P5 PRESENTATION | AE STUDIO

PERSONAL INFORMATION

Randy Rocha (4665856)

Address:

Telephone:

E-mail:

STUDIO

Architectural Engineering (Open Building)

Design tutor: Mauro Parravicini

Research tutor: Hans Hoogenboom

BT tutor: Gilbert Koskamp

Studiochoice:

My way of designing in general is to provide (technical) solutions for environmental and societal problems in the built environment. I see myself as a true architectural engineer and therefore this studio is the best fit for me.

TITLE

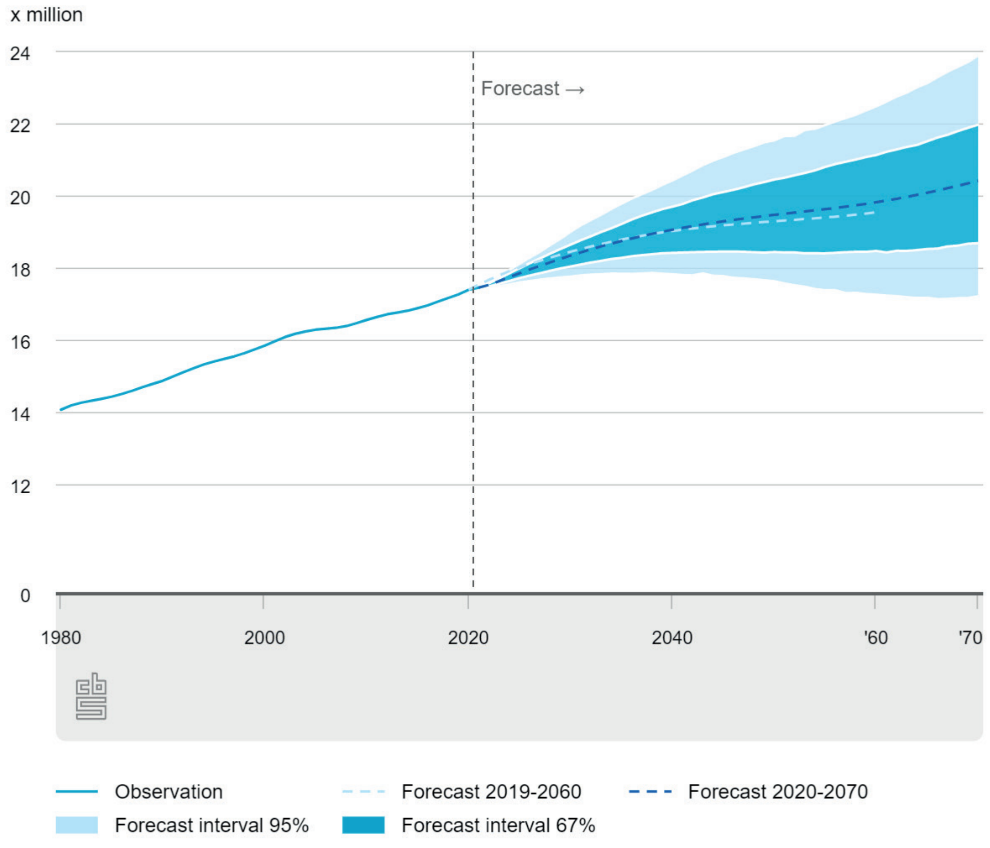
A SUSTAINABLY OPTIMIZED HIGHRISE CONCEPT

Sustainability, Highrise, Structure, Computational Design, Carbon Footprint,

PROBLEM STATEMENT

BACKGROUND

POPULATION GROWTH

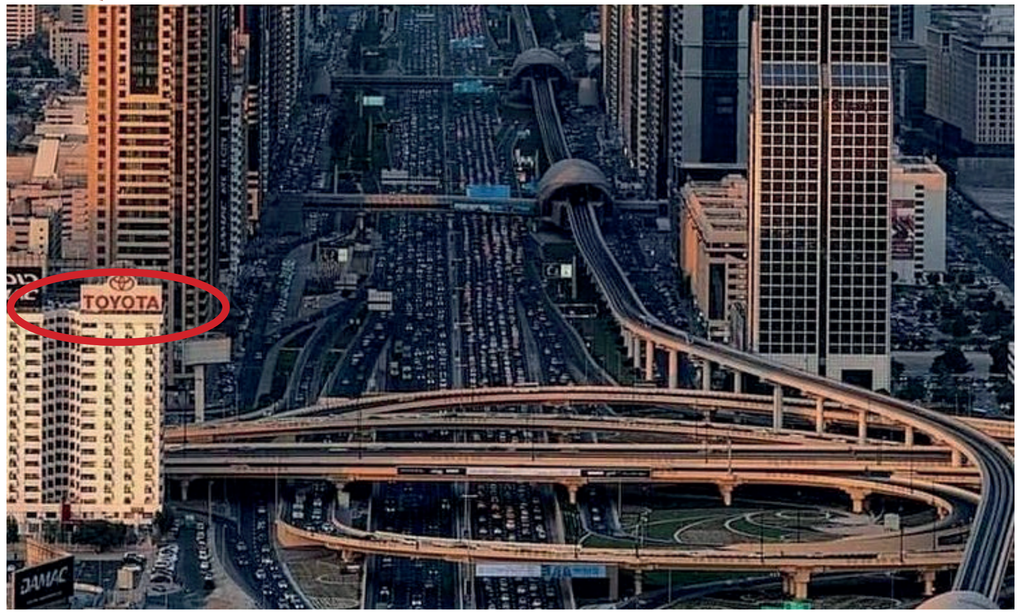


Estimated population growth, Netherlands (CBS, 2020b)

CLIMATE CHANGE

URBANIZATION

Dubai in the 80s (NLR Group, n.d.)



Dubai as we know ([[Dubai nowadays]], n.d.)

POPULATION GROWTH

- A growing population means we need more space in cities to accommodate residences, workspaces, and other facilities.

- The Netherlands needs at least 1.044.500 residences by 2030 due to population growth.

URBANIZATION

- Existing cities as we know have been developing up to the point that it becomes highly concentrated with buildings and traffic.

- This effect decreases the liveability within a city with hardly any opportunities to densify.

CLIMATE CHANGE

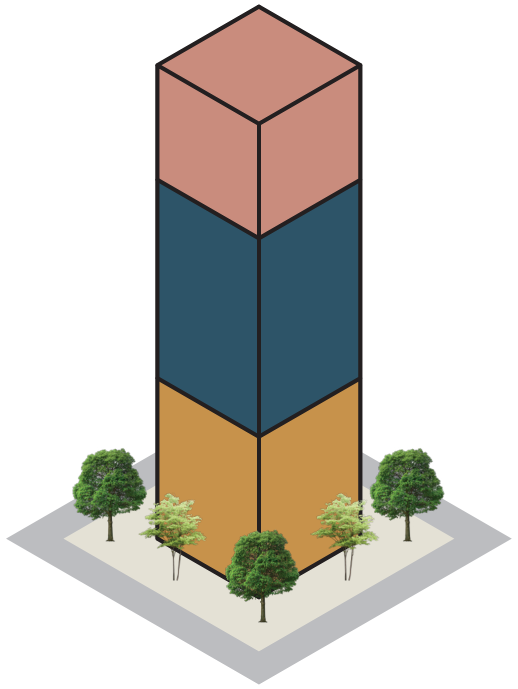
- The buildings and construction sector accounts for 39% of energy and process-related CO2, which makes this sector one of the major contributors to climate change (I.E.A., 2019).

- We need to rethink the way how we design and use our buildings to achieve a sustainable built environment.

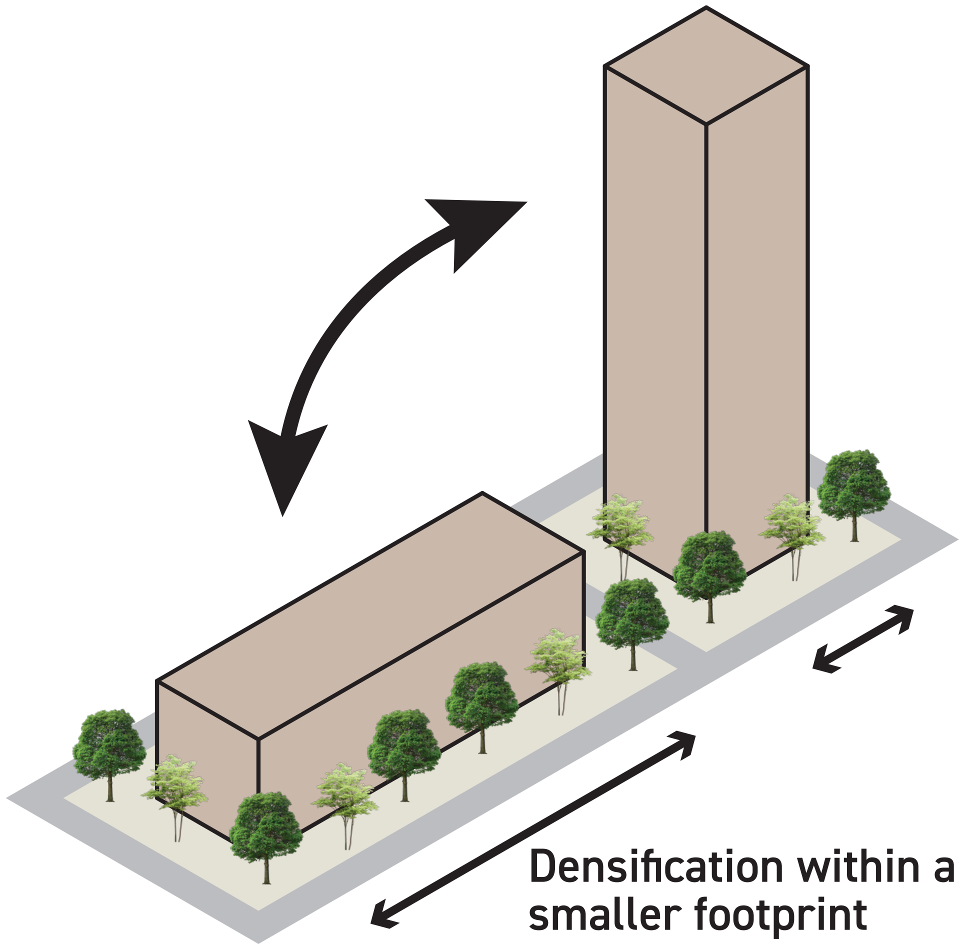
PROBLEM STATEMENT

POTENTIAL OF HIGHRISE

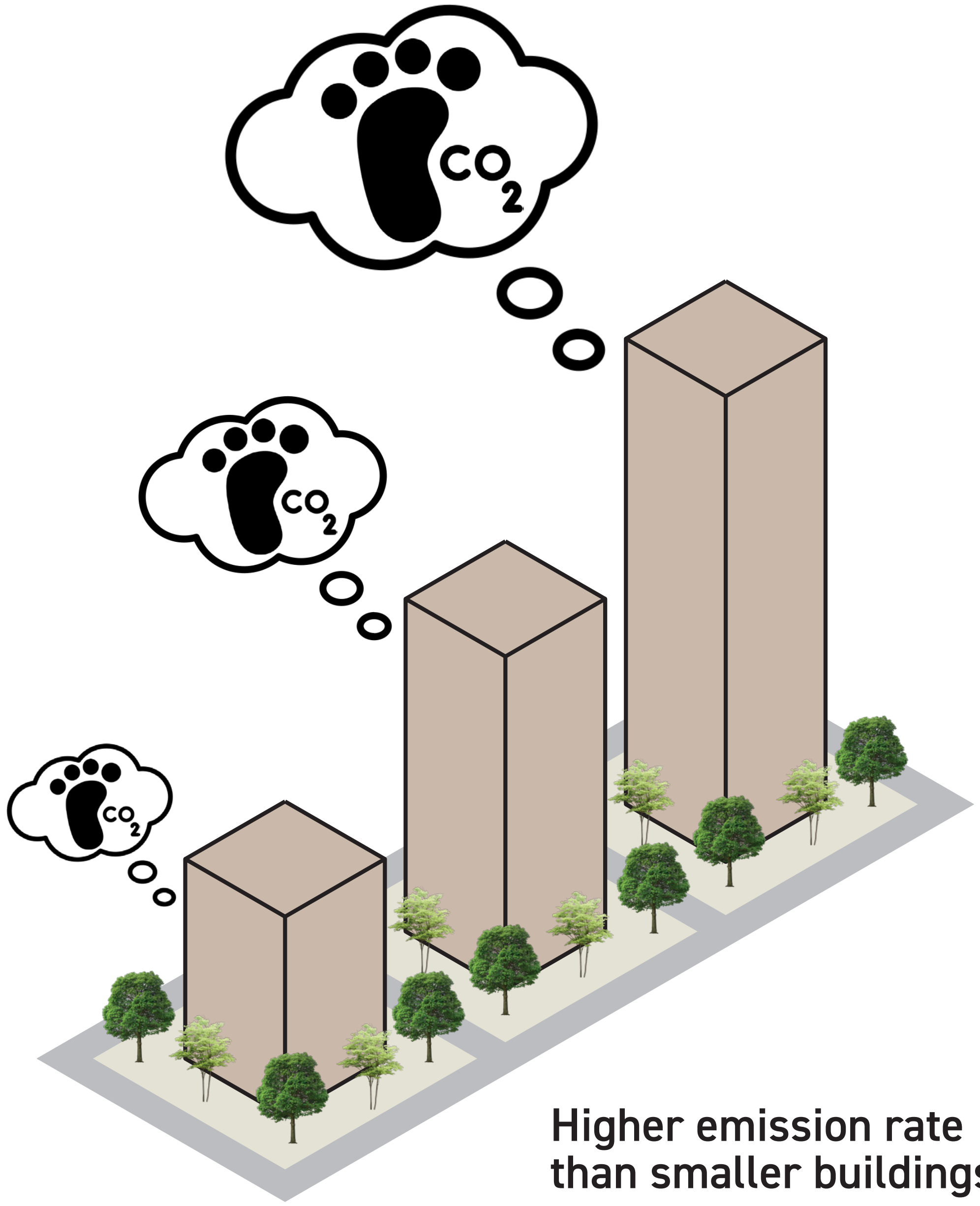
(ZESO Architects, ca. 2018)



Multifunctionality opportunities



Densification within a smaller footprint



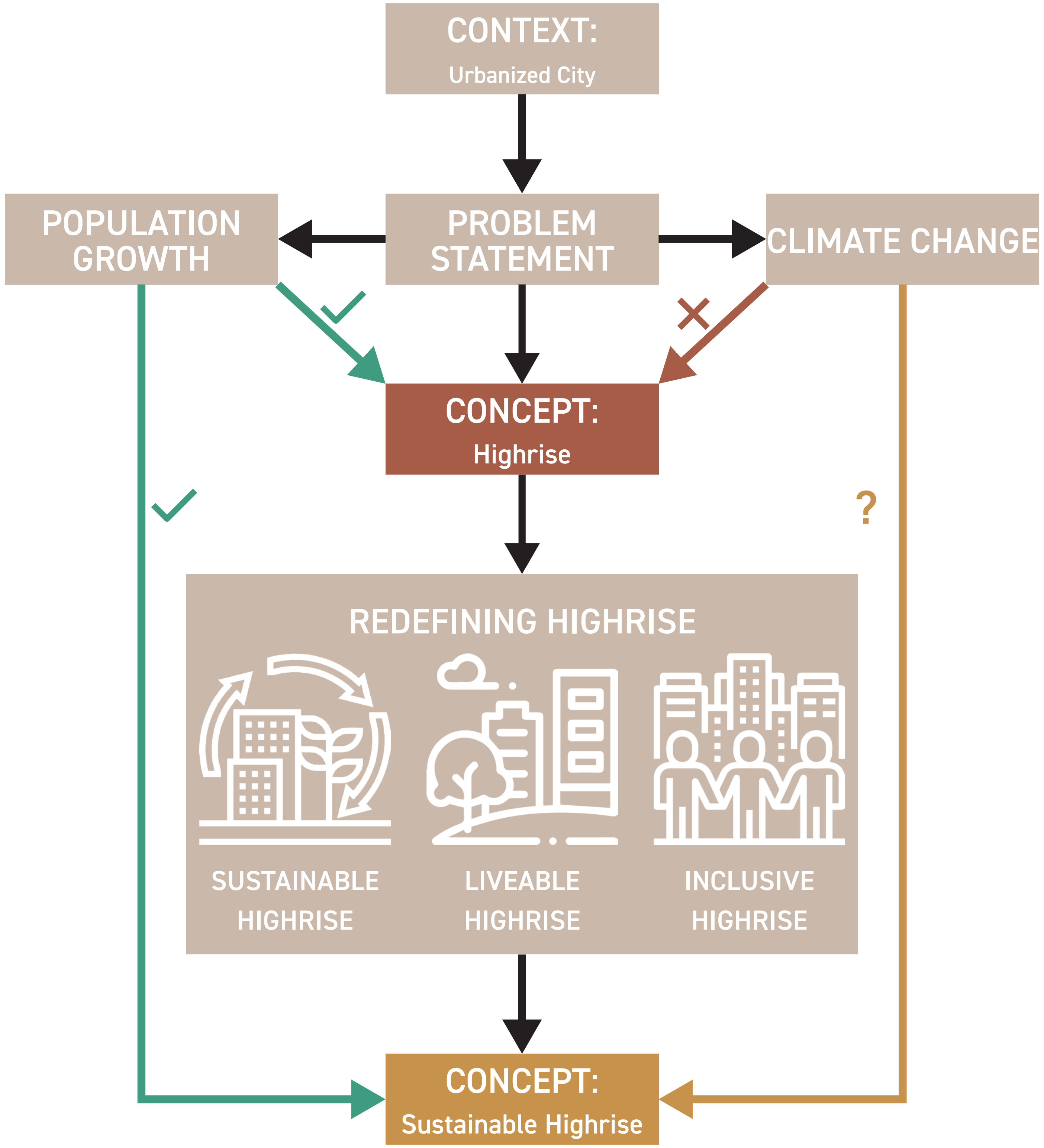
Higher emission rate than smaller buildings

PROS

- Densification within a relatively small footprint
- Lower land prices
- Attracting investors
- Potential for multi-functional use
- Land is preserved when only a small building footprint is being used instead of a big footprint

CONS

- Highrise buildings are not sustainable at all
- Highrise buildings emit significantly more carbon than medium or low-sized buildings
- Highrise buildings require a lot of extensive materials and installations, which contributes to a high carbon footprint



PERSONAL GOALS

- I want to prove that a highrise building can be designed significantly more sustainable than traditional highrise buildings.

- I want to prove that a sustainable highrise concept also contributes to a liveable and inclusive building and city environment.

DESIGN QUESTION

Is it possible to design a sustainable highrise concept for an urbanized modern city to account for population growth and climate change while also making sure that it contributes to a liveable and inclusive city and building environment?

DESIGN TOOLS

-Computational Design Methods

- Applying, Analyzing, and comprehending Data inputs and results

- Designer's Intuition and skills

- Knowledge of Building and Construction

- Assessing Aesthetic and functional value

Design decisions will be checked if they follow the principal of a sustainable highrise concept, a liveable highrise concept and/ or an inclusive highrise concept.

SUSTAINABLE HIGHRISE

LIVEABLE HIGHRISE

INCLUSIVE HIGHRISE

SUSTAINABLE HIGHRISE

Material Management

Flexibility

Energy Efficiency

LIVEABLE HIGHRISE

Safety and Comfort

Relation with the Cityscape

Public Spaces & Greenery

INCLUSIVE HIGHRISE

Multifunctionality

Multiple Target Groups

(Social) Rent & For Sale

SUSTAINABLE HIGHRISE

- Applying materials and methods with a smaller carbon footprint than traditional materials.
- Designing for future adaptability.
- Implementing clever ways to reduce energy consumption and produce renewable energy.

LIVEABLE HIGHRISE

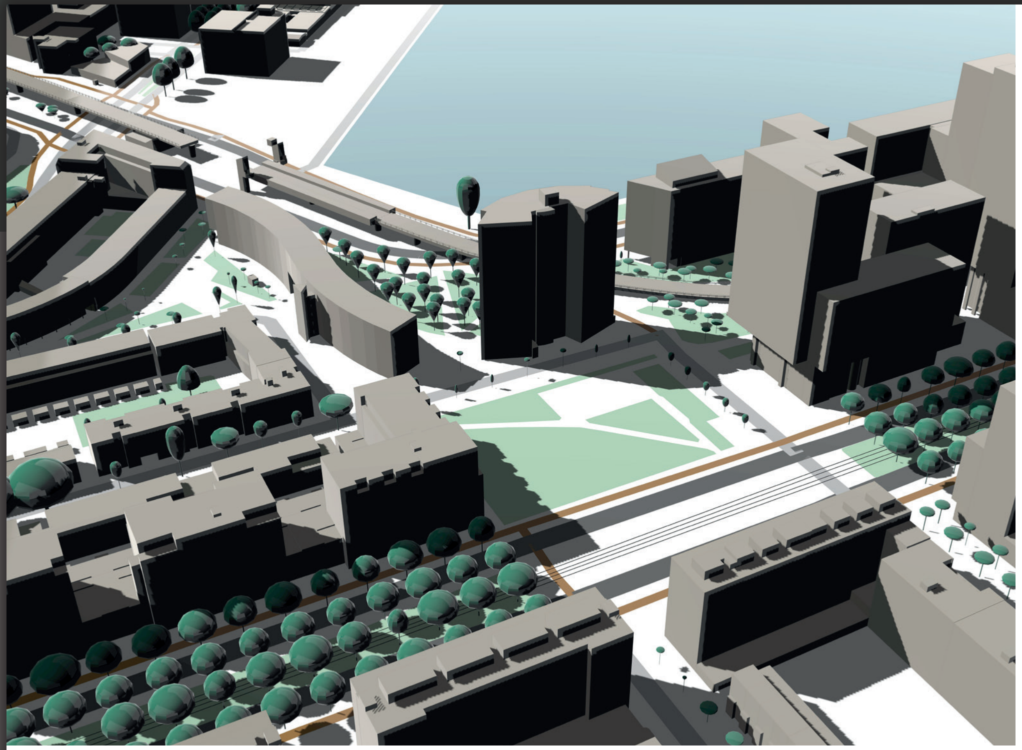
- Creating the best possible conditions for fire safety and climate comfort
- Integrating the building and its surroundings to the cityscape.
- Adding spatial qualities, such as public spaces and greenery.

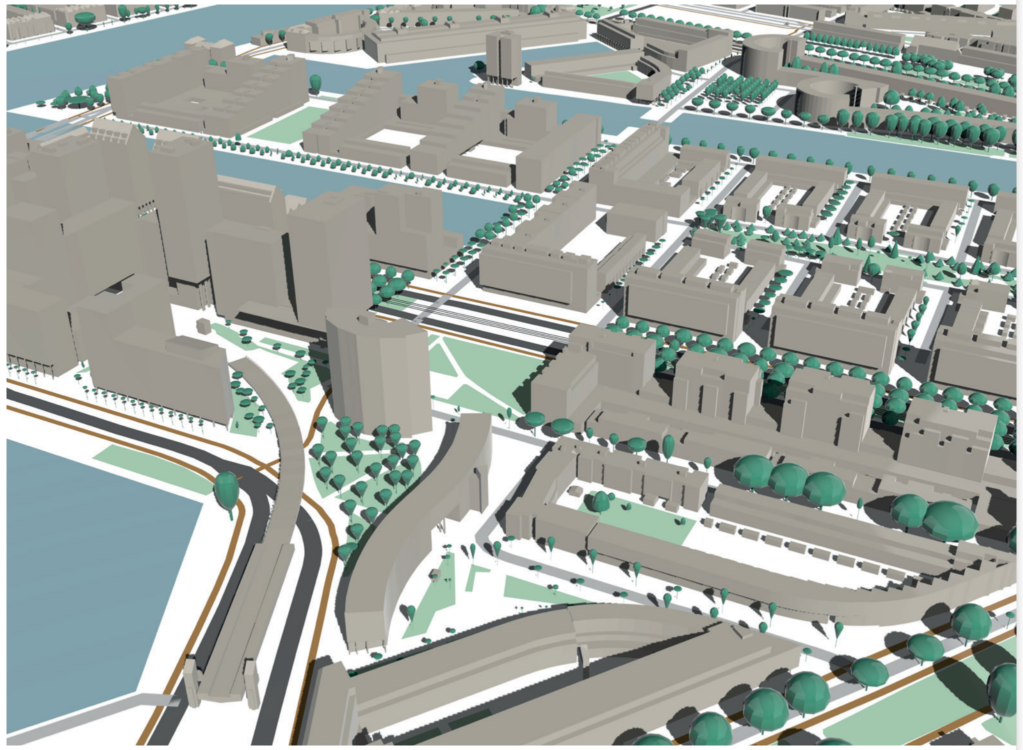
INCLUSIVE HIGHRISE

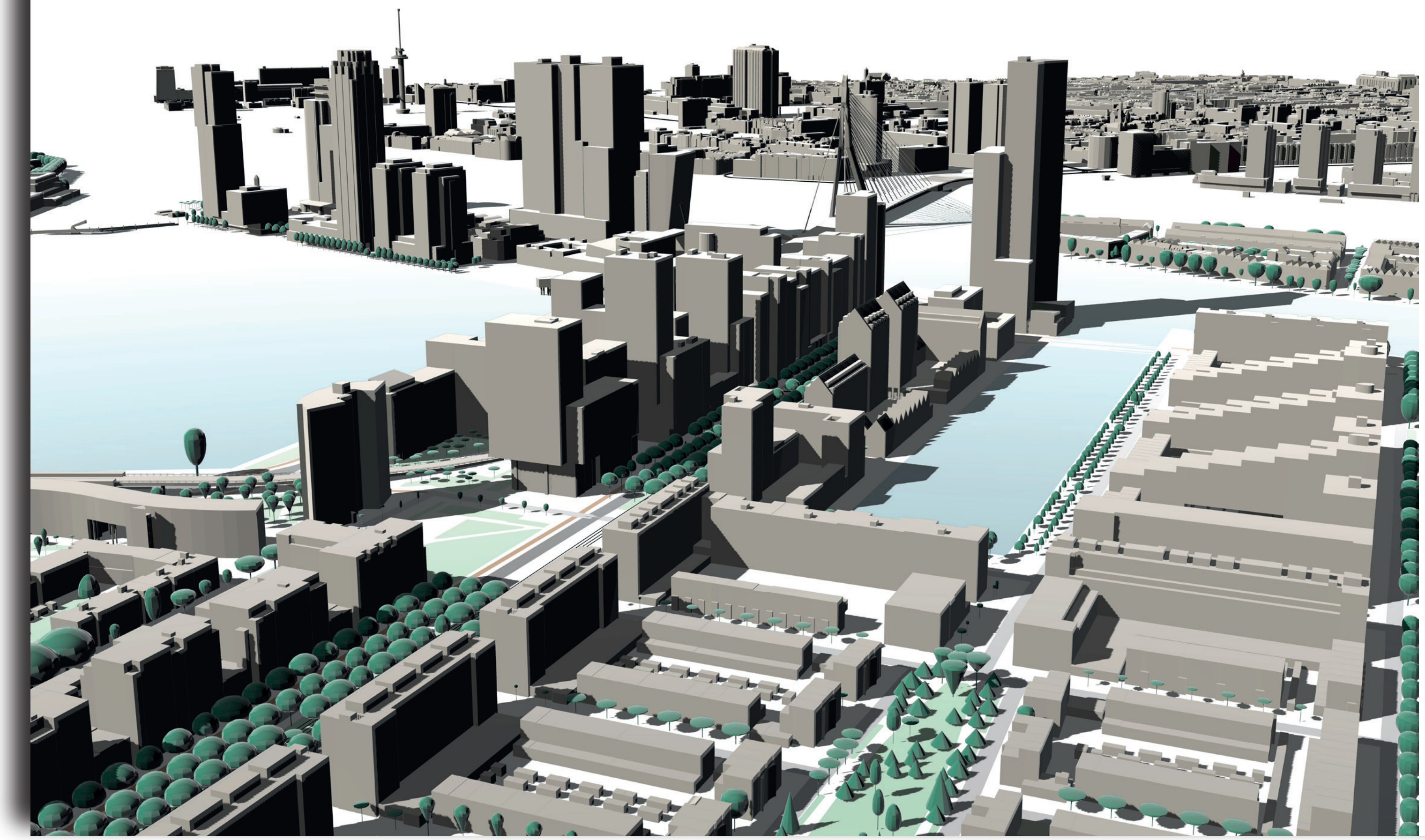
- Including a Living, Working and Leisure multifunctionality.
- Attracting multiple target groups.
- Offering housing suitable for inhabitants from multiple income groups.

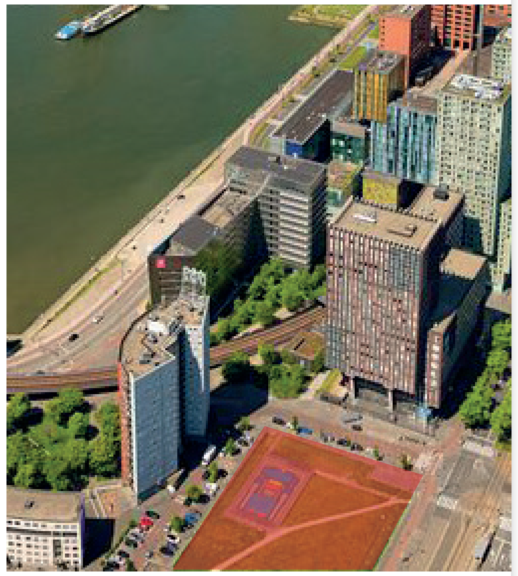
CONTEXT PLAN

ANALYSIS









(Aerophotostock, 2022)

ROTTERDAM CITY CENTRE

- Highrise should only be used when there is a huge demand for densification with limited amount of space.

- Therefore, the location must be a rapid-growing modern city that has been affected by urbanization.

- The huge demand for densification and the limited amount of space due to urbanization needs to be addressed by the city municipality and policy.

- The city centre of Rotterdam is therefore a suitable location to implement highrise densification.

CONTEXT PLAN

ANALYSIS

ROTTERDAM CITY CENTRE

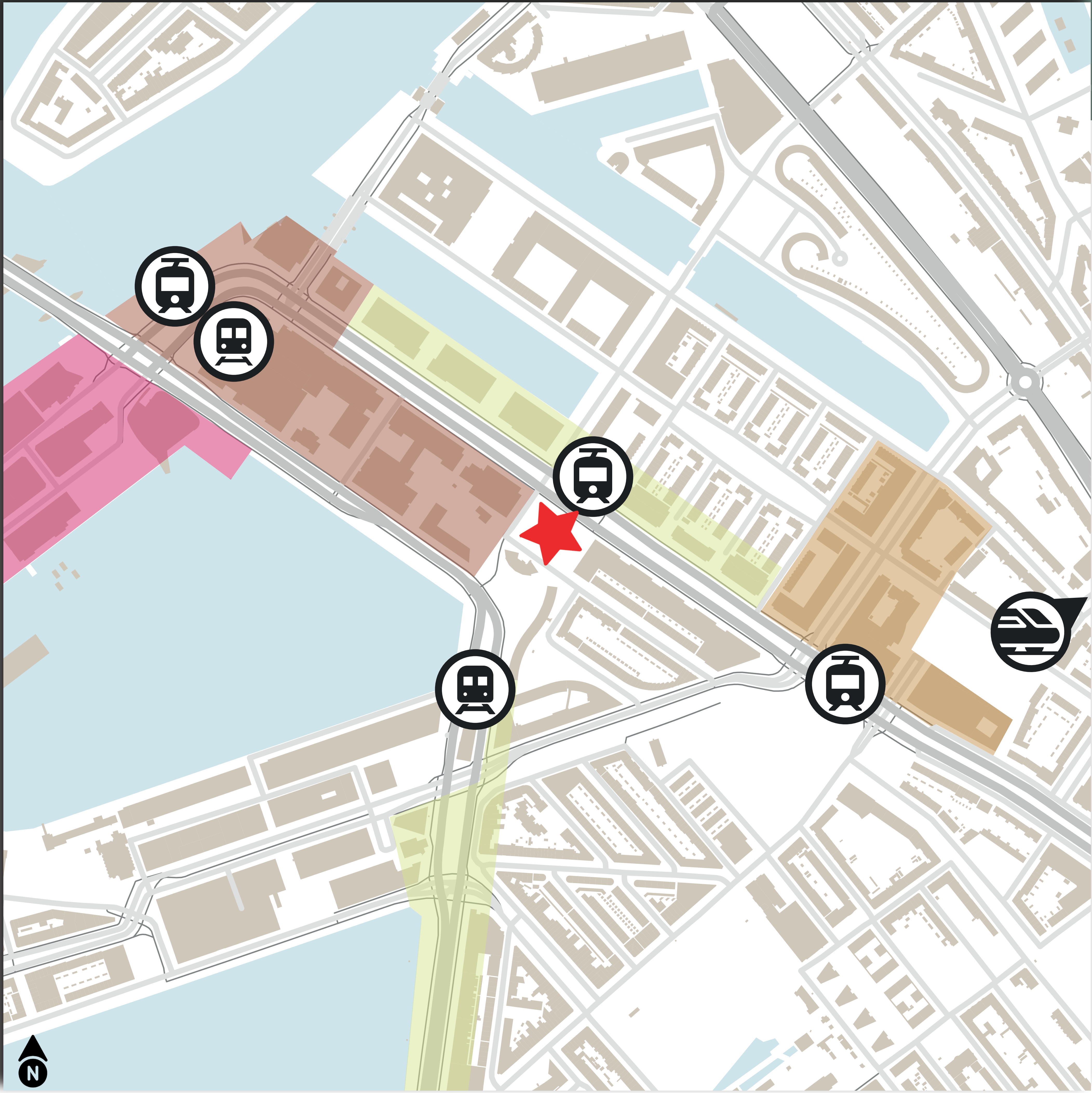
- The Municipality of Rotterdam has demanded that highrise projects in the city of Rotterdam must be connected to a High Quality Public Transport and mobility Hub for accessibility.

-Highrise projects also need to be located within the highrise zone defined by city policy as displayed in this map.

-The chosen site is located just within the highrise zone and right between two mobility hubs, and therefore a suitable location.

MAP LEGEND

Buildings
Water
Highrise Zone (70m+ permitted)
City Roads
Railways (Tram, Train, Metro)
PT HQ Public Transport Hub
Site Location



CONTEXT PLAN

ANALYSIS

ROTTERDAM CITY CENTRE

- The site is also has limited space for densification, which fits within the scope of this project.

- The site is located right between a metro station, tramstop, two city roads, bicycle paths and pedestrian walkways, and therefore very accessible with multiple ways of mobility.

- The functions present in this neighbourhood can be clustered with different types. These zones are well located near this site.

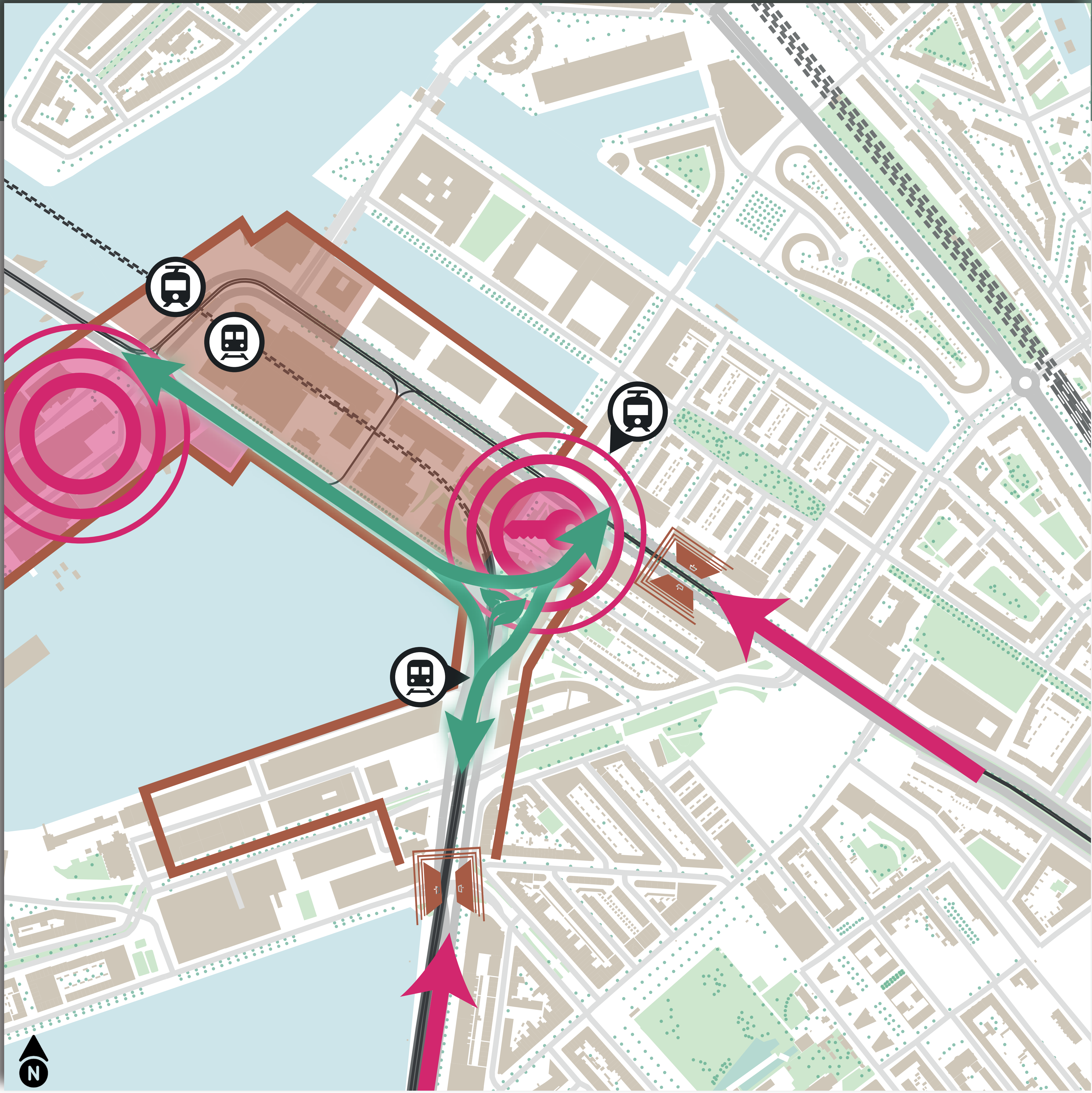
MAP LEGEND

- Buildings
- Water
- Working/ low interaction plinth
- Plinth with basic facilities
- Few Functions on the plinth
- Living, Working and Leisure
- Site Location

1 : 5.000

CONTEXT PLAN

URBAN SCALE STRATEGY



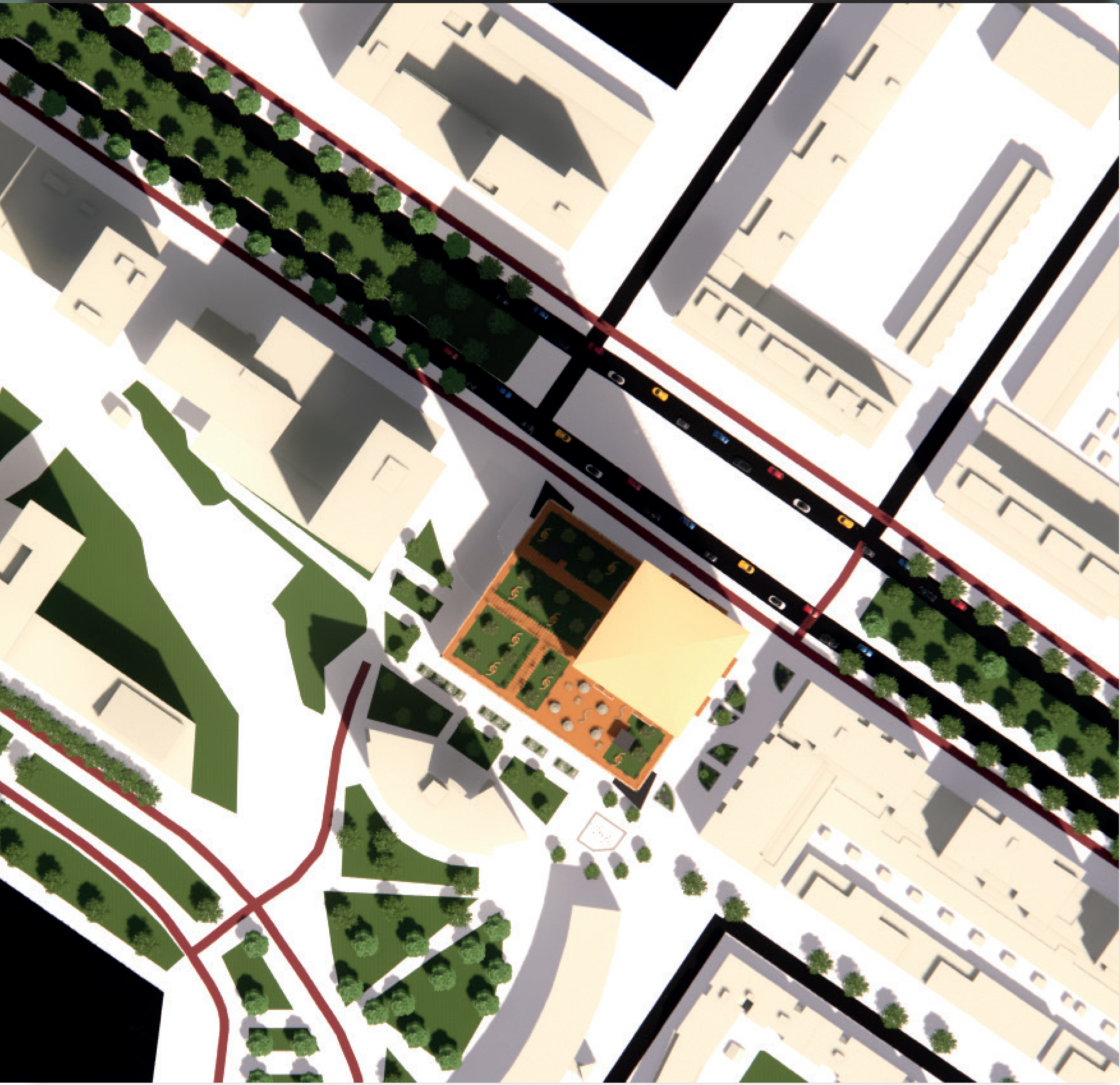
URBAN CHARACTER

- The accessibility points at the border of the highrise zone can be considered as gateways to the city centre.
- Since the building is located right between the city centre and residential area, it will be the major key to connect these areas between the gateways.
- The key to this strategy is for the building to be a vibrant place.
- As a means of connecting these places I have added high quality greenery pathways as the connector which increases interaction with the plinths.

MAP LEGEND

Buildings
Greenery
Water
Green Connection
Highrise Zone/ City Centre
Living, Working and Leisure Hub
Working/ low interaction plinth

1 : 5.000



CONTEXT PLAN

BUILDING SITE SCALE STRATEGY

URBAN CHARACTER

-The Building surrounding reflects the ambition of integrating greenery and public scenery to give more green spaces to the city.

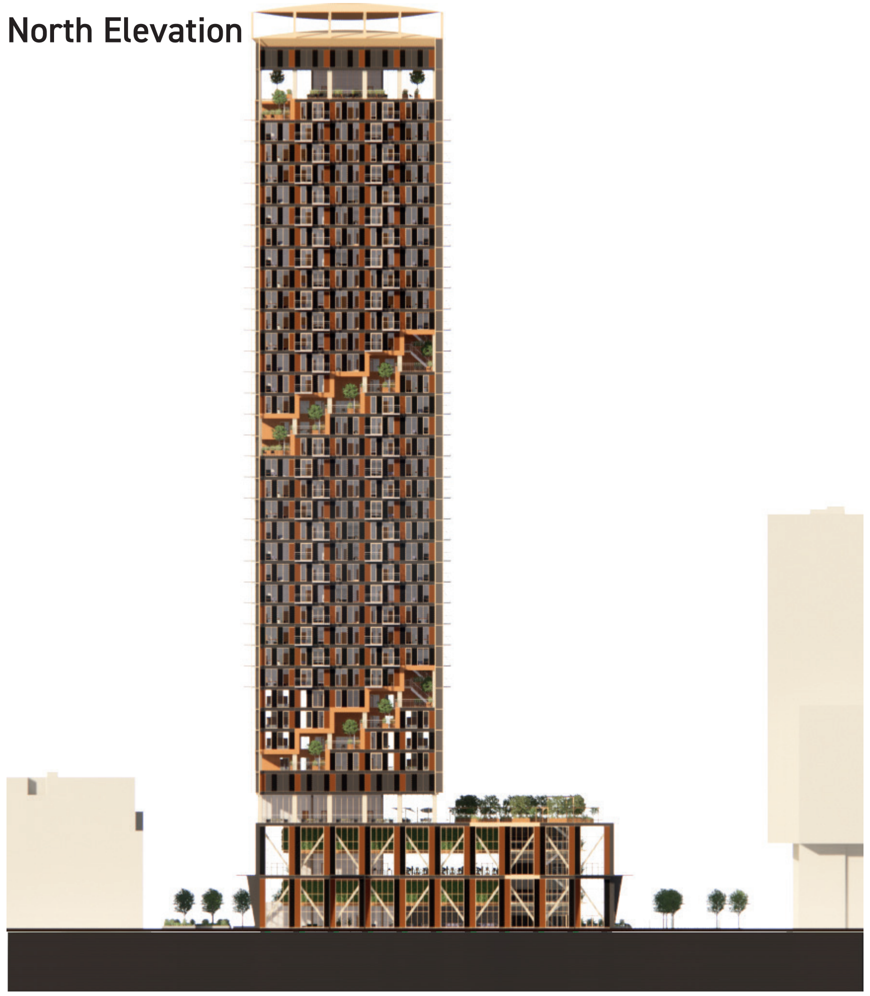
-More green and public scenery increases liveability and inclusivity.

DESIGN PARAMETERS

-Increasing Greenery & Public Scenery
-Increasing Accessibility
-More room for pedestrians

1 : 1.000

North Elevation



East Elevation

South Elevation

West Elevation

CONTEXT PLAN

ELEVATIONS

-The facade panels and materials represent the metallic character of the harbour of Rotterdam.

-The building has a public roof terrace and summit for views.

-The Spiral in the facade contain Terraces with timber and greenery.

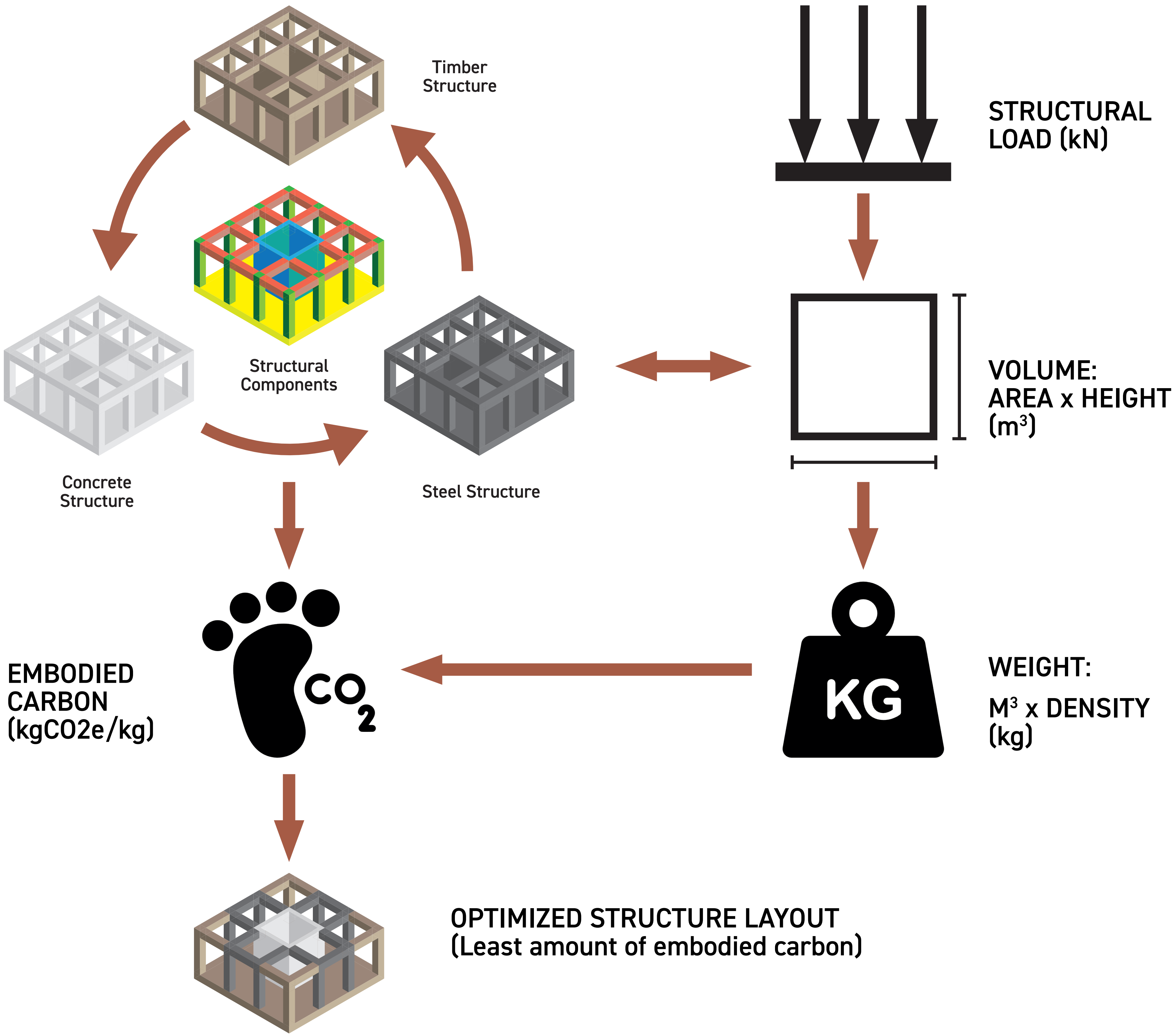
-Every Terrace is available for all residents. This contributes to more interaction between neighbours and even different floors.

DESIGN PARAMETERS

-Increasing Greenery & Public Scenery
-Increasing Accessibility
-More room for pedestrians

1 : 1.000

PARAMETRIC STRATEGY - THEMATIC RESEARCH



STRUCTURAL DESIGN

THEMATIC RESEARCH

PERSONAL GOALS

- I want to test if a simplified highrise structure layout can be significantly more sustainable compared to a traditional highrise structure layout.

- I want to see which materials result to an optimized carbon footprint layout by means of parametric design optimization.

RESEARCH QUESTION

To what extent is it possible to reduce carbon footprint of a highrise structure with parametric design methods?

Subquestion 1:

Which highrise structure strategy has the best potential to effectively reduce its carbon footprint?

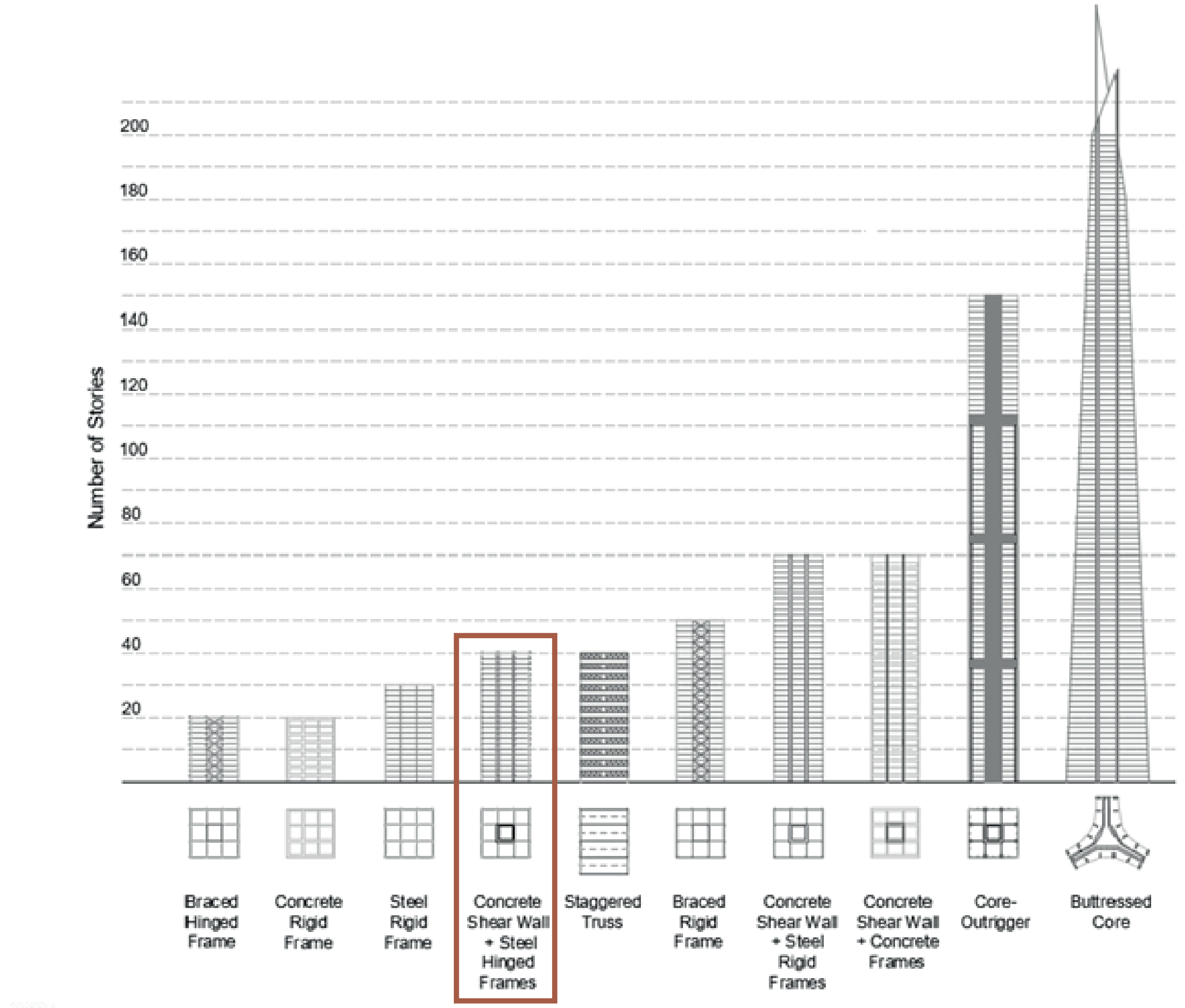
Sub-question 2:

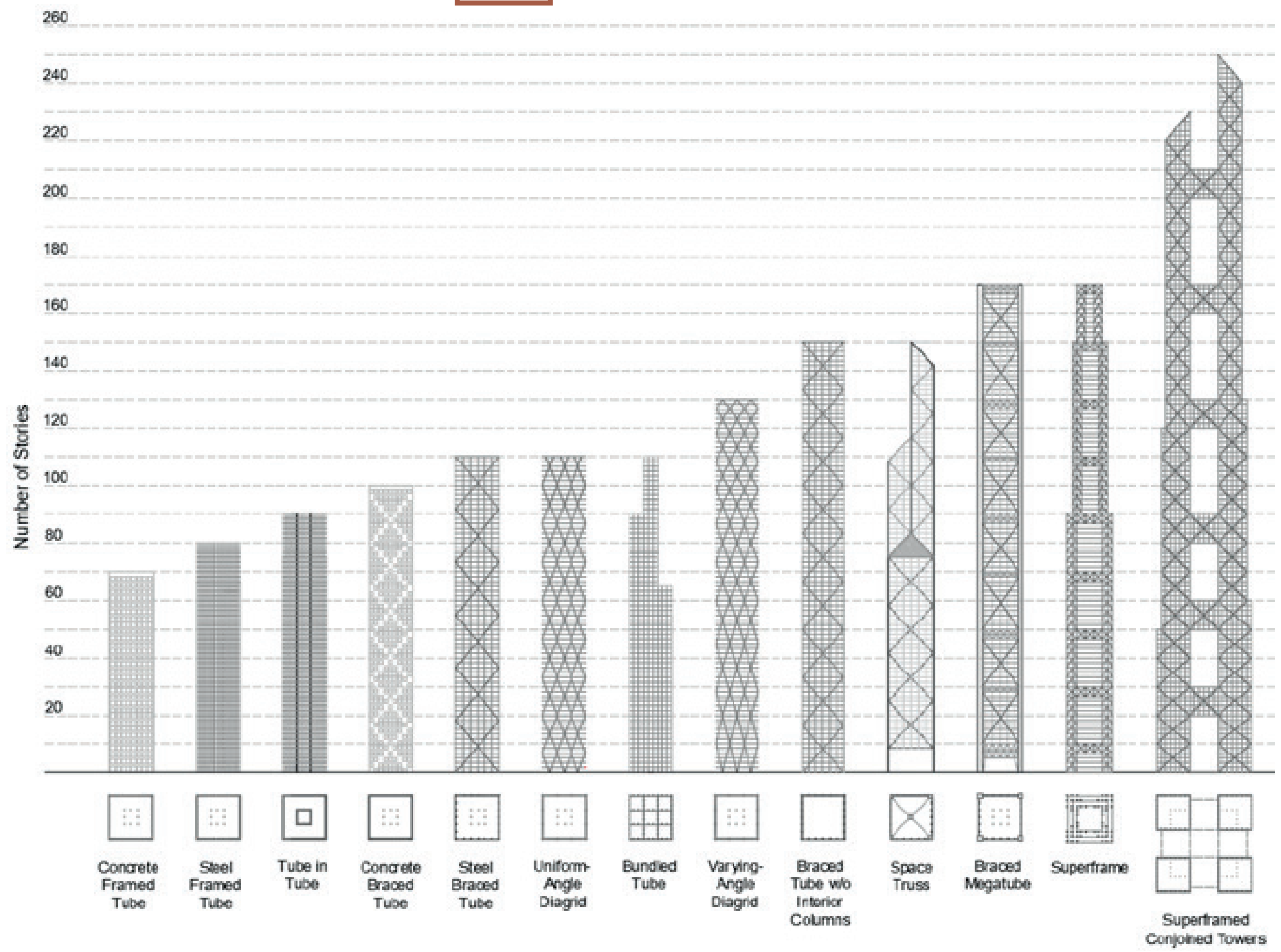
How to reduce carbon footprint of a structure?

Subquestion 3:

How do you generate a structural layout with the least carbon footprint possible with parametric design?

Literature Research, Experimentation, Data analysis





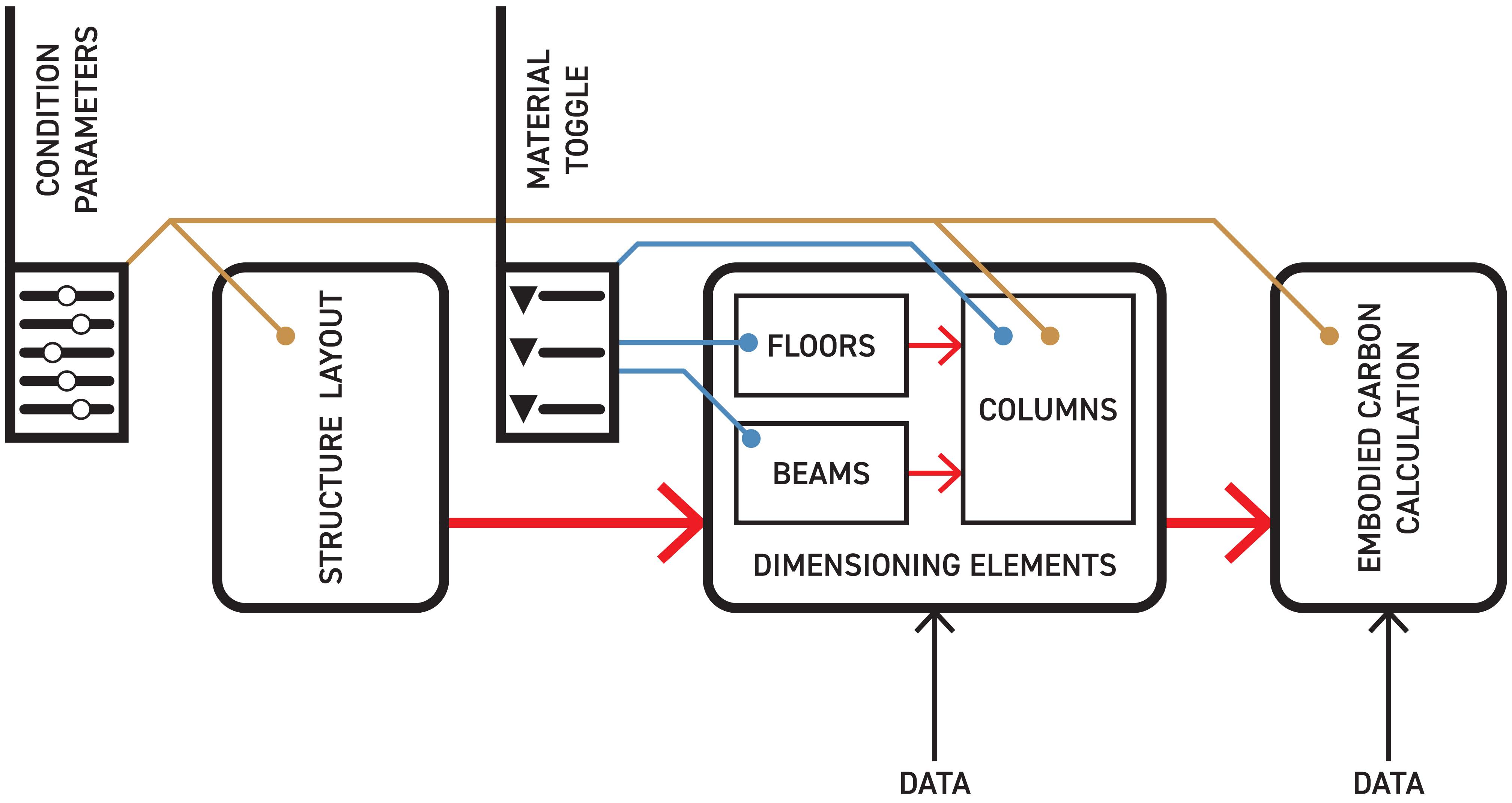
CHOOSING A HIGHRISE STRUCTURE STRATEGY

- In order to find out to what extent it is possible to reduce carbon footprint of a highrise structure with parametric design methods, it is important to use a highrise structure strategy that has the best potential to effectively reduce its carbon footprint.

- Choosing a highrise structure with lots of elements that does not require to be lateral load or moment resisting has the best potential to effectively reduce carbon footprint of a structure since the use of timber and other hybrid methods is more feasible in this layout.

- Therefore, a shear wall (core) + hinged frame structure has been investigated.

- The height is limited at 40 floors, which is approximately 150 meters high. This is our maximum height for the structure.



PARAMETRIC DESIGN SCRIPT

- A parametric model has been made to find an optimized structure layout in terms of carbon footprint by material.

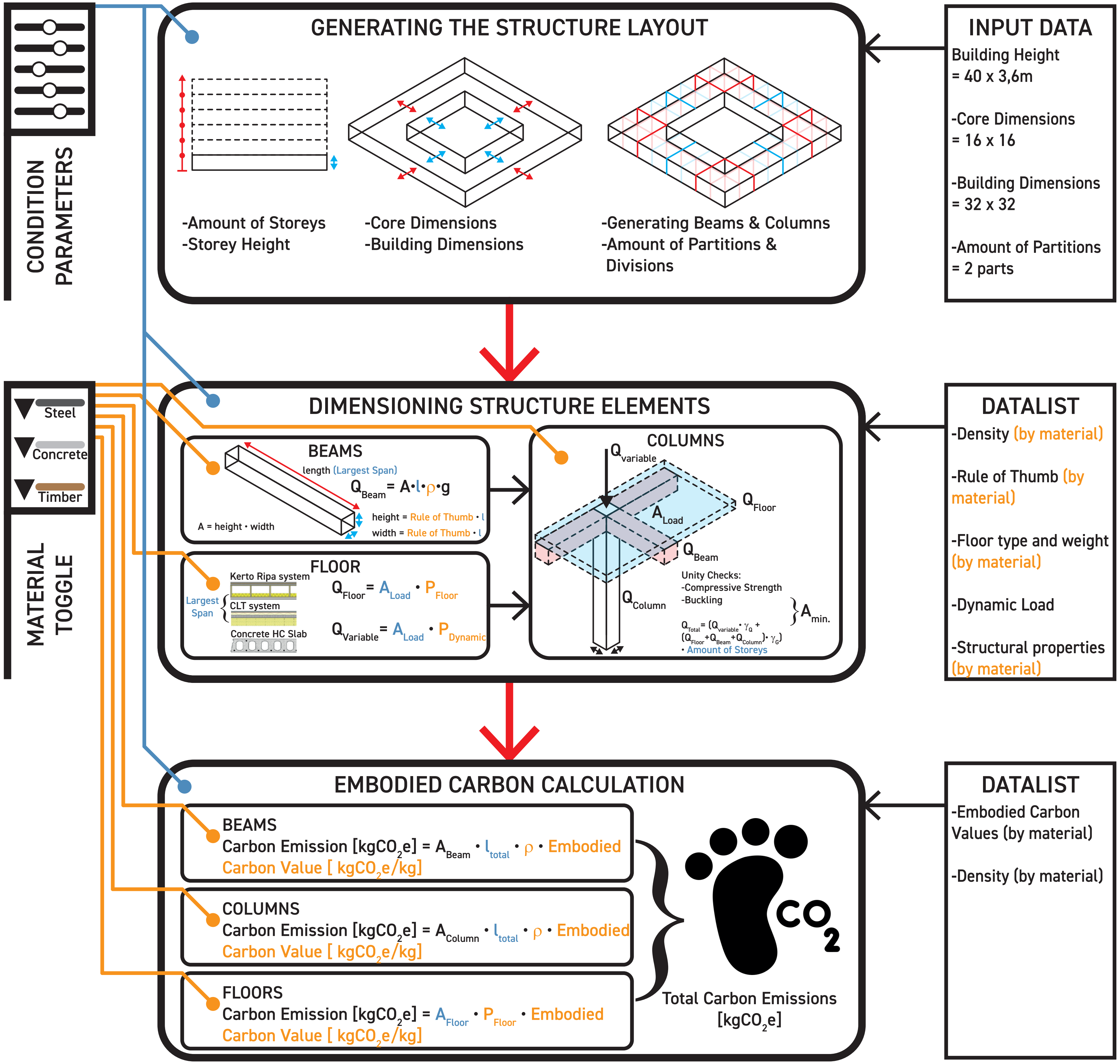
- The parametric script can be categorized in 3 major components.

- The Parametric model has 2 locations where parameters can be changed to influence the outcome.

- To conduct the experiment, data has been collected for the structural and carbon footprint properties of construction materials and elements.

STRUCTURAL DESIGN

THEMATIC RESEARCH



PARAMETRIC DESIGN PROCESS

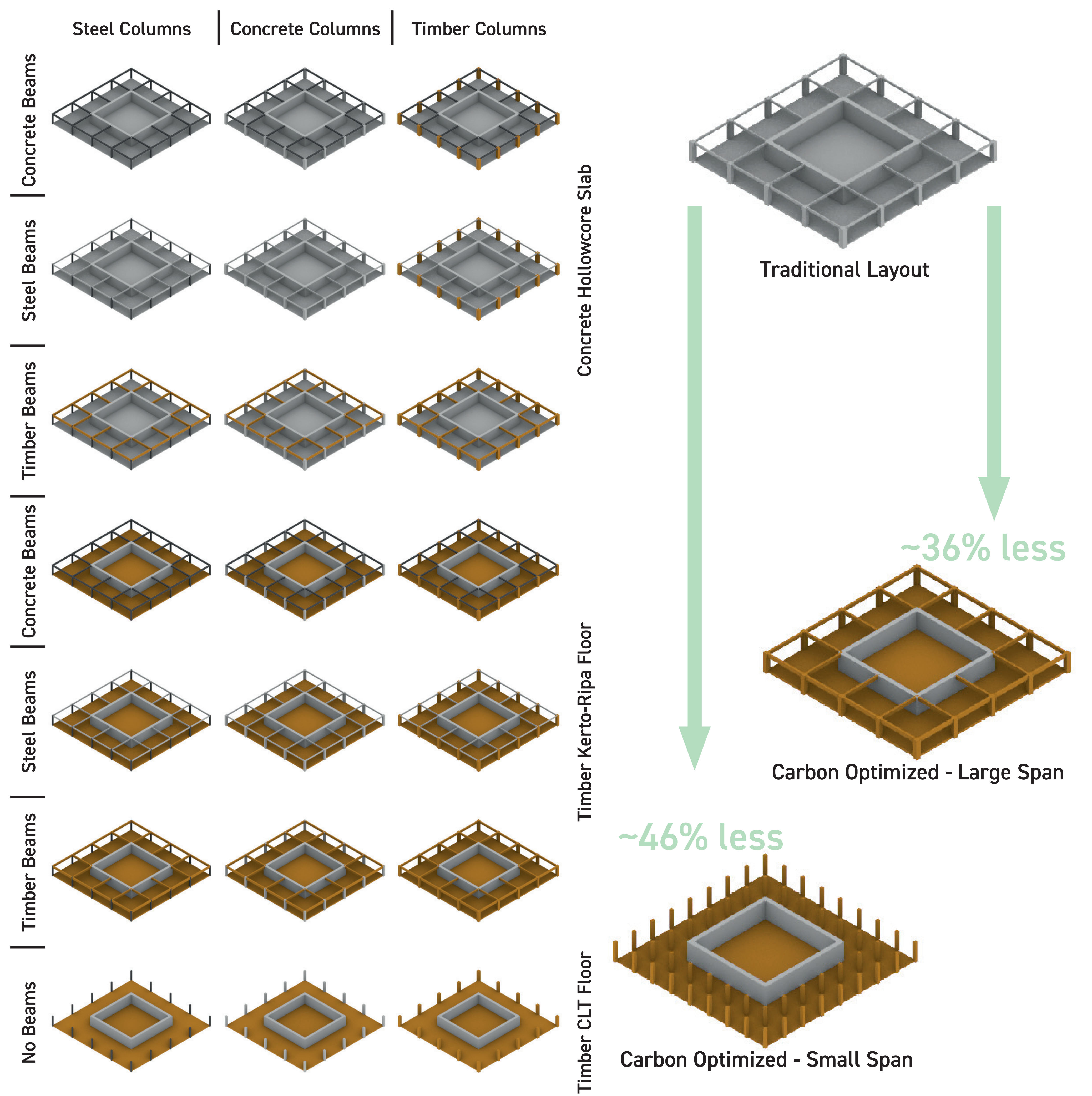
- The first step is to generate the structure layout by applying the right conditions for the configuration.

- The next step is to apply dimensions to the structural elements by applying their material specific (structural) properties retrieved from data sources.

- The Final step is to calculate the carbon emissions from the material specific embodied carbon value, and with the sum of the elements you get the total carbon emission for that structure layout.

- In order to generate a simple but yet reliable simulation, I only made a calculation for the ground floor with similar sized members, and applied rule of thumb rules where possible.

- The core has been left out of the calculation since its thickness is significantly determined by stability and therefore it is assumed that its dimensions also remains the same in all occasions.



THEMATIC RESEARCH RESULTS

- 75% of the total embodied carbon value is from floors, and this is also confirmed by literature (Eleftheriadis et al., 2018).

- A core with a hinged frame structural layout containing Kerto Ripa slabs, timber beams and timber columns has the least total amount of embodied carbon with a potential of up to 36% less CO2 compared to a traditional layout.

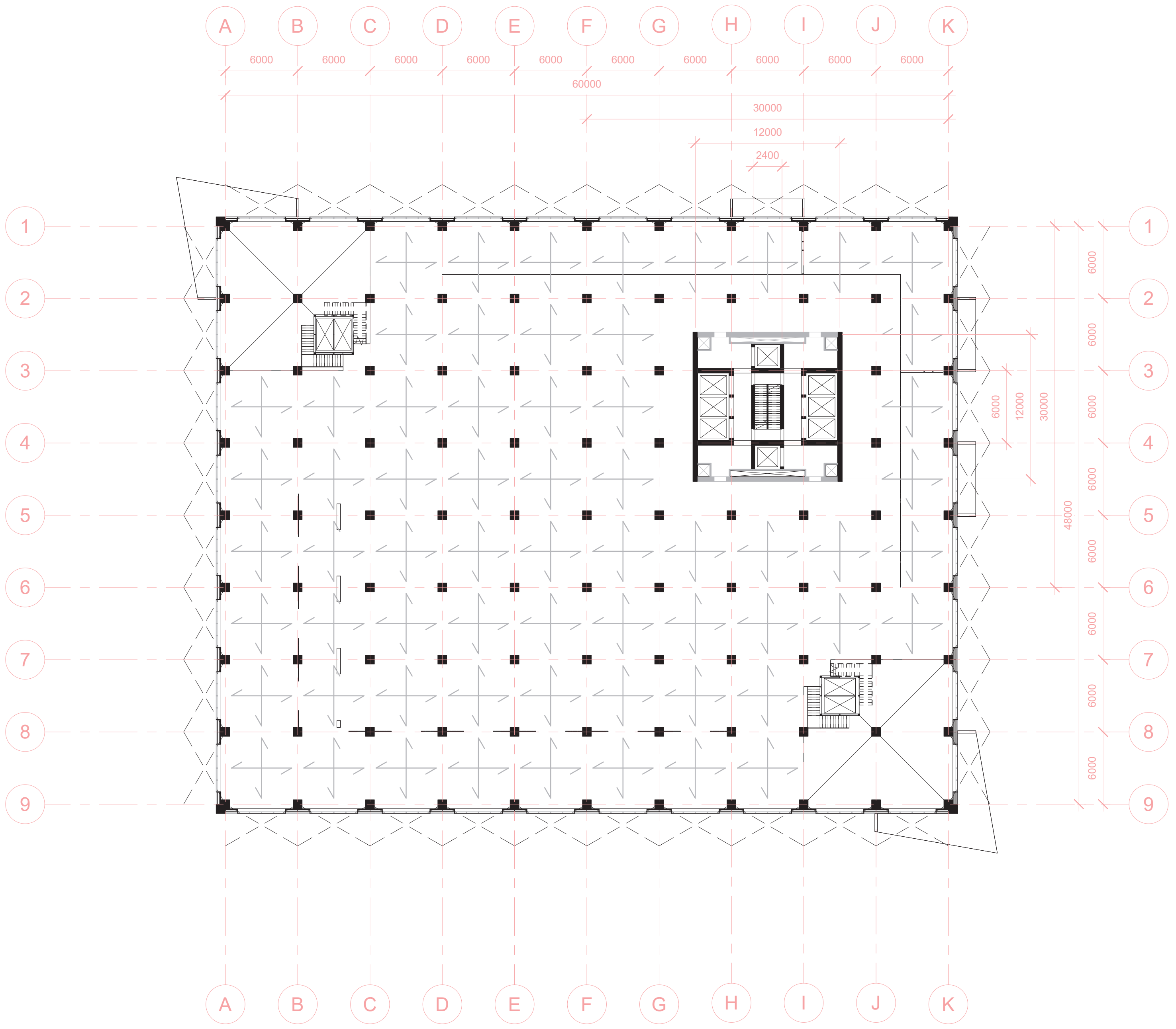
- If you reduce the span, you actually reduce the total amount of CO2 significantly.

- A Timber structural frame with a CLT Floor has therefore the highest potential to reduce carbon footprint if the spans are kept short with a value of up to 46%

- Reducing carbon footprint of a highrise structure with parametric design can therefore be done to a great extent.

STRUCTURAL DESIGN

STRUCTURAL GRID AND DIMENSIONS



-The grid has a uniform layout of 6m

-The core is 12m in width

-Two sides of the core are reserved for shafts and those walls are not structural

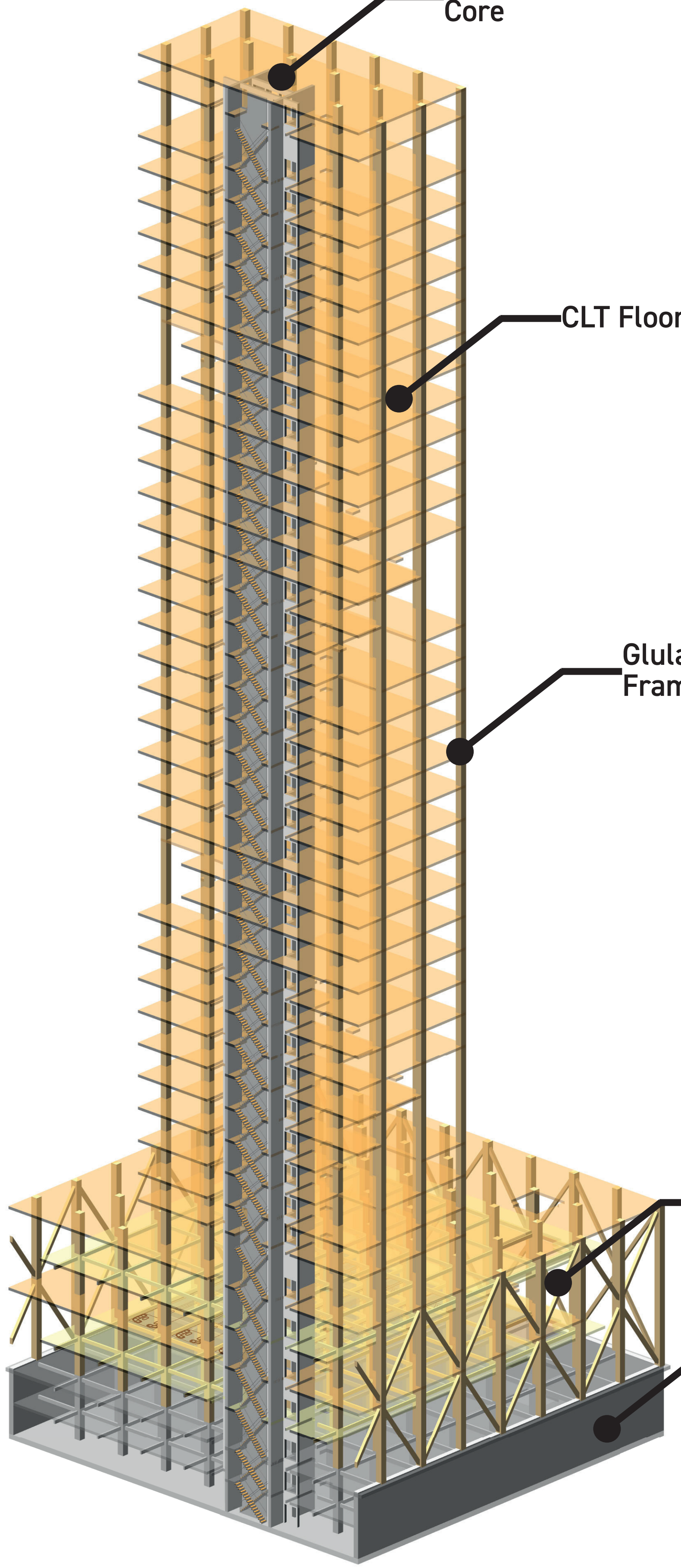
-The columns are potentially 0,75m x 0,75m on the groundfloor

DESIGN PARAMETERS

-0,75m x0,75m Glulam Columns
-12m x 12m Concrete Stability Core
-Highrise Footprint 30m x 30m
-Lowrise Footprint 60m x 48m
-200mm Structural CLT Floors

STRUCTURAL DESIGN

3D STRUCTURE SECTION



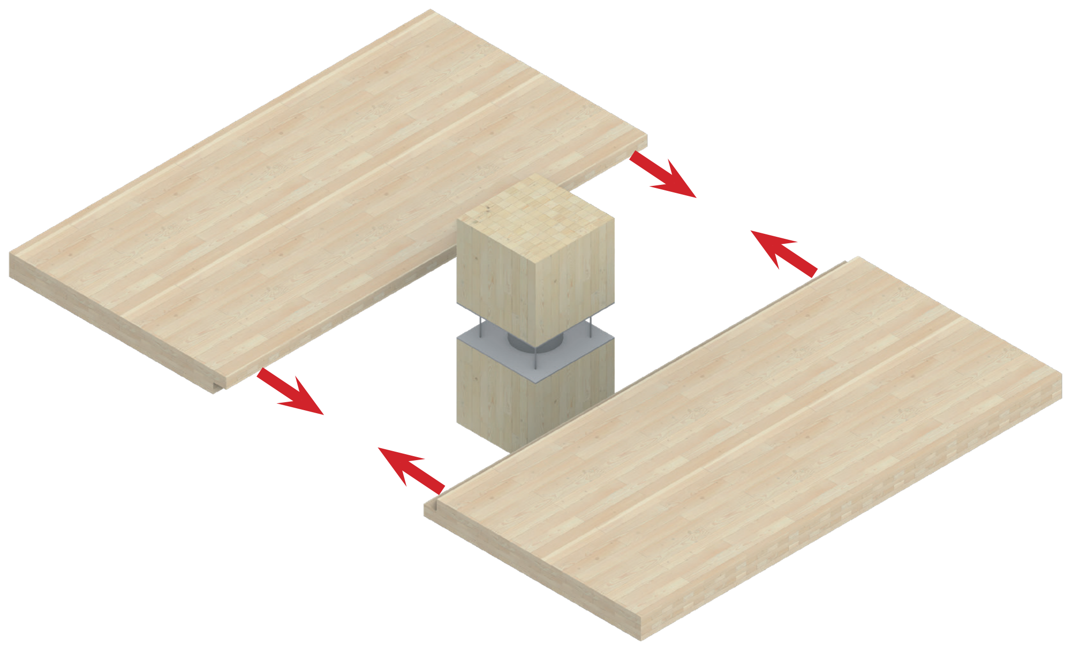
-The concrete stability core contains the main escapestairs

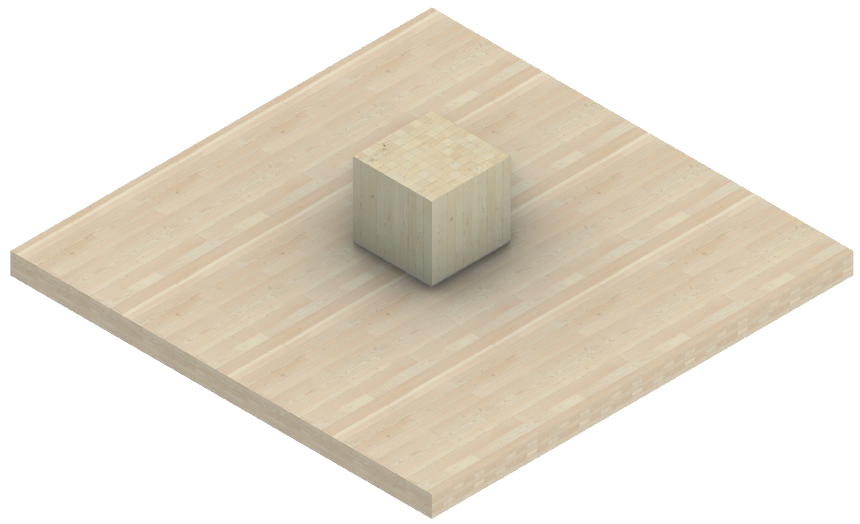
-The core is decentralized, hence the extra stability walls in the core and stability bracings on the streetconnected layer

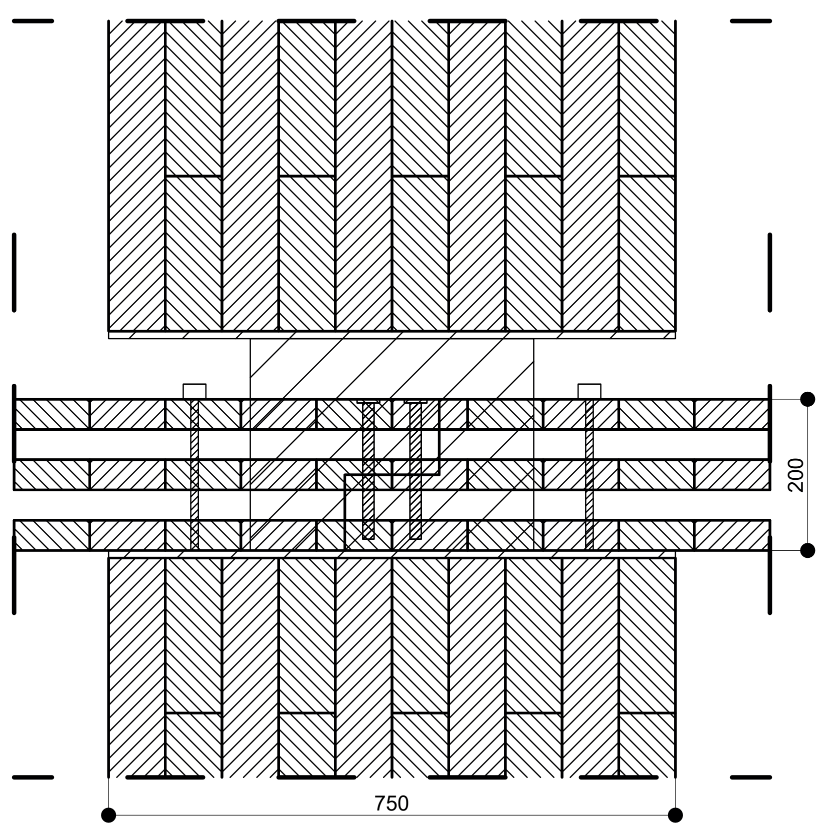
-On the street connected layer, there are removable beams and floors to increase floorheight flexibility

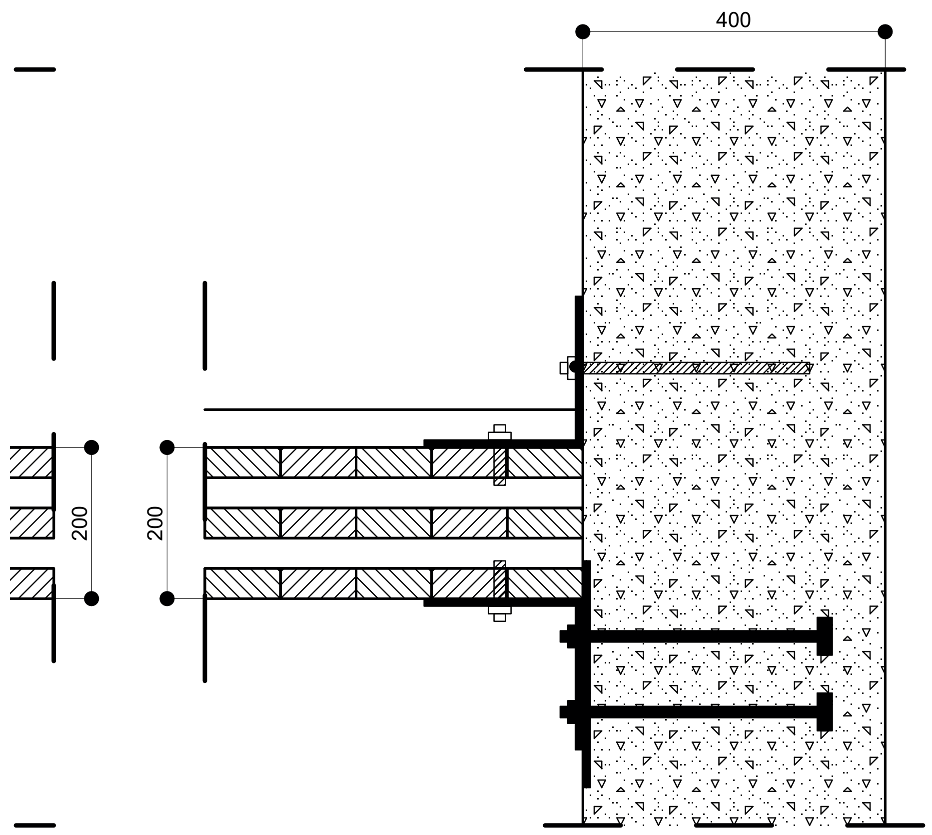
DESIGN PARAMETERS

-0,75m x0,75m Glulam Columns
-12m x 12m Concrete Stability Core
-Highrise Footprint 30m x 30m
-Lowrise Footprint 60m x 48m
-200mm Structural CLT Floors









-The CLT floors are Joined with each other by means of stepped rebates. These steps are anchored with heavy duty screws

-The CLT Floors are connected to the columns by a steel frame

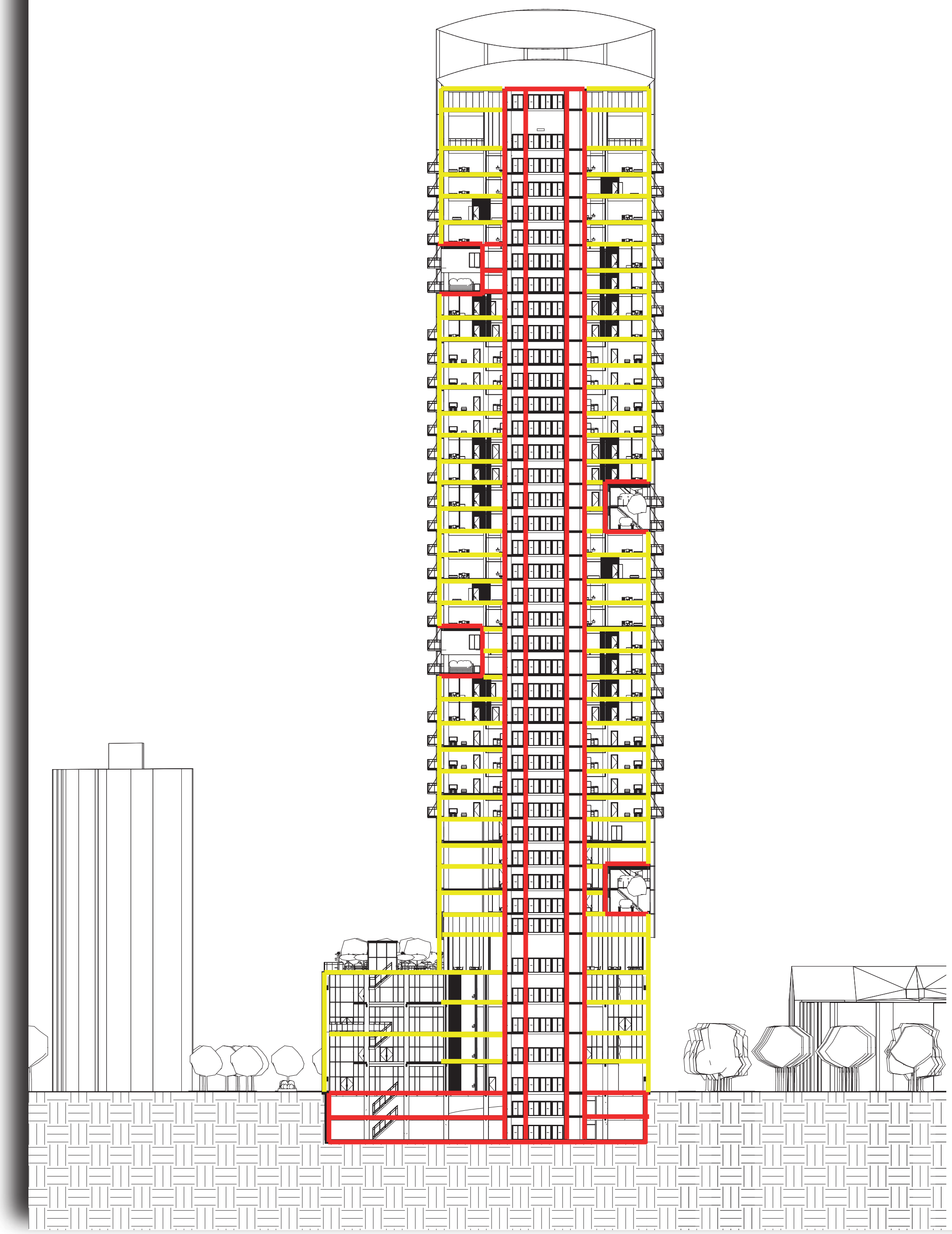
-The CLT floors are connected to the core by steel corner profiles that are anchored to the core

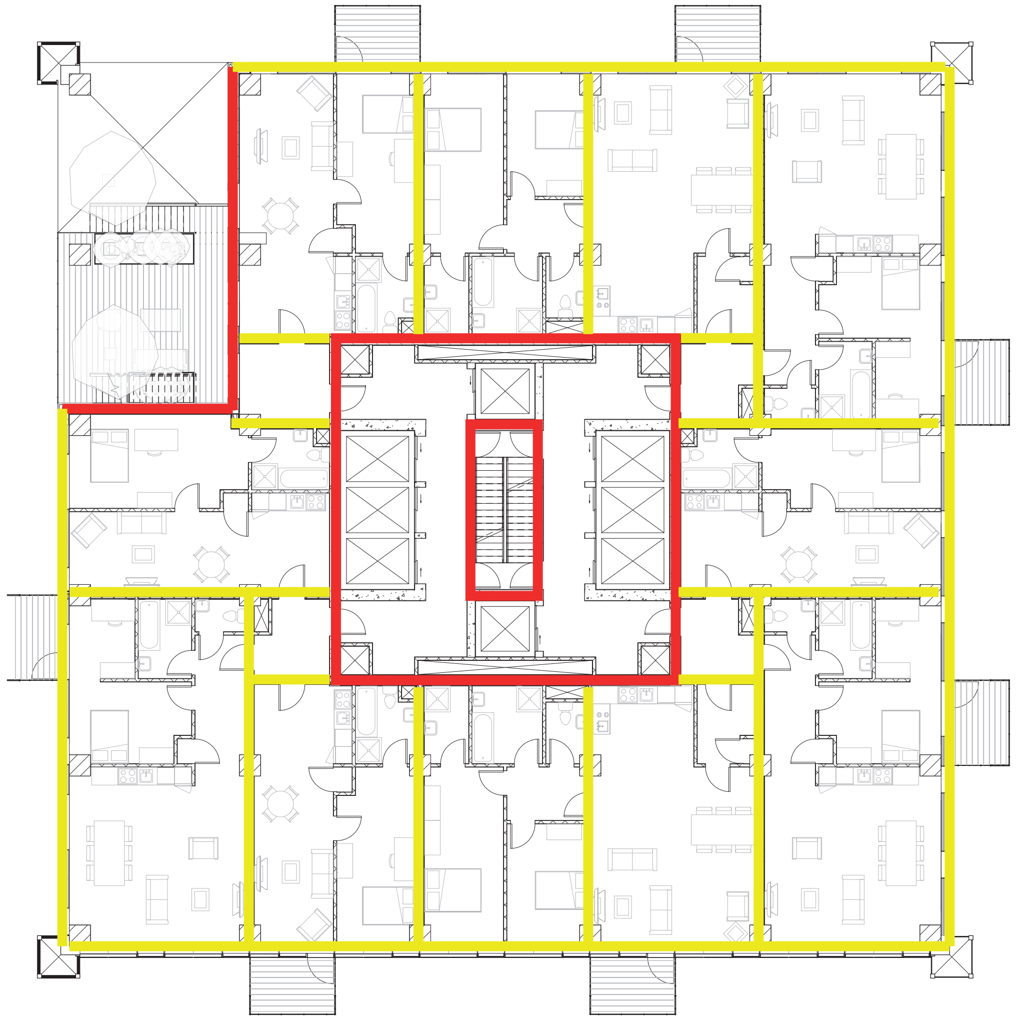
DESIGN PARAMETERS

-0,75m x0,75m Glulam Columns
-12m x 12m Concrete Stability Core
-Highrise Footprint 30m x 30m
-Lowrise Footprint 60m x 48m
-200mm Structural CLT Floors

CLIMATE STRATEGY

FIRE SAFETY





-The fire escape stairs is also protected from the outside

-The terraces on each floor are interconnected with stairs.

-Due to the Terrace walls being REI 120 it can also be used as a secondary escaperoute

-The partition walls, and the floors are also Fire protected

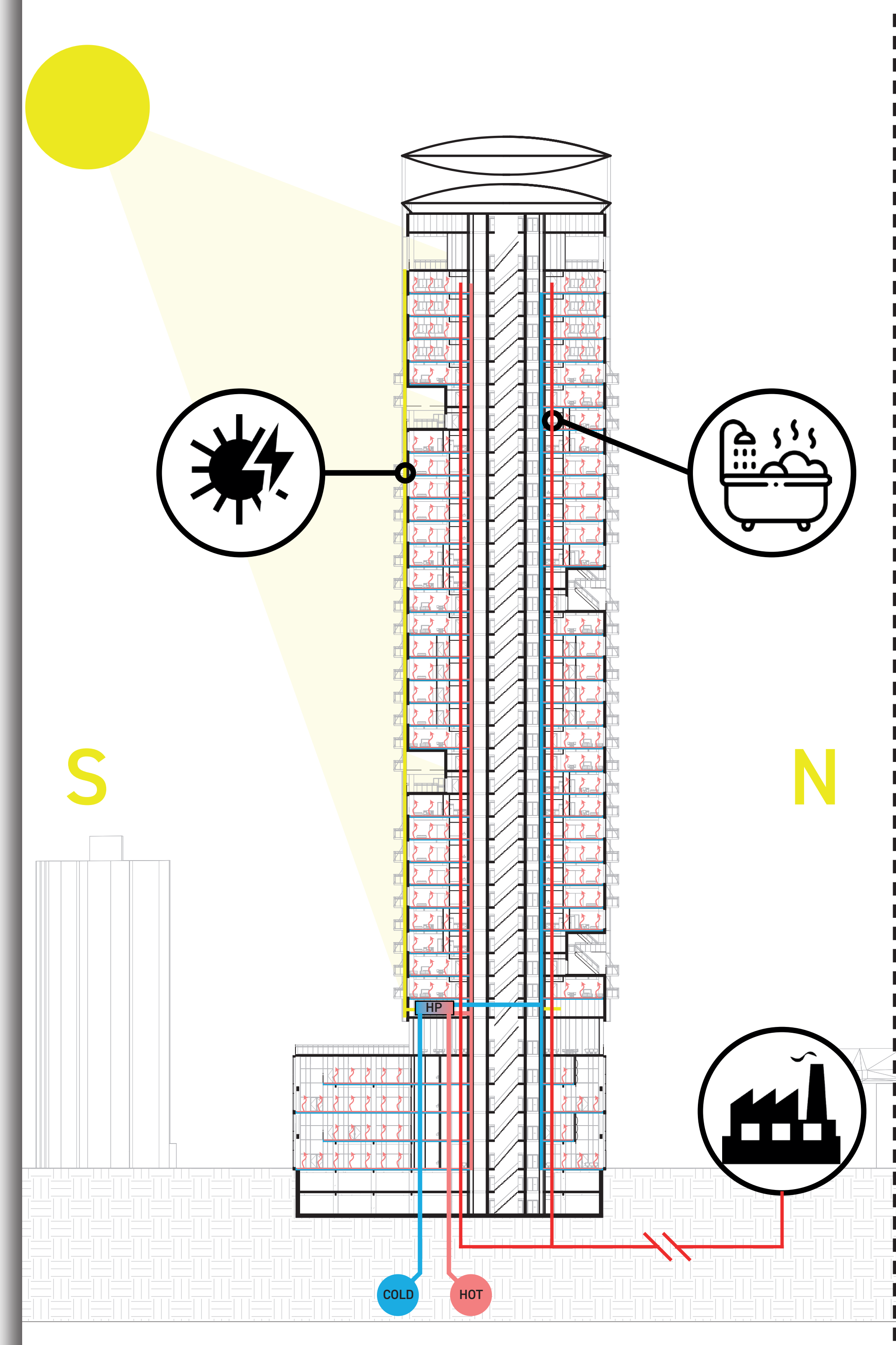
DESIGN PARAMETERS

-Structure REI 120
-Escape Stairs REI 120
-Partion Walls REI 90
-CLT Floors REI 90
-0,7mm/min Churn Rate, Timber

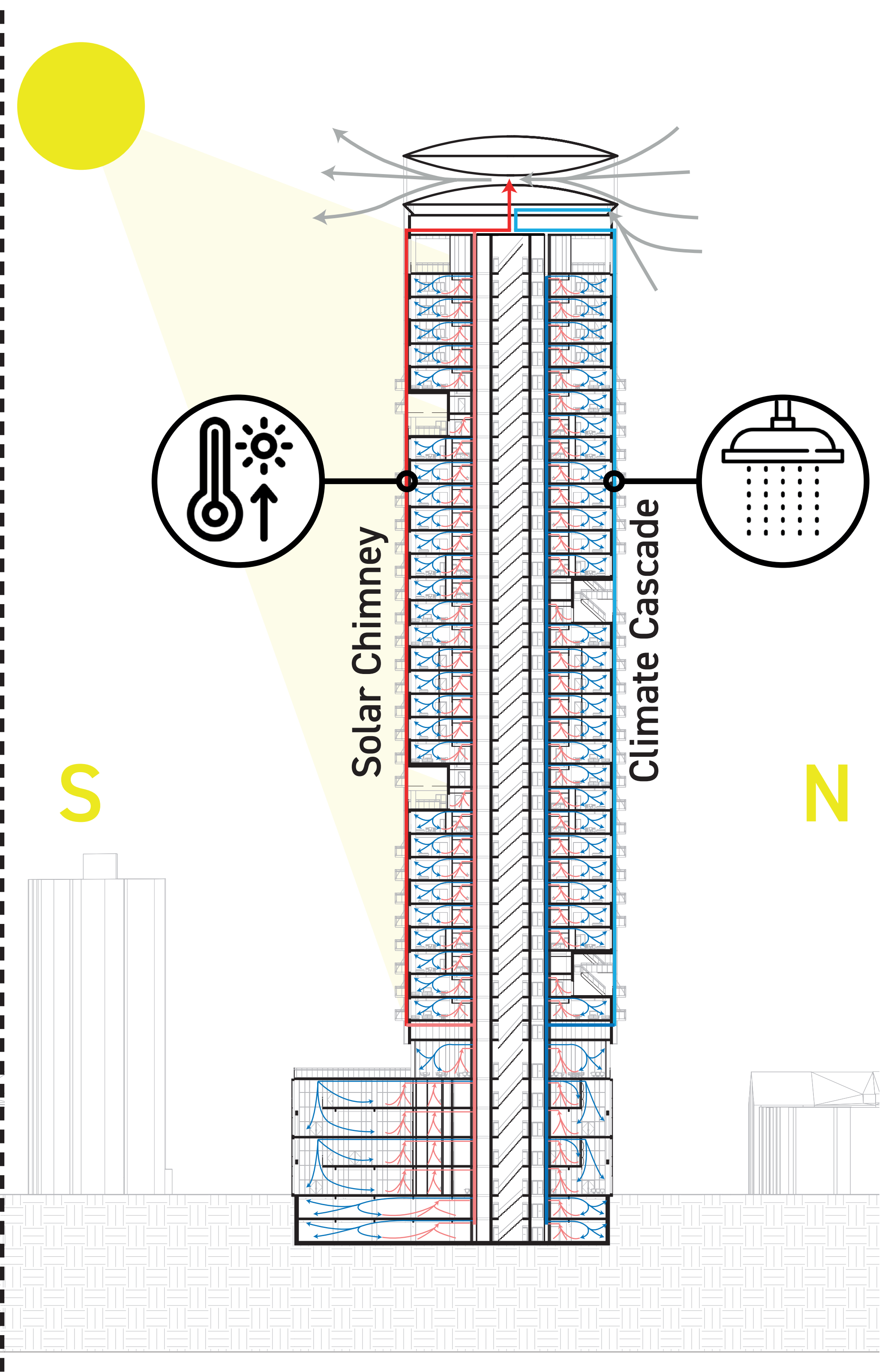
CLIMATE STRATEGY

VENTILATION, COOLING & HEATING

Heating System Diagram



Ventilation Diagram



-The ventilation system operates on the concept of Earth, Wind & Fire.

-This system contributes to sustainability because it has potential to operate passively with perfect conditions.

-The heating system operates with a central heatpump with floorheating, powered by Kameleon Facade Solar panels, while hot water is transfered from residual heat of the harbour of Rotterdam.

-This system contributes to sustainability due to multiple passive strategies

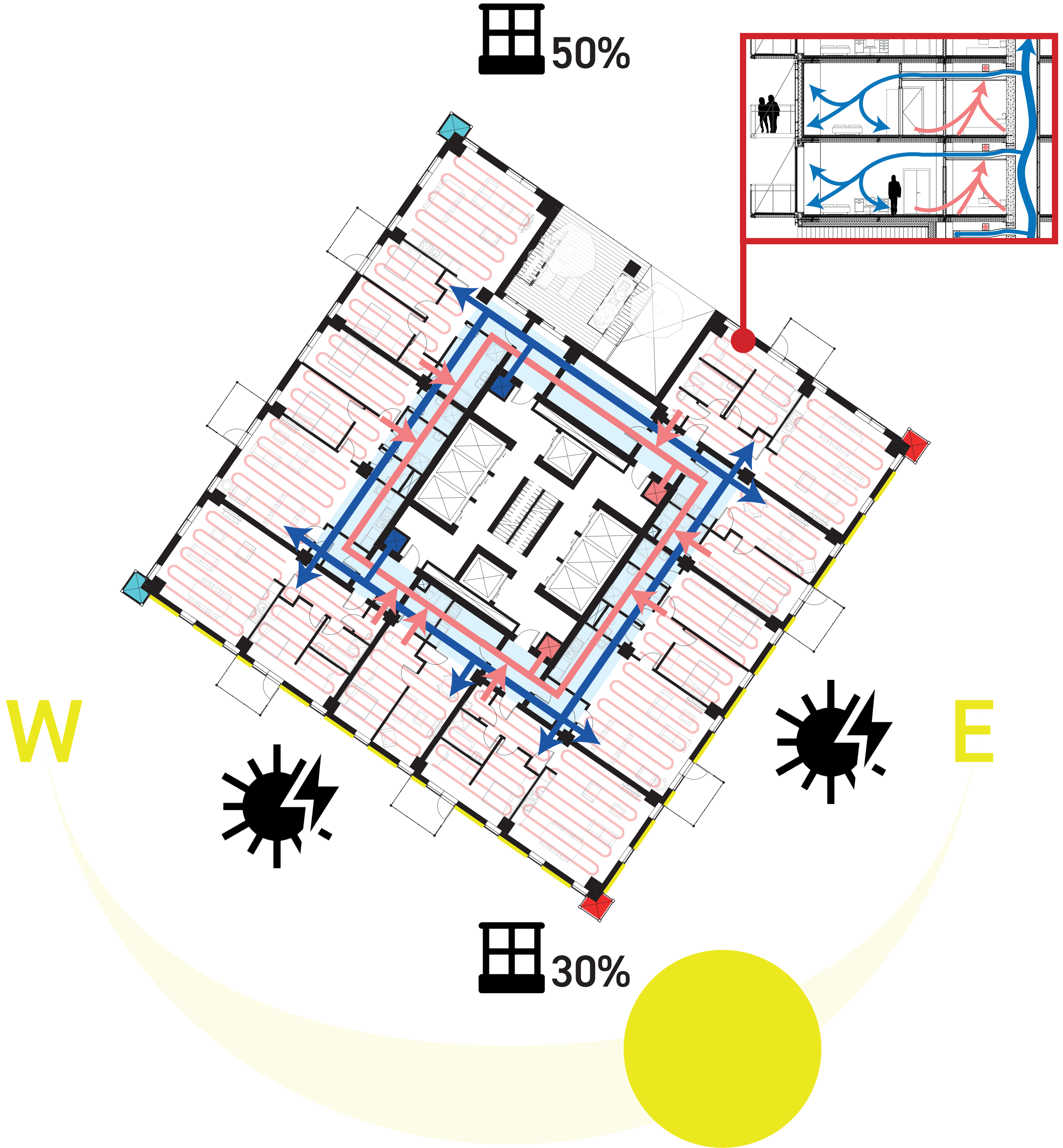
DESIGN PARAMETERS

-25m^3/pp/h Ventilation demand
-Floorheating T >35°
-Tapwater T > 60°
-8 - 16m^2 shafts depending on Airvelocity
-Tapwater T > 60°

1 : 1.000

CLIMATE STRATEGY

VENTILATION, COOLING & HEATING



-Between the core and the first grid lines, there is a zone destined for the distribution of shafts and plumbing fixtures.

-The Ceiling is lowered within this zone to make room for these installations.

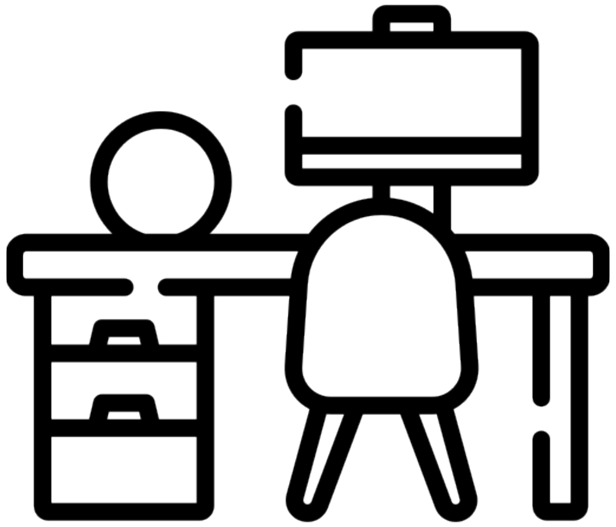
-Air is blown and pulled outside this zone. This ensures that the timber floor is always visible outside this zone.

-The window-wall ratio is less on the southside to maintain thermal comfort while the north side is higher.

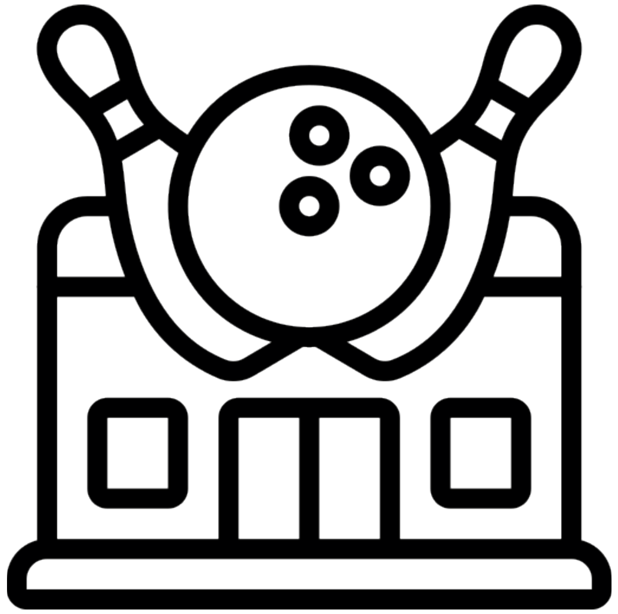
DESIGN PARAMETERS

-25m^3/pp/h Ventilation demand
-Floorheating T >35°
-Tapwater T > 60°
-8 - 16m^2 shafts depending on Airvelocity
-Tapwater T > 60°
-min. 30% Window Ratio for thermal comfort on southside
-min. 50% Window Ratio for catching sunlight and views on northside

1 : 250



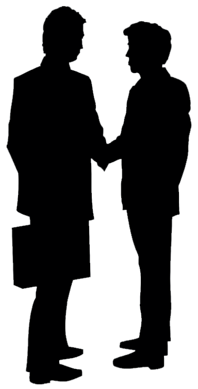
Offices



Leisure Activities

Starters

Multiple Target Groups



Knowledge Workers

PROGRAM STRATEGY

TARGET GROUPS

OFFICES

- Offices spaces will be placed in the building for anticipating the labour market, and to create facilities where the building and city generates money.

- These working spaces are suitable for knowledge workers and since you create more job opportunities, there should be more than enough room for starters.

LEISURE ACTIVITIES

- Leisure activities will be integrated in the building to attract visitors and to create a vibrant atmosphere.

- These activities are suitable for multiple target groups, from young to old.

Social Rental Housing

Middle Class Rental Housing

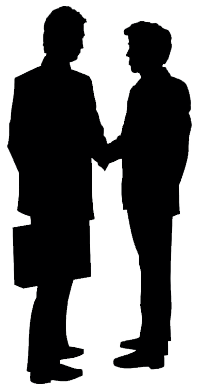
Housing For Sale

Starters

Couples

Large Families

Seniors



Knowledge Workers

Small Families

HOUSING

- Rotterdam has the most amount of social housing in the Netherlands, but the demand is still high (Holtermans, 2022).

- Starters are known to have the most troubles in finding a house in all sectors. Starters are also known to have a below average income (NOS, 2020). Social housing is therefore a great solution.

- Rotterdam is planning to drastically expand the amount of middle class rental housing.

- With Middle class rental housing I want to promote a diverse community of people (starters, knowledge workers, couples and small families of all age).

- I want to integrate families with a high income with housing that is destined to be sold.

- With this layout, I want to create a diverse community from various income groups.

PROGRAM STRATEGY

SECTION

-The functions are distributed from public to private the higher you go.

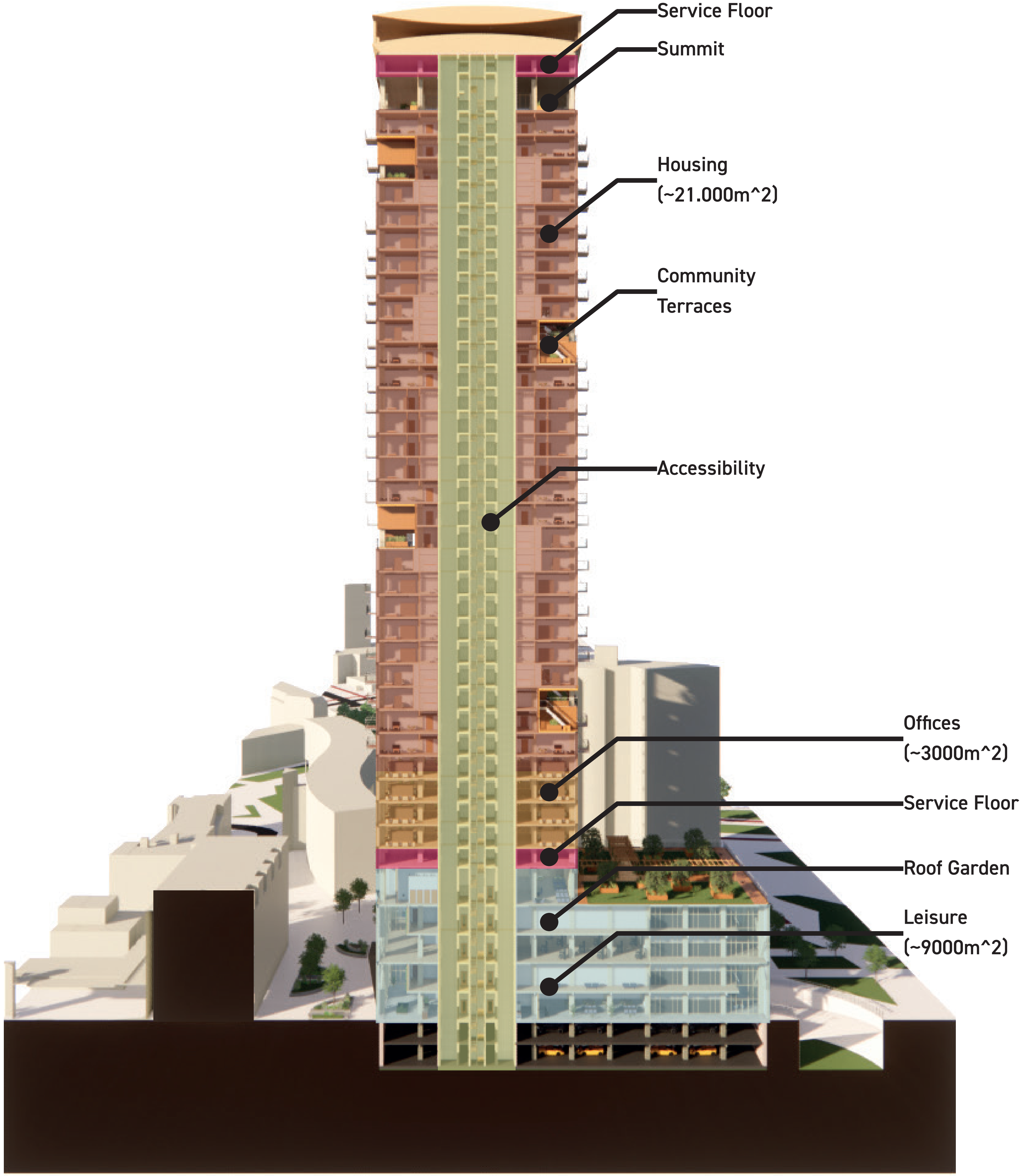
-The building has 2 service floors for installations

-This building layout has 238 apartments but could be scaled up to 272

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 750



PROGRAM STRATEGY

SECTION

-The functions are distributed from public to private the higher you go.

-The building has 2 service floors for installations

-This building layout has 238 apartments but could be scaled up to 272

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 750

PROGRAM STRATEGY

FLOORPLANS

LEISURE - GROUND FLOOR

-Every function has a seperate entrance

-Two entrances for leisure functions

-Restaurant and 8-ball pool

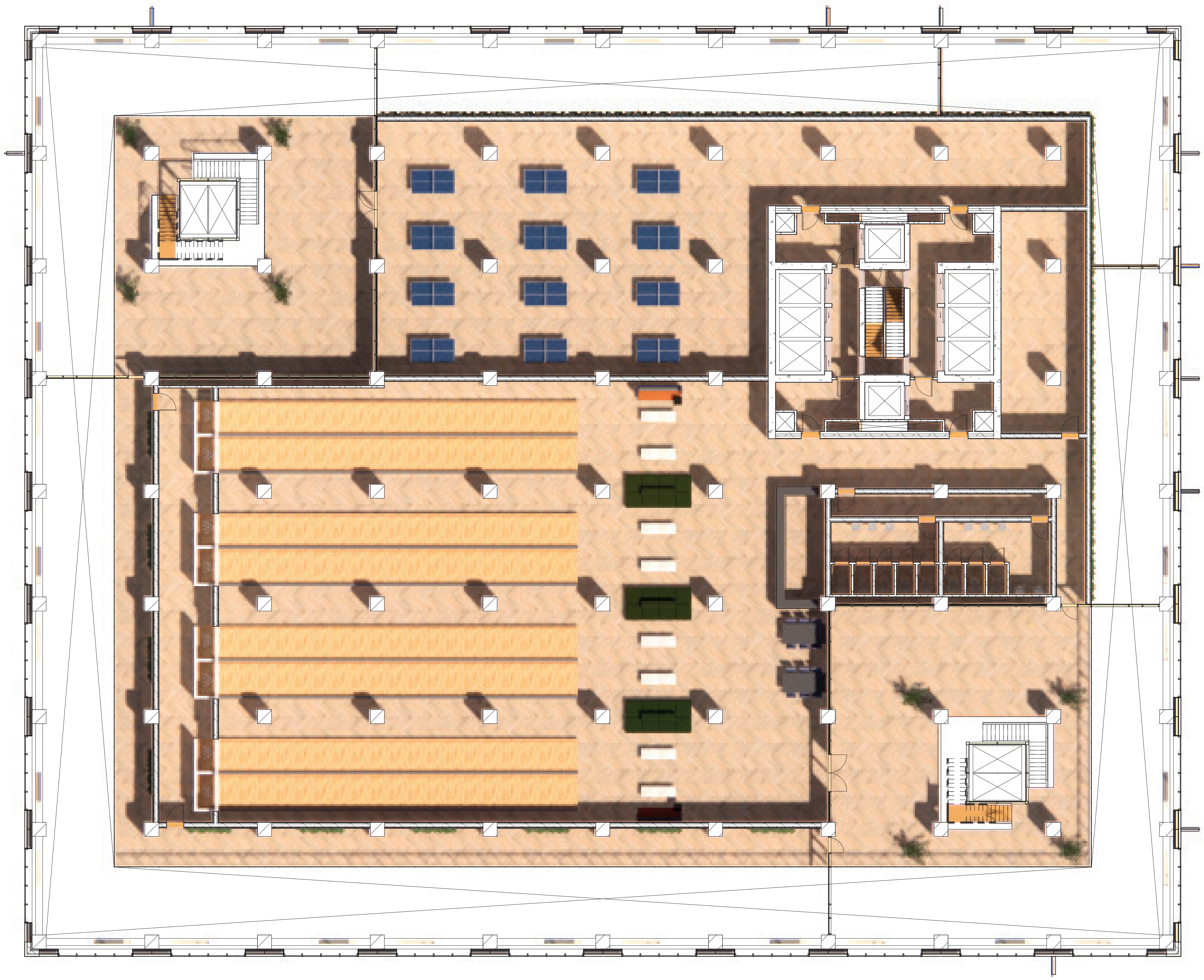
DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 250

PROGRAM STRATEGY

FLOORPLANS



LEISURE - 1ST FLOOR

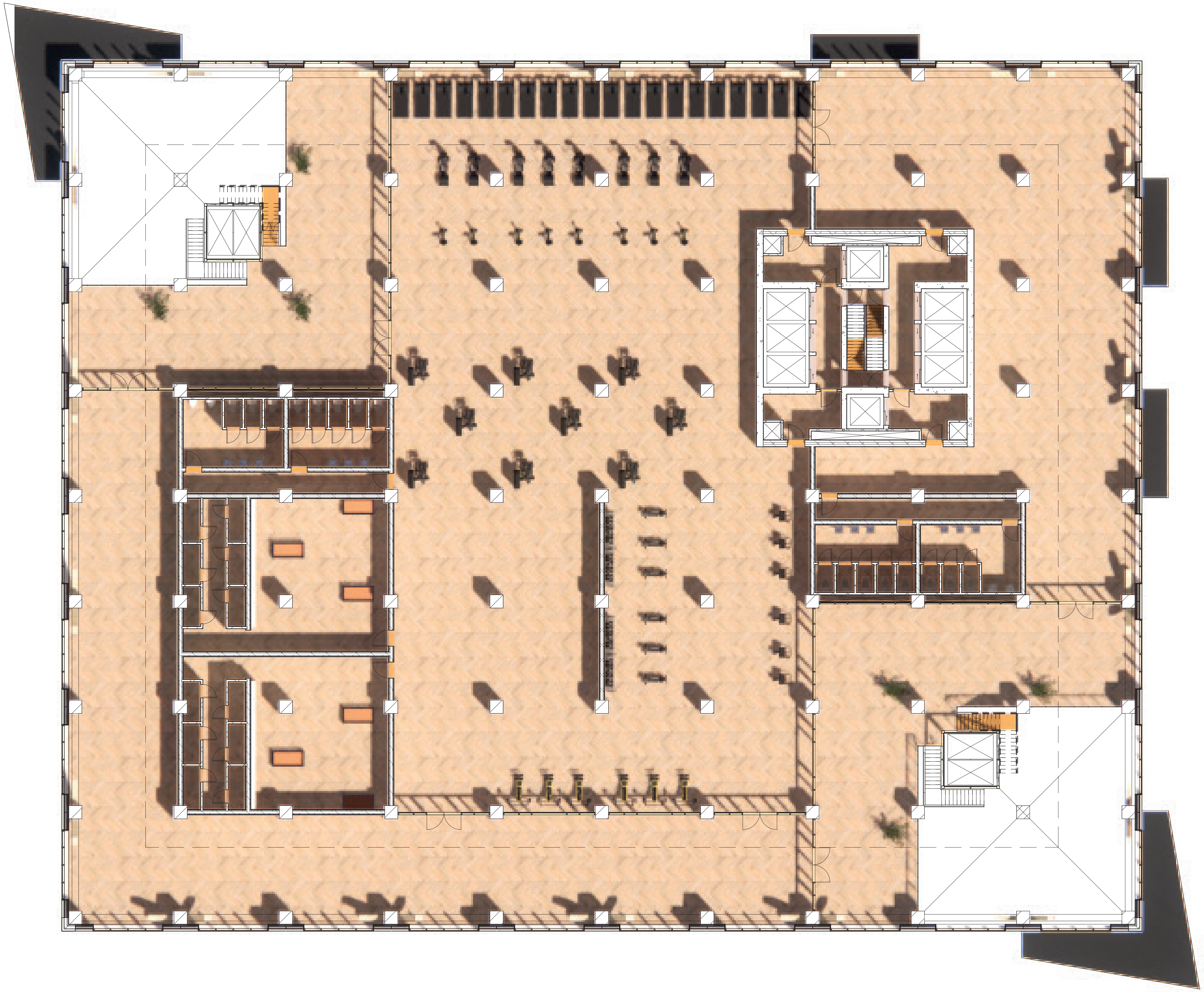
-Removable floor is constructed as a mezzanine

-Bowling alley

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 250



LEISURE - 2ND FLOOR

-Fitness and physiotherapy

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 250

LEISURE - 4TH FLOOR

-Restaurant and Roofterrace

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 250


D8
COPAIN

PROGRAM STRATEGY

FLOORPLANS

OFFICE - FLOORPLAN

Regular workspaces, flex-workspaces and conference rooms

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 150

PROGRAM STRATEGY

FLOORPLANS

RESIDENTIAL - FLOORPLAN

-4 types of apartments

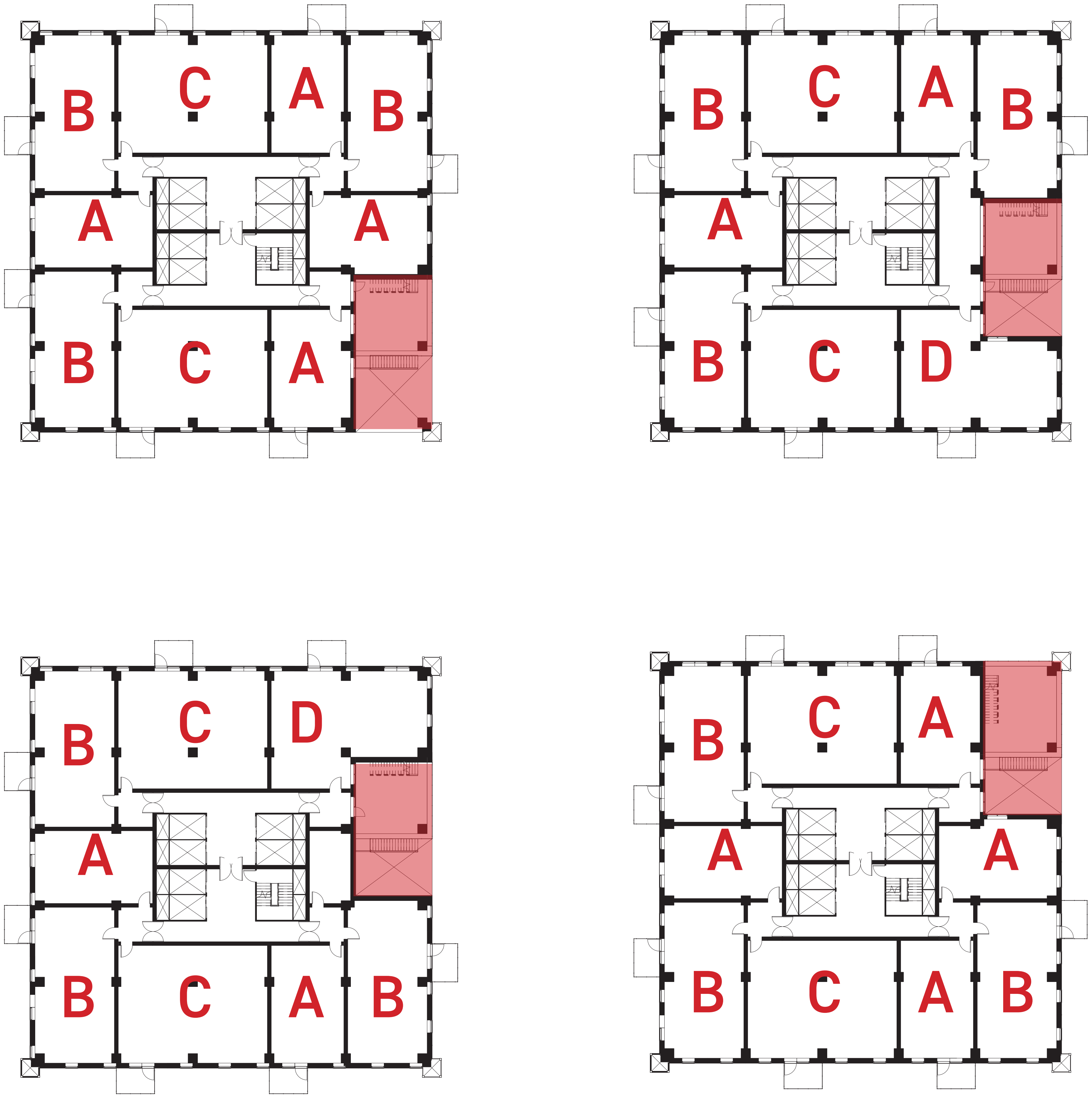
DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 150

PROGRAM STRATEGY

FLOORPLANS



RESIDENTIAL - HOUSING SEQUENCE

-Every 4th floor turns the layout 90 degrees.

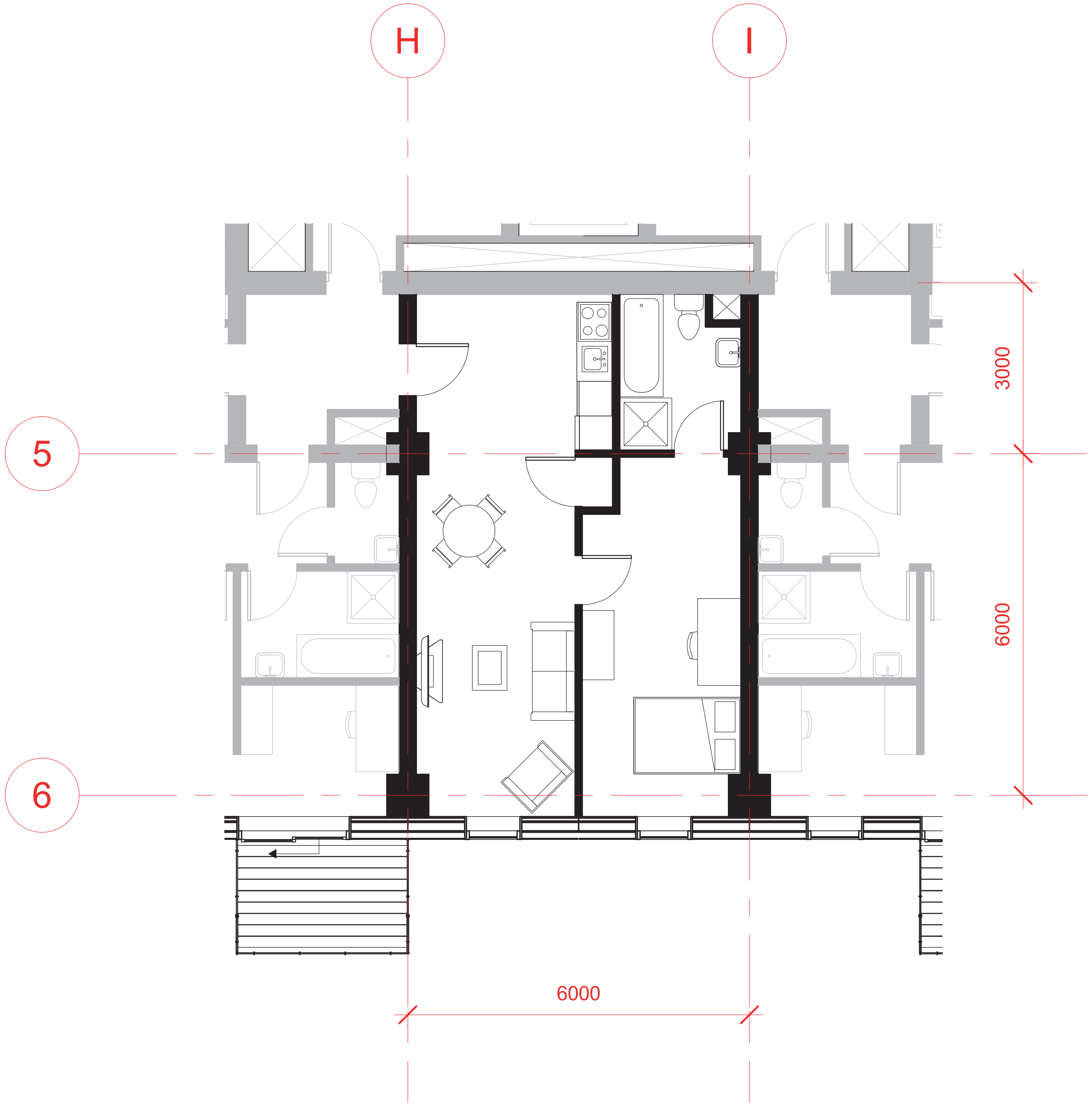
-The apartments respond well to the movement of the terraces

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 100

A - Starters Studio (c.a. 50 m²)



RESIDENTIAL - HOUSING UNITS TYPE A

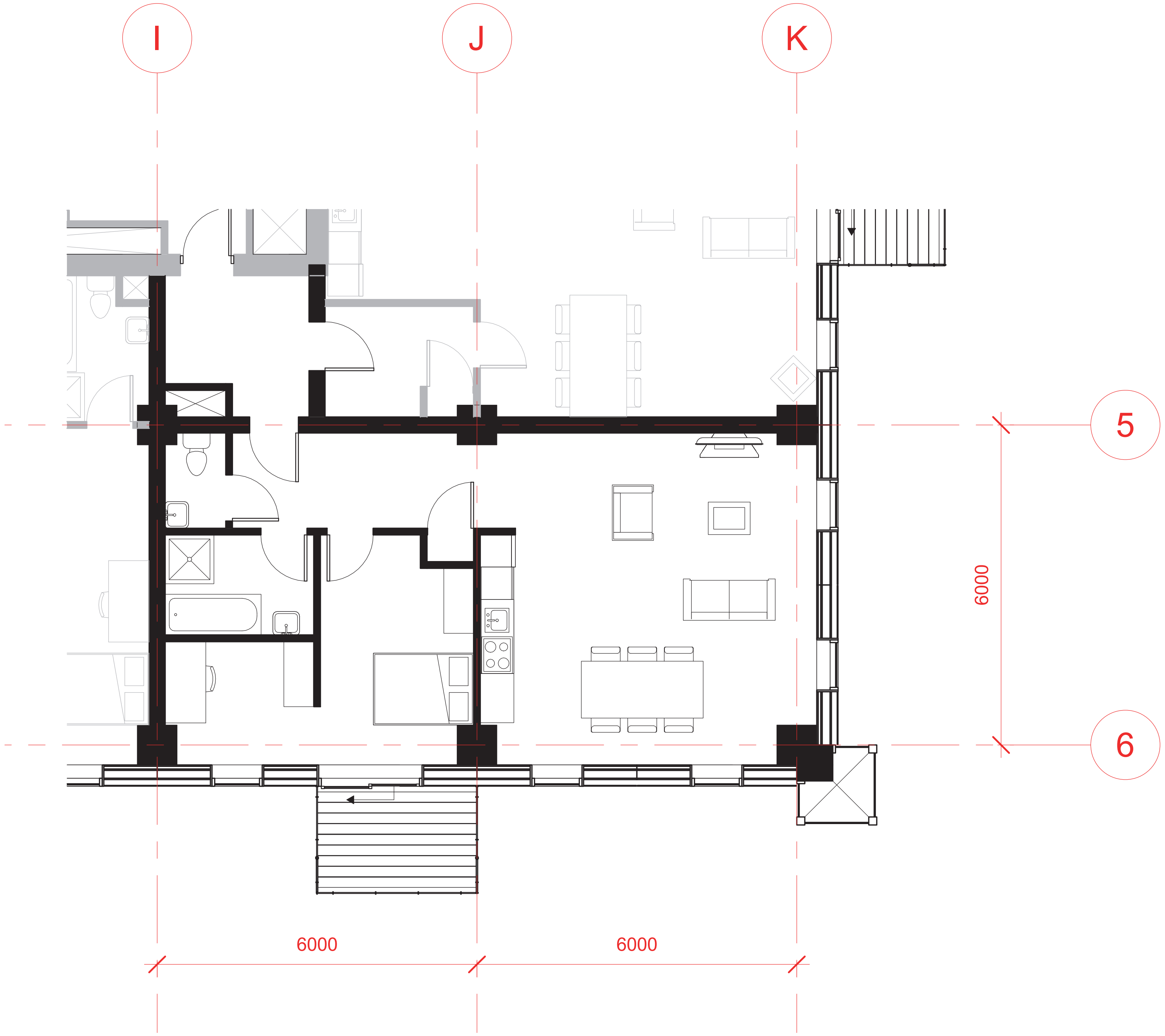
-Destined for starters and/ or seniors

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 100

B - Middle Class Apartment (c.a. 70 m²)



RESIDENTIAL - HOUSING UNITS TYPE B

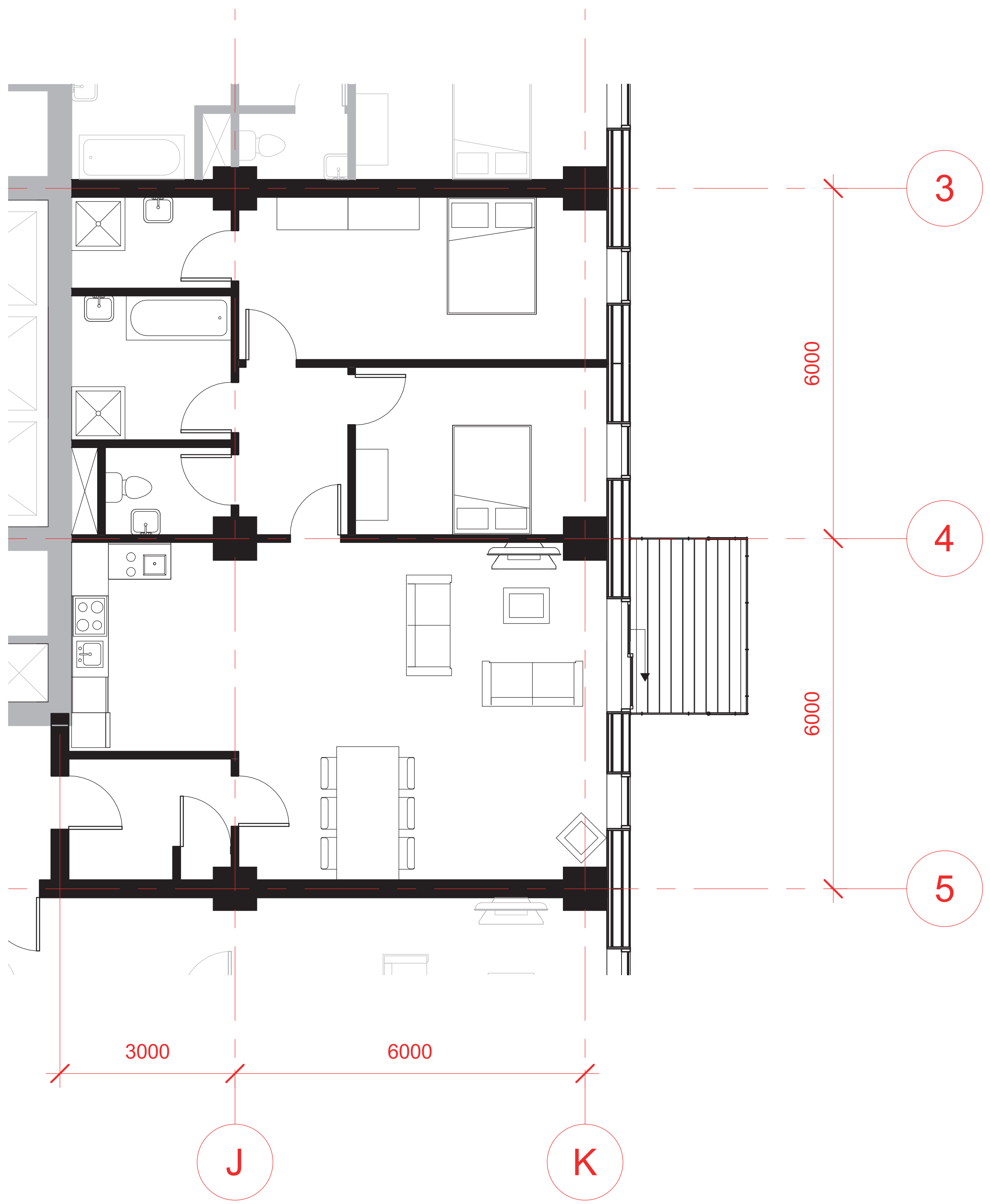
-Destined for couples, knowledge workers and small families

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 100

C - Large Family Apartment (c.a. 110 m²)



RESIDENTIAL - HOUSING UNITS TYPE C

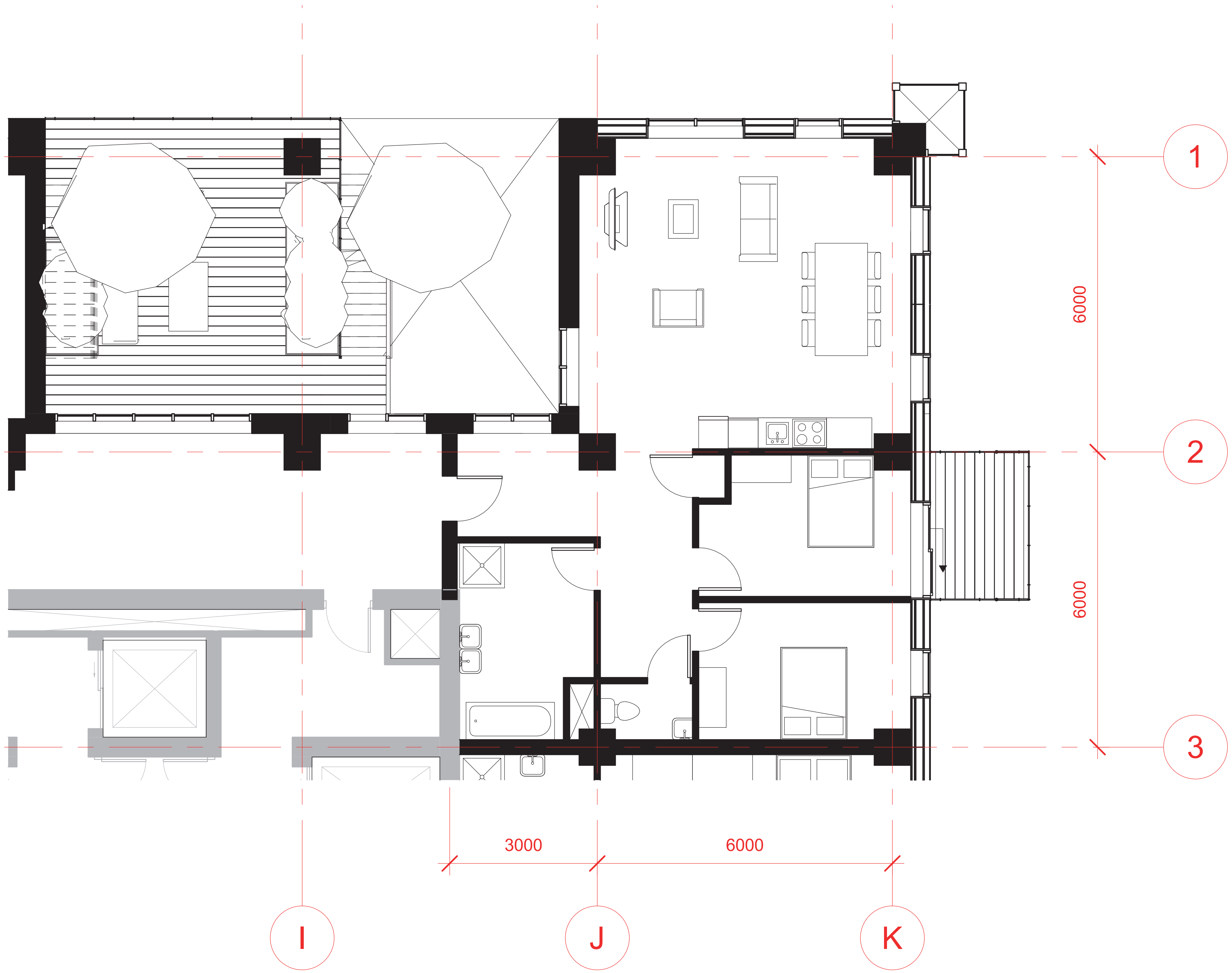
-Destined for large families

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 100

D - Medium Family Apartment (c.a. 90 m^2)



RESIDENTIAL - HOUSING UNITS TYPE D

-Destined for medium sized families

DESIGN PARAMETERS

-Public to semi-public distribution
-Increasing Accessibility
-Surface Area efficiency
-Entrances and elevators for each function

1 : 100

BUILDING TECHNOLOGY

FACADE FRAGMENT FRONTVIEW

-The combination between modular facade elements, terrace structures, and flexible floorplans is summarized in this fragment

DESIGN PARAMETERS

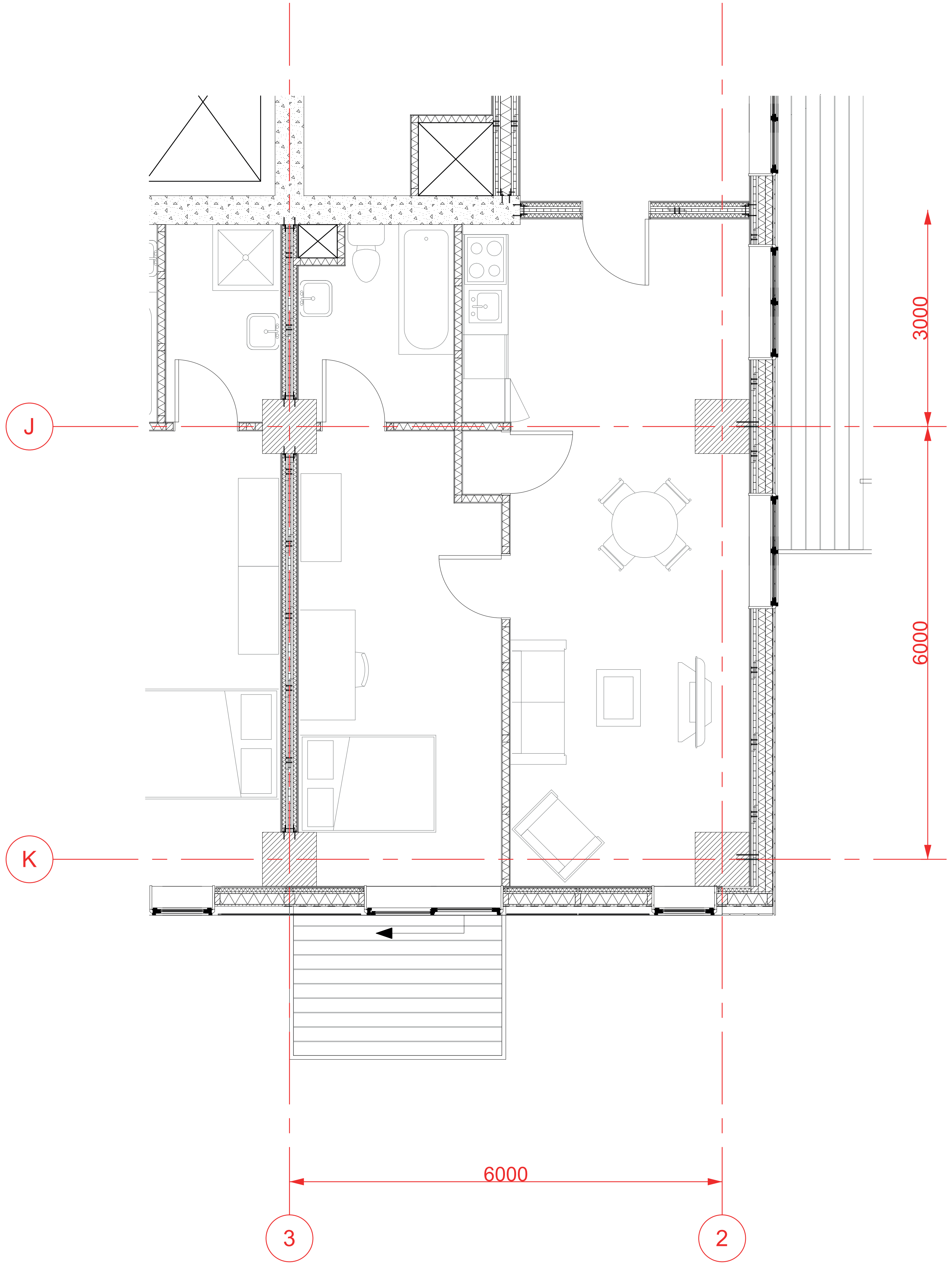
-Rc> 4,7 (facade)/ 6,3 (roof)
-Dry Floor system (no screeds)
-REI >90 (Partition wall)/ 120 (Escape)
-Lightweight sep. walls with timber studs
-Max. Partition Wall Module length 1m
-3m x 2m Balcony Size
-6m x 3,6m Facade Module size from grid
-6 modular facade combinations from 1 facade system

Rw > 52dB Ln,w <54dB

1 : 50

BUILDING TECHNOLOGY

FACADE FRAGMENT FLOORPLAN



- The internal walls are made out of timber stud systems for less weight, easy removability and less carbon footprint.

-The partition walls are made from Insulated CLT walls casted into place from 1m wide modules for easy removability.

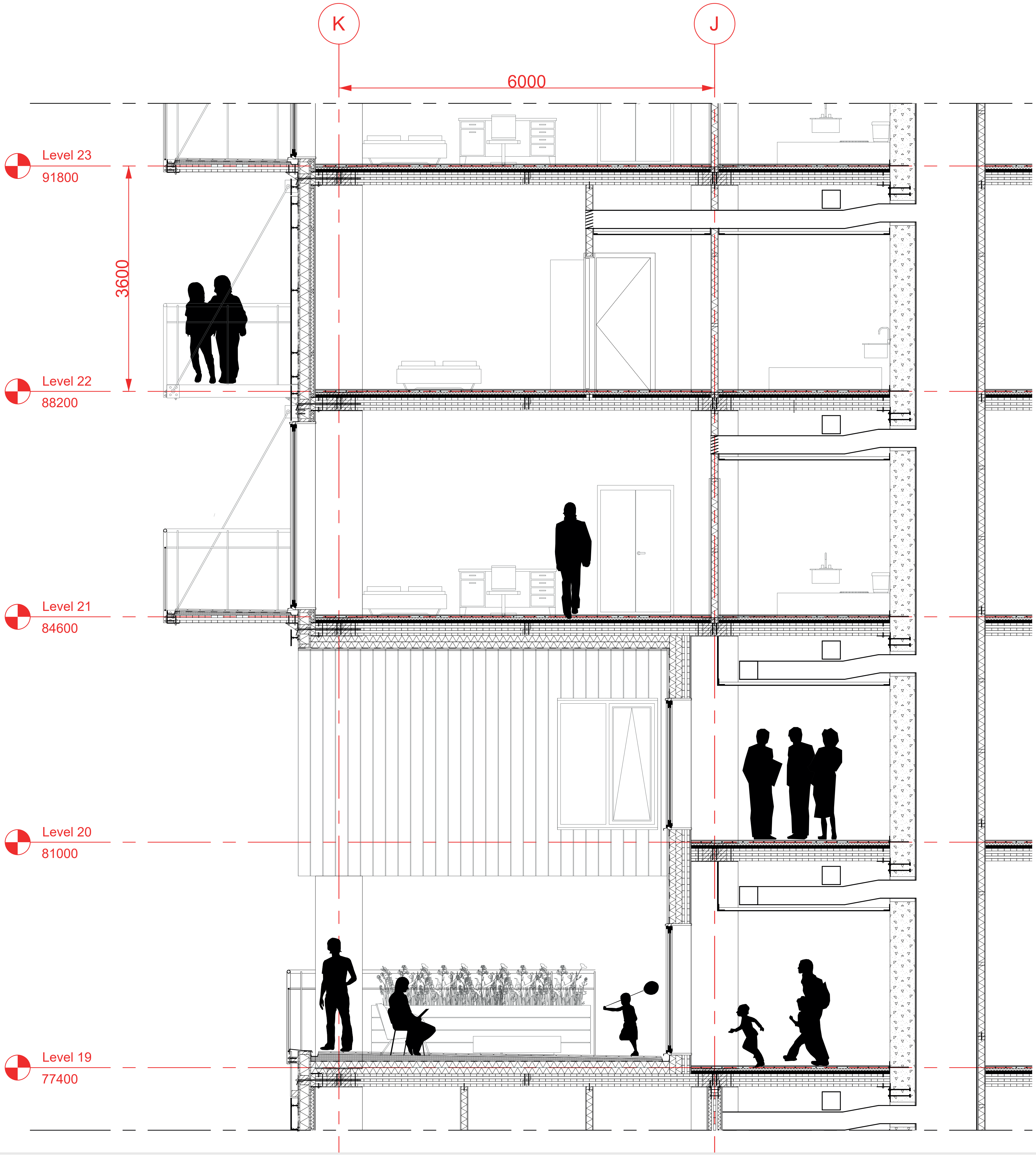
-The Terrace Walls are positioned outside the structural footprint to efficiently anchor them onto the column and for a continuous insulation line.

The modular facade elements are available without windows, with windows or with windows and balconies

DESIGN PARAMETERS

-Rc> 4,7 (facade)/ 6,3 (roof)
-Dry Floor system (no screeds)
-REI >90 (Partition wall)/ 120 (Escape)
-Lightweight sep. walls with timber studs
-Max. Partition Wall Module length 1m
-3m x 2m Balcony Size
-6m x 3,6m Facade Module size from grid
-6 modular facade combinations from 1 facade system
Rw > 52dB Ln,w <54dB

1 : 50



BUILDING TECHNOLOGY

FACADE FRAGMENT SECTION

- The internal walls are made out of timber stud systems for less weight, easy removability and less carbon footprint.

-The partition walls are made from Insulated CLT walls casted into place from 1m wide modules for easy removability.

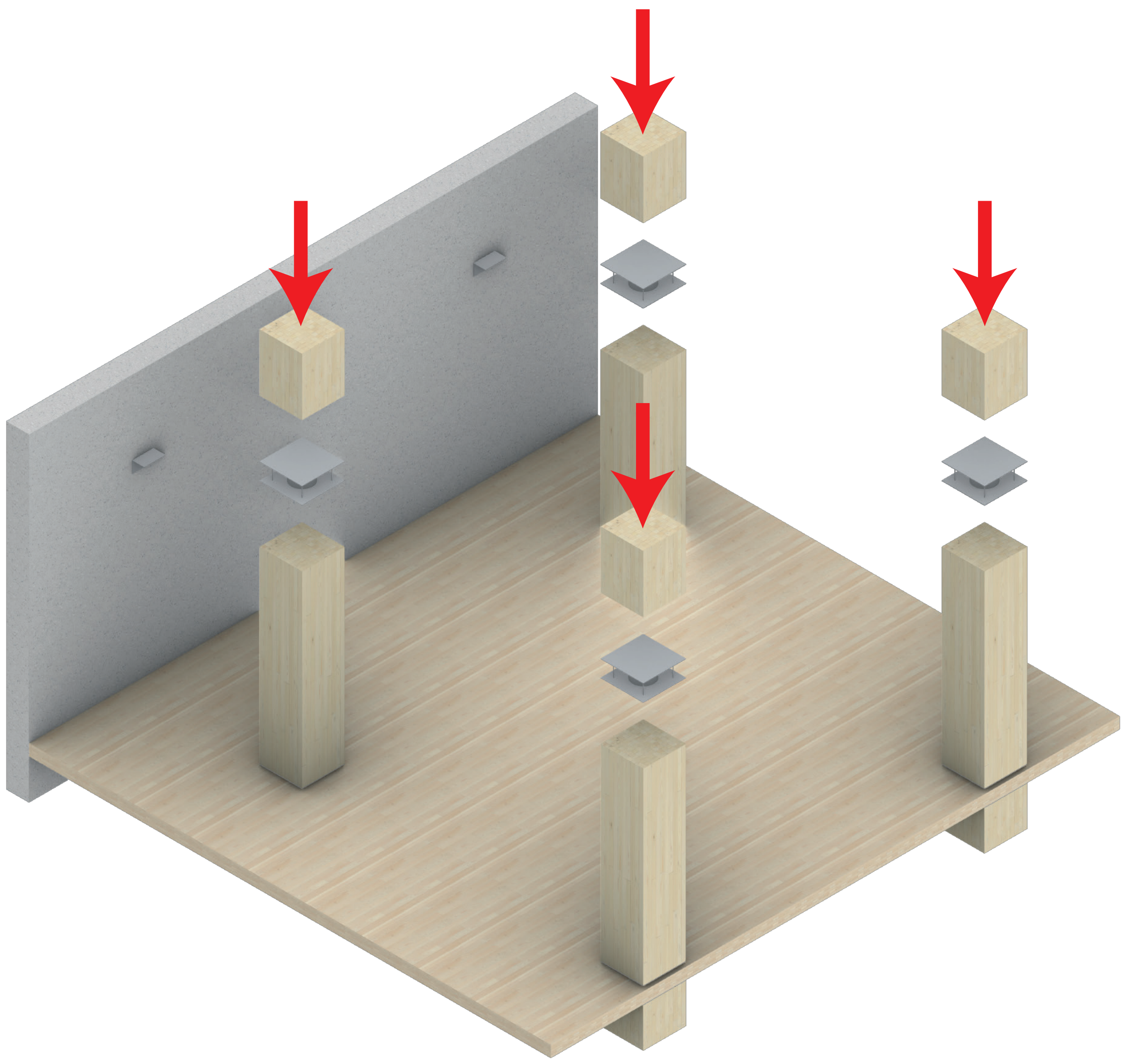
-The Terrace Walls are positioned outside the structural footprint to efficiently anchor them onto the column and for a continuous insulation line.

The modular facade elements are available without windows, with windows or with windows and balconies

DESIGN PARAMETERS

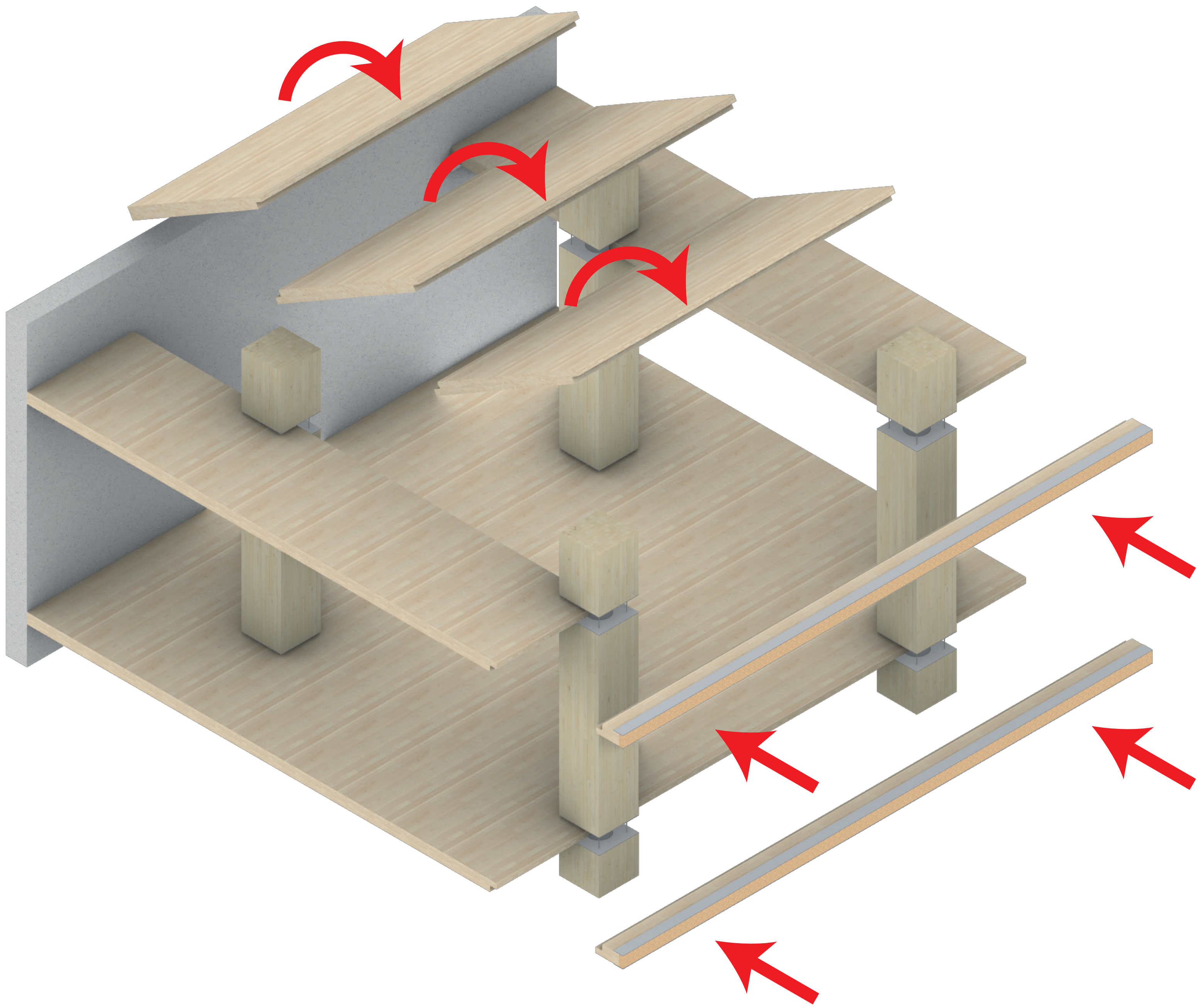
-Rc> 4,7 (facade)/ 6,3 (roof)
-Dry Floor system (no screeds)
-REI >90 (Partition wall)/ 120 (Escape)
-Lightweight sep. walls with timber studs
-Max. Partition Wall Module length 1m
-3m x 2m Balcony Size
-6m x 3,6m Facade Module size from grid
-6 modular facade combinations from 1 facade system
Rw > 52dB Ln,w <54dB

1 : 50



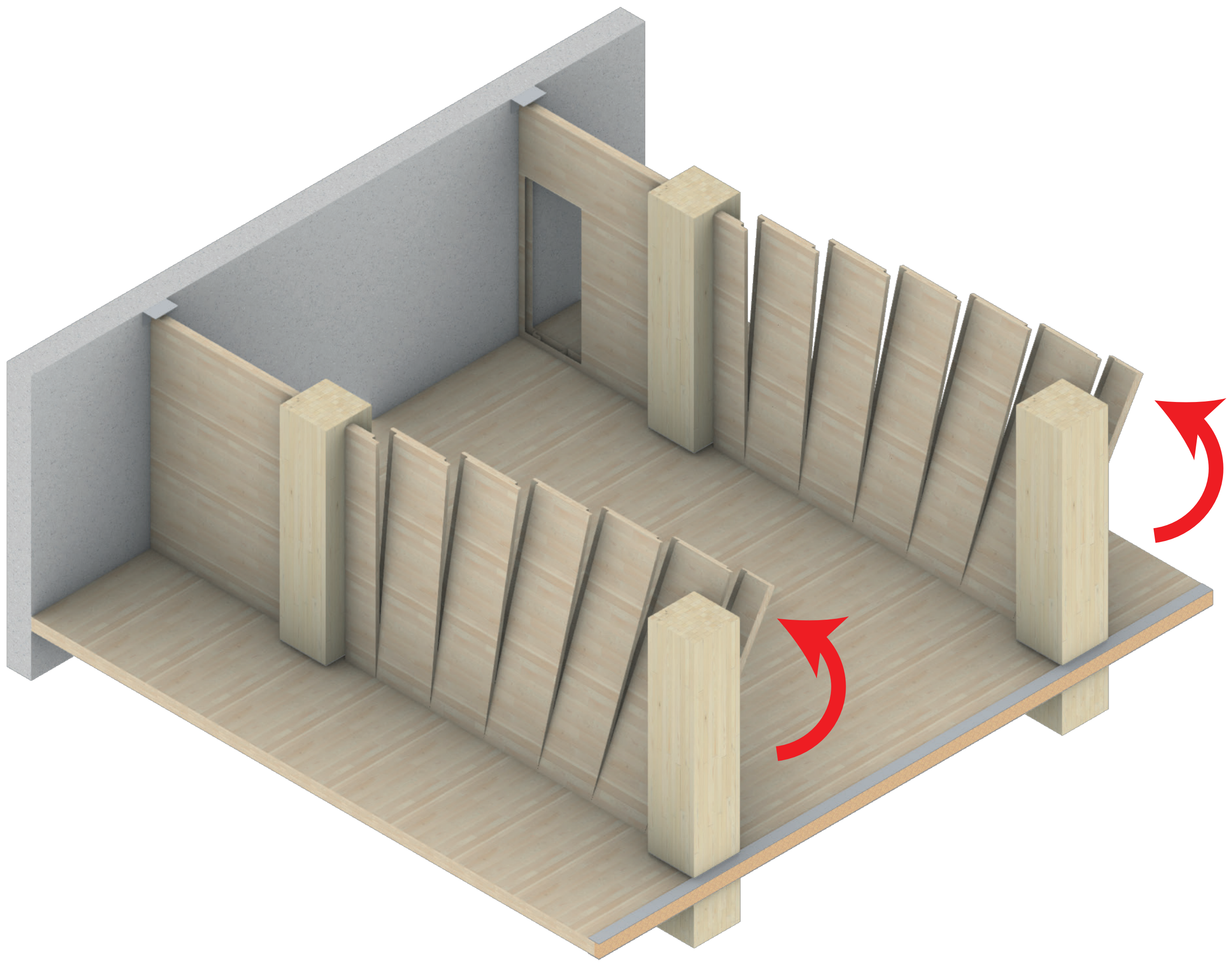
1. Assembly of the columns

1 : 10



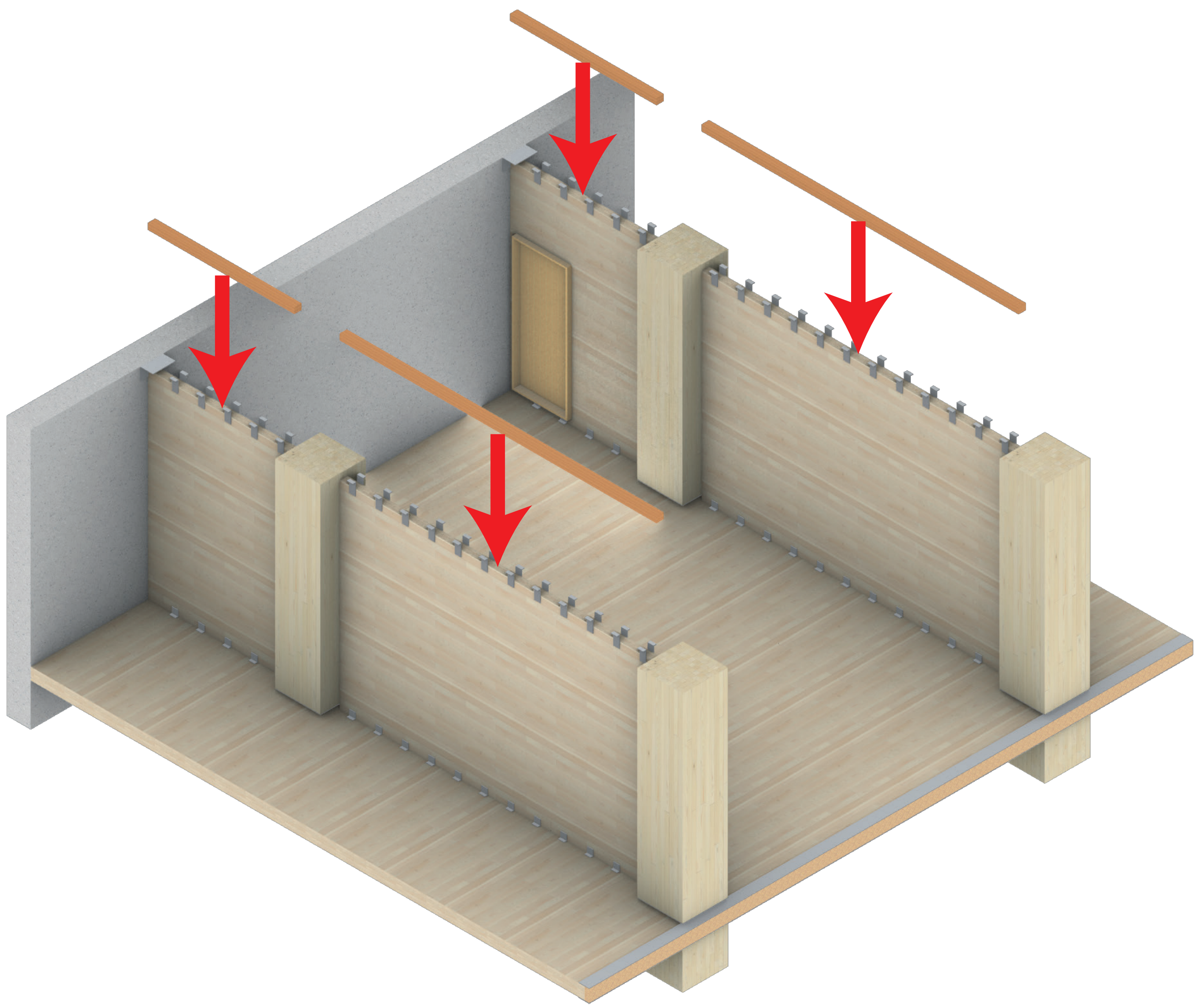
1. Assembly of the columns
2. Assembly of the CLT Floors on columns

1 : 10



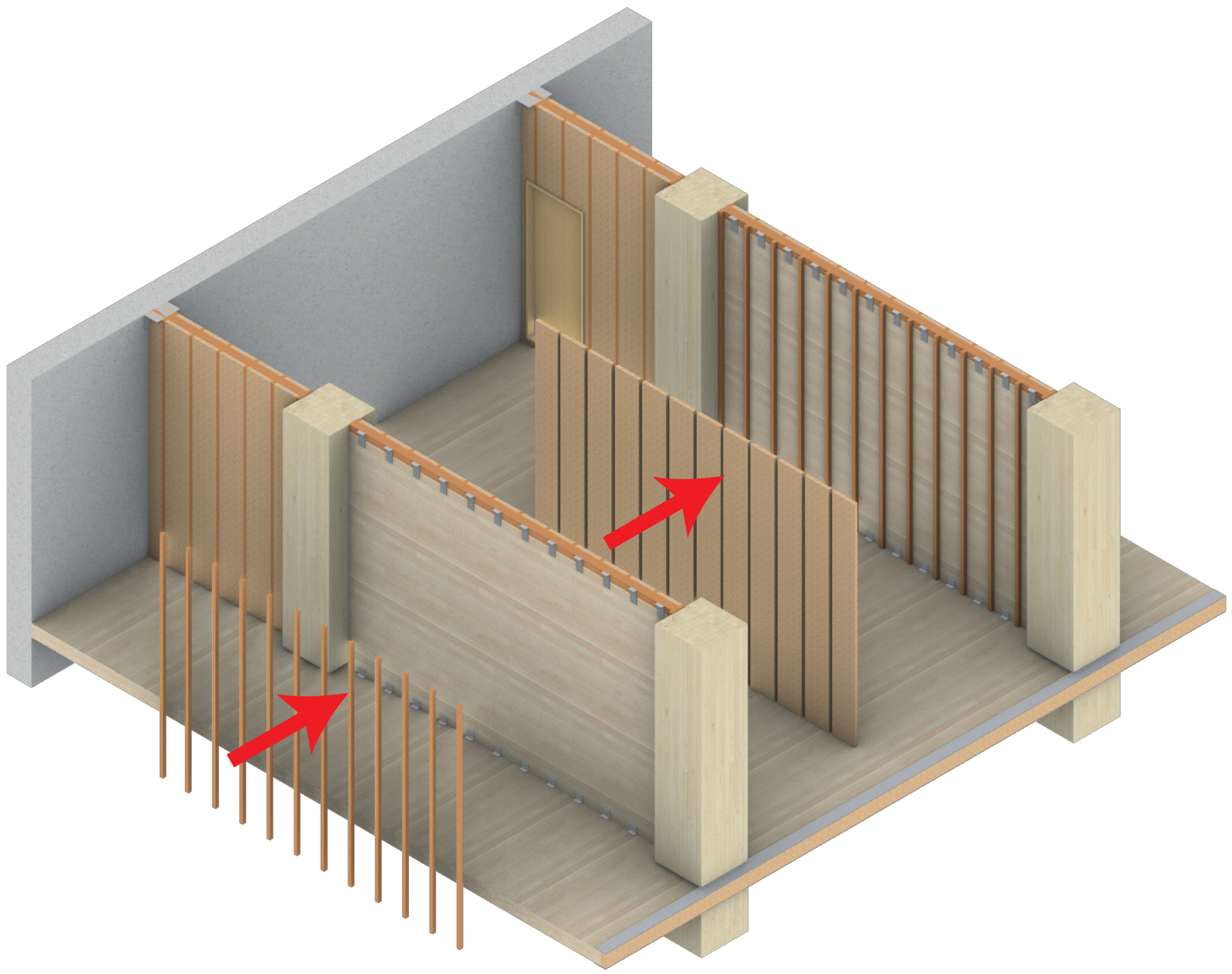
1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units

1 : 10



1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls

1 : 10



BUILDING TECHNOLOGY

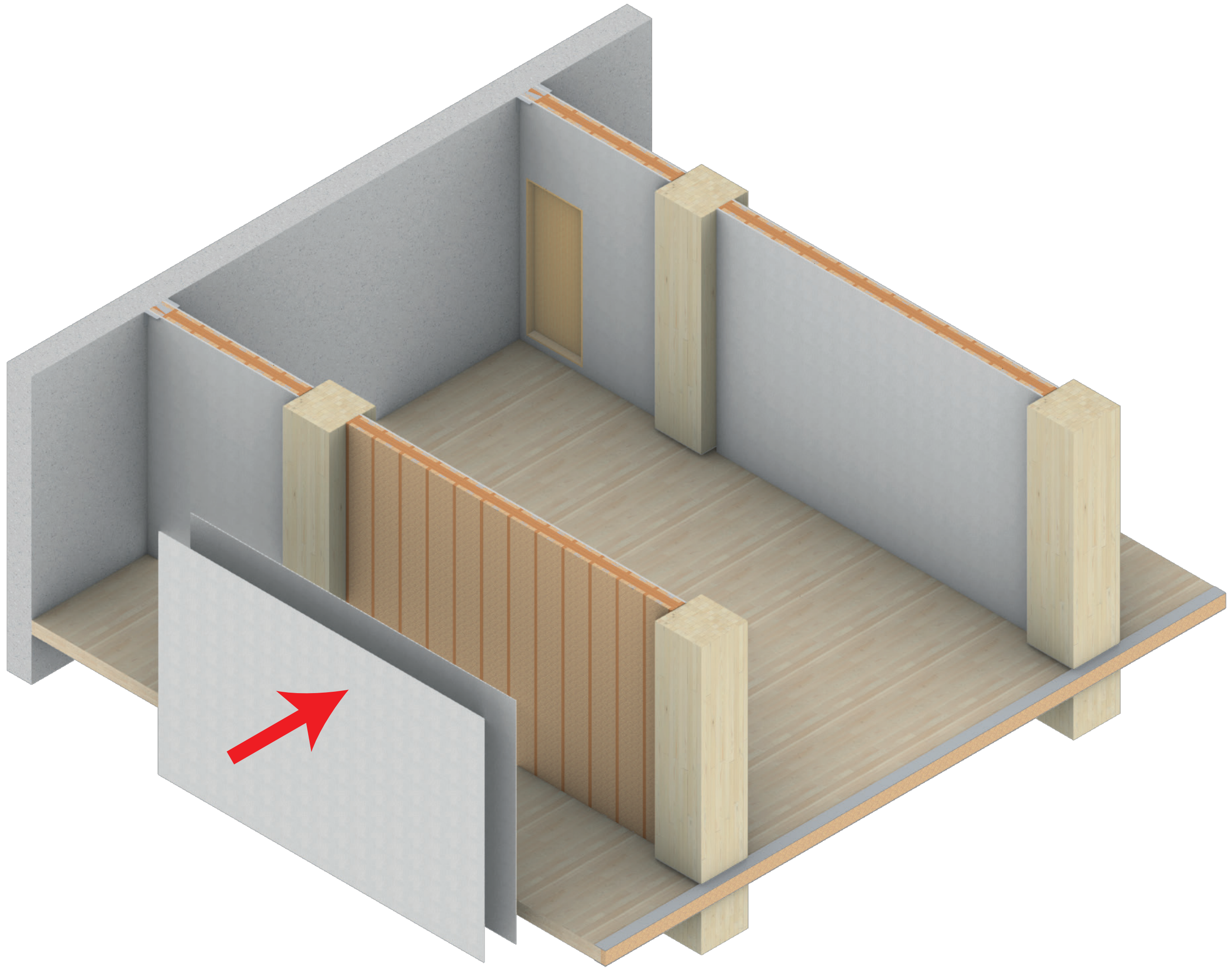
MODULAR FACADE ASSEMBLY

1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation

1 : 10

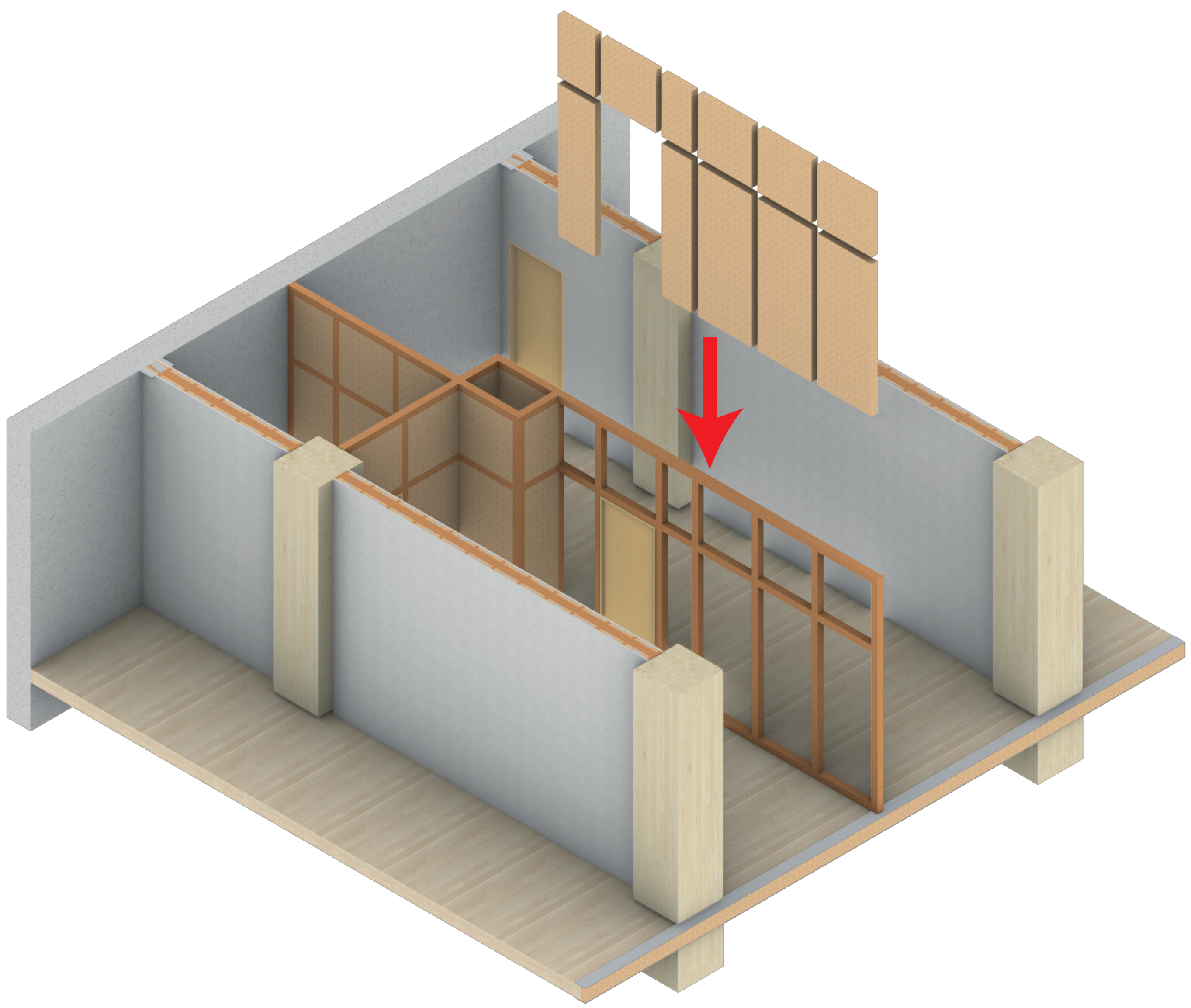
BUILDING TECHNOLOGY

MODULAR FACADE ASSEMBLY



1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety

1 : 10

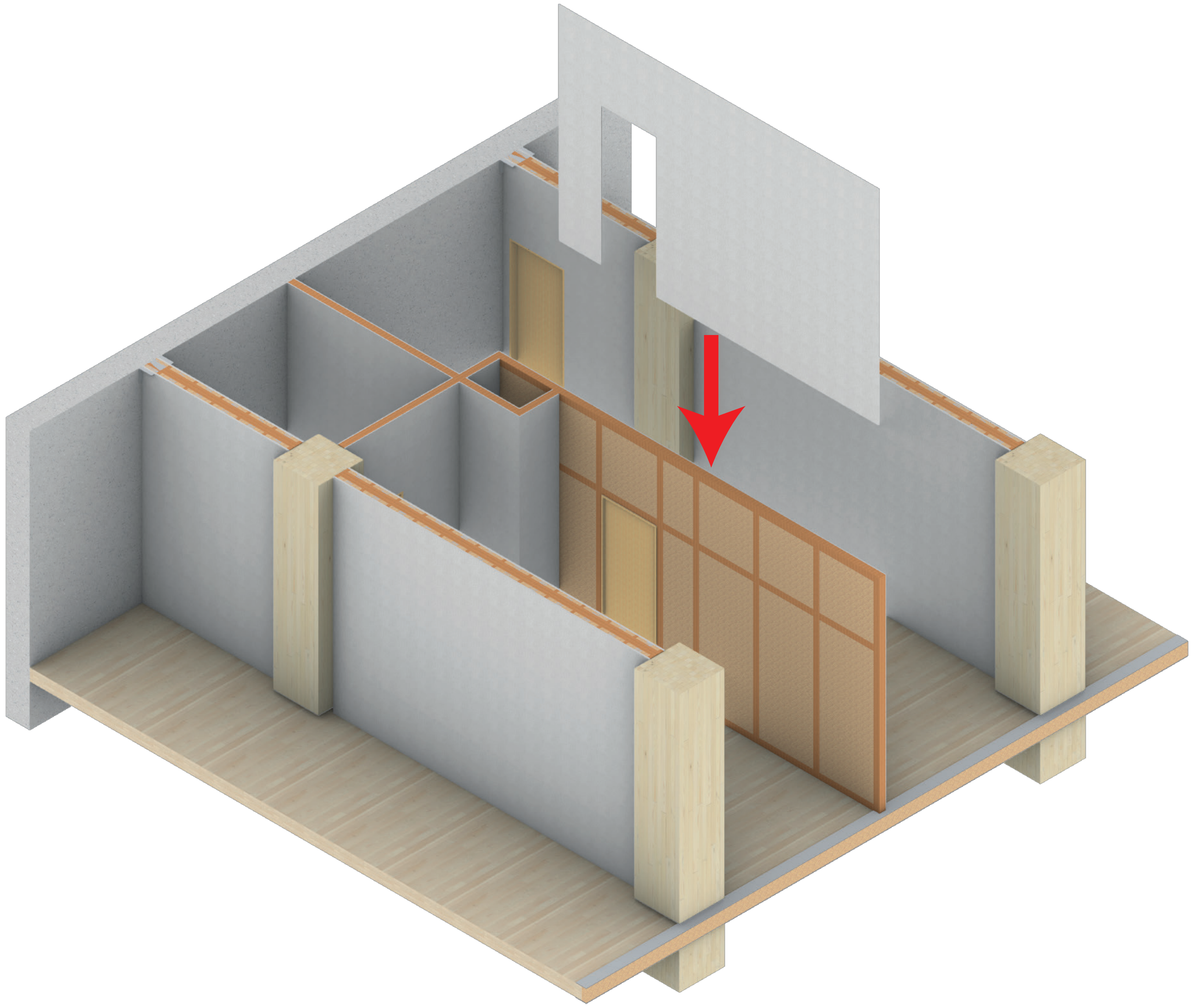


BUILDING TECHNOLOGY

MODULAR FACADE ASSEMBLY

1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety
7. Assembly of the Studs

1 : 10



BUILDING TECHNOLOGY

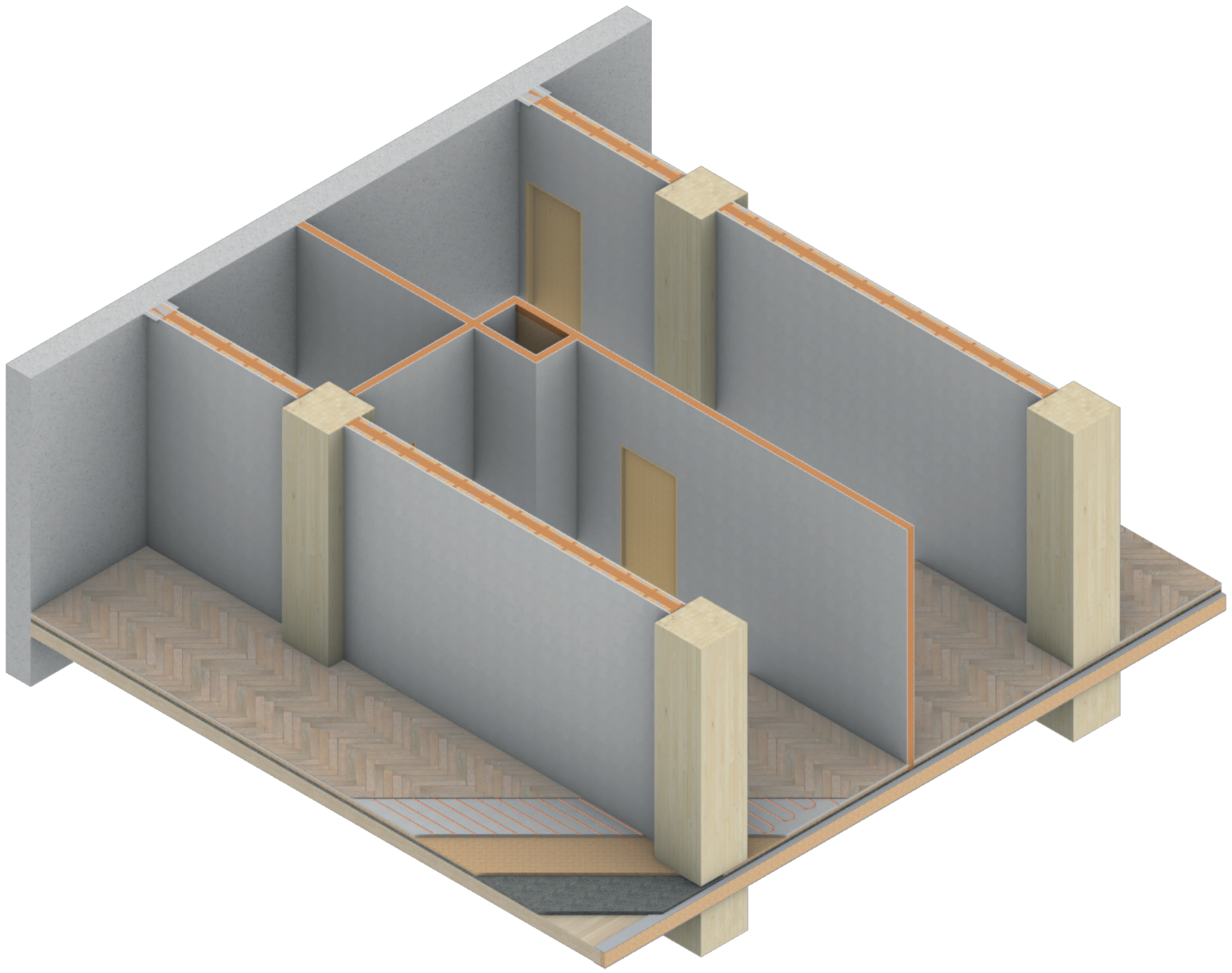
MODULAR FACADE ASSEMBLY

1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety
7. Assembly of the Studs
8. Finish with Gypsum Wallboard

1 : 10

BUILDING TECHNOLOGY

MODULAR FACADE ASSEMBLY

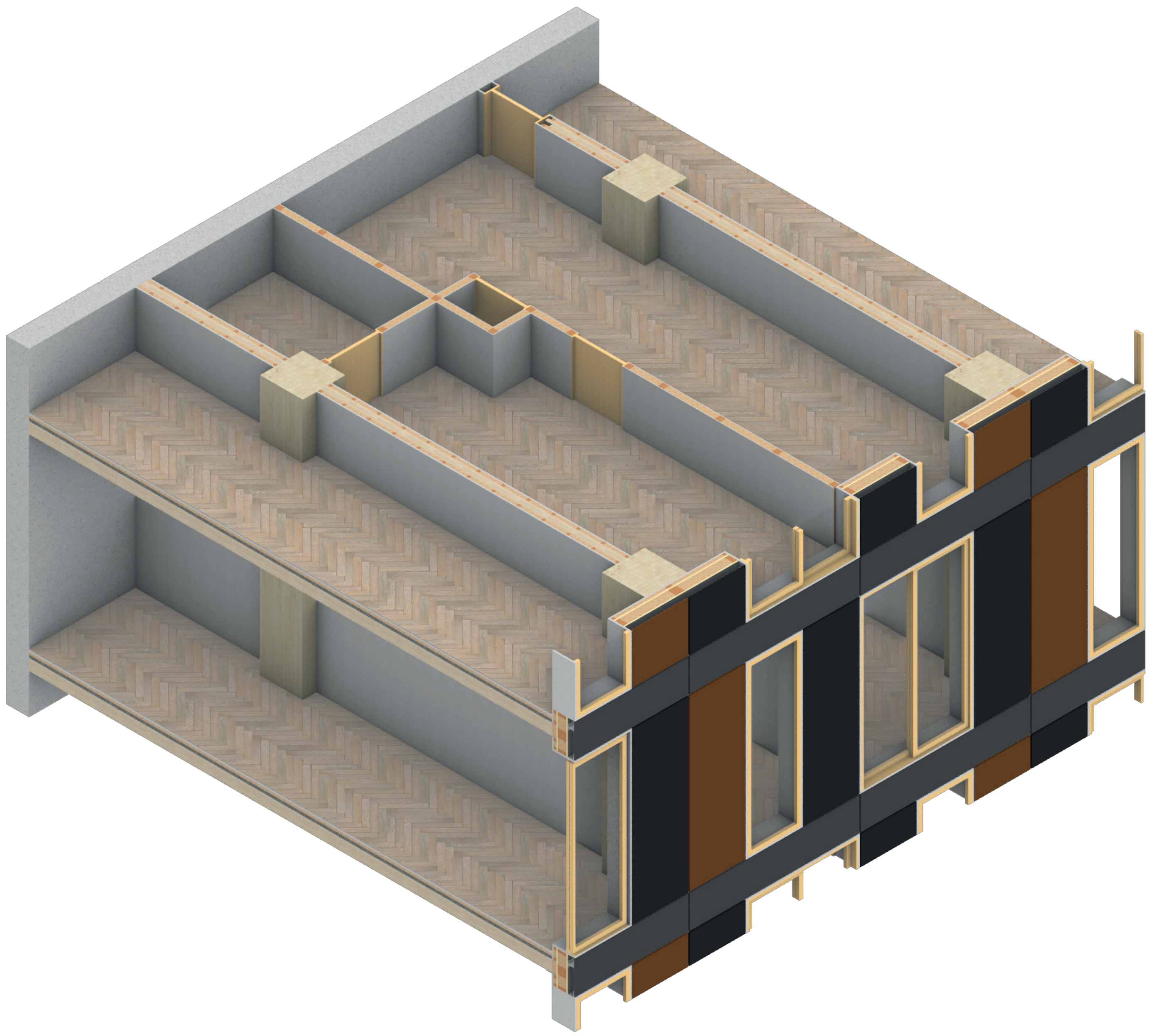


1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety
7. Assembly of the Studs
8. Finish with Gypsum Wallboard
9. Floorlayering

1 : 10

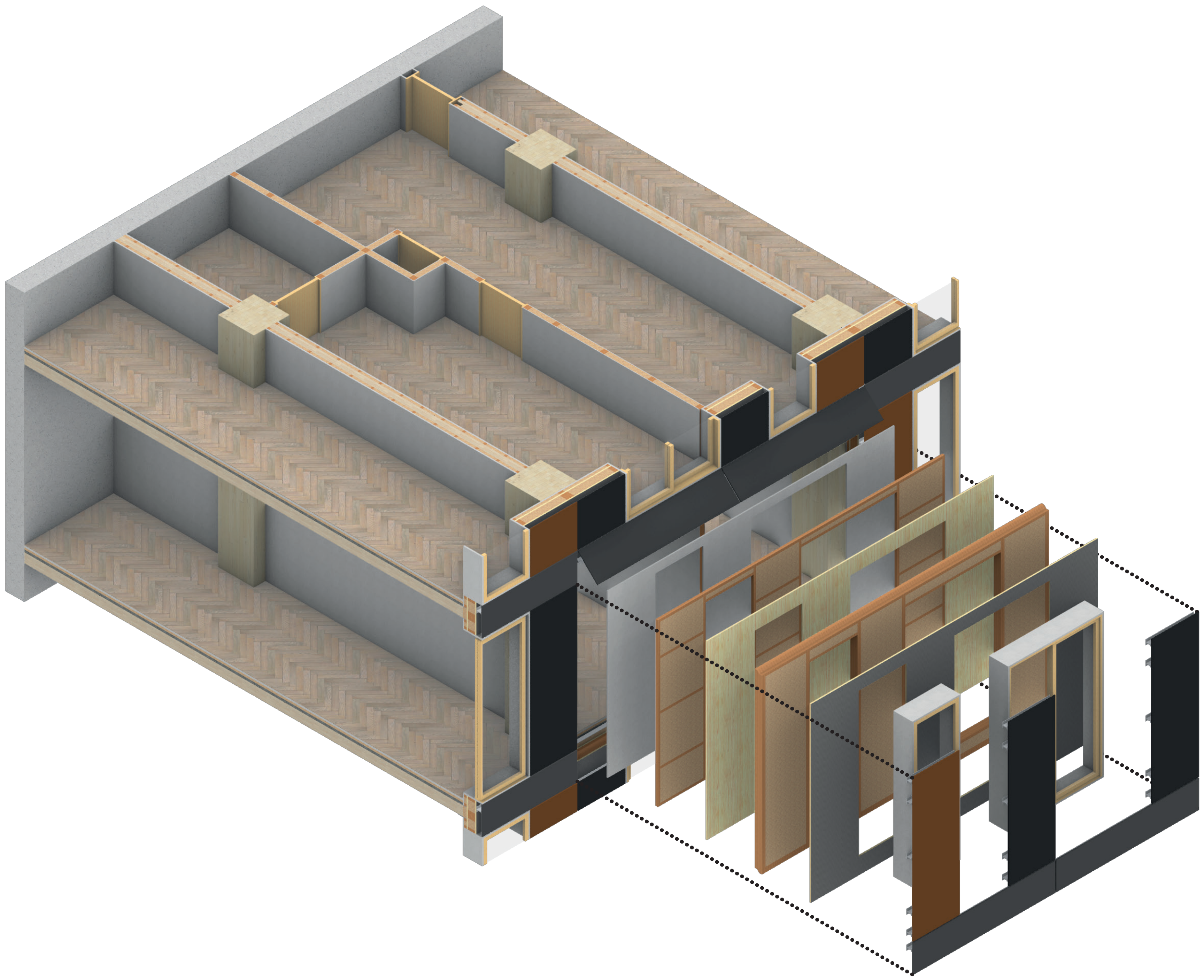
BUILDING TECHNOLOGY

MODULAR FACADE ASSEMBLY



1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety
7. Assembly of the Studs
8. Finish with Gypsum Wallboard
9. Floorlayering
10. Assembly of the facade

1 : 10



BUILDING TECHNOLOGY

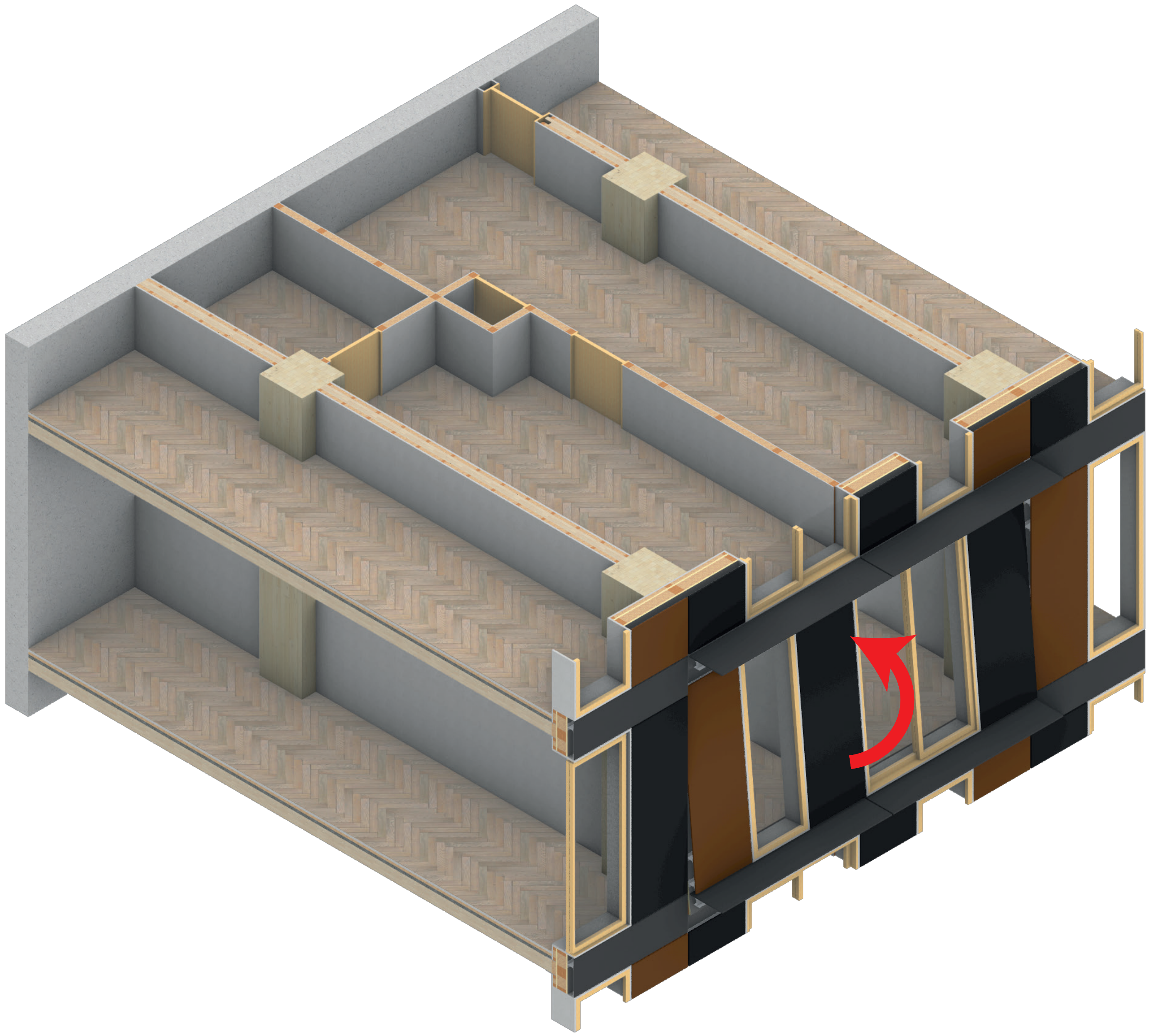
MODULAR FACADE ASSEMBLY

1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety
7. Assembly of the Studs
8. Finish with Gypsum Wallboard
9. Floorlayering
10. Assembly of the facade
11. Modular facade Unit Layering

1 : 10

BUILDING TECHNOLOGY

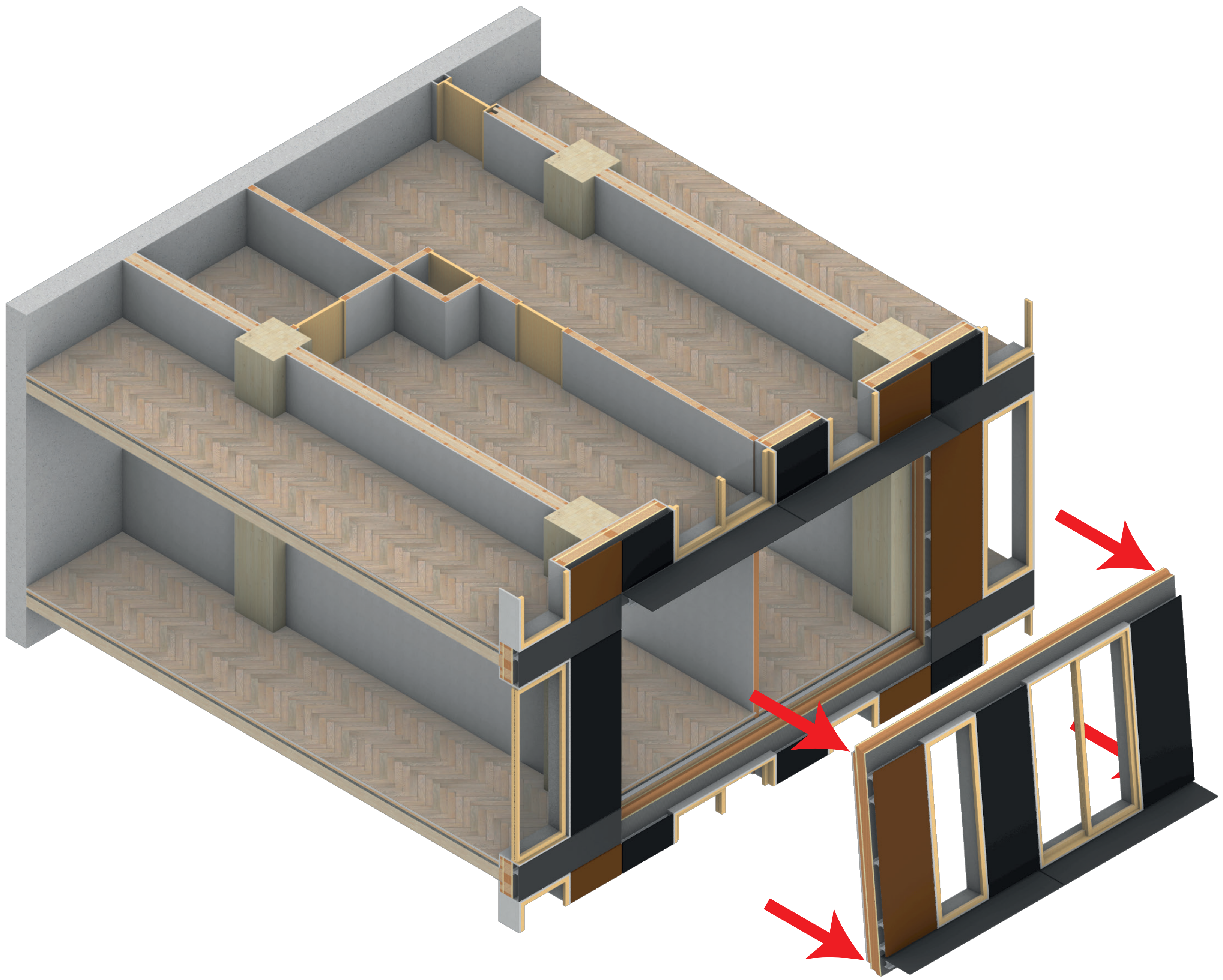
MODULAR FACADE ASSEMBLY



1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety
7. Assembly of the Studs
8. Finish with Gypsum Wallboard
9. Floorlayering
10. Assembly of the facade
11. Modular facade Unit Layering
12. Remove joints from facade element

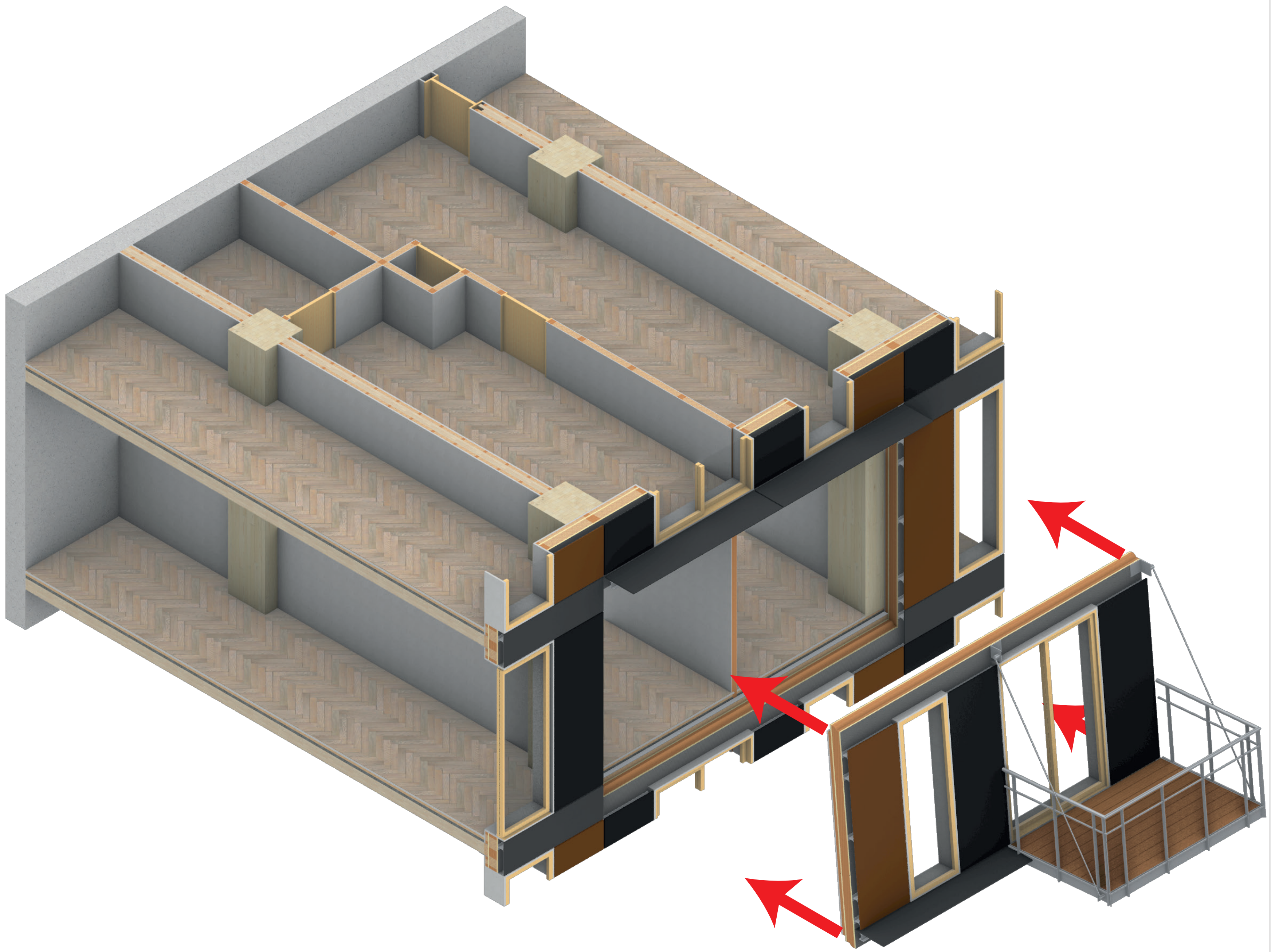
1 : 10

MODULAR FACADE ASSEMBLY



1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety
7. Assembly of the Studs
8. Finish with Gypsum Wallboard
9. Floorlayering
10. Assembly of the facade
11. Modular facade Unit Layering
12. Remove joints from facade element
13. Remove old facade unit

1 : 10



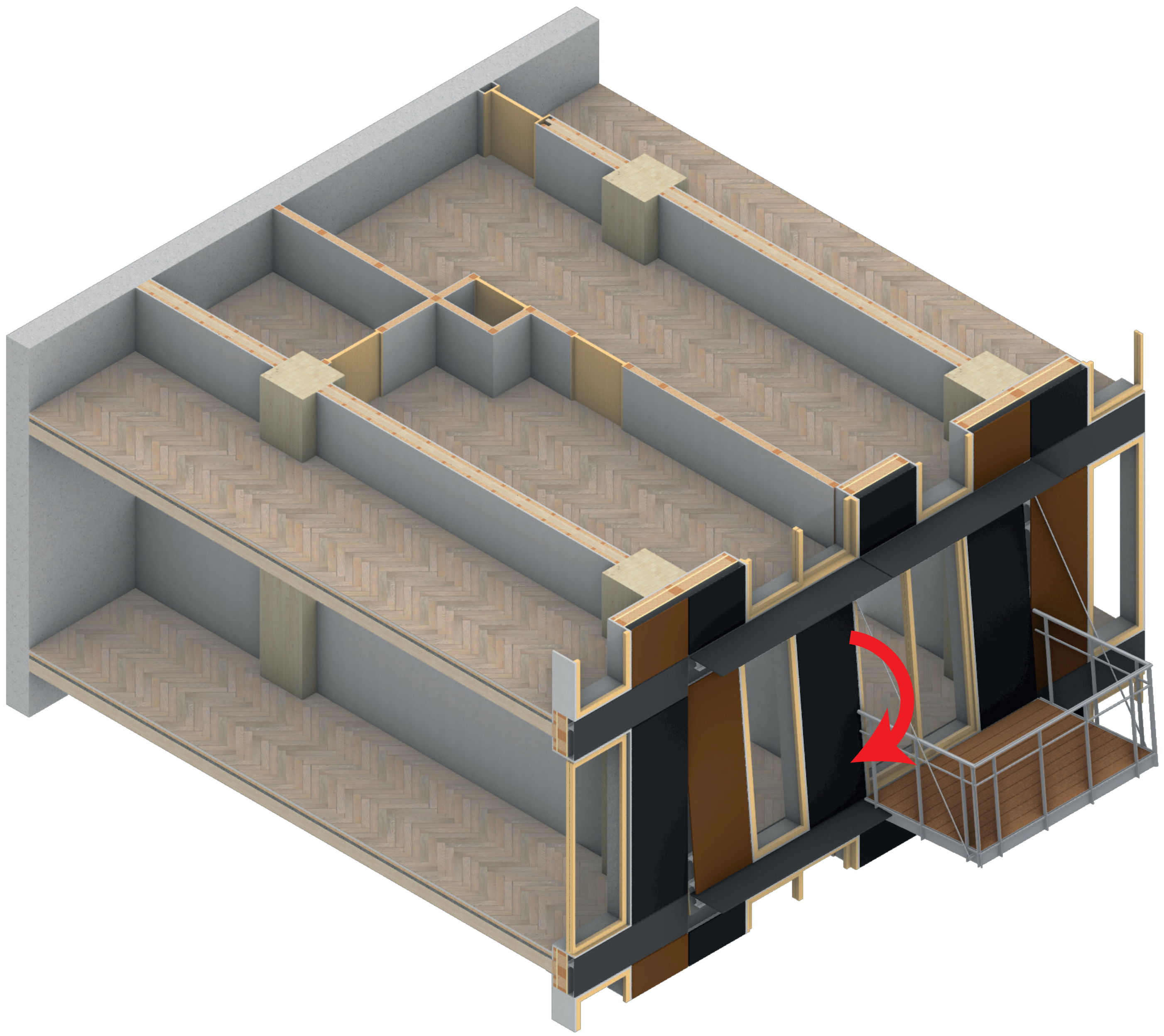
BUILDING TECHNOLOGY

MODULAR FACADE ASSEMBLY

1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety
7. Assembly of the Studs
8. Finish with Gypsum Wallboard
9. Floorlayering
10. Assembly of the facade
11. Modular facade Unit Layering
12. Remove joints from facade element
13. Remove old facade unit
14. Assemble new facade unit

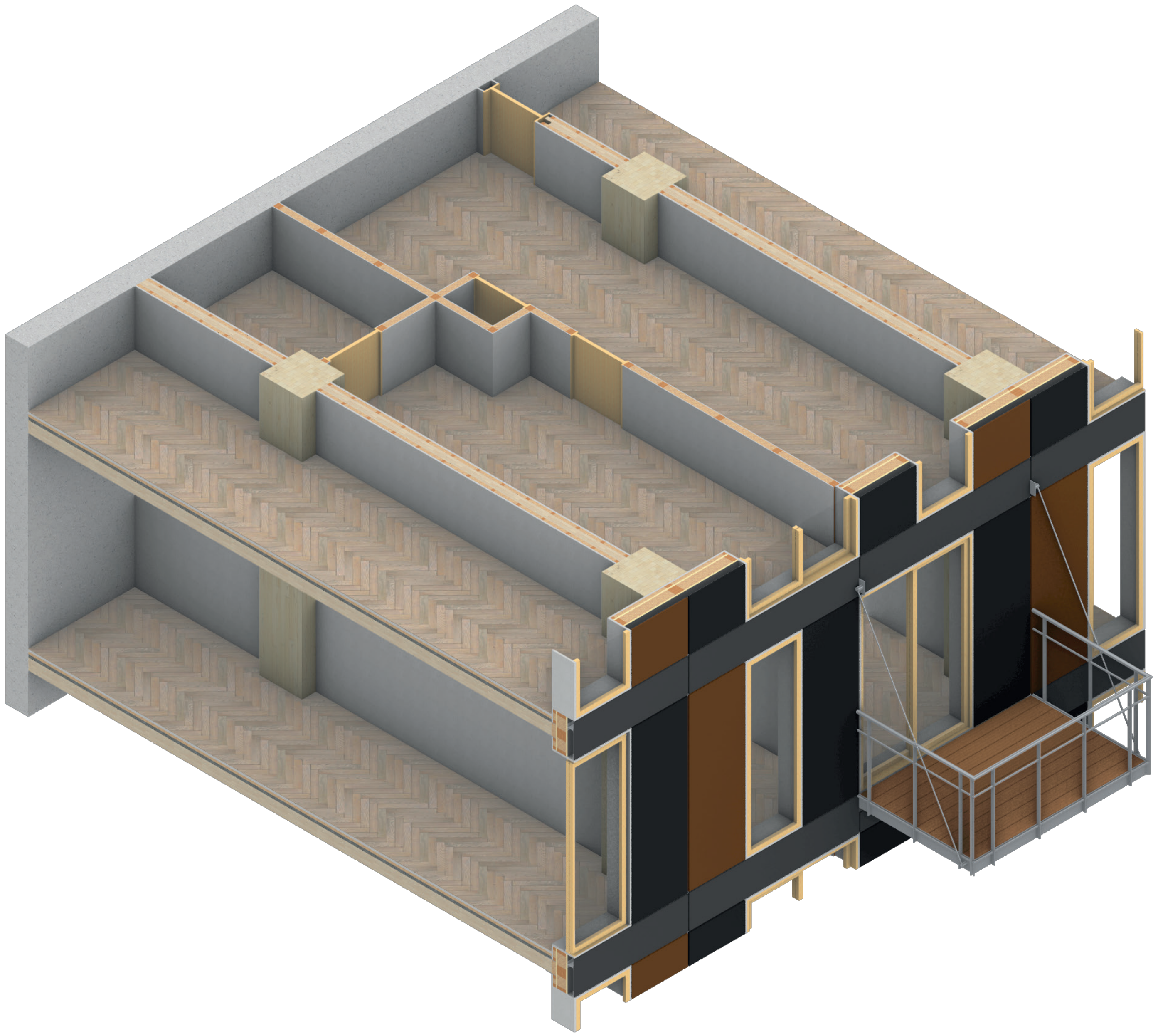
1 : 10

MODULAR FACADE ASSEMBLY



1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety
7. Assembly of the Studs
8. Finish with Gypsum Wallboard
9. Floorlayering
10. Assembly of the facade
11. Modular facade Unit Layering
12. Remove joints from facade element
13. Remove old facade unit
14. Assemble new facade unit
15. Anchor the new facade onto the floor

1 : 10



BUILDING TECHNOLOGY

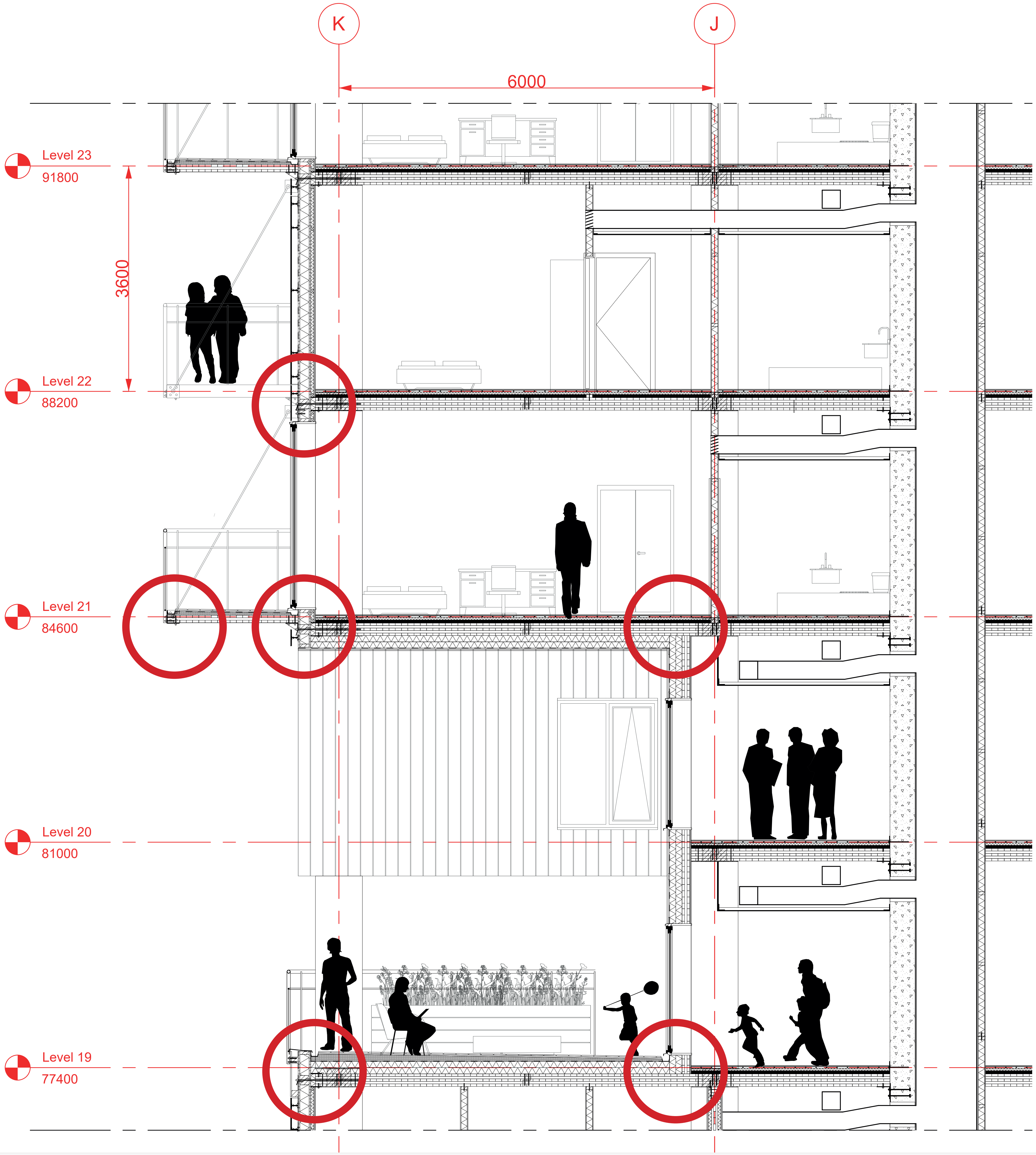
MODULAR FACADE ASSEMBLY

1. Assembly of the columns
2. Assembly of the CLT Floors on columns
3. Assembly of the modular CLT wall units
4. Securing the walls
5. Acoustic insulation
6. Gypsum wallboard finsish for firesafety
7. Assembly of the Studs
8. Finish with Gypsum Wallboard
9. Floorlayering
10. Assembly of the facade
11. Modular facade Unit Layering
12. Remove joints from facade element
13. Remove old facade unit
14. Assemble new facade unit
15. Anchor the new facade onto the floor
16. Facade element replaced

1 : 10

BUILDING TECHNOLOGY

FACADE FRAGMENT SECTION

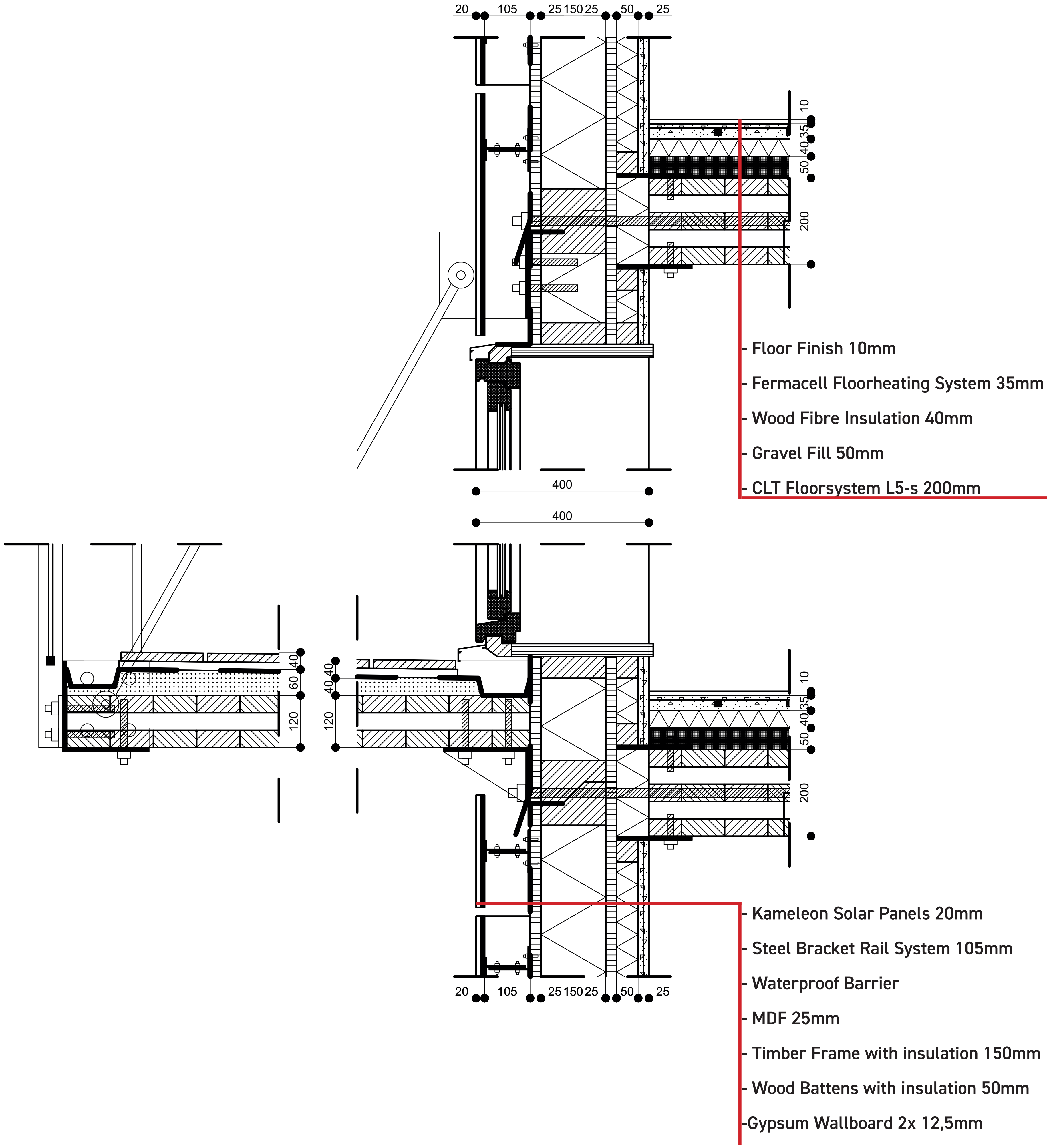


DESIGN PARAMETERS

-Rc> 4,7 (facade)/ 6,3 (roof)
-Dry Floor system (no screeds)
-REI >90 (Partition wall)/ 120 (Escape)
-Lightweight sep. walls with timber studs
-Max. Partition Wall Module length 1m
-3m x 2m Balcony Size
-6m x 3,6m Facade Module size from grid
-6 modular facade combinations from 1 facade system

Rw > 52dB Ln,w <54dB

1 : 50



MODULAR FACADE

-The Modular facade elements are constructed with mostly low-carbon materials

-The insulation Line is Maintained due to the steel profile at the end of the floorslab to prevent coldbridges

-The Facade elements are always anchored to the structural CLT floorsystem, which is maintained visible

-The Balcony has a suspended structure

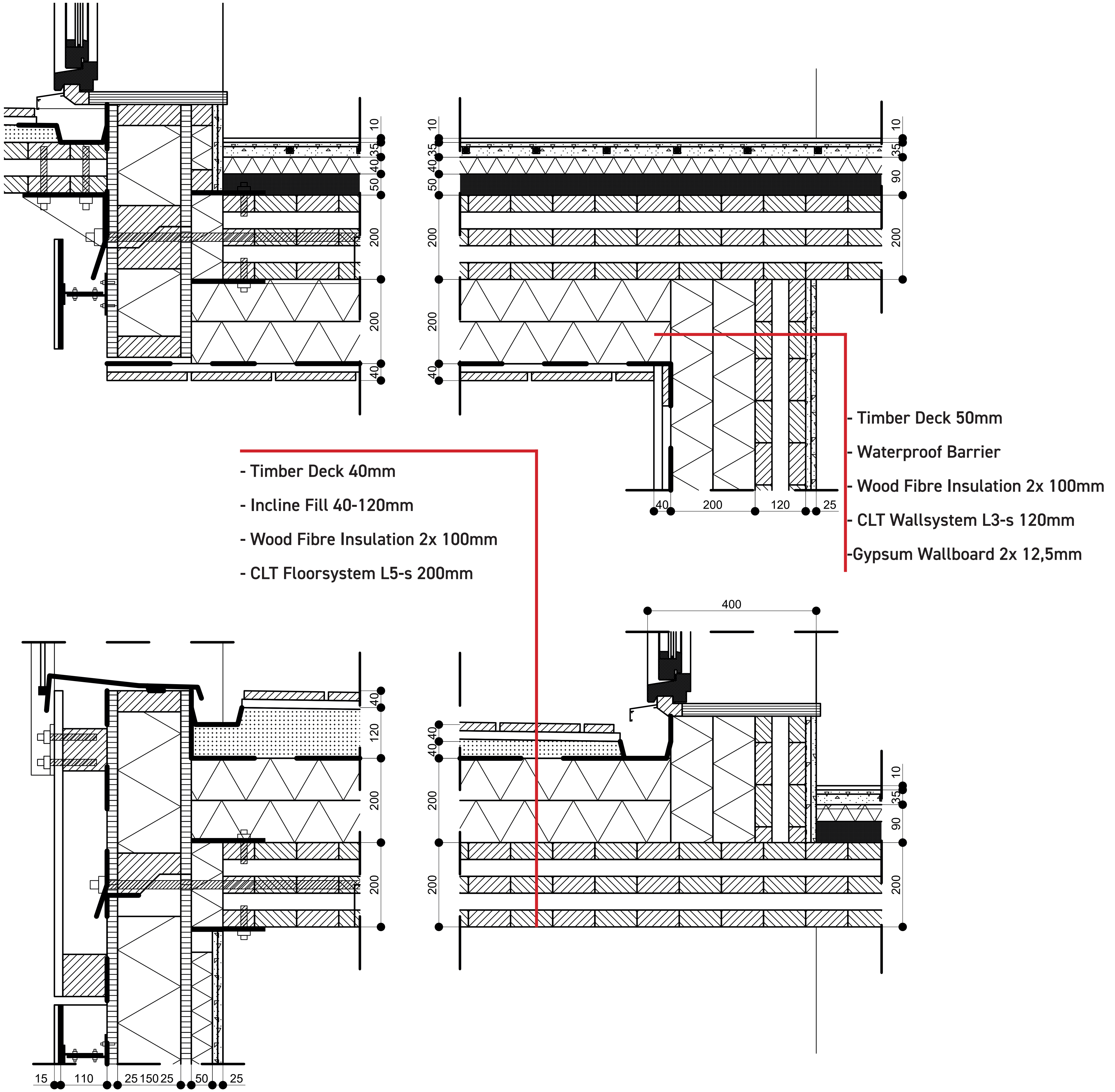
DESIGN PARAMETERS

-Rc> 4,7 (facade)/ 6,3 (roof)
-Dry Floor system (no screeds)
-REI >90 (Partition wall)/ 120 (Escape)
-Lightweight sep. walls with timber studs
-Max. Partition Wall Module length 1m
-3m x 2m Balcony Size
-6m x 3,6m Facade Module size from grid
-6 modular facade combinations from 1 facade system
Rw > 52dB Ln,w <54dB

1 : 10

BUILDING TECHNOLOGY

FACADE FRAGMENT DETAILS



TERRACE FLOOR

-The terrace floor and also the Balconies have efficient rainwater drainage (2cm/m)

-The Terrace Floors and walls are alll 120min fireproof due to the fire resistant properties of the CLT elements and Gypsum Board elements

-The timber deck finishlayers create the roofterrace feeling

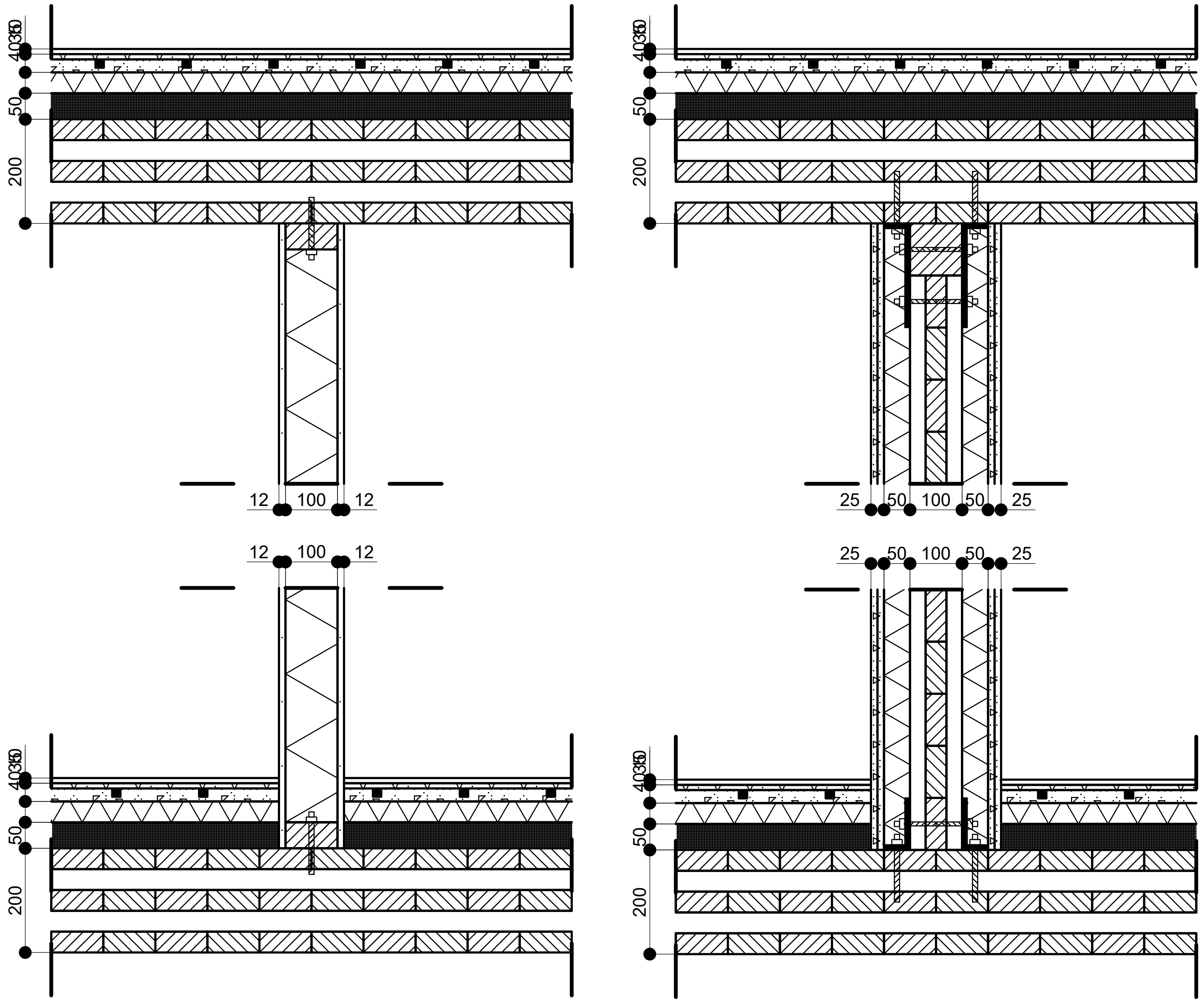
DESIGN PARAMETERS

-Rc> 4,7 (facade)/ 6,3 (roof)
-Dry Floor system (no screeds)
-REI >90 (Partition wall)/ 120 (Escape)
-Lightweight sep. walls with timber studs
-Max. Partition Wall Module length 1m
-3m x 2m Balcony Size
-6m x 3,6m Facade Module size from grid
-6 modular facade combinations from 1 facade system
Rw > 52dB Ln,w <54dB

1 : 10

BUILDING TECHNOLOGY

WALL DETAILS



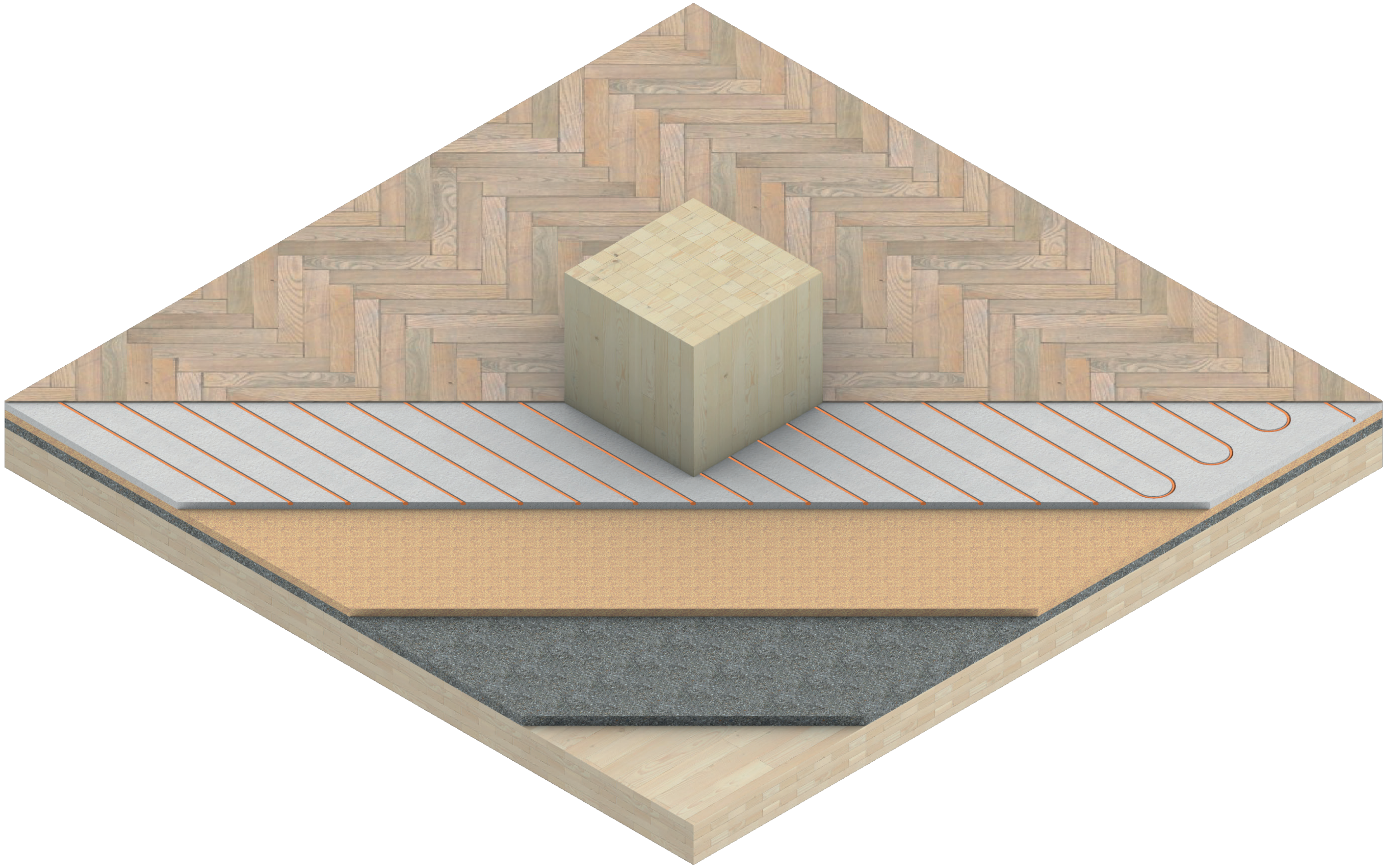
-The walls are modeled in such a way that you can easily (dis)assemble when functions or layouts change.

DESIGN PARAMETERS

-Rc> 4,7 (facade)/ 6,3 (roof)
-Dry Floor system (no screeds)
-REI >90 (Partition wall)/ 120 (Escape)
-Lightweight sep. walls with timber studs
-Max. Partition Wall Module length 1m
-3m x 2m Balcony Size
-6m x 3,6m Facade Module size from grid
-6 modular facade combinations from 1 facade system

Rw > 52dB Ln,w <54dB

1 : 10



Dry Floorsystem

-The floorlayers are very sustainable and increase performance of fire safety, thermal comfort and acoustics

-The floorheating system pipes are installed on Fermacell Gypsum Boards.

-Because the floorfinish layers contain no wet screed at all, it can be easily removed when the interior walls need to be rearranged

DESIGN PARAMETERS

-Rc> 4,7 (facade)/ 6,3 (roof)
-Dry Floor system (no screeds)
-REI >90 (Partition wall)/ 120 (Escape)
-Lightweight sep. walls with timber studs
-Max. Partition Wall Module length 1m
-3m x 2m Balcony Size
-6m x 3,6m Facade Module size from grid
-6 modular facade combinations from 1 facade system
Rw > 52dB Ln,w <54dB

1 : 10

?

CONCLUSION

Design Question

Is it possible to design a sustainable highrise concept for an urbanized modern city to account for population growth and climate change while also making sure that it contributes to a liveable and inclusive city and building environment?

-It can be done to a great extent

-We still have to remain critical

-More research is needed