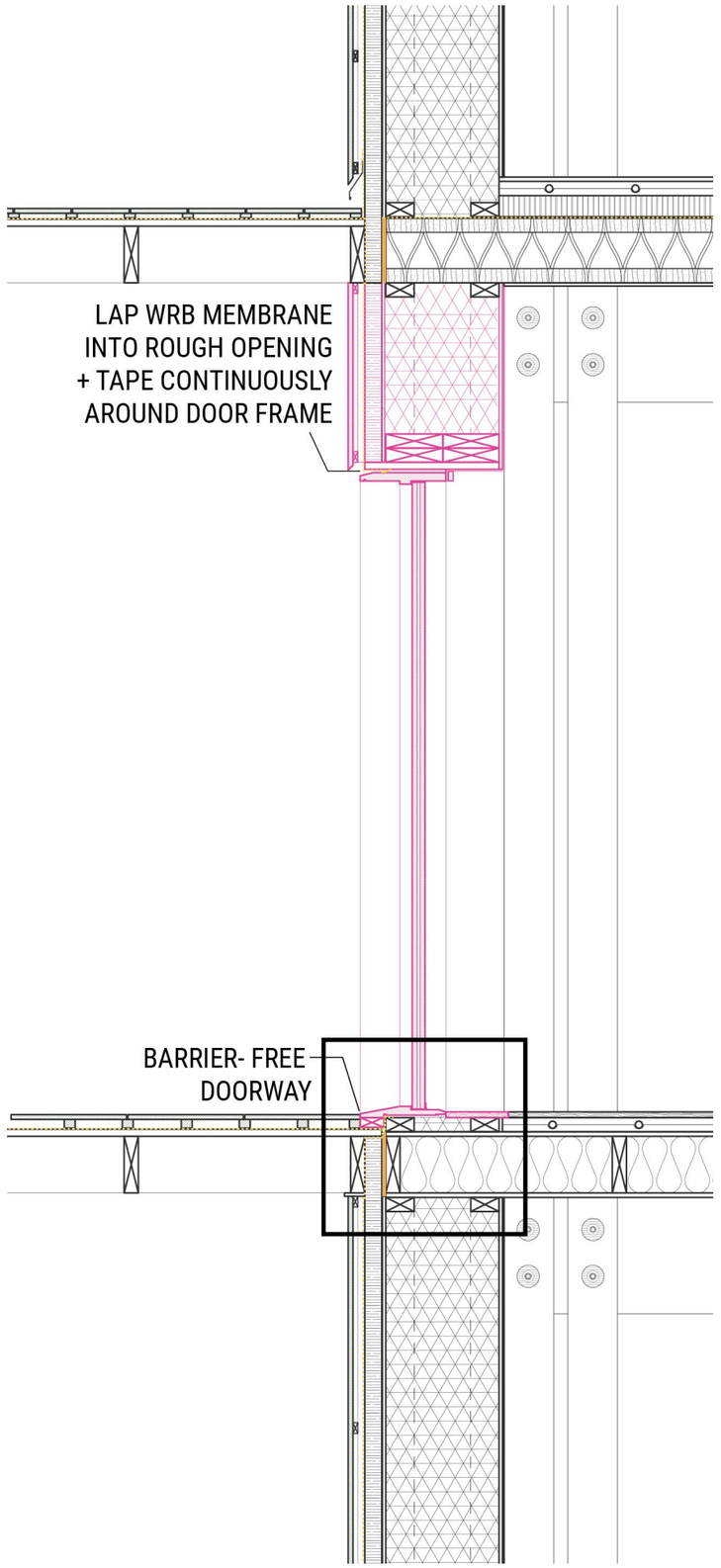


adapted scenario plan 1:20



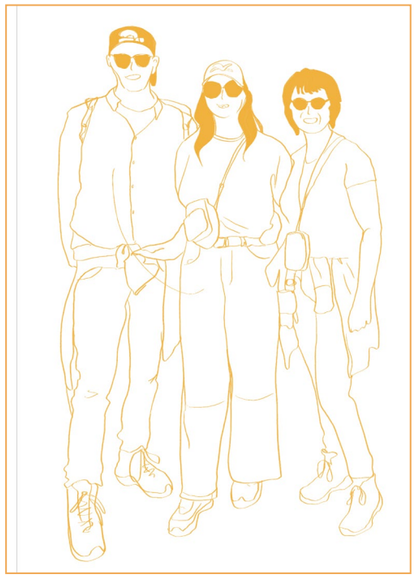
adapted scenario section 1:20



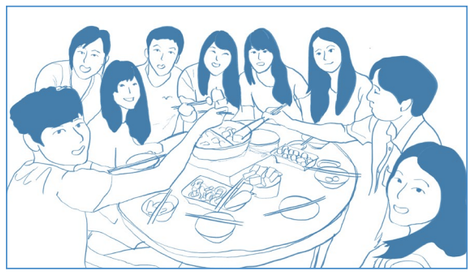


adapted scenario detail 1:5

The Jouhal Family

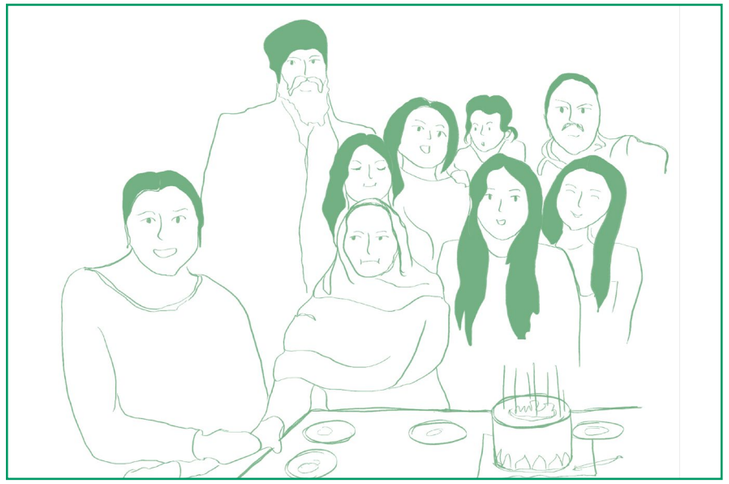


The Massen Family



The Cheuk Family

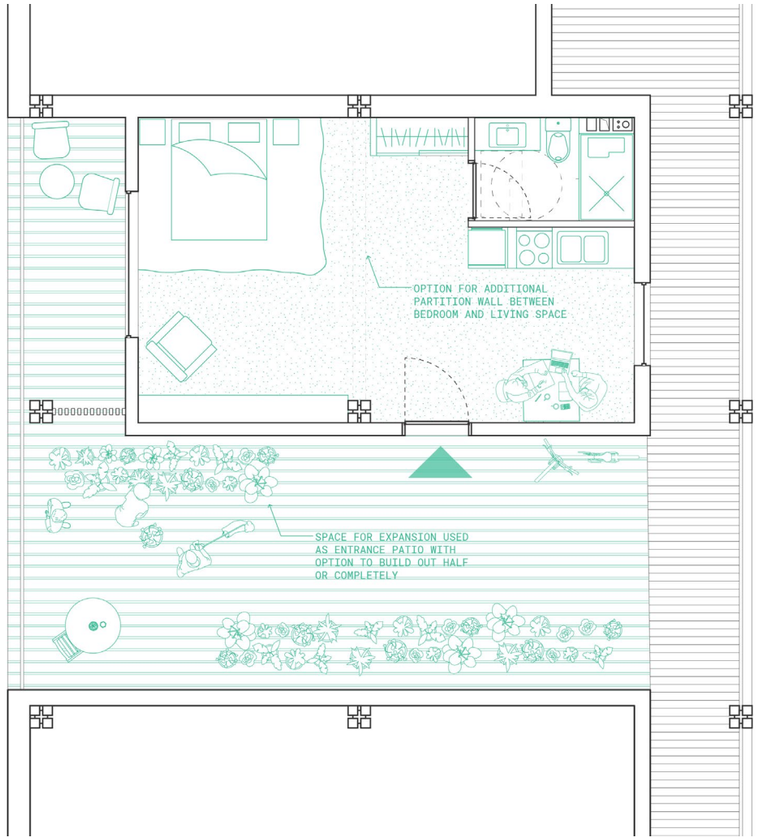
LETS PLAY THE PLAYBOOK !



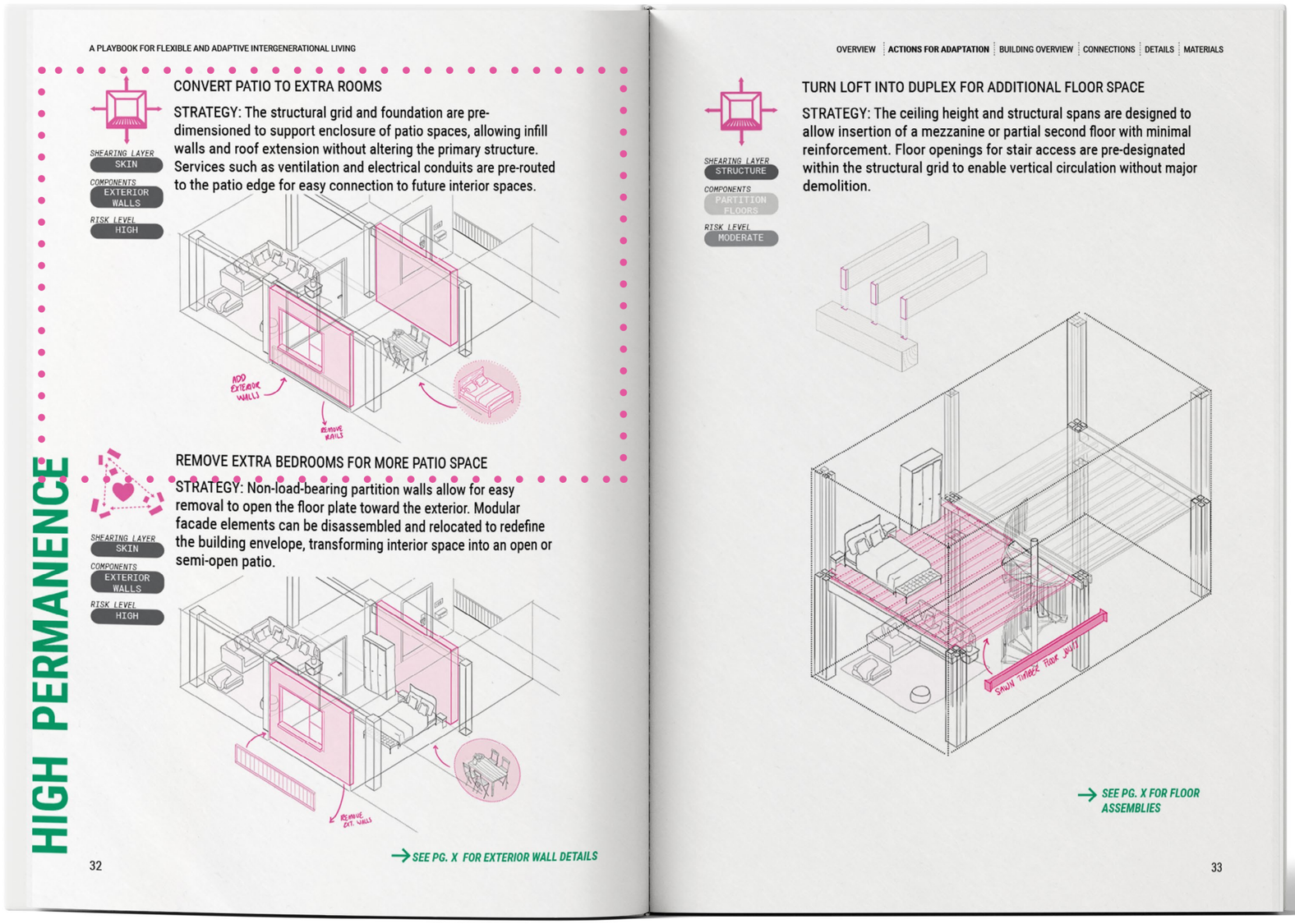
LONG TERM SCENARIO: The Jouhal Family [1-Bedroom Flat]

With relatives already living within the neighbourhood, Harliv and her husband move to a 1 bedroom. As they prepare to welcome a child, the grandparents join them permanently to help raise the children and grow old close to family.

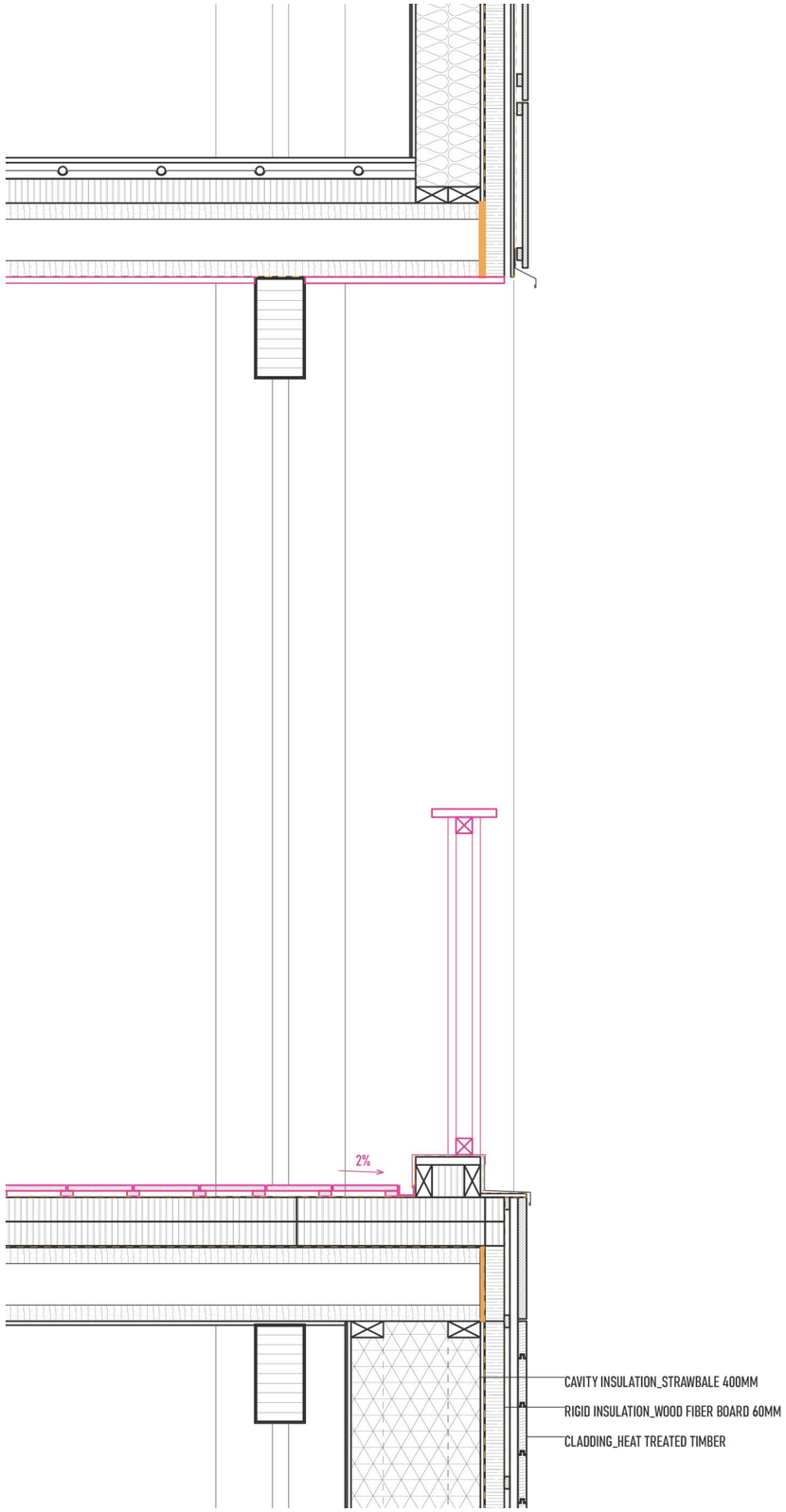
ACTION: convert patio to create 2 new bedrooms

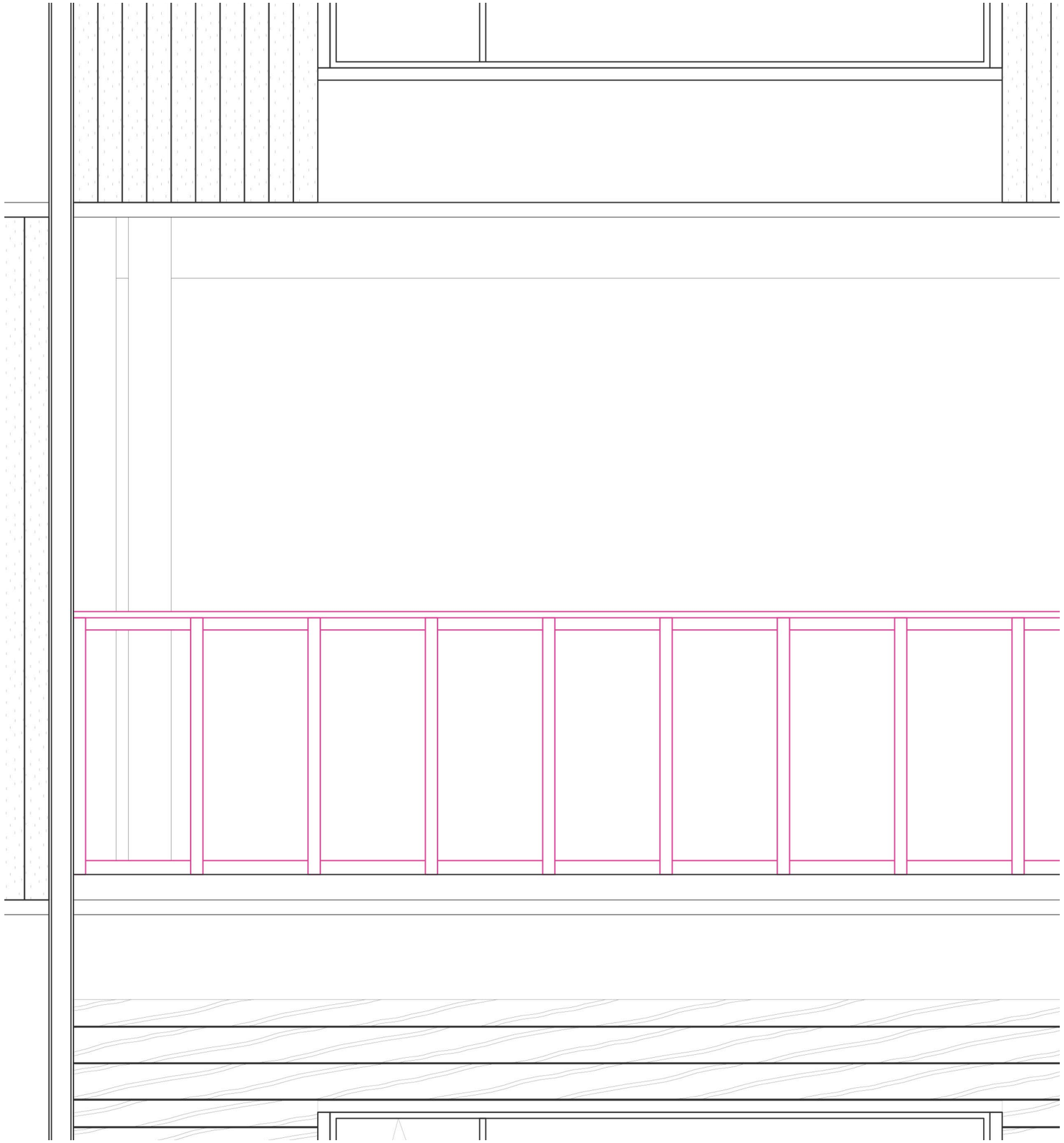


existing living situation

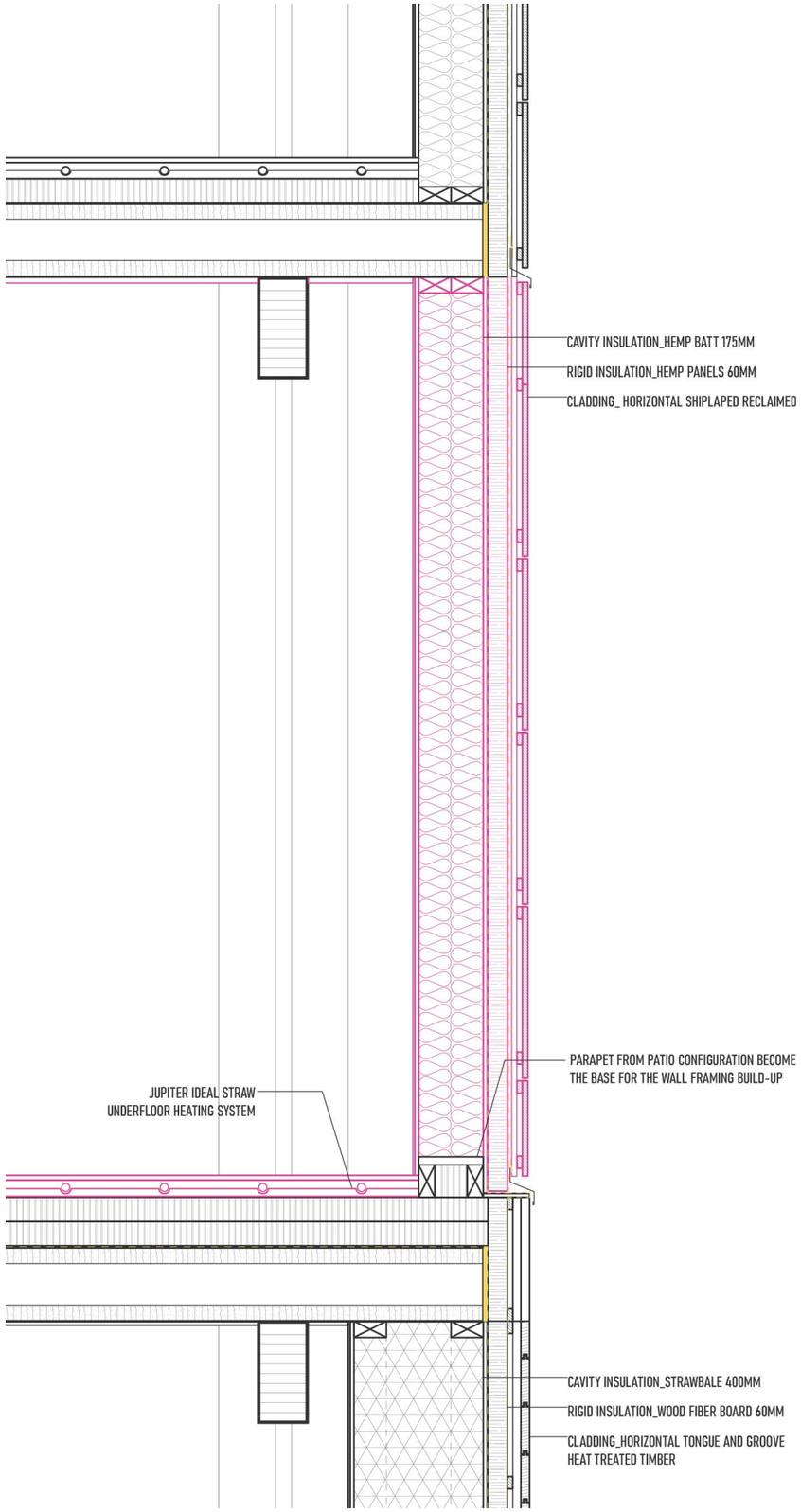


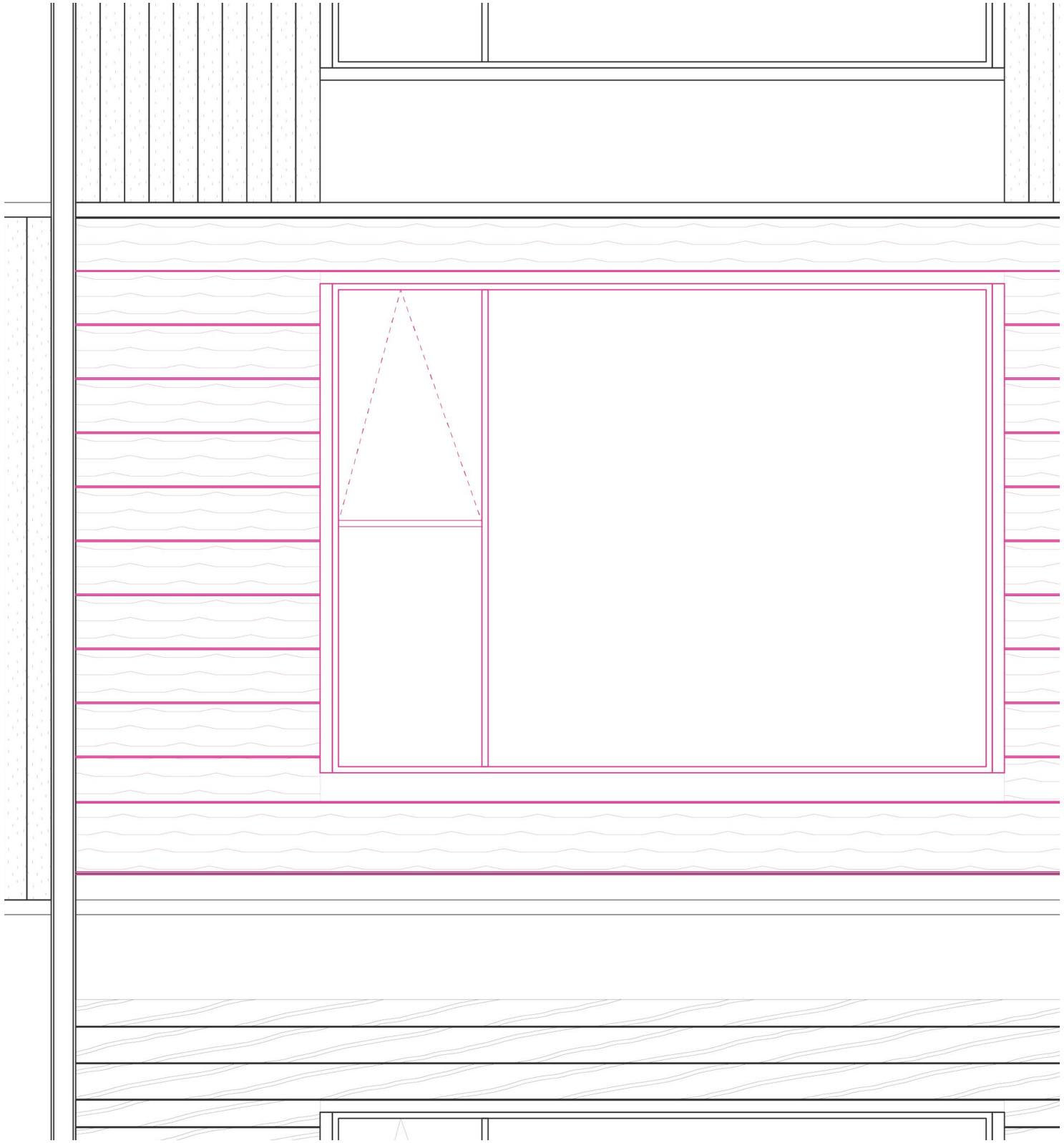
LETS PLAY THE PLAYBOOK ! (3)



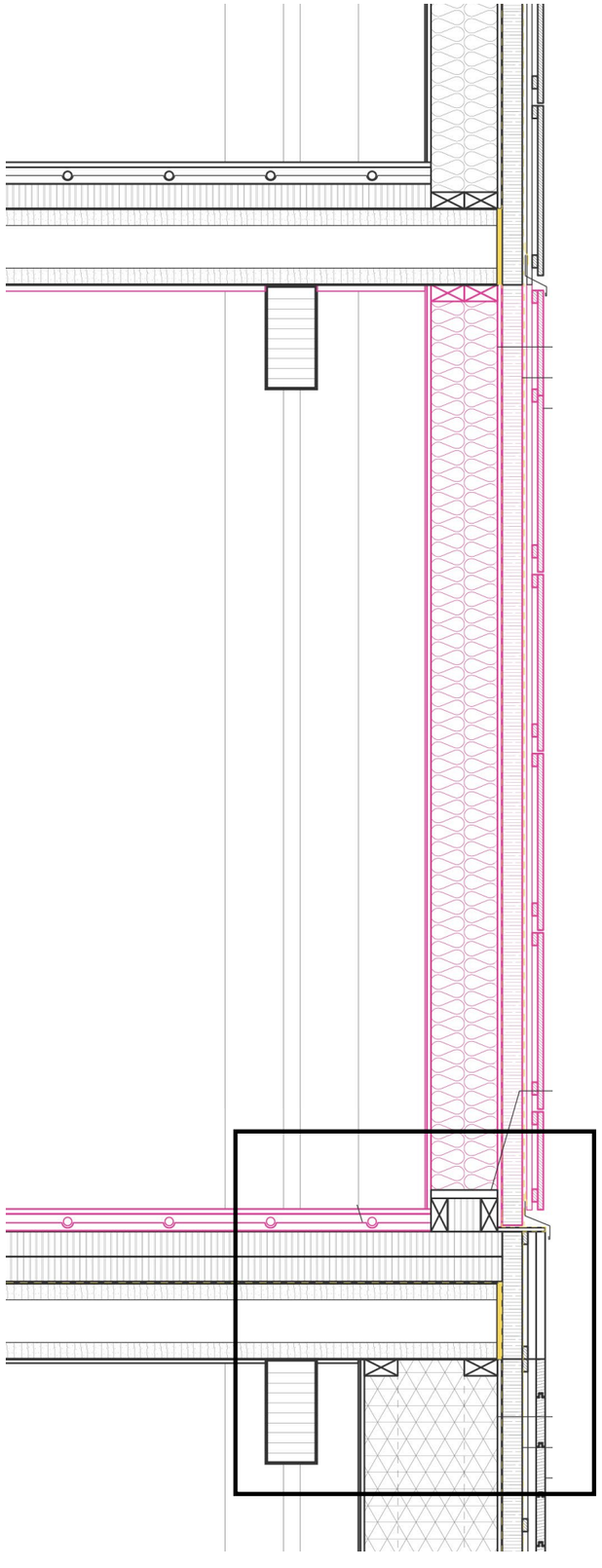


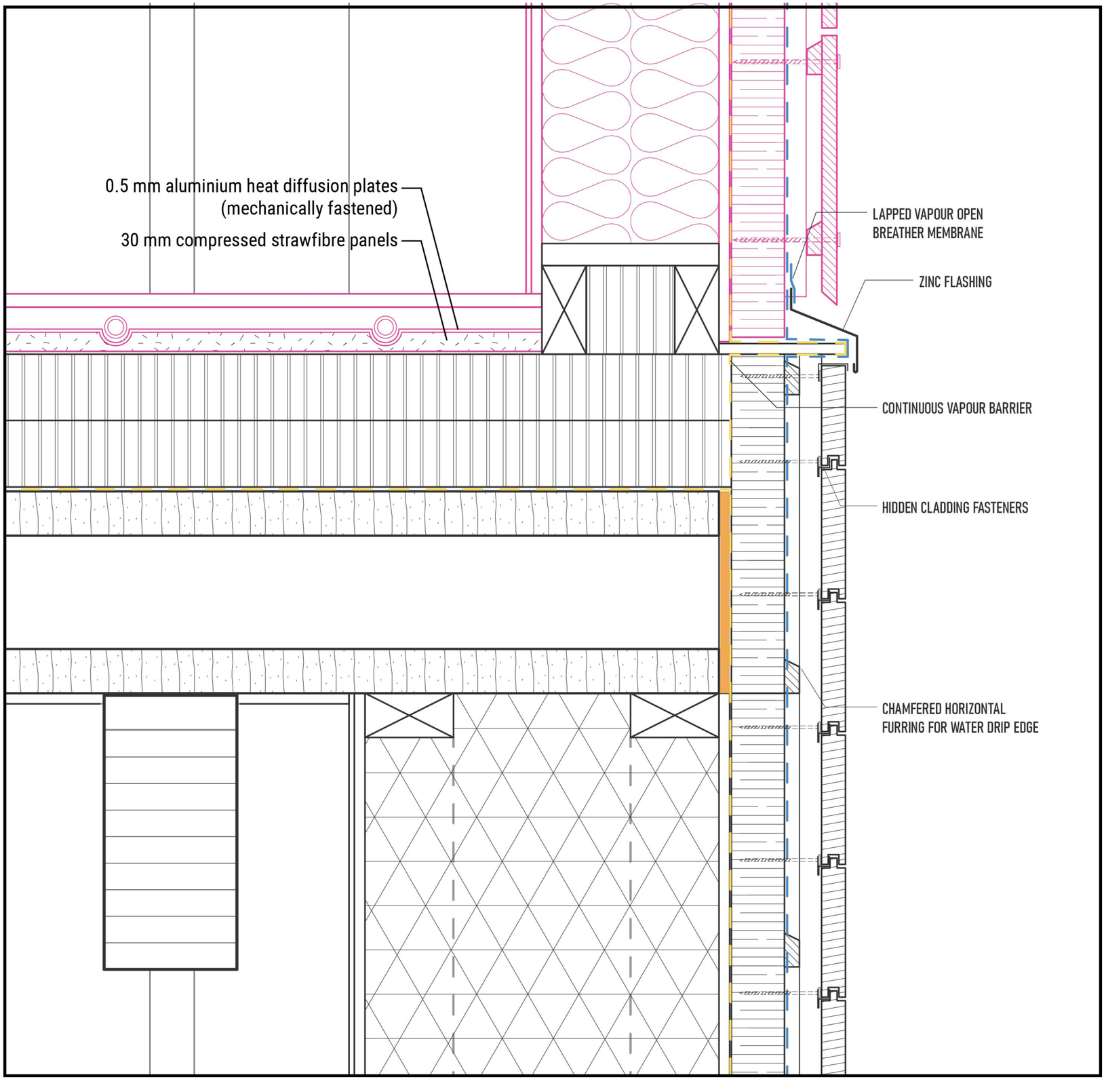
SCENARIO 3_ patio configuration



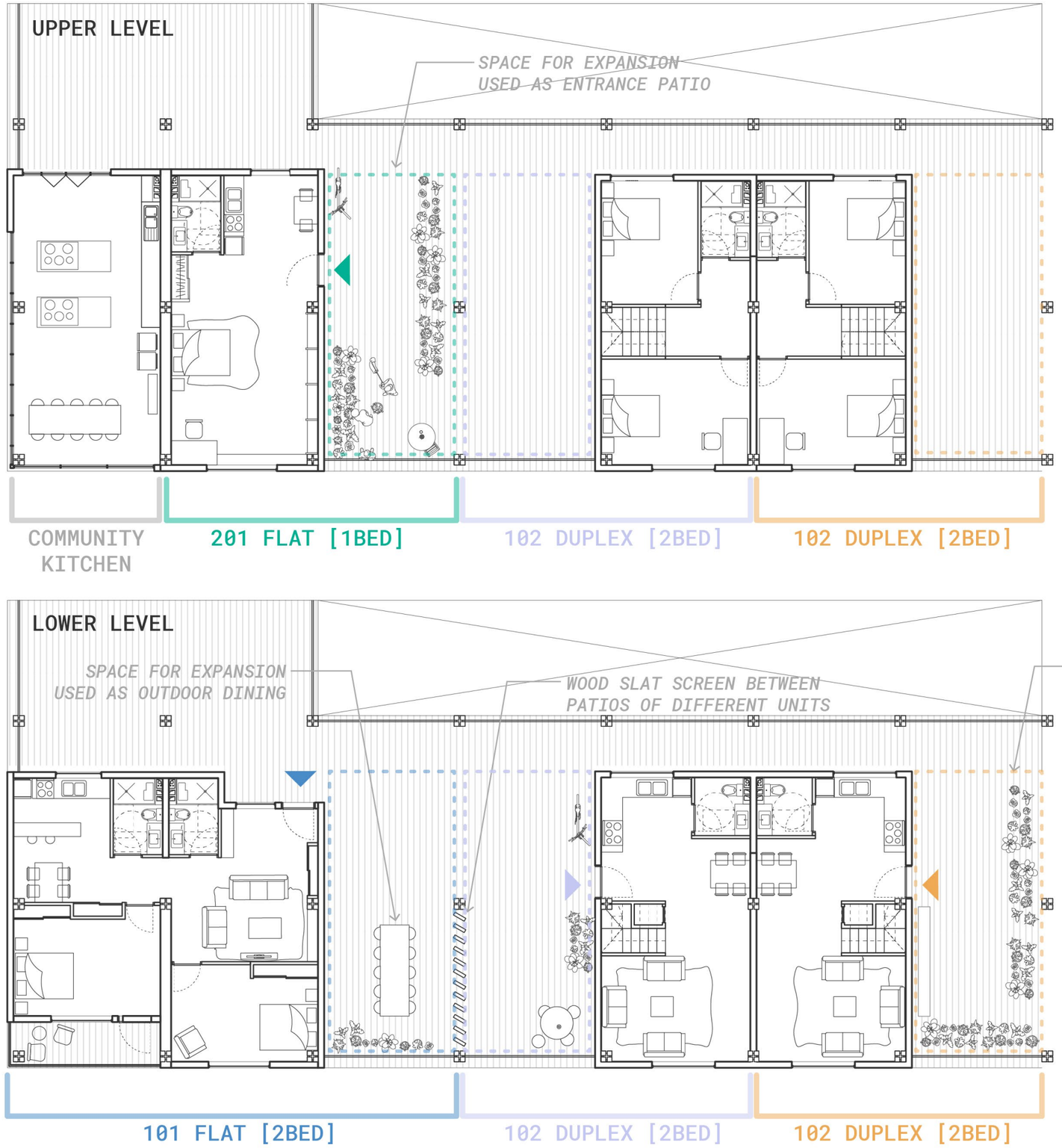


SCENARIO 3_ room configuration

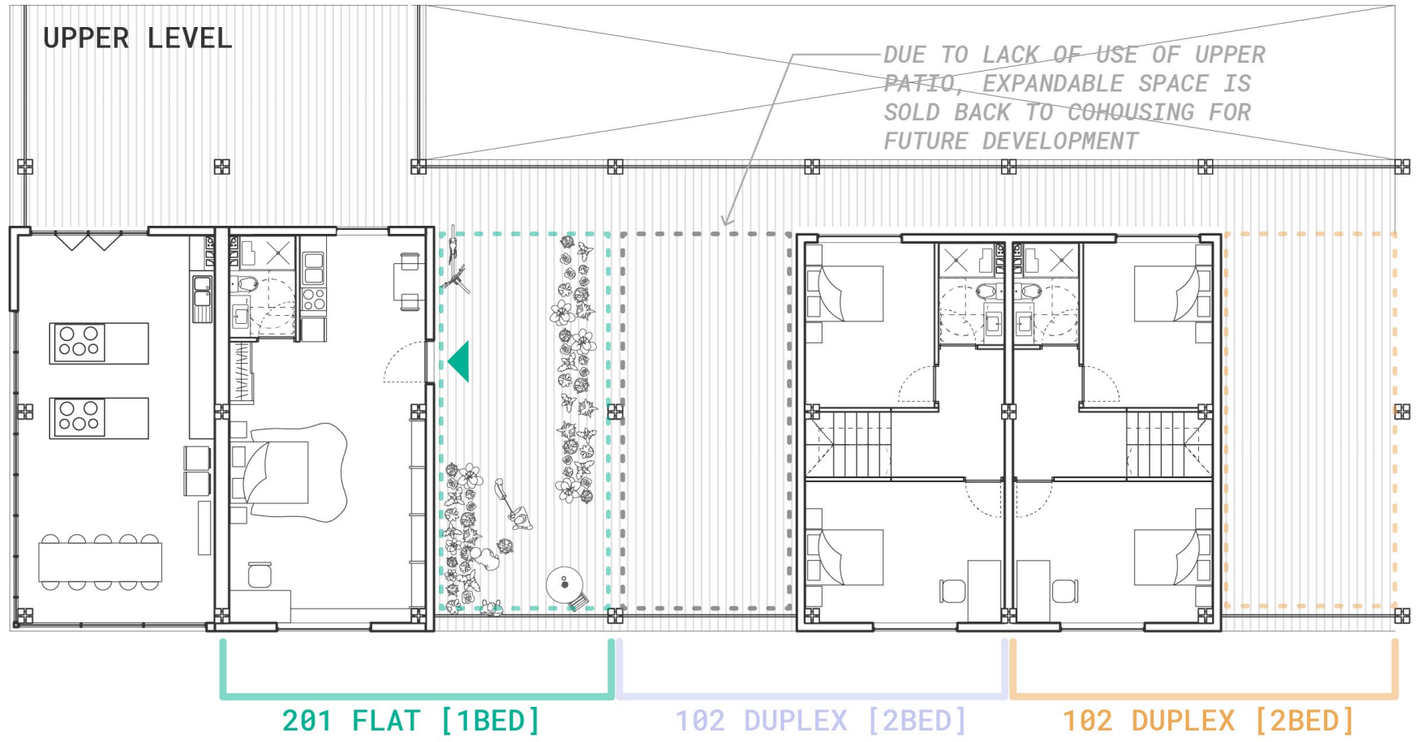




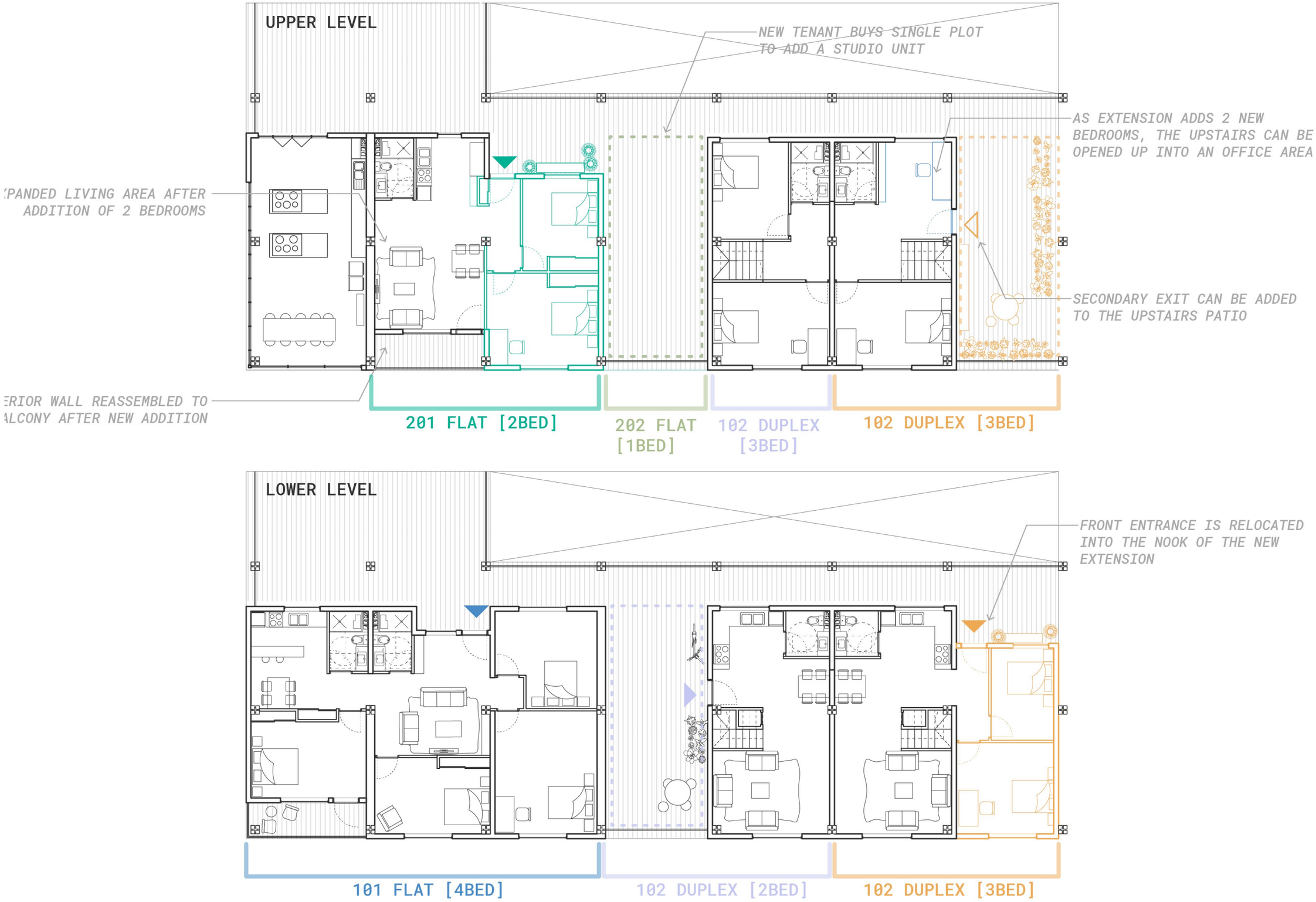
adapted scenario detail 1:5



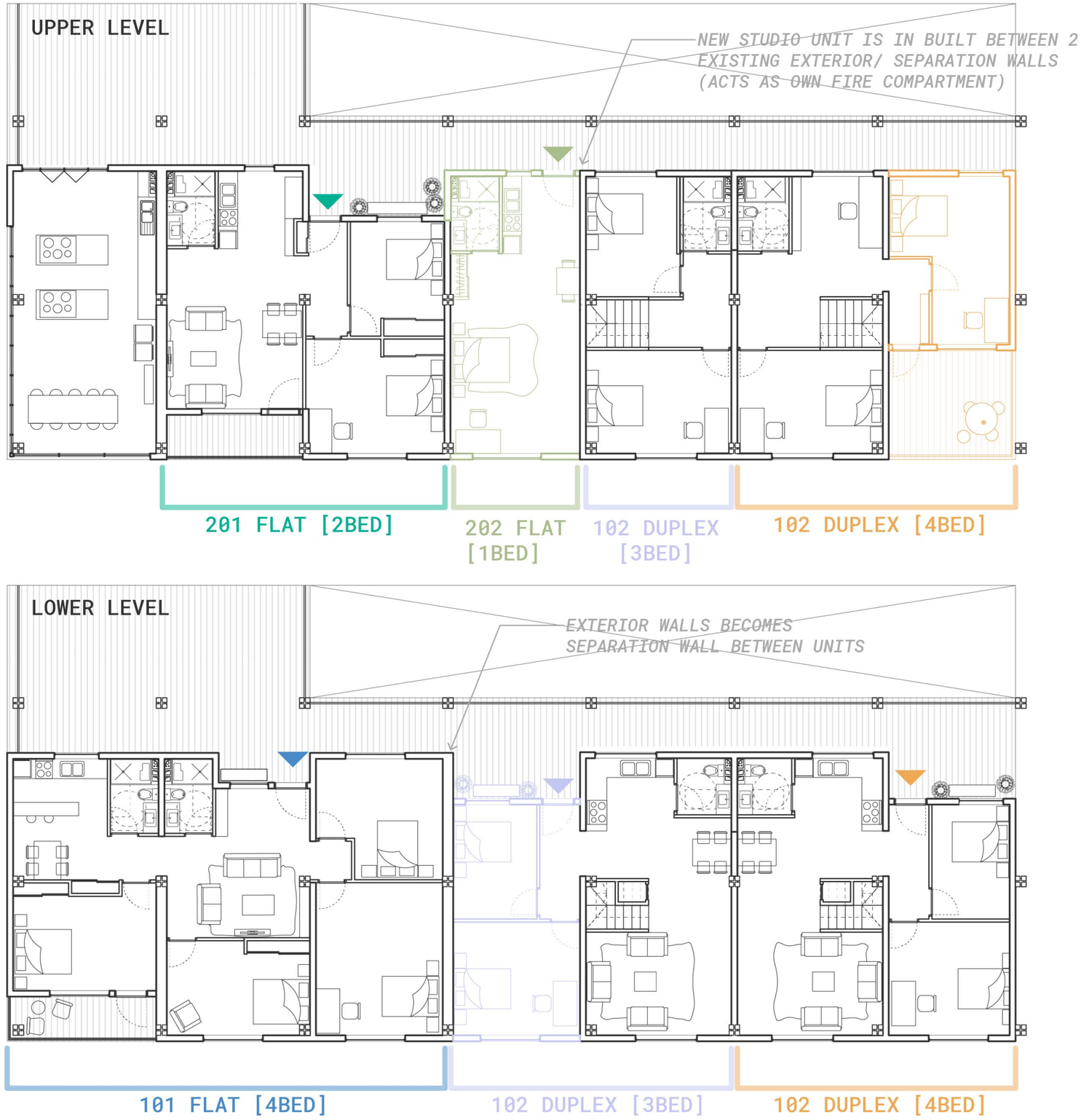
UNIT ADAPTATION OVER TIME (1)



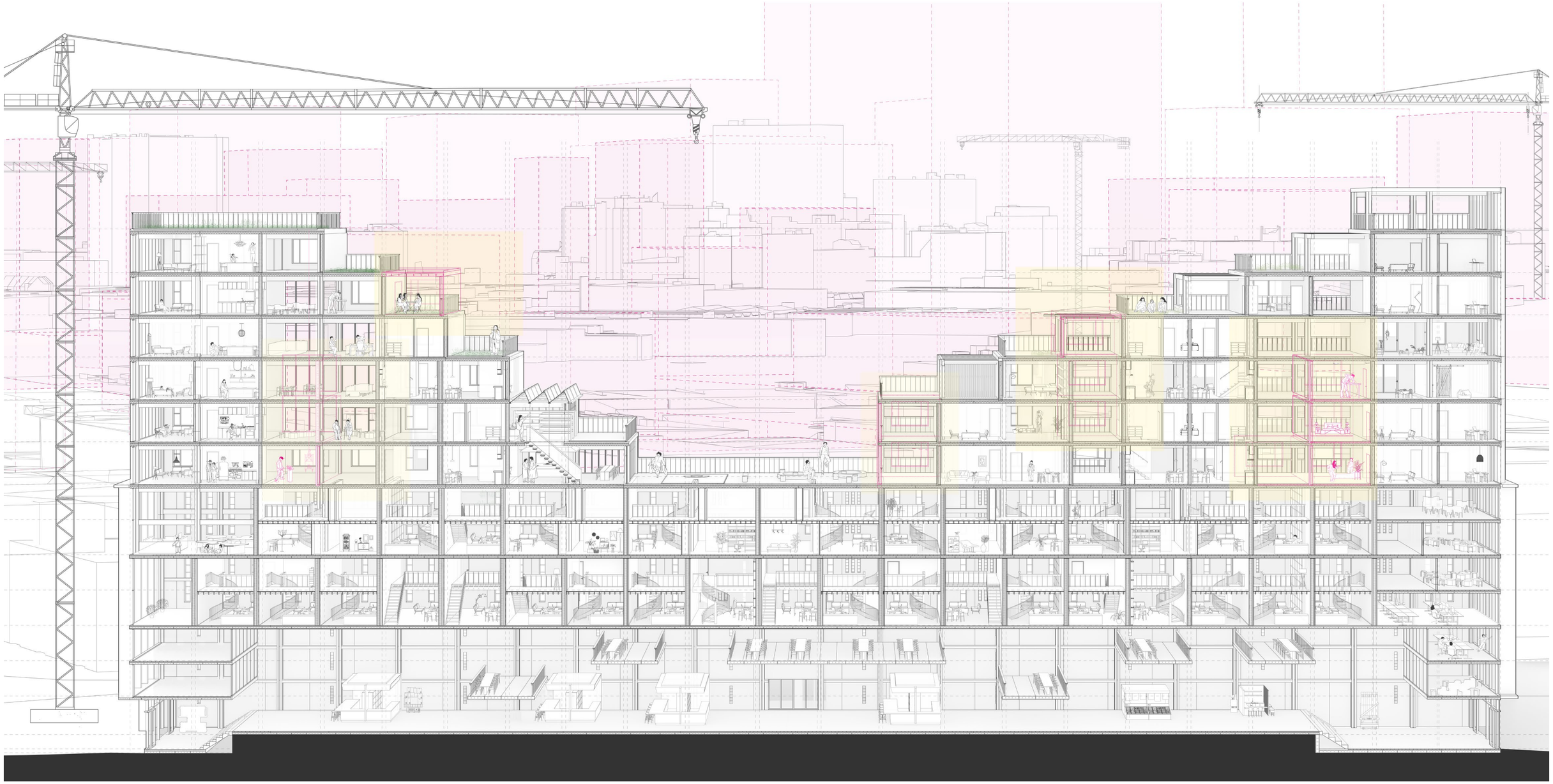
UNIT ADAPTATION OVER TIME (2)



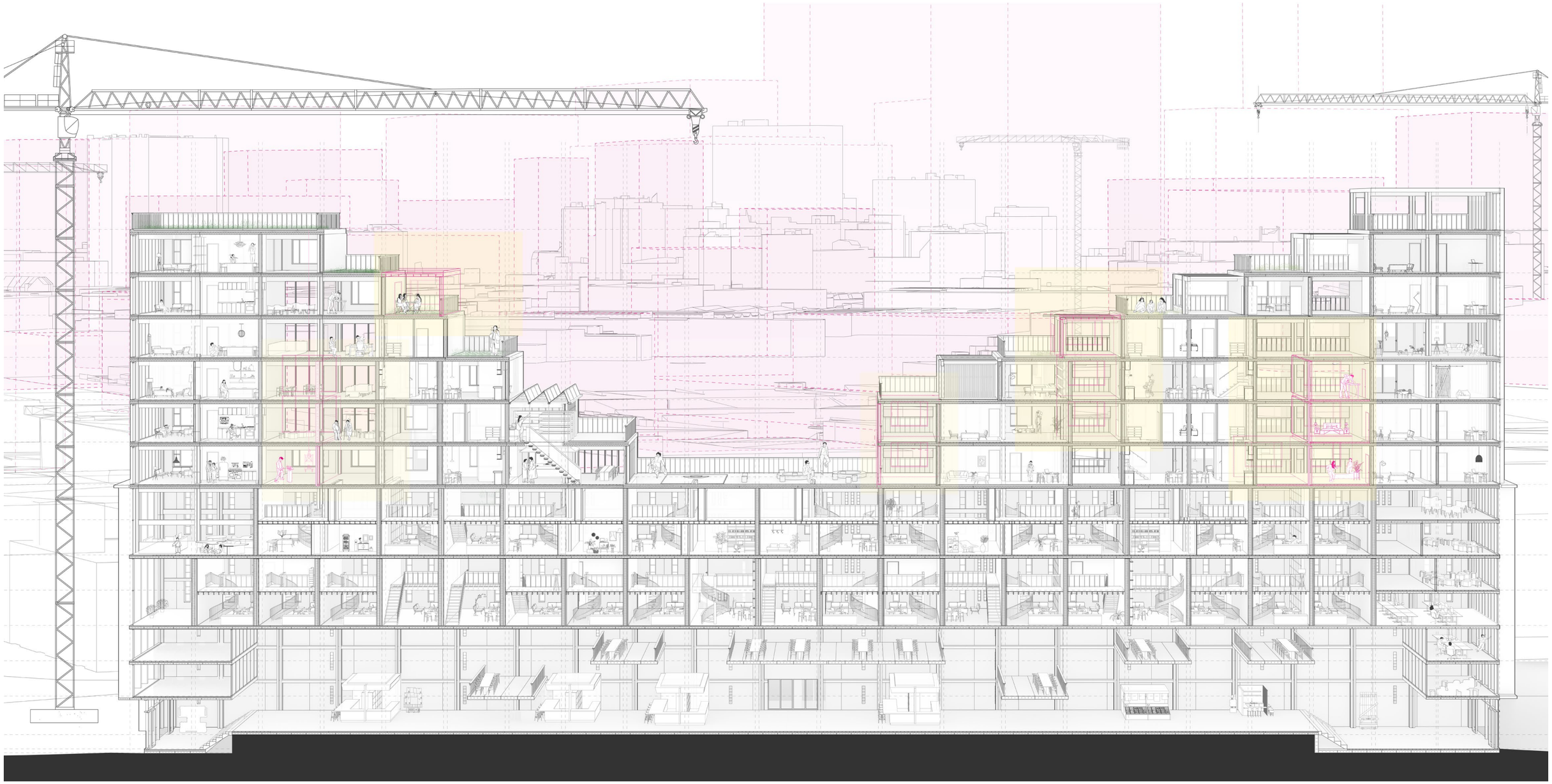
UNIT ADAPTATION OVER TIME (3)



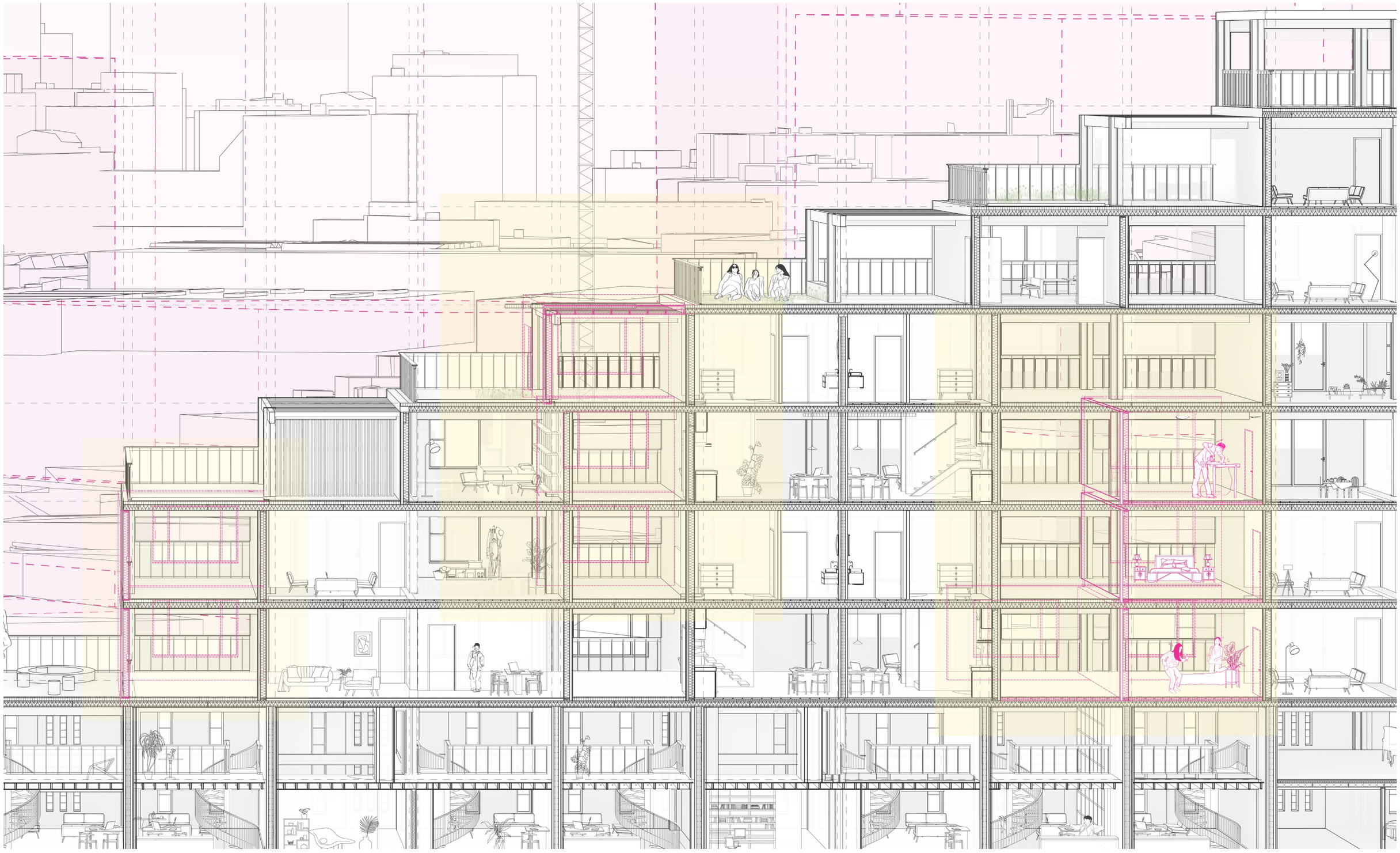
UNIT ADAPTATION OVER TIME (4)



ADAPTATION AT URBAN SCALE



ADAPTATION AT URBAN SCALE



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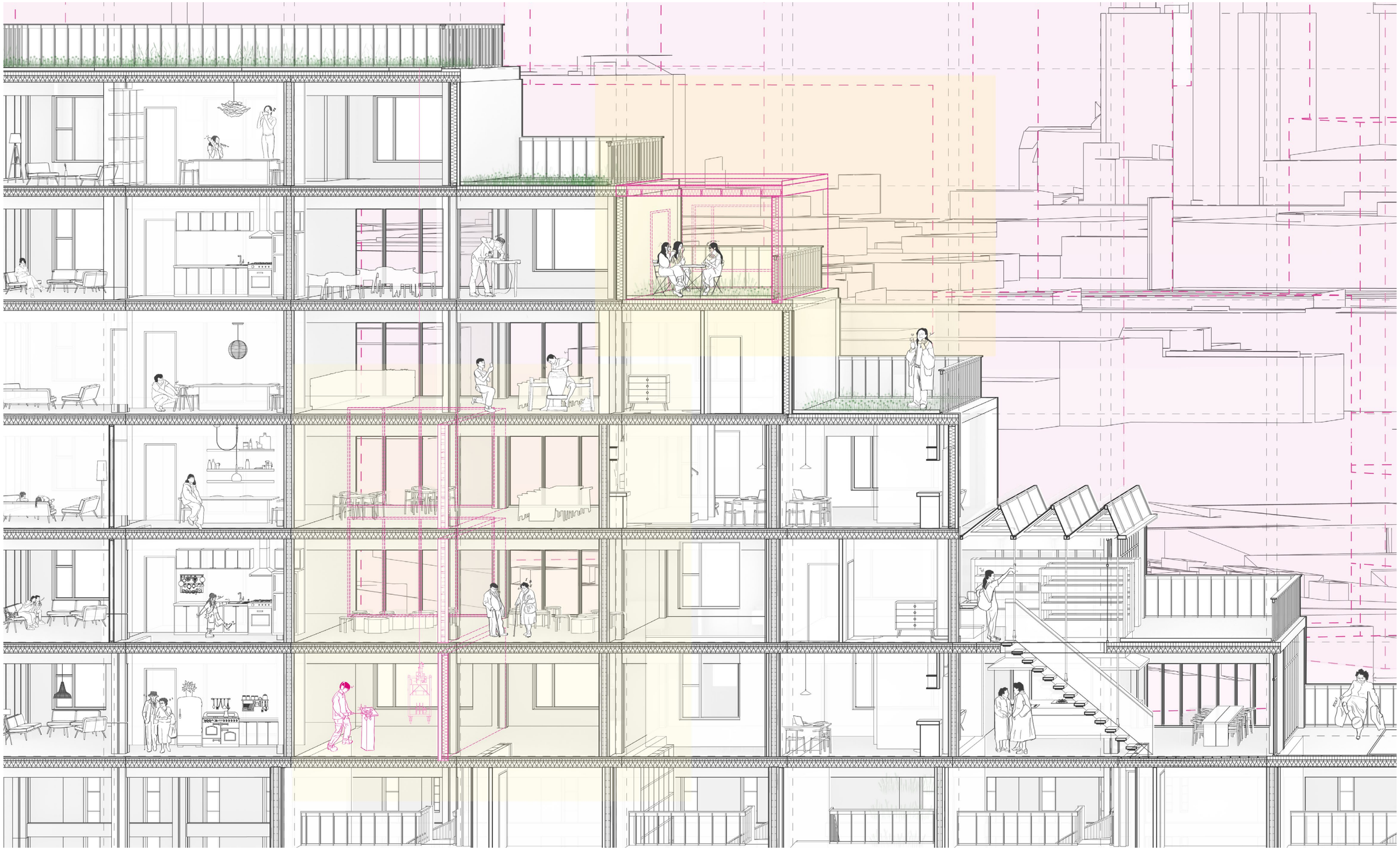
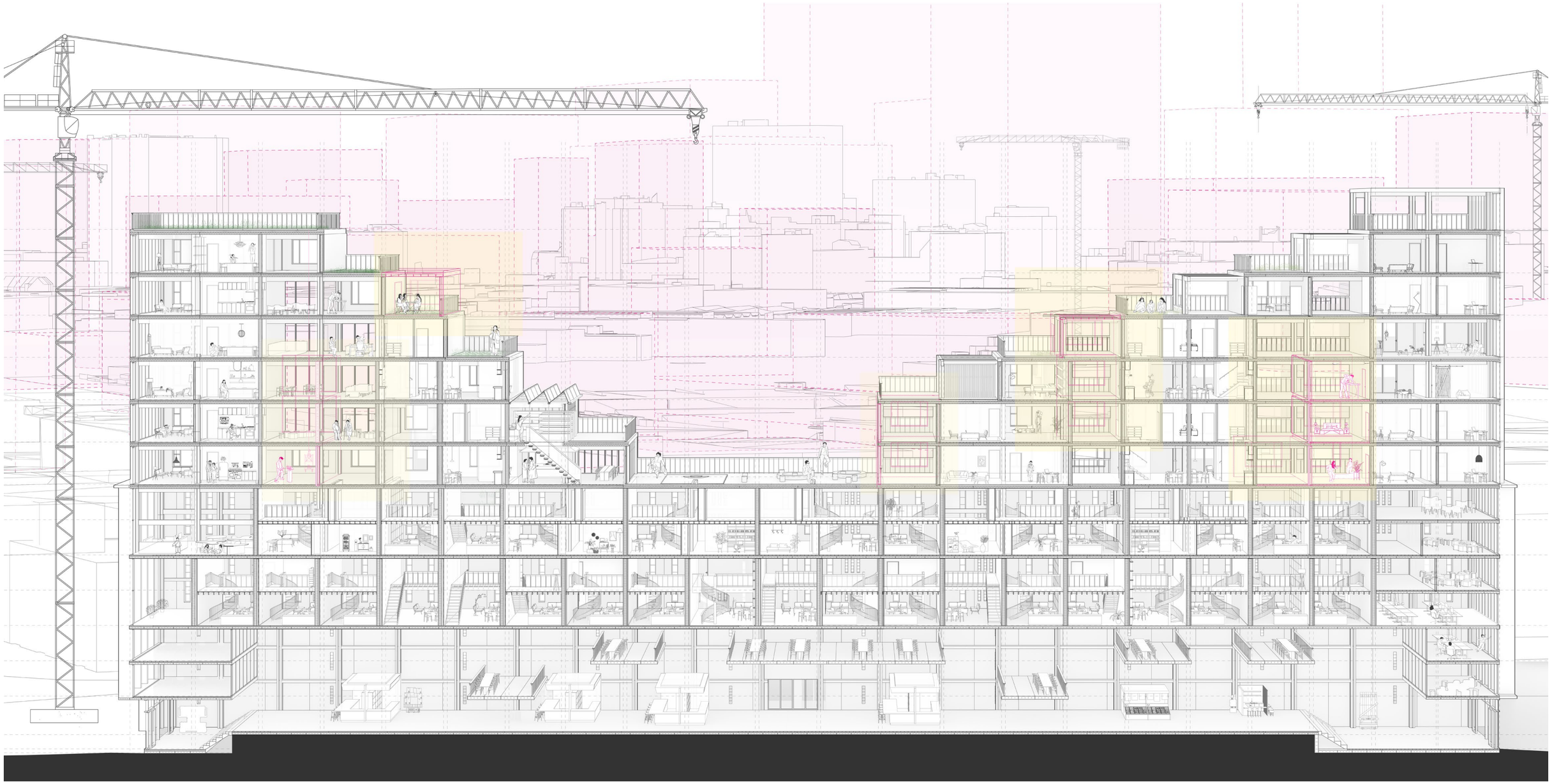
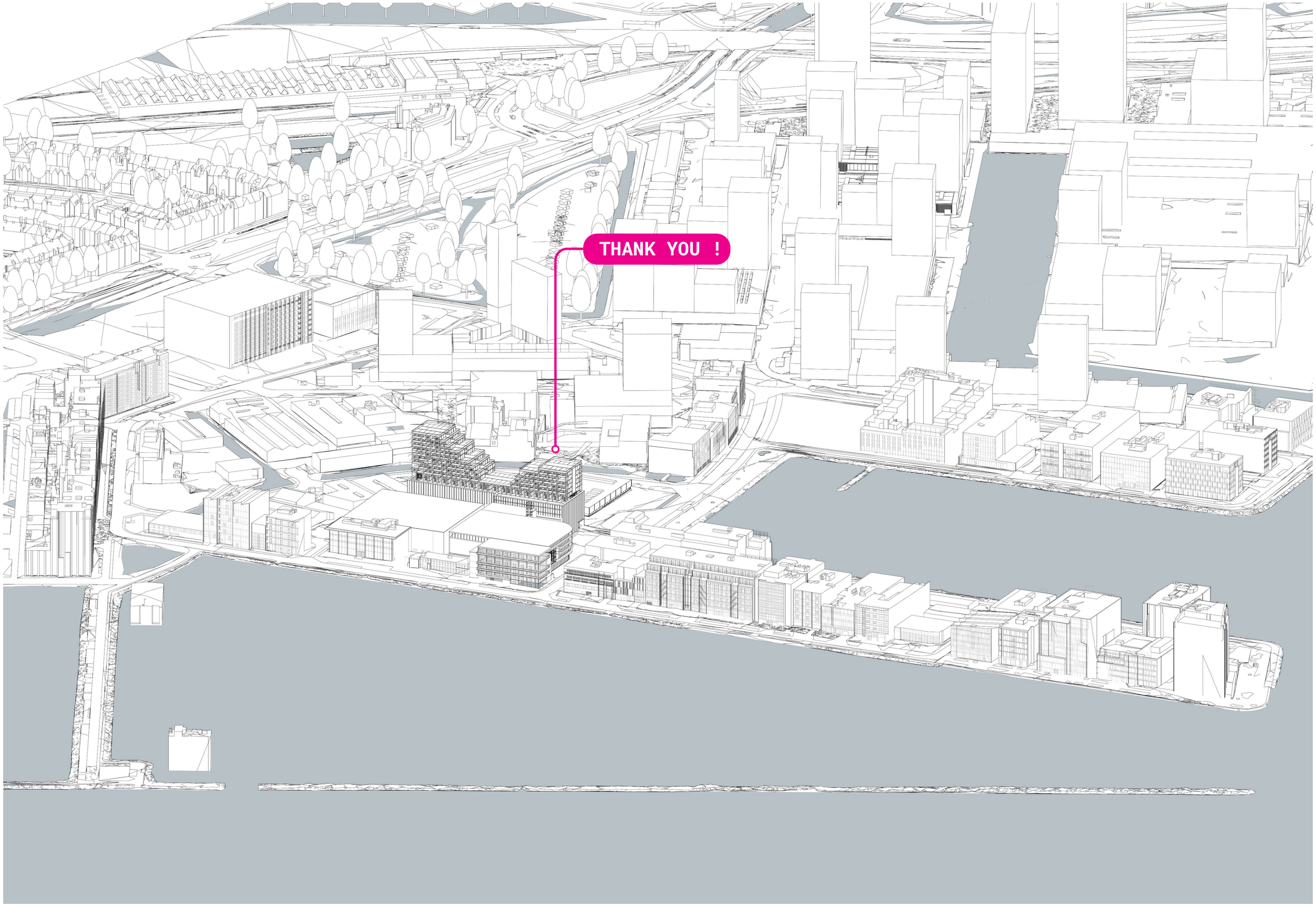


ADAPTATION AT URBAN SCALE



ADAPTATION AT URBAN SCALE


THANK YOU !