Project 1

Industralized Building System

Group 11

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INTRODUCTION

1.1 INTRODUCTION TO INDUSTRIALISED BUILDING SYSTEM (IBS)

1.2 INDUSTRALISED BUILDING SYSTEM IN MALAYSIA

1.3 TYPES OF INDUSTRIALISED BUILDINGS SYSTEM

1.4 ADVANTAGE AND DISADVANTAGES OF INDUSTRIALISED BUILDING SYSTEM

1 INTRODUCTION

1.1 INTRODUCTION TO IBS

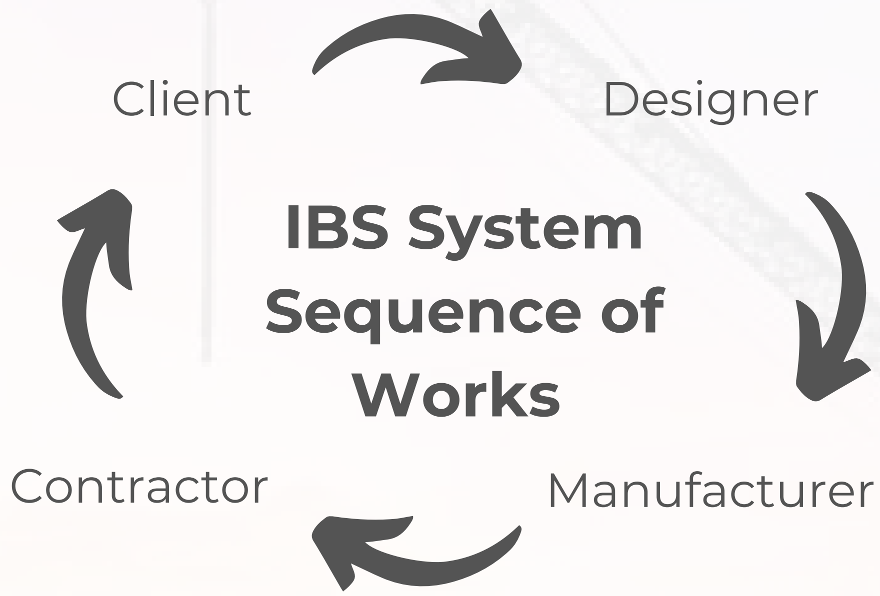
IBS, a term often used in the construction world in Malaysia is a type of construction where the construction components are manufactured in a controlled environement that is either off-site or on-site.

IBS components are usually assembled off-site in a factory with the use of machines and then ships off to the construction site for assembly.

In other parts of the world, IBS is also known as Pre-fabricated construction, Modern Method of Construction (MMC) or Off-site Construction. IBS construction method is increasing in popularity due to its efficiency in construction which saves time, costs as well as manpower.

1.2 IBS SYSTEMS IN MALAYSIA

- Government Initiatives: The Malaysian government has been actively promoting the adoption of IBS since the early 2000s as a way to address various challenges in the construction industry.
- Research and Development: There is ongoing research and development in Malaysia to further improve and innovate IBS technologies.



All in all, Malaysia's IBS system is a major initiative to modernize the construction industry by promoting the use of prefabricated components and systems.

1.3 TYPES OF INDUSTRIALIZED BUILDING SYSTEM (IBS)

Steel framing system

Steel is a high-strength material, which makes it ideal for supporting heavy loads and withstanding various environmental conditions.

Timber framing system

In IBS, timber framing components such as wall panels, floor panels, and roof trusses can be pre-fabricated off-site in controlled factory environments.

Blockwork system

The use of pre-fabricated blocks in IBS can reduce on-site waste generation compared to traditional block laying, as off-site manufacturing is typically more precise and efficient.

Fromwork system

IBS often incorporates modular construction techniques. In this context, formwork systems are designed to be compatible with modular building components.

Precast concrete system

The most used IBS which includes precast concrete columns, slabs, beams, walls along with 3D components such as staircases, balconies, lifts and toilets.

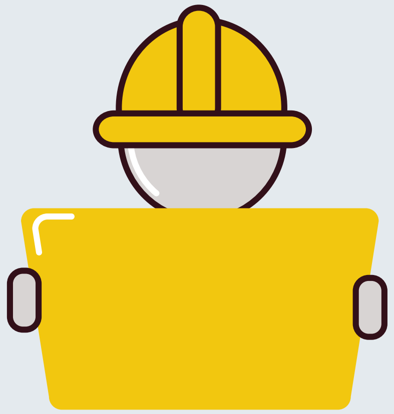
1 INTRODUCTION

1.4 ADVANTAGES AND DISADVANTAGE OF INDUSTRIALIZED BUILDING SYSTEM (IBS)

ADVANTAGES

SPEED OF CONSTRUCTION

IBS components are typically prefabricated in controlled factory environments, which can significantly reduce construction time compared to traditional construction methods.

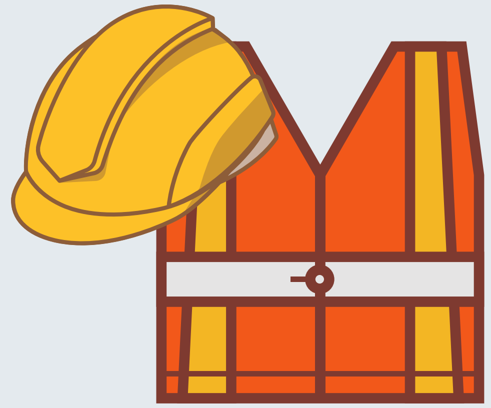


ENVIRONMENTAL BENEFITS

IBS can contribute to sustainability goals by reducing construction waste and site disturbance.

SAFETY

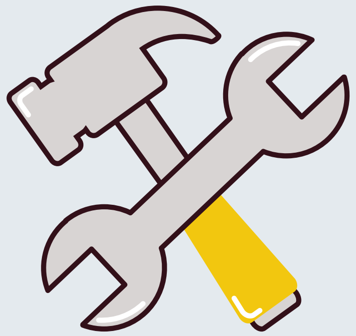
IBS construction typically requires fewer workers on site, which reduces the risk of accidents and injuries.



DISADVANTAGES

MAINTENANCE AND REPAIRS

Repairing or modifying IBS components can be more challenging and costly than traditional construction methods.



TRANSPORTATION CHALLENGES

Transporting large precast elements to the construction site can be logistically complex and costly.

HIGH INITIAL COSTS

Implementing IBS technology and setting up manufacturing facilities can require significant upfront investment.

2

BLOCKWORK SYSTEM

2.1 INTRODUCTION TO BLOCKWORK SYSTEM

2.2 TYPES OF BLOCKWORK SYSTEM

2.3 ADVANTAGE AND DISADVANTAGES OF BLOCKWORK SYSTEM

2.4 CONSIDERATION WHEN SELECTING BLOCK

2 BLOCKWORK SYSTEM

2.1 INTRODUCTION TO BLOCKWORK SYSTEM

Blockwork involves the construction using concrete or cement blocks that exceed the size of typical clay or concrete bricks. These blocks are designed with a hollow core to reduce weight and enhance insulation capabilities, offering various densities to match diverse needs. Their practicality and affordability have established them as a widely embraced substitute for clay bricks. However, they typically demand an extra finish for aesthetic and water-resistant purposes. Blockwork is commonly employed in the construction of interior partition walls and retaining walls.

USES OF BLOCKWORK

Blockwork is a versatile and practical construction method with many advantages. It is suitable for a wide range of projects, from load-bearing walls to non-load-bearing partitions.

EXAMPLES OF USES OF BLOCKWORK

Walls: Blockwork is frequently employed to construct walls, both interior and exterior. These walls can serve as structural elements, providing support and stability to buildings.

Partition Walls: Internal partition walls within buildings can be built using blockwork. These walls help divide spaces into rooms or sections and provide privacy and sound insulation.

Retaining Walls: Blockwork is often used to create retaining walls in landscaping. These walls can hold back soil or provide terracing in sloped areas.

Fire Walls: Due to their fire-resistant properties, block walls are suitable for creating firewalls to prevent the spread of fires in buildings.

Foundations: Concrete blocks may be used in foundation walls to provide structural support and stability to a building's base.

Exterior Cladding: Blockwork can be used as an exterior cladding material, providing both structural support and an aesthetic finish.

Industrial and Commercial Buildings: Blockwork is commonly used in industrial and commercial construction for its strength and durability.

Insulated Concrete Forms (ICFs): In some cases, specialized block systems, known as ICFs, are used to create highly insulated and energy-efficient walls in residential and commercial buildings.

2.2 TYPES OF BLOCKS

Standard Concrete Blocks

Standard concrete blocks are the most commonly used blocks in blockwork systems. They come in various sizes and are versatile for a wide range of construction applications.

Hollow Concrete Blocks

Hollow concrete blocks have empty voids or cores within them, which reduce their weight and improve their insulation properties. They are often used in load-bearing and partition walls.

Solid Concrete Blocks

Solid blocks are denser and heavier than hollow blocks. They are suitable for load-bearing walls and structural components.

Lightweight Concrete Blocks

Lightweight blocks are made using lightweight aggregates, such as expanded clay or shale. They are used when weight reduction is critical.

Interlocking Concrete Blocks

Interlocking blocks are designed to fit together like puzzle pieces, eliminating the need for mortar in some applications. They are commonly used for retaining walls and landscaping.

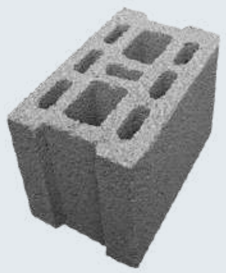
Autoclaved Aerated Concrete (AAC) Bloc

AAC blocks are lightweight, precast concrete blocks known for their excellent insulation properties. They are commonly used in residential and commercial construction.

Concrete Masonry Units (CMUs)

CMUs are a broad category that includes various types of concrete blocks

Pumice Blocks



Pumice blocks are lightweight and have good insulation properties. They are used for both structural and insulating purposes.

Cinder Blocks (Concrete Cinder Blocks)

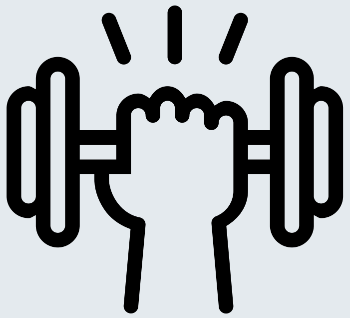
Similar to standard concrete blocks but are made with coal ash, which makes them lighter. They are often used for non-load-bearing walls and partitions.

2.3 ADVANTAGES AND DISADVANTAGES OF BLOCKWORK SYSTEM

ADVANTAGES

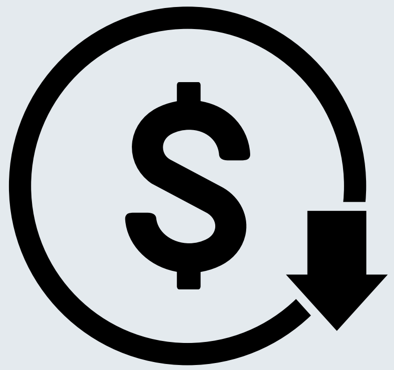
STRENGTH AND DURABILITY

Blockwork is known for its structural strength and durability, making it suitable for load-bearing walls and long-lasting structures.



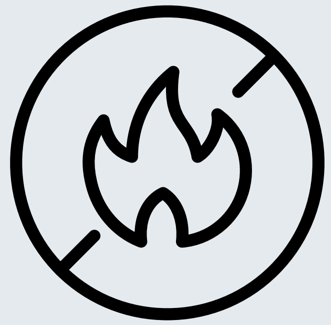
COST-EFFECTIVE

Concrete blocks are often more affordable than some alternative construction materials like solid bricks or stone.



FIRE RESISTANCE

Blockwork inherently possesses fire-resistant properties, enhancing safety and safeguarding against fire hazards.



CONSTRUCTION EFFICIENCY

Blockwork construction is typically faster compared to traditional bricklaying due to larger and more manageable block sizes.

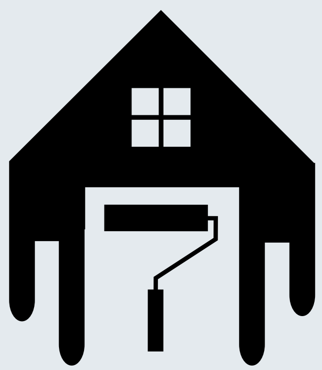
DISADVANTAGES

THERMAL MASS CHARACTERISTICS

While blockwork exhibits commendable insulation properties with hollow blocks, it possesses higher thermal mass compared to certain alternative materials, which could lead to slower temperature fluctuations within the building.

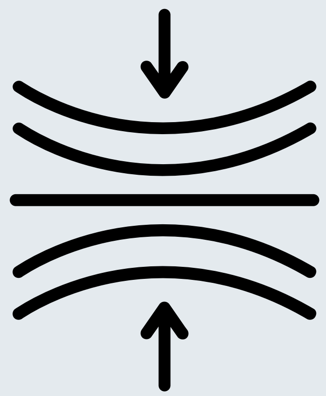
SURFACE FINISH REQUIREMENTS

Achieving a desired appearance may necessitate additional finishing efforts on blockwork surfaces, potentially increasing labor and material costs.



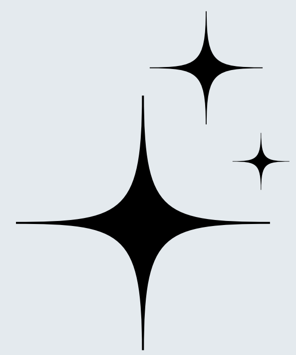
LIMITED LOAD TOLERANCE

Blockwork may not be suitable for very heavy loads without additional structural reinforcement.

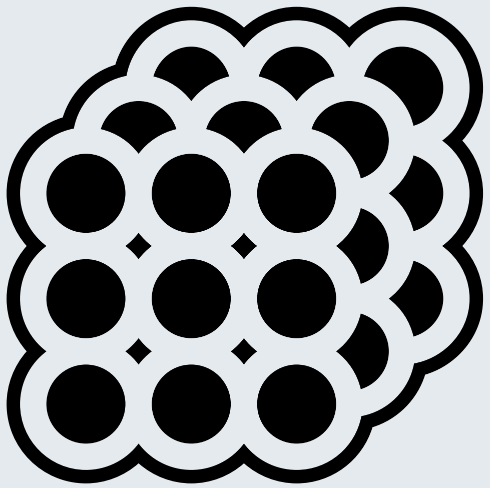


AESTHETIC CONSIDERATIONS

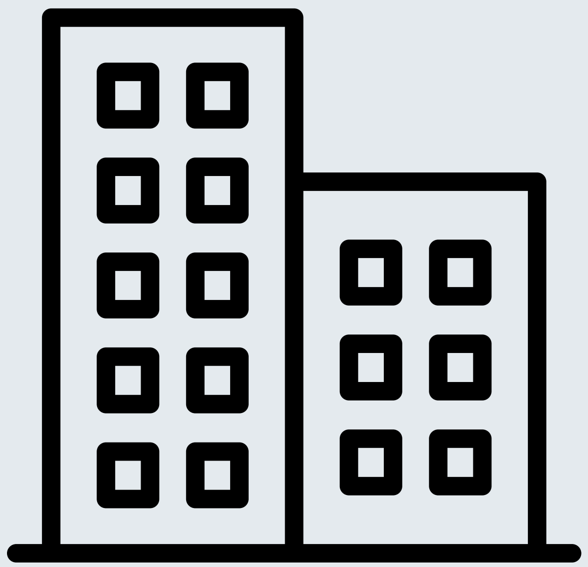
Blockwork may not offer the same visual appeal as solid brick or natural stone construction, which could be a drawback in specific architectural designs.



2.4 CONSIDERATION WHEN SELECTING BLOCKWORK

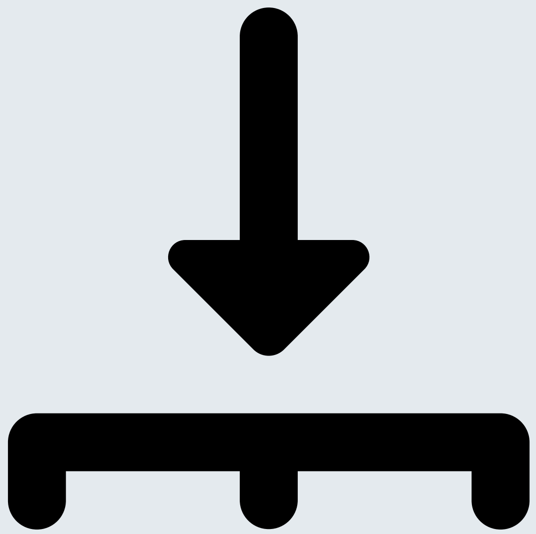


Density

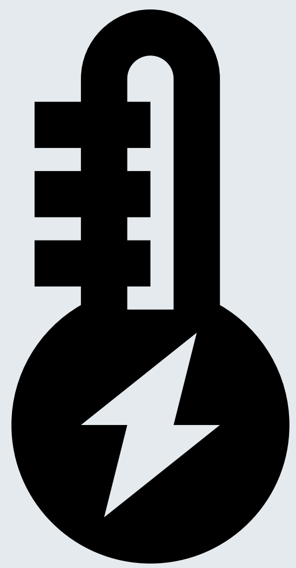


Appearance

Weight and Handling Properties



Load Bearing Characteristic



Thermal Characteristics

3

CONCEPT FRAMEWORK

3.0 IBS COMPONENT

3.1 CONCRETE MANSORY UNIT
3.1.1 TYPES OF BLOCKS USED
3.1.2 CONSTRUCTION METHOD FOR CMU
3.1.3 FABRICATION PROCESS OF CMU
3.1.4 MANUFACTURING PROCESS OF CMU
3.1.5 INSTALLATION PROCESS OF CMU

3.2 BEAMS AND COLUMNS (CMU)

3.3 STRIP FOUNDATION

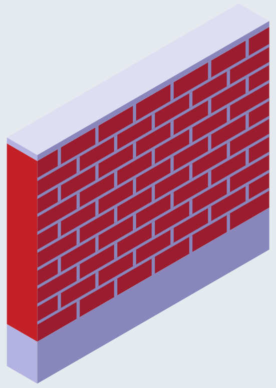
3.4 PRECAST HOLLOW CORE SLAB

3.5 PRECAST CONCRETE STAIRS

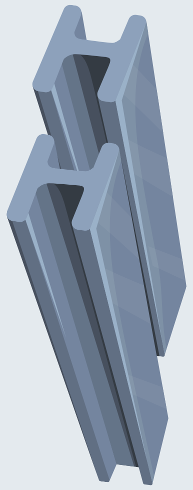
3.6 LIGHTWEIGHT STEEL TRUSS

3.0 IBS COMPONENT

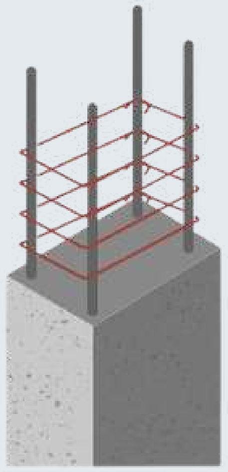
BLOCKWORK COMPONENT



Wall

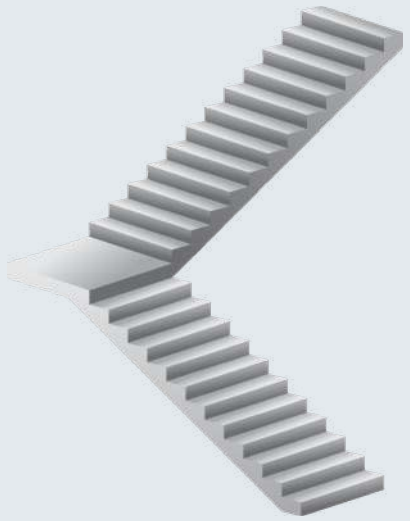


Beams

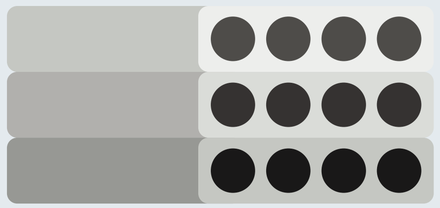


Columns

PRECAST COMPONENT

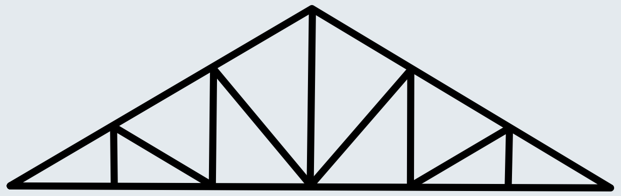


Staircase



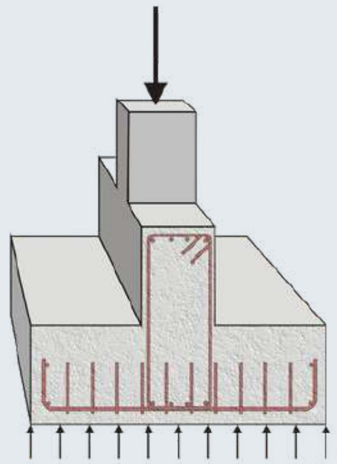
Hollow Core Slab

PREFABRICATED COMPONENT

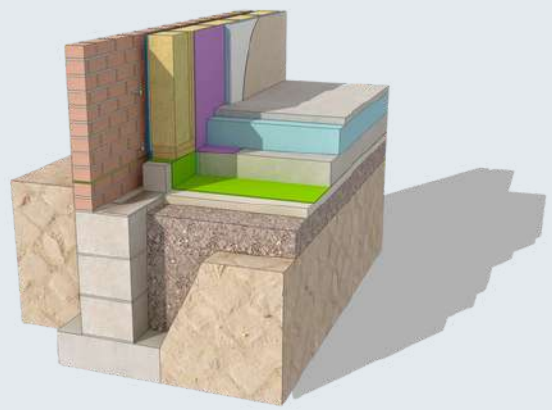


Lightweight
Steel Roof Truss

CAST-IN SITU COMPONENT



Strip Foundation



Ground Floor Slab

3.1 CONCRETE MANSORY UNIT (CMU)

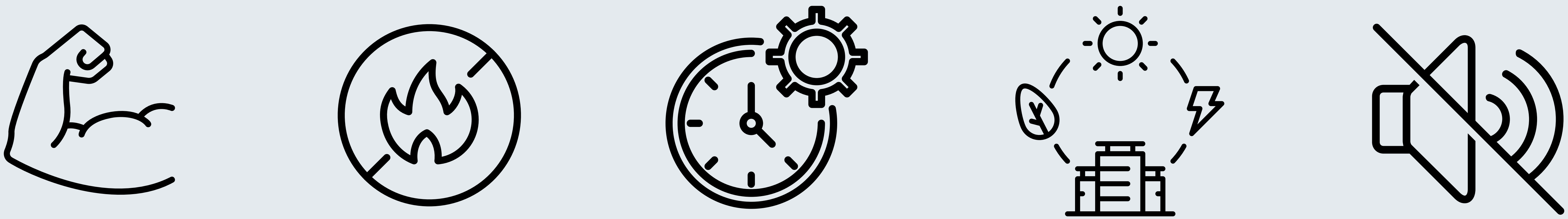
A pallet of CMU

CMU Exterior Wall

An interior wall of painted CMU

Blocks with reduced density may utilize industrial byproducts like fly ash or bottom ash as an aggregate. Recycled materials, including post-consumer glass, slag cement, or recycled aggregate, are frequently incorporated into the composition of these blocks. The inclusion of recycled materials can result in distinct block appearances, such as a terrazzo finish, and may facilitate the attainment of LEED certification for the final structure. Lightweight blocks can also be manufactured using autoclaved aerated concrete.

Concrete Masonry Units provide attributes like robustness, durability, fire resistance, energy efficiency, and sound insulation to a wall system. Furthermore, Concrete Masonry Units come in a wide array of sizes, shapes, colors, and architectural finishes, making it possible to achieve a multitude of different looks and functions in construction projects.



Strength Durability | Fire Resistance | Time Efficient | Energy Efficient | Sound Attenuation

3.1.1 TYPES OF BLOCKS USED

Hollow Concrete block-Wall

The drawbacks of random rubble masonry, common in many hilly areas, are the excessive use of stones, mortar and labor, also its non-uniformity and the risk of water penetration. By precasting the stones into uniform concrete blocks these drawbacks are eliminated.

Solid Concrete Block-Floor Slab

A concrete slab is a common structural element of modern buildings, consisting of a flat, horizontal surface made of cast concrete.Steel-reinforced slabs, typically between 100 and 500 mm thick. are most often used to construct floors and ceilings, while thinner mud slabs may be used for exterior paving.

3.1.2 CONSTRUCTION METHOD FOR CMU

Mortared Construction

This is the most common method of CMU construction, where units are bonded together with mortar. Varying the bond or joint pattern of a concrete masonry wall can create different visual effects

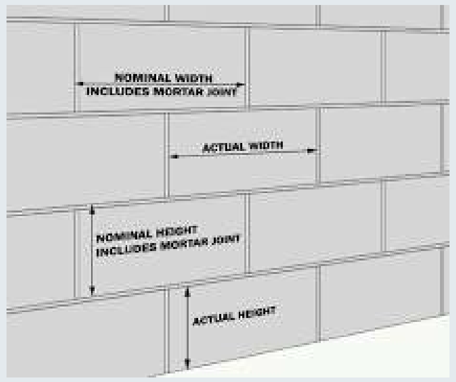
Dry-Stacked Construction

In this method, CMUs are laid dry, without mortar, and are held together by their weight and interlocking shapes. Small pieces of wood can be used to simulate the mortar joints and check the spacing for openings such as windows and doors.

CONSTRUCTION SEQUENCE

MARKING OF LAYOUT

The layout of the building is marked on the ground, indicating the location of walls, footings, and other structural elements.



EXCAVATION

The site is excavated to the required depth and dimensions, and the soil is compacted to provide a stable base for the foundation.

FOUNDATION WORK

The foundation is constructed, which may include footings, stem walls, or a slab-on-grade.

COLUMN CASTING

If reinforced construction is being used, columns are cast and cured before the walls are constructed.

CONSTRUCTION OF WALLS

The CMUs are laid according to the design and construction method being used. Mortared construction involves bonding the units together with mortar.

FLOORING AND FINISHING

The floors are installed, and any necessary finishing work is completed.

3.1.3 FABRICATION PROCESS OF CMU

The aggregates such as sand and crushed stone form the main structure of the block.

SAND

CRUSHED STONE

CONCRETE BLOCK MATERIALS

CEMENT

The cement acts as a binder that holds the aggregates together and solidifies the block when it it mixed with water.

PIGMENT

WATER

3.1.4 MANUFACTURING PROCESS OF CMU

MIXING > MOLDING > CURING > CUBING & STORING

Concrete masonry units (CMU) are manufactured through a series of stages in the production process. These stages typically include:

1 Raw Material Preparation

- ***Material Selection***: The primary raw materials for CMU blocks are Portland cement, aggregates (such as sand and gravel), and water. Other additives may be used for specific properties.
- ***Mixing***: The raw materials are carefully proportioned and mixed to create a concrete mixture. The exact composition may vary depending on the desired block characteristics, such as strength and color.

2 Molding

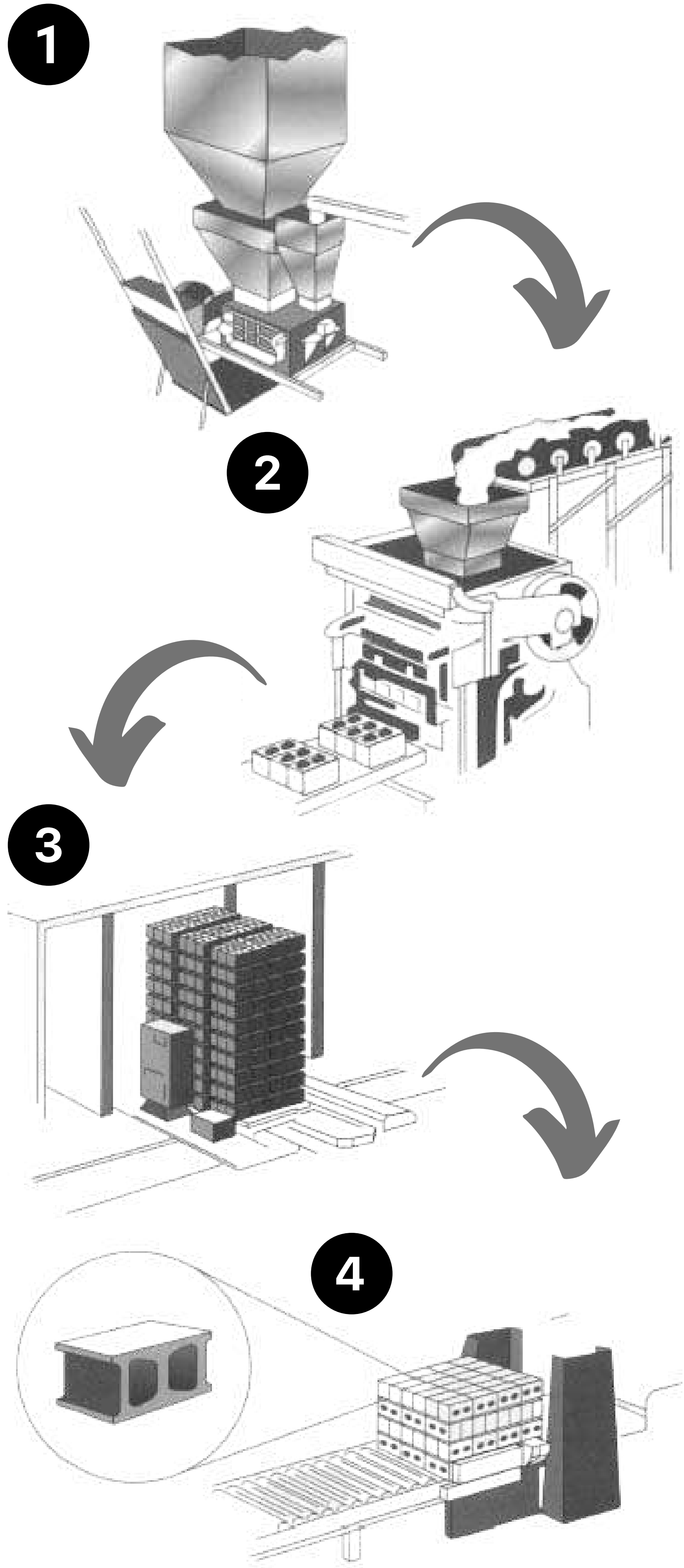
- ***Forming the Block***: The mixed concrete is placed into molds to give it its desired shape. These molds are often made of steel and come in various shapes and sizes to produce different types of CMU blocks.
- ***Compaction***: The concrete in the molds is compacted to remove air voids and ensure a dense, strong block. This can be done through vibration or hydraulic pressure.

3 Curing

- ***Moisture and Temperature Control***: The newly formed blocks need to cure to develop their strength and durability. They are typically placed in a curing chamber or water curing tank, where they are kept at controlled moisture and temperature levels for a specific duration. Curing can take several hours or days, depending on the block type and desired properties.

4 Finishing and Packaging

- ***Surface Treatment***: After curing, the blocks may undergo surface treatments if needed. This can include shot blasting, texturing, or painting for decorative or functional purposes.
- ***Quality Control***: Blocks are inspected for defects, including size, shape, and strength. Those that don't meet quality standards are discarded.
- ***Packaging***: Once the CMU blocks pass quality control, they are typically stacked on pallets or packaged in some other way for shipping and distribution to construction sites.



3.1.5 INSTALLATION PROCESS OF CMU

1

Obtain necessary permits and approvals, review plans and specifications, and prepare a project schedule.

2

Provide horizontal and vertical reinforcement as per construction drawings.

3

Install the CMU according to the design and construction methods used.

4

For running adhesive, place the ruler diagonally against the wall.

5

Mount the CMU wall on a strong rigid base to prevent deformation of the support system.

6

Cut or block lampshades required by other industries.

7

Locate CMUs to accommodate openings for doors, windows, or other features.

3.2 BEAMS AND COLUMNS - CMU

Concrete Mansory Units are used for the beams and columns in the apartment due to its durability and resistance to many things such as fires, termites and mold. CMU also has high resistance against natural disasters compared to most other materials as it can withstand earthquakes, hurricane and tornado effects.

The CMU used are U-shape CHB for the beams and normal CHB for the columns. Concre is used to fill the voids of the blocks with metal rebar to increase its durability and tens strength.

3.3 ISOLATED FOOTING FOUNDATION

Isolated footing foundations are a type of **shallow foundation** used to support individual **columns or pillars**. They are made of **concrete** and can be **reinforced with steel bars** to increase their strength.

Isolated footing foundations are **commonly used** in building construction because they are inexpensive to construct and easy to design and build. However, isolated footing foundations are not suitable for heavy structures or on bad soil

3.4 PRECAST HOLLOW CORE SLAB

A precast hollow core slab is a type of prestressed concrete slab with continuous voids that reduce weight and cost.

It is primarily used as a floor and roof deck system in multi-story apartment buildings and other structures.

The slab has tubular voids extending the full length of the slab, typically with a diameter equal to 2/3 to 3/4 the thickness of the slab.

3.5 PRECAST CONCRETE STAIRS

Precast stairs are a type of construction material used in residential and commercial settings.

They are the fastest and most economical way to add or replace steps for any home.

The advantages of using precast stairs include speed of construction, durability, custom dimensions, and timely production process.

3.6 LIGHTWEIGHT STEEL TRUSS

Lightweight steel trusses are fabricated from galvanized steel strips that have been rolled into shapes to add strength.

They are commonly used in commercial and residential construction for their ability to span long distances, resist fire and pests, and provide a stable platform for roofing and flooring systems

4

PRECEDENT STUDY

4.1 PRECEDENT STUDY 1

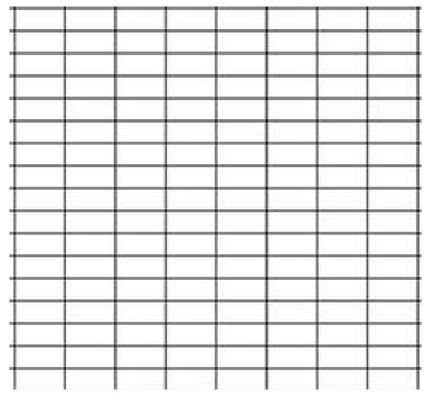
4.2 PRECEDENT STUDY 2

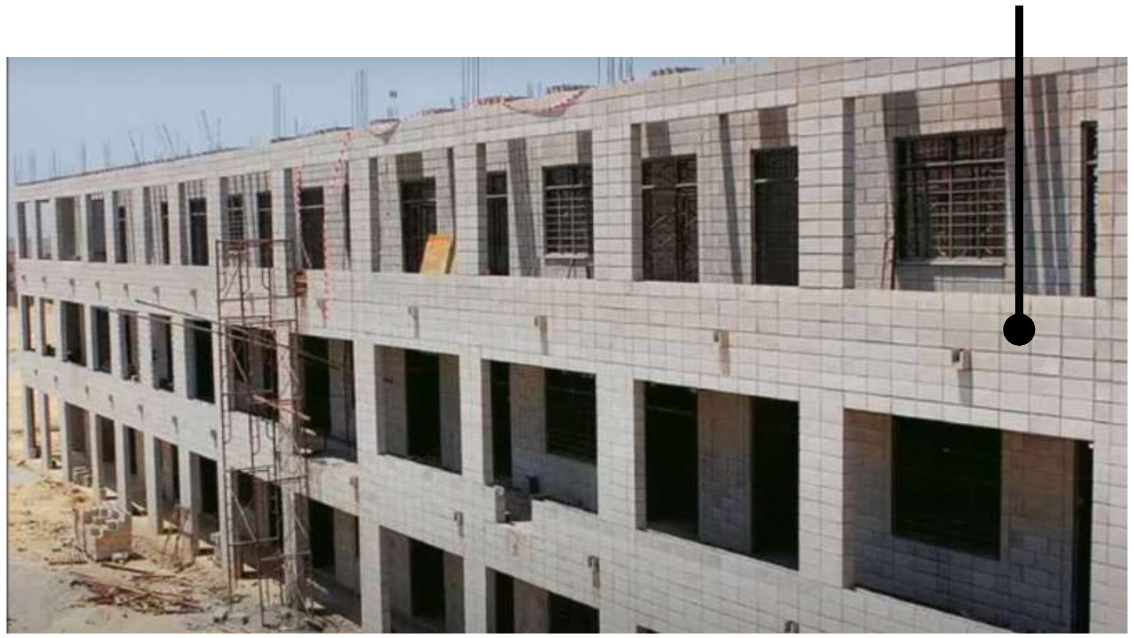
SMK Bandar Enstek

Precedent Studies 1

A secondary school that has 11 buildings which includes classrooms, laboratories, canteen, offices and others. **The walls and columns of the building are built with Concrete Hollow Blocks (CHB)**. **CHB columns are filled with reinforced concrete and added rebar for increased strength and durability**.

Concrete Hollow Blocks are stacked forming a grid pattern which saves costs due to not having to cut them into half blocks





Location:

Bandar Baru Enstek, Negeri Sembilan, Malaysia

Architect:

Syed Ahmad Ibrahim Associates Architect Sdn Bhd

Built:

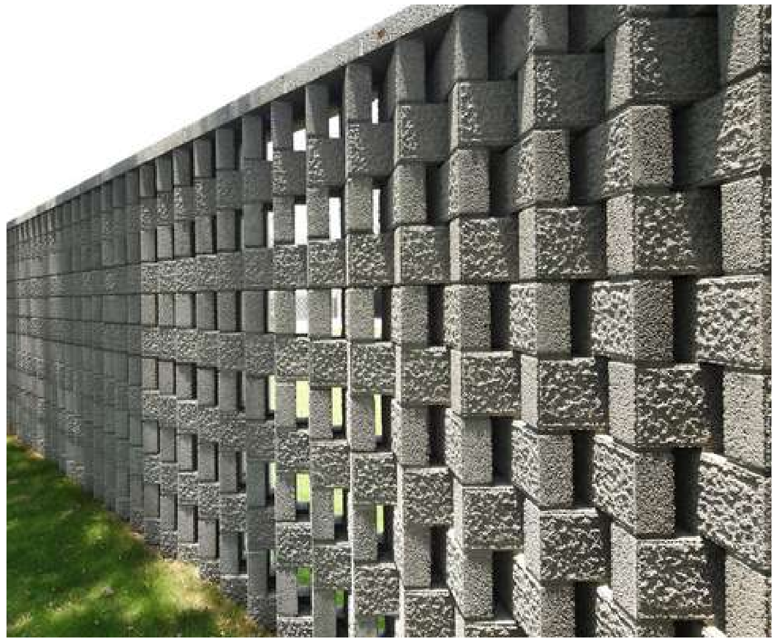
2015

IBS System used:

Concrete Hollow Block (CHB)
Precast Concrete Slab
Prefab Metal Roof Truss
Precast Concrete Stair

Lianyuan Retreat

Precedent Studies 2



This building features a **double skinned design with precast reinforced concrete as the main structure and a type of CMU Block for the outer layer which is the Concrete Hollow Block (CHB).**

CHBs are used for walls as a response to the hot climate of Kaohsiung **as it can resist high temperatures and provide better thermal insulation.**

Location:

Alian District, Kaohsiung City, Taiwan

Architect:

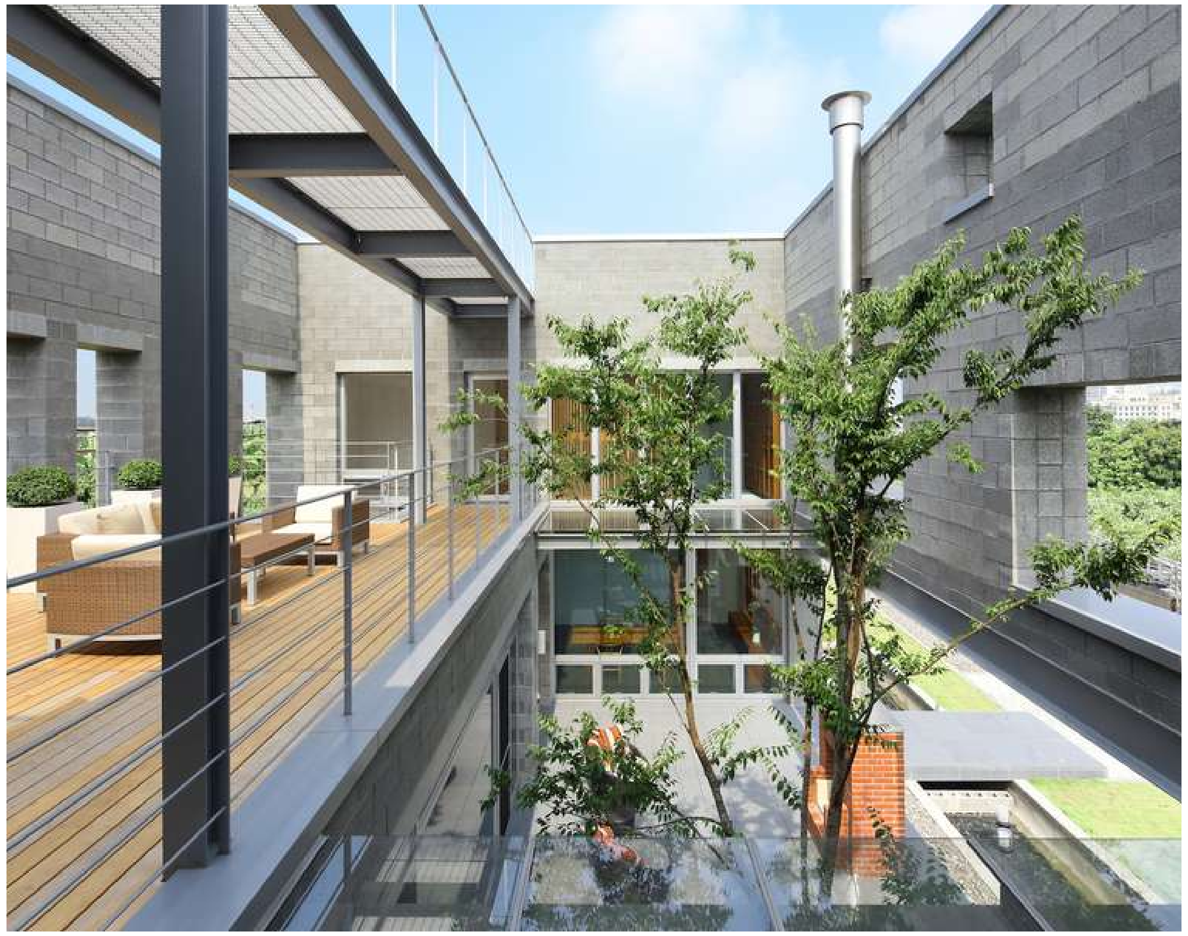
JYCArchitect + DCDAssociates

Built:

2016

IBS System used:

Concrete Hollow Block (CHB)
Precast Concrete Column and Beam
Precast Concrete Slab
Steel Column



5

TECHNICAL DRAWINGS

5.1 ARCHITECTURAL PLANS

5.1.1 LABELLINGS

5.1.2 GROUND FLOOR PLAN

5.1.3 FIRST FLOOR PLAN

5.1.4 SECOND FLOOR PLAN

5.1.5 ROOF FLOOR PLAN

5.2 ELEVATIONS

5.2.1 NORTH ELEVATION

5.2.2 EAST ELEVATION

5.2.3 SOUTHELEVATION

5.2.4 WEST ELEVATION

5.3 SECTIONS

5.3.1 SECTION A-A’

5.3.2 SECTION B-B’

5.4 STRUCTURAL PLANS

5.4.1 FOUNDATION PLAN

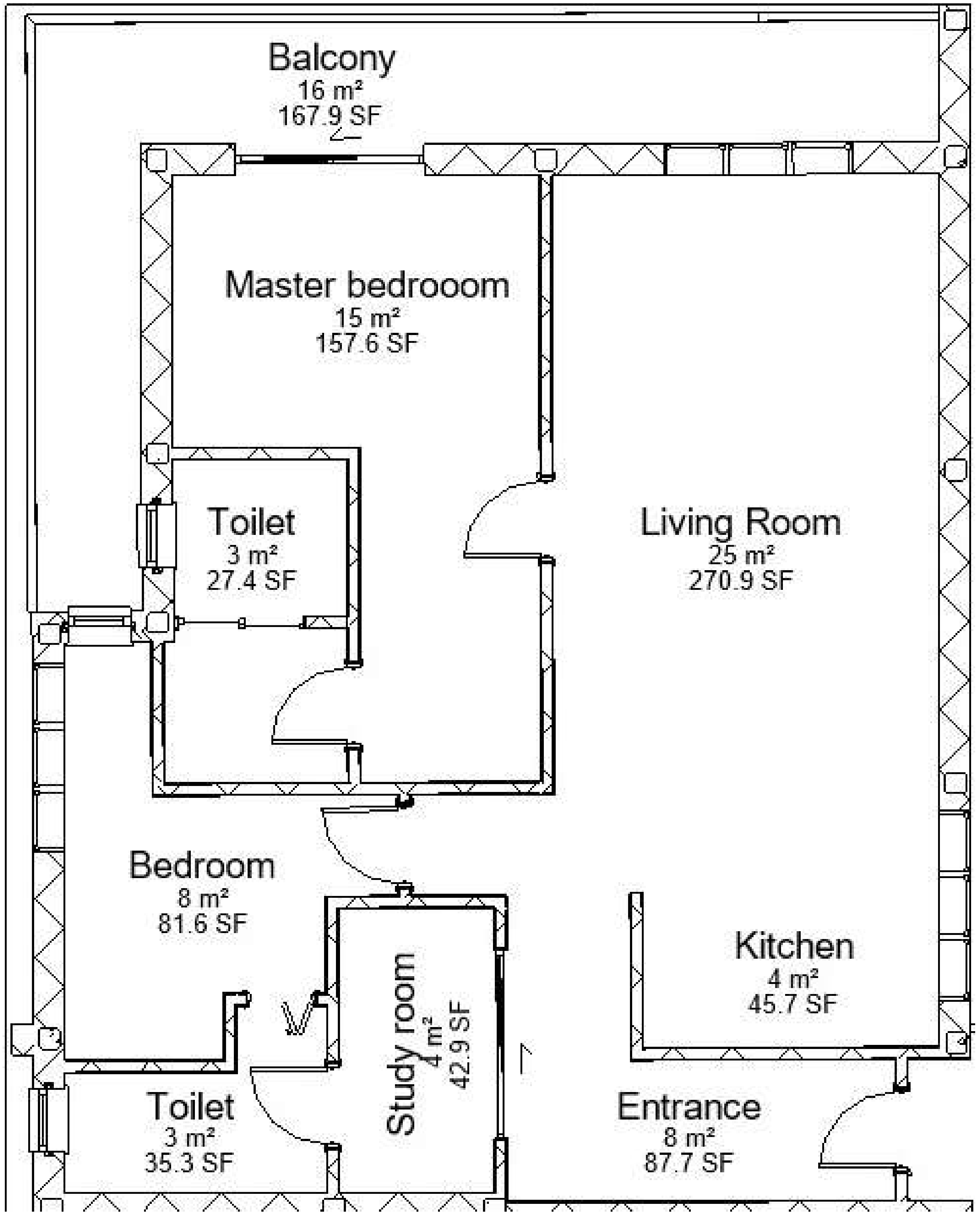
5.4.2 ROOF STRUCTURE PLAN

5.5 PERSPECTIVE VIEWS

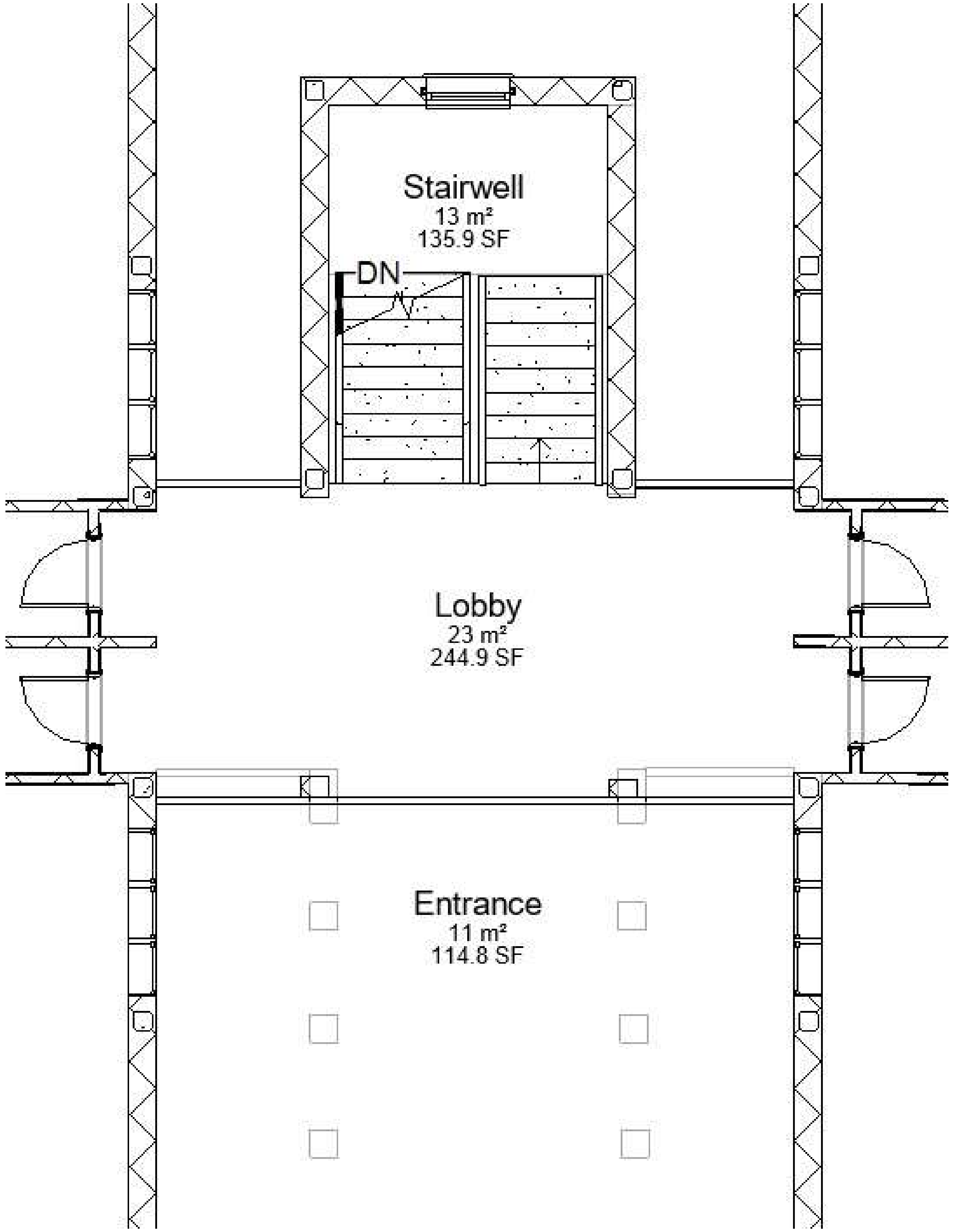
5.5.1 PERSPECTIVE VIEW 1

5.5.2 PERSPECTIVE VIEW 2

UNIT WITH ROOM LABELING



GROUND FLOOR PLAN ZOOM IN



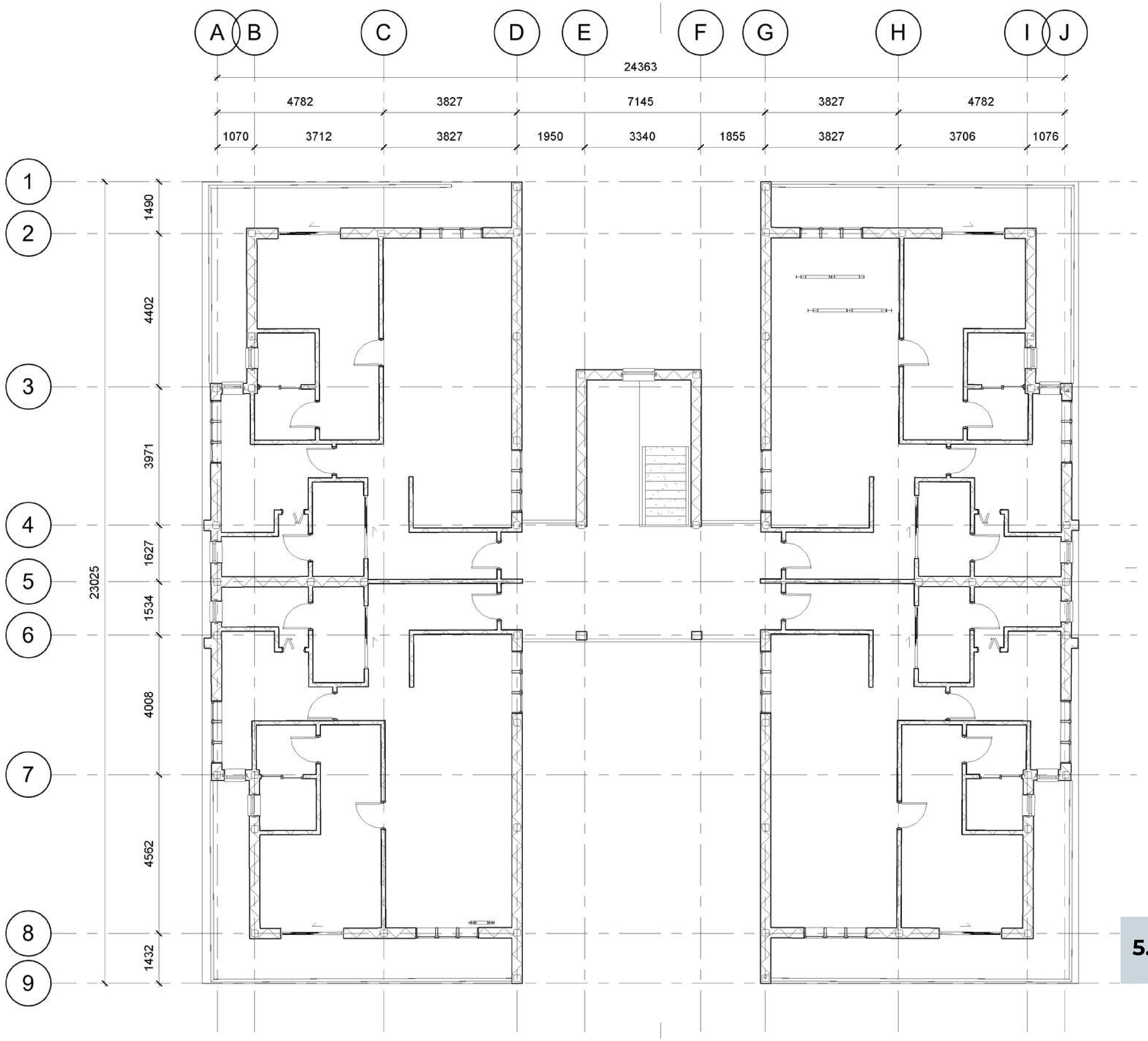
6 EQUAL UNITS

6 MIRRORED UNITS

5.1.1 LABELLINGS

Scale NTS

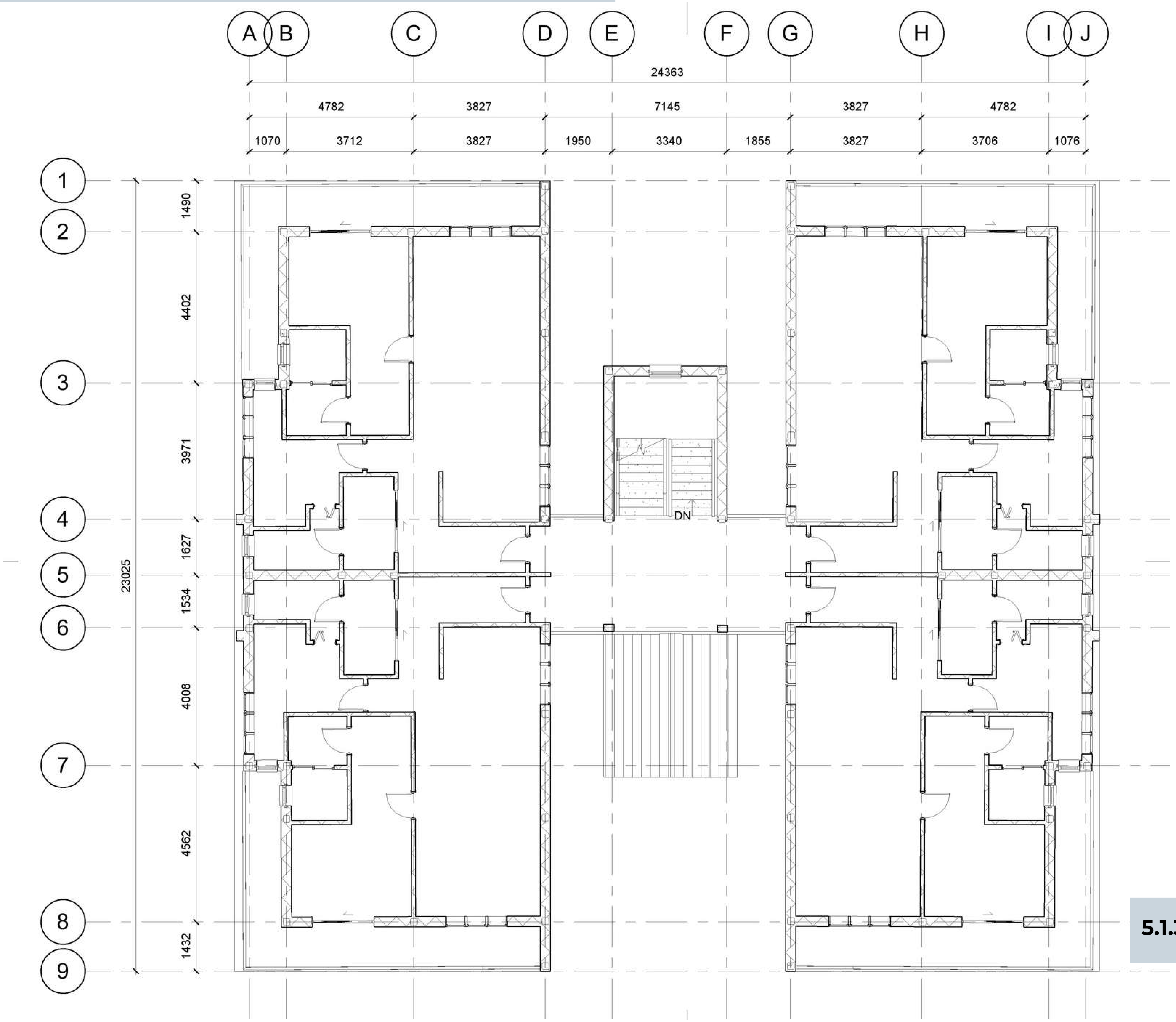
5 TECHNICAL DRAWINGS



5.1.2 GROUND FLOOR PLAN

Scale 1:100

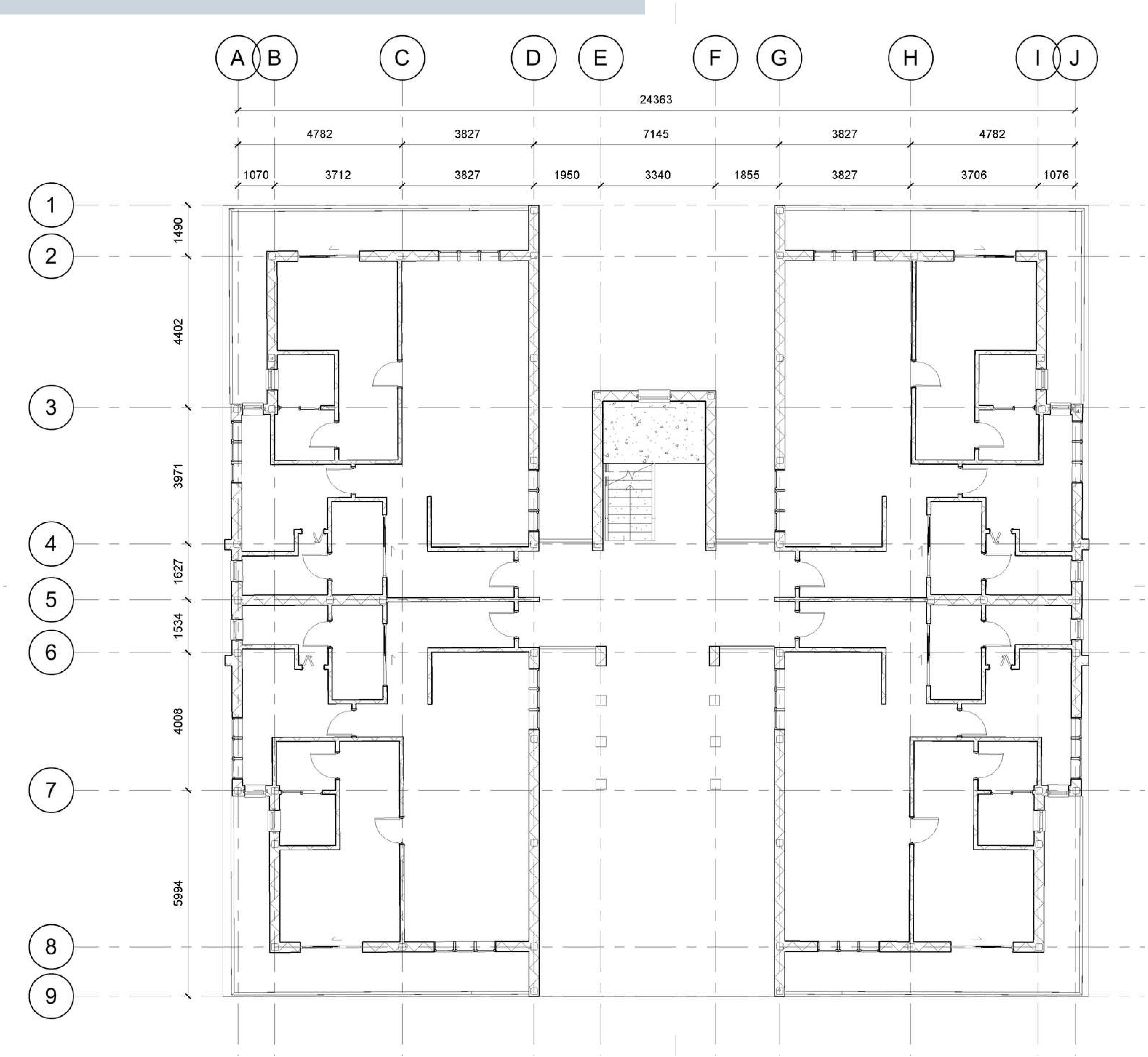
5 TECHNICAL DRAWINGS



5.1.3 FIRST FLOOR PLAN

Scale 1:100

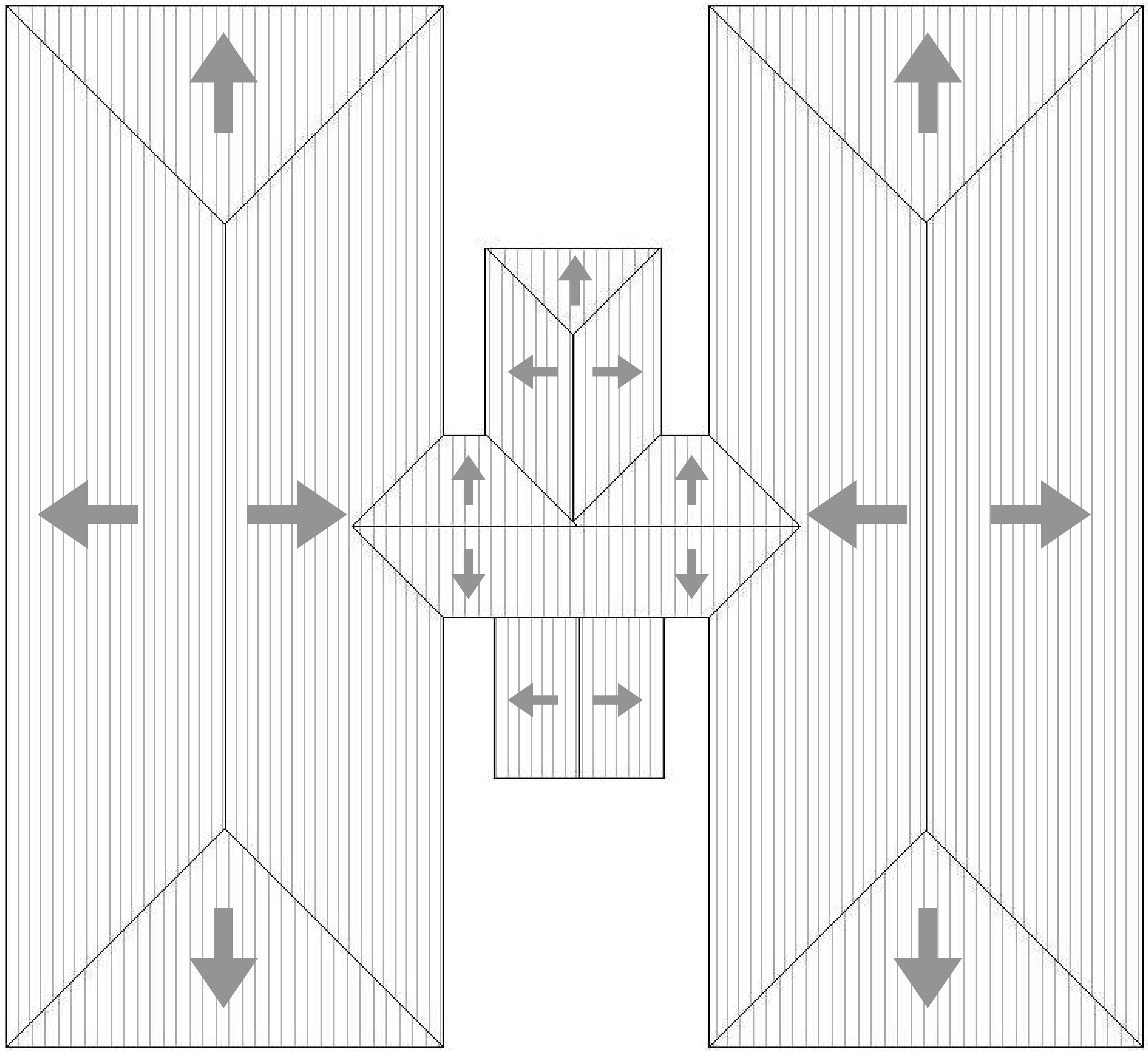
5 TECHNICAL DRAWINGS



5.1.4 SECOND FLOOR PLAN

Scale 1:100

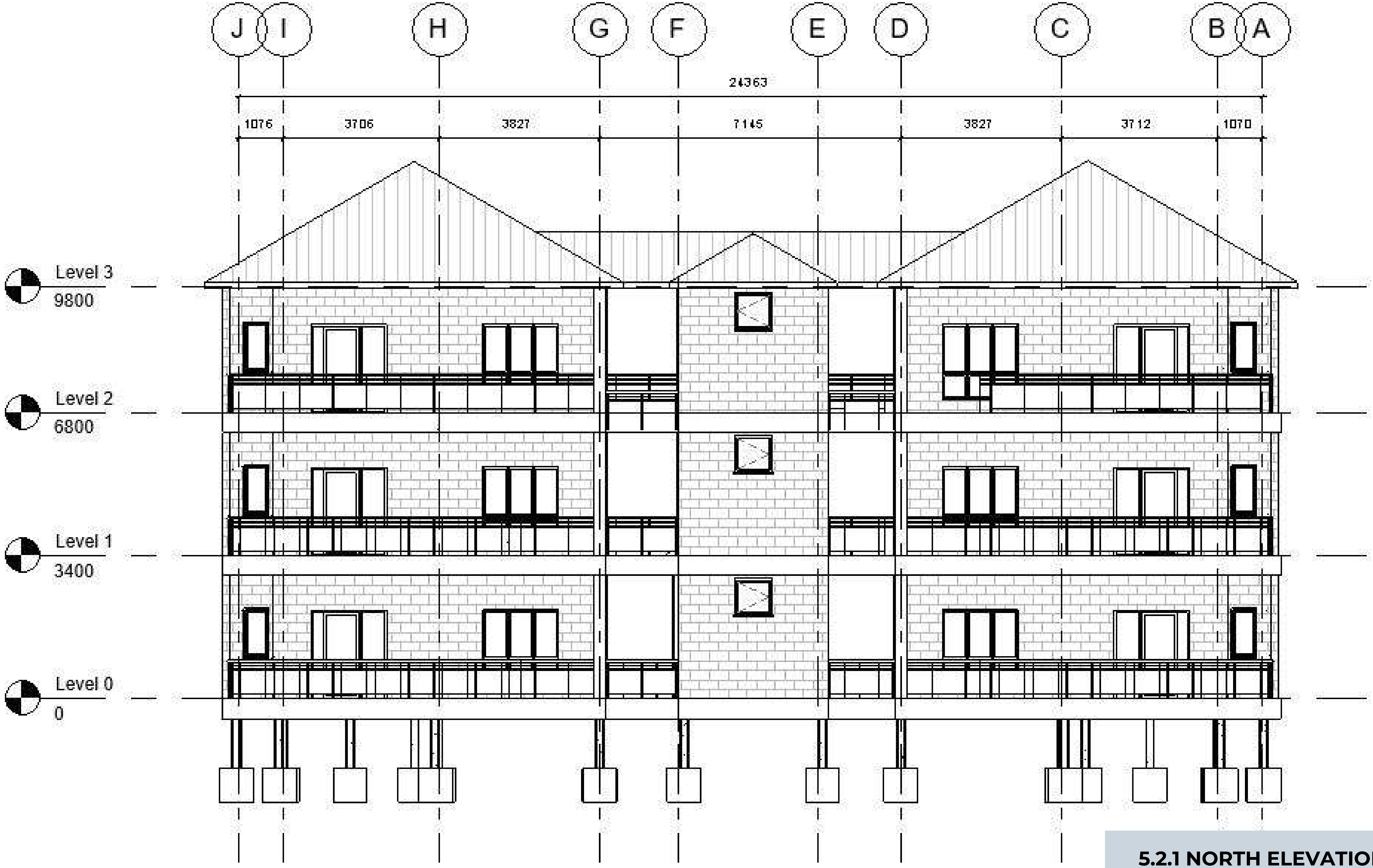
5 TECHNICAL DRAWINGS



5.1.5 ROOF PLAN

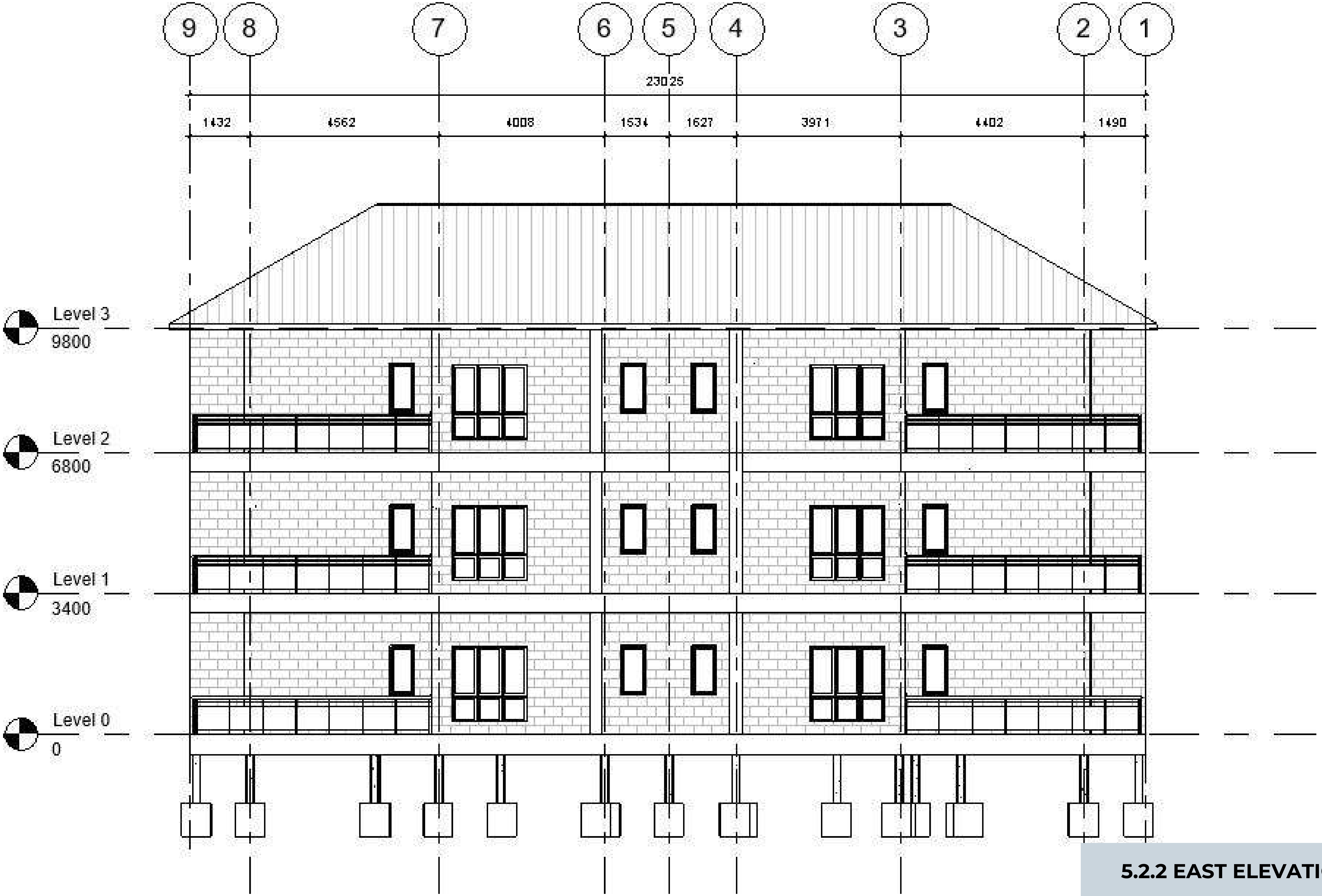
Scale 1:100

5 TECHNICAL DRAWINGS



5.2.1 NORTH ELEVATION

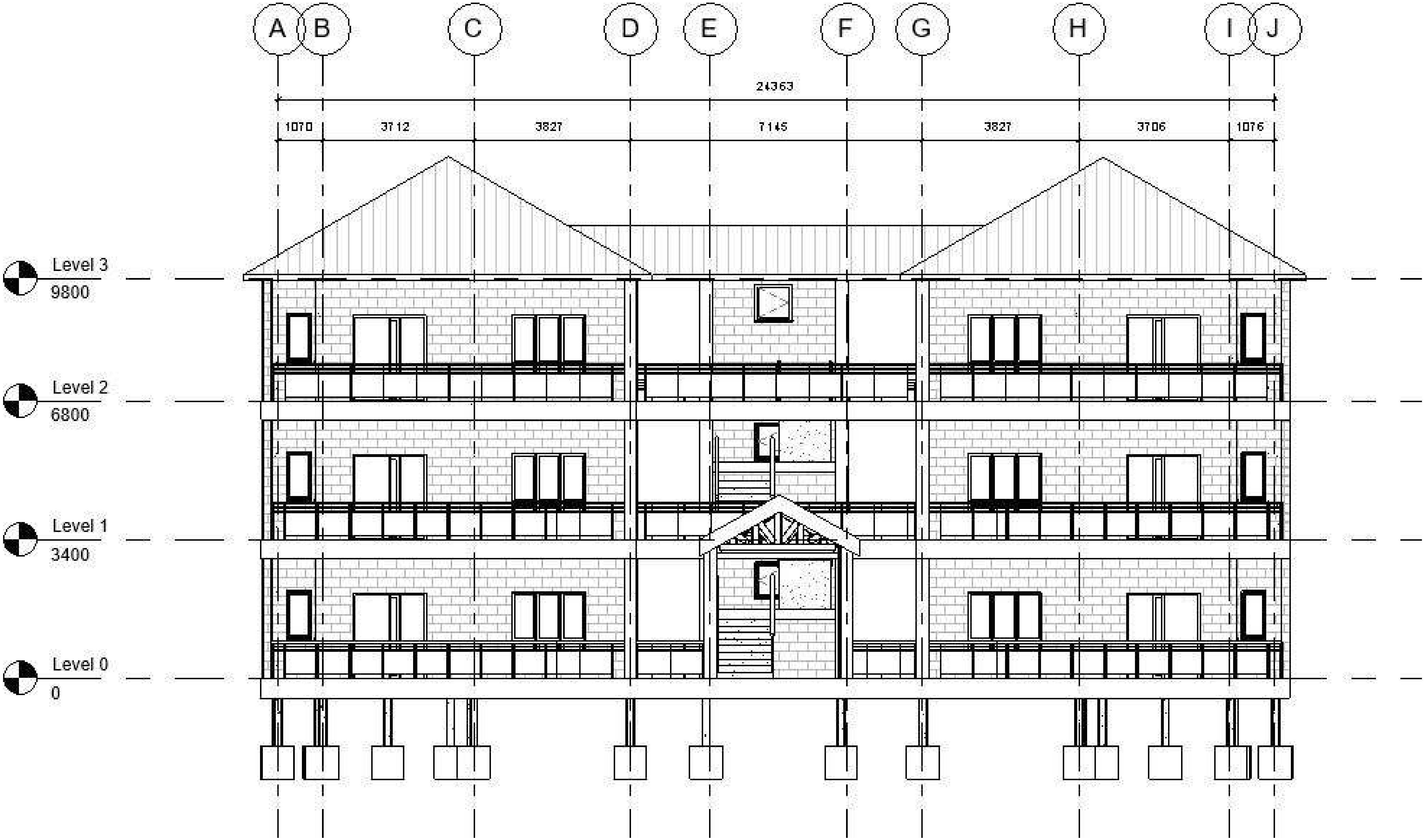
Scale 1:100



5.2.2 EAST ELEVATION

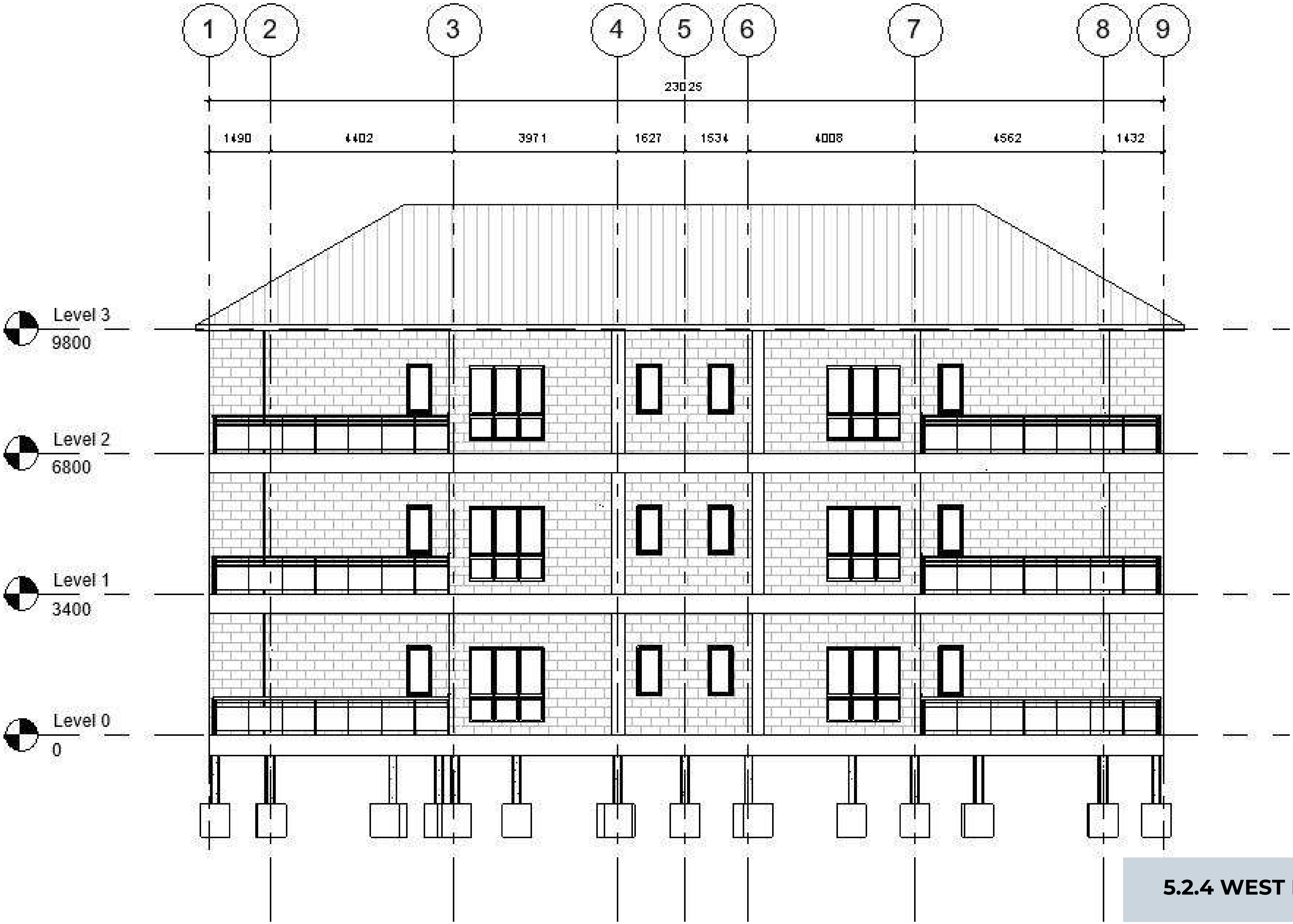
Scale 1:100

5 TECHNICAL DRAWINGS



5.2.3 SOUTH ELEVATION

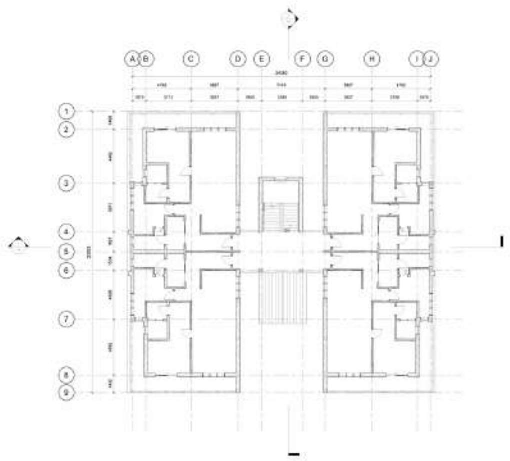
Scale 1:100



5.2.4 WEST ELEVATION

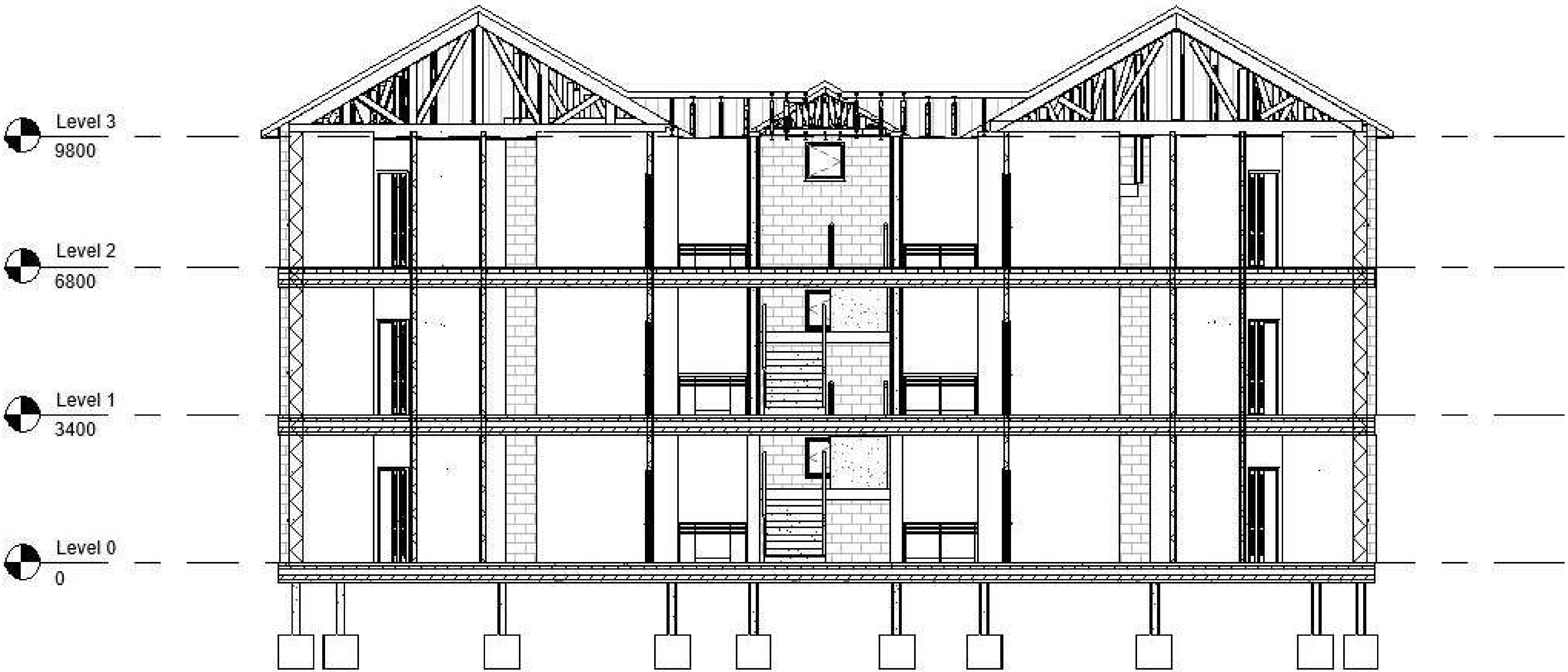
Scale 1:100

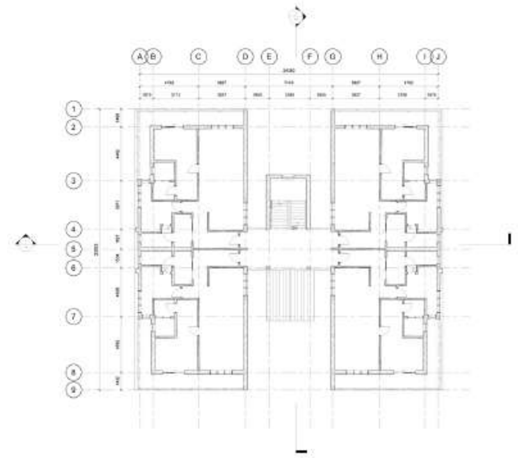
5 TECHNICAL DRAWINGS



5.3.1 SECTION A-A

Scale 1:100





5.3.2 SECTION B-B

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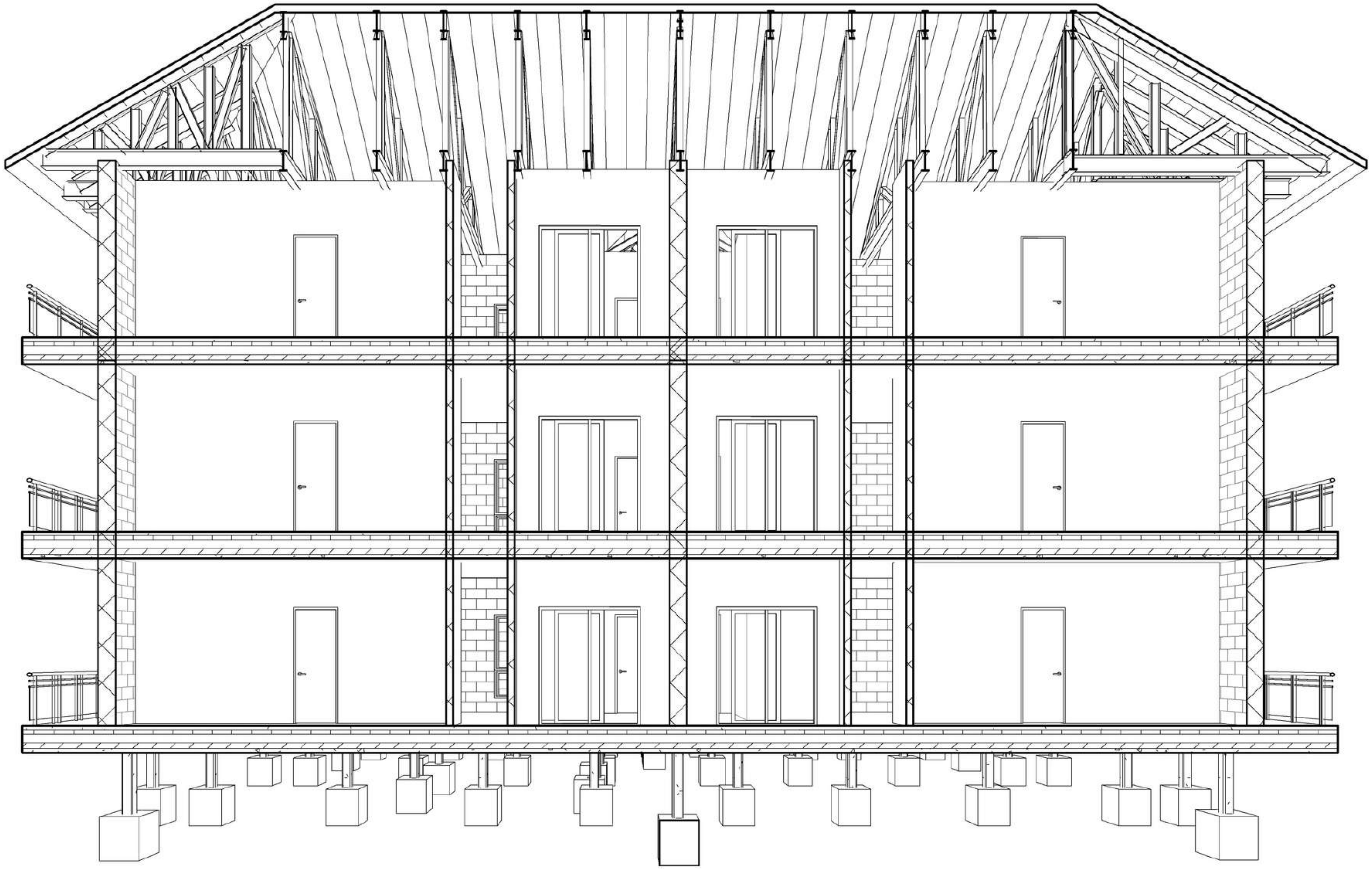
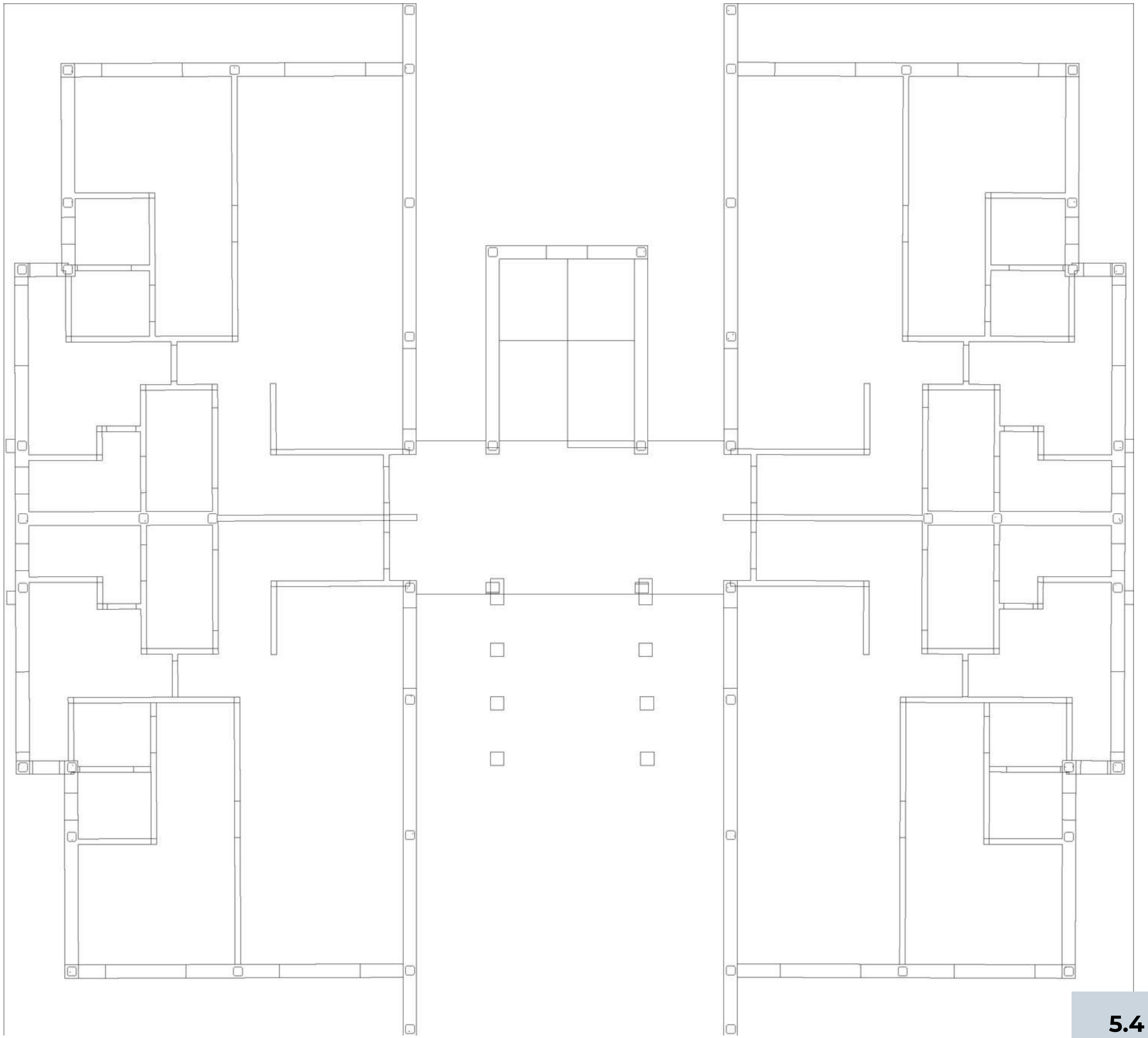


5.3.3 SECTIONAL PERSPECTIVE

Scale 1:100

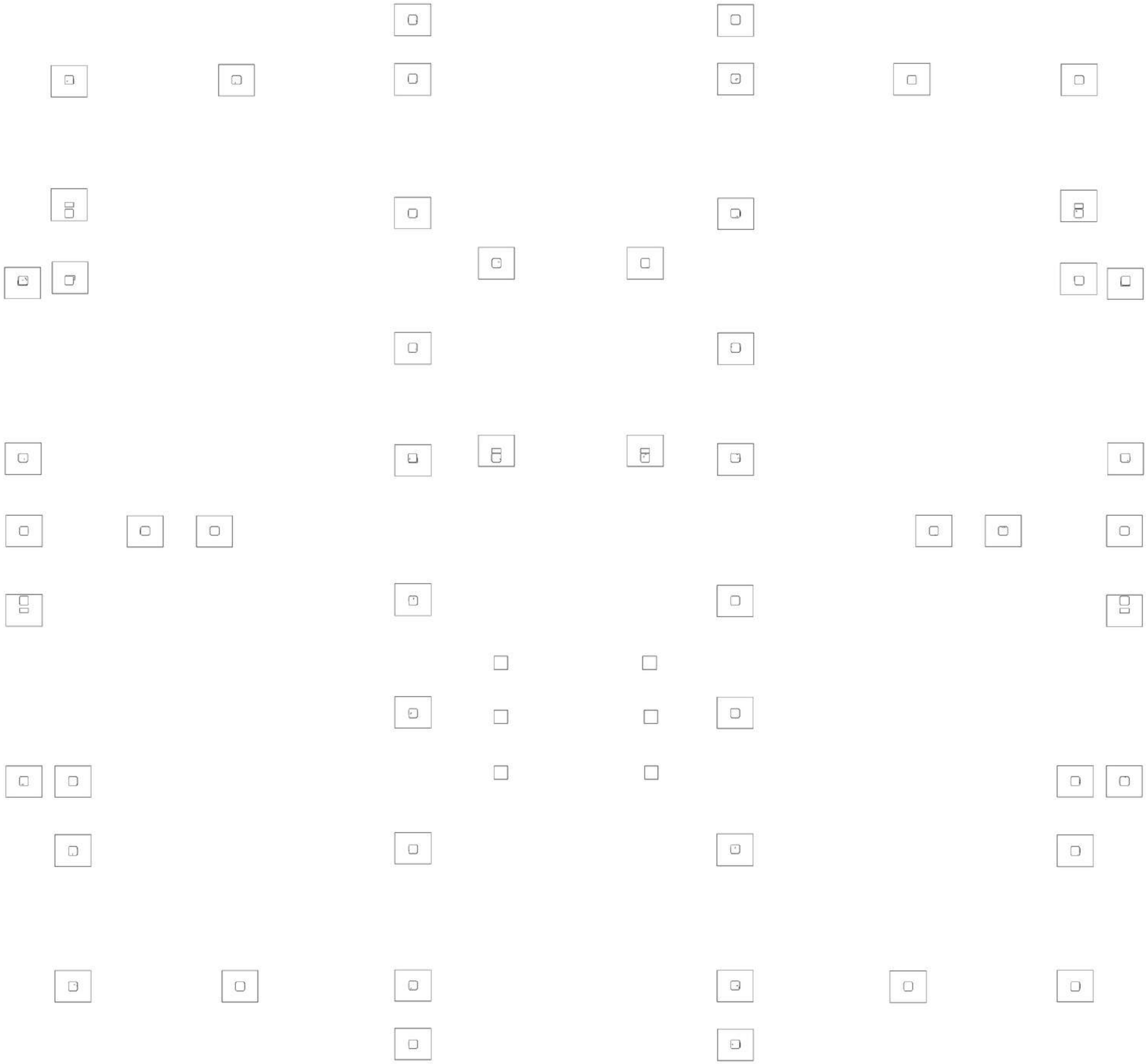
5 TECHNICAL DRAWINGS



5.4 STRUCTURAL PLANS

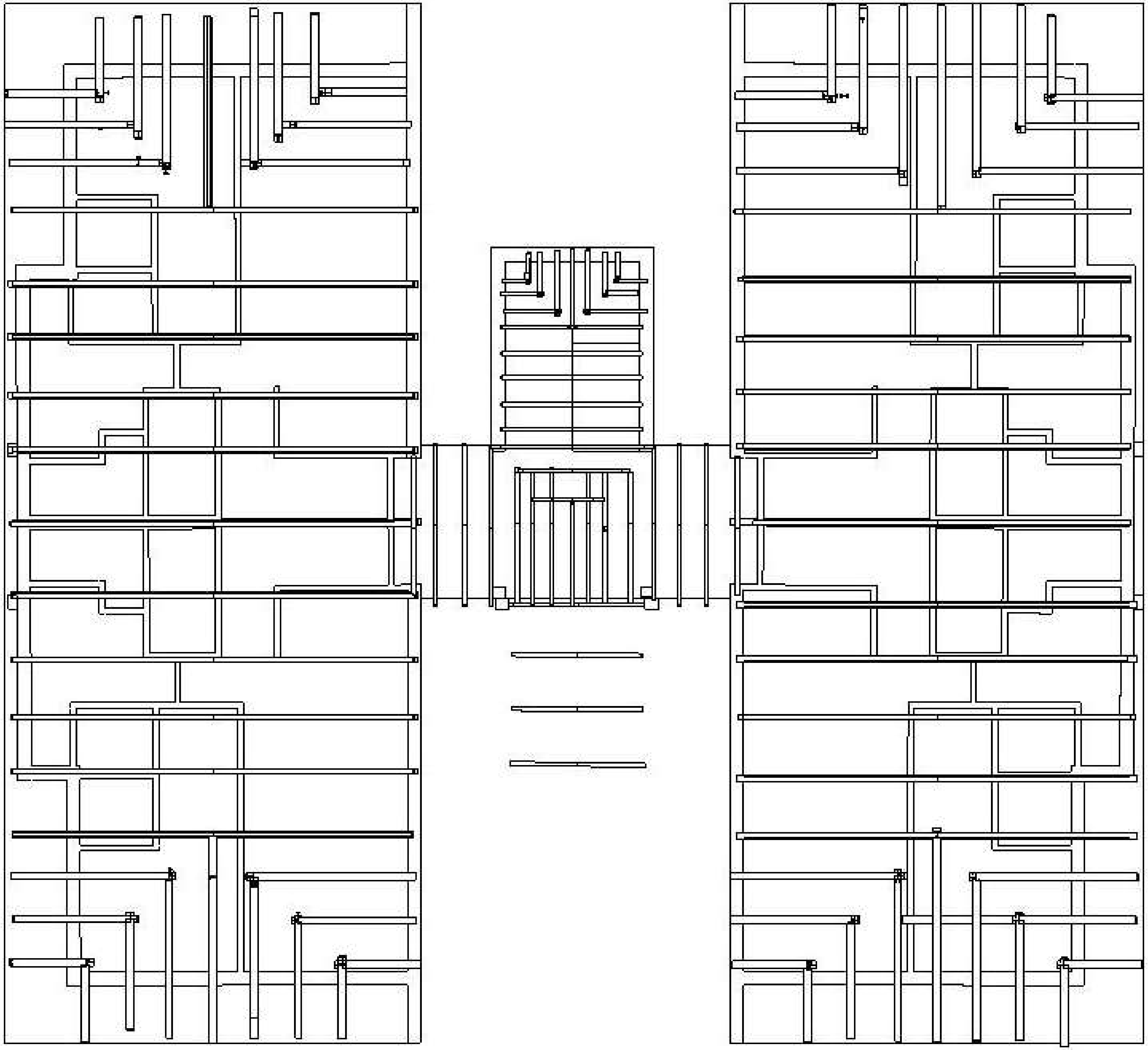
Scale 1:100

5 TECHNICAL DRAWINGS



5.4.1 FOUNDATION PLAN

5 TECHNICAL DRAWINGS



5.4.2 ROOF STRUCTURE PLAN

5 TECHNICAL DRAWINGS

5.5.1 PRESPECTIVE VIEW 1

Scale NTS

5.5.2 PRESPECTIVE VIEW 2

Scale NTS

6

CONSTRUCTION SCHEDULE

6.1 CONCRETE MASONRY UNIT BLOCKS

6.2 PRECAST HOLLOW CORE SLAB SCHEDULE

6.3 PREFABRICATED DOORS

6.4 PRECAST LINTEL

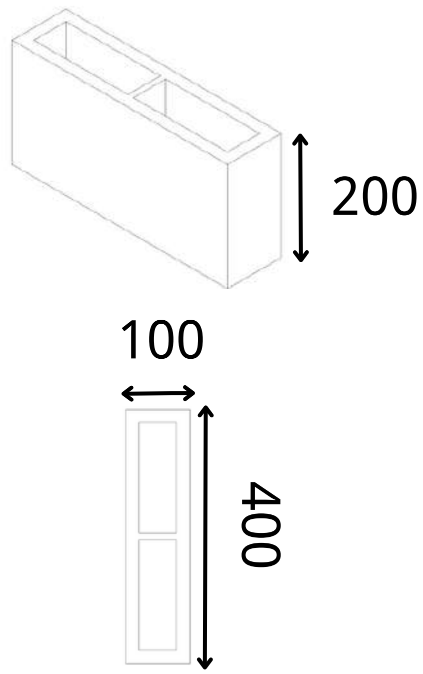
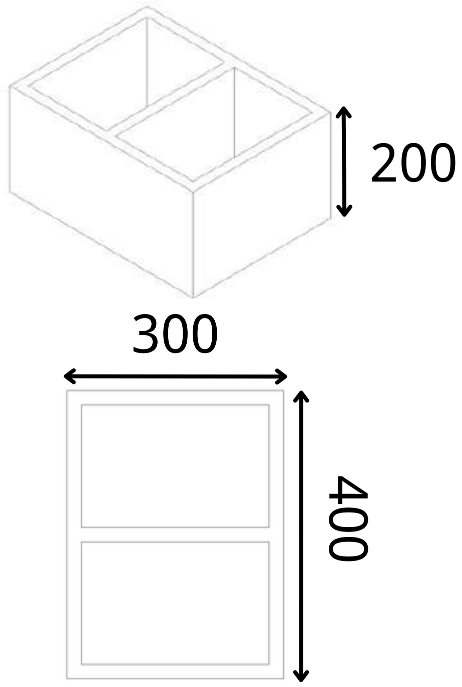
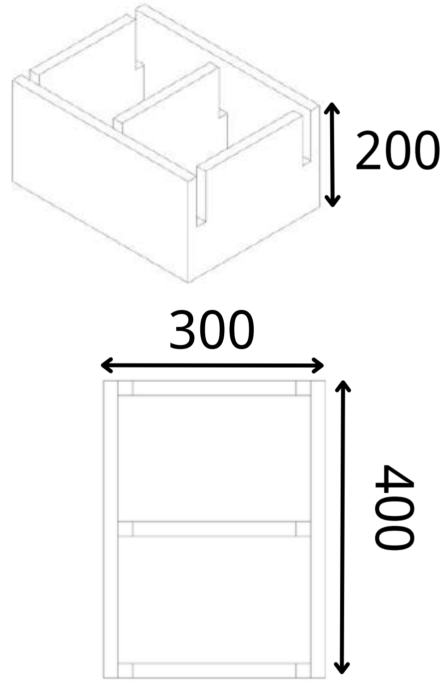
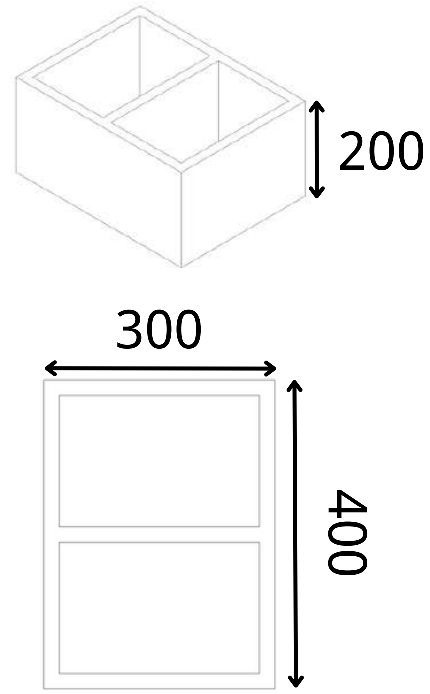
6.5 PREFABRICATED WINDOW

6.6 PRECAST CONCRETE STAIRS

6.7 STEEL ROOF TRUSS

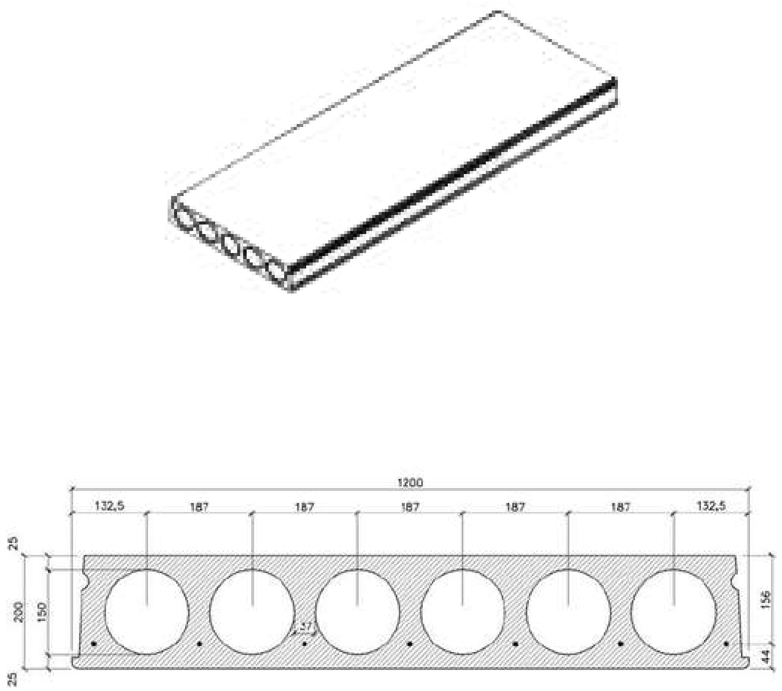
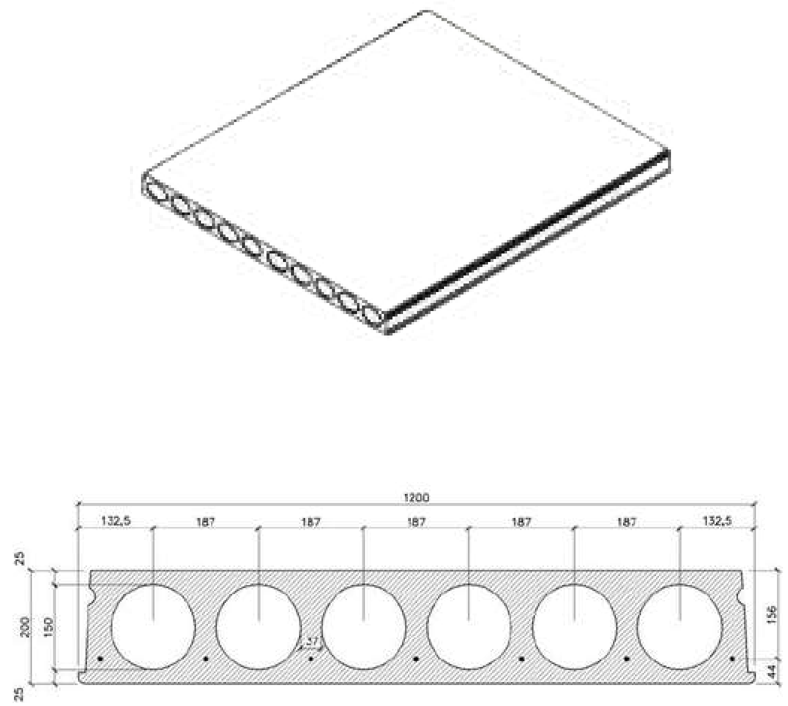
6 CONSTRUCTION SCHEDULE

6.1 CONCRETE MASONRY UNIT BLOCKS

COMPONENTS	**WALLS**		**BEAMS**	**COLUMNS**
CODE	CMB1	CMB2	B1	C1
DIMENSIONS (MM)				

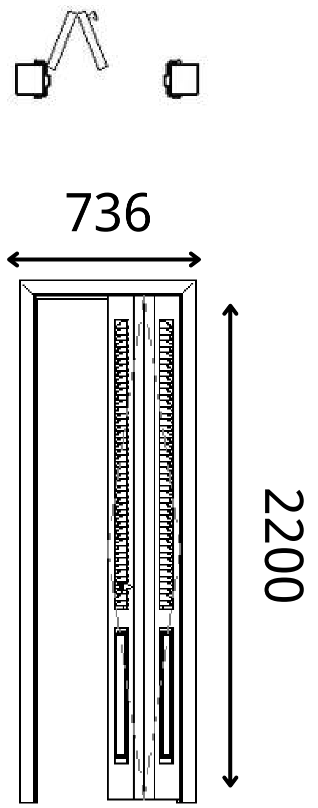
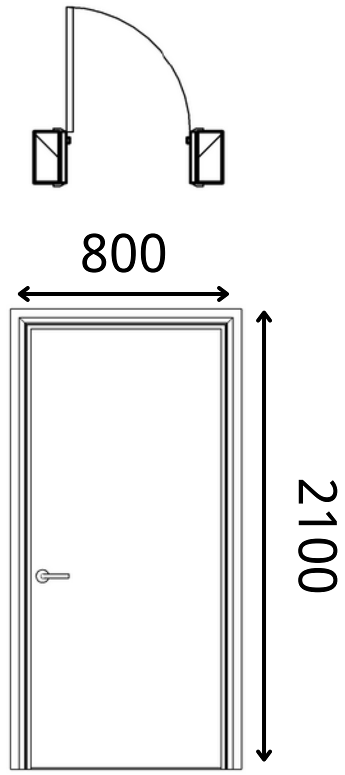
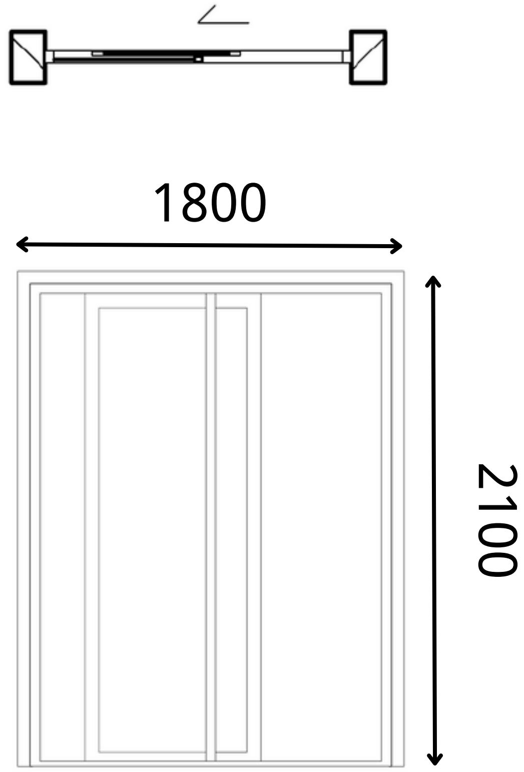
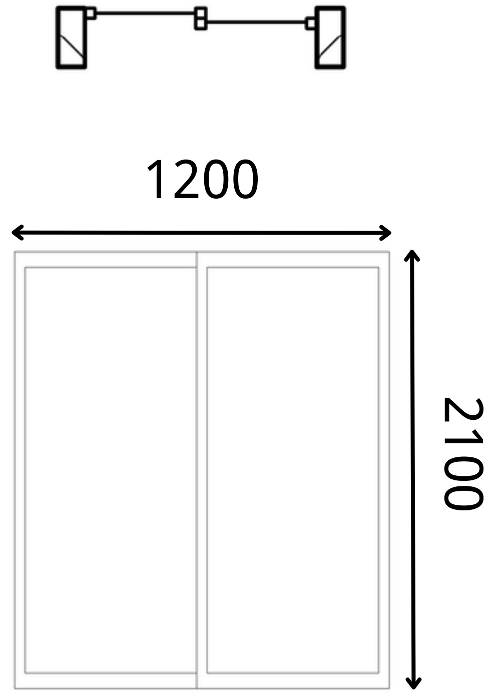
6 CONSTRUCTION SCHEDULE

6.2 PRECAST HOLLOW CORE SLAB SCHEDULE

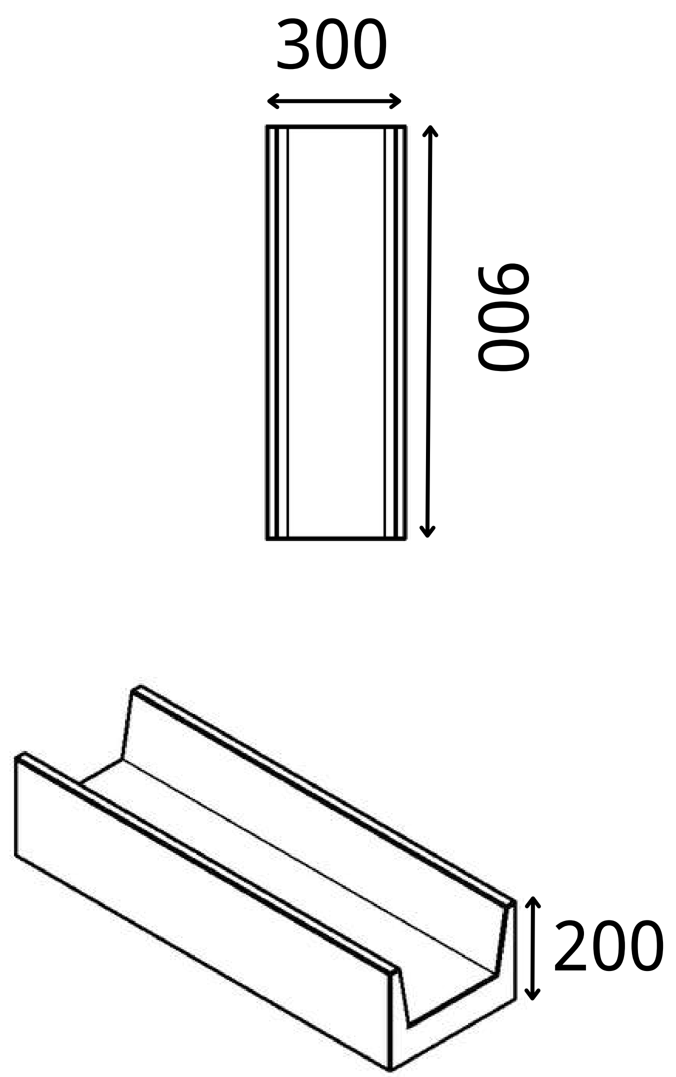
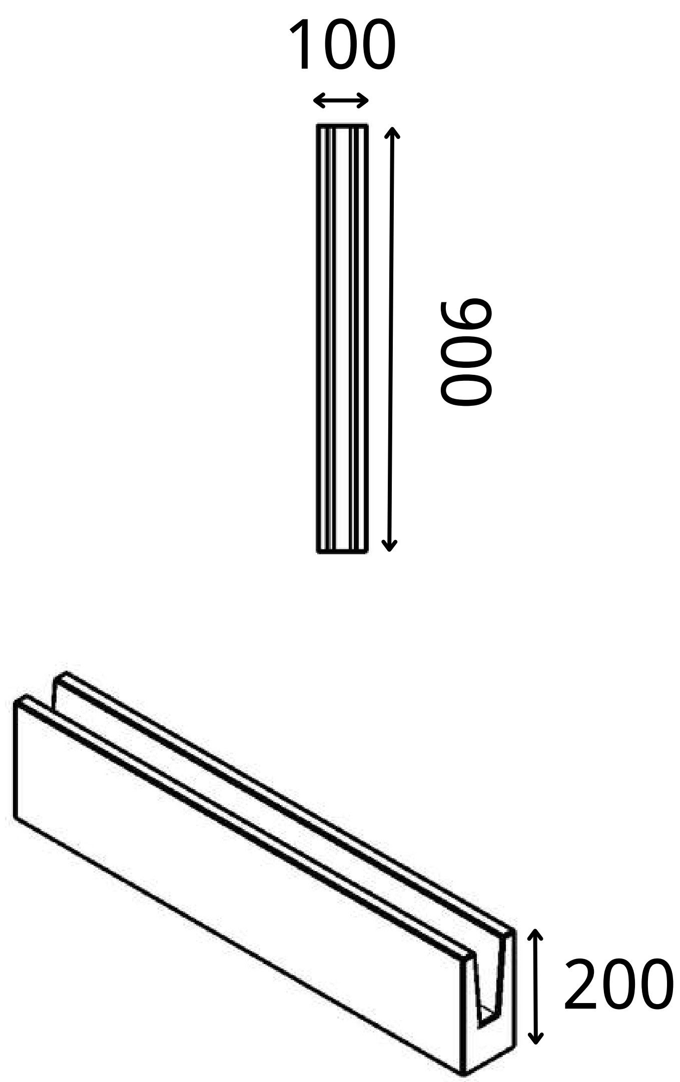
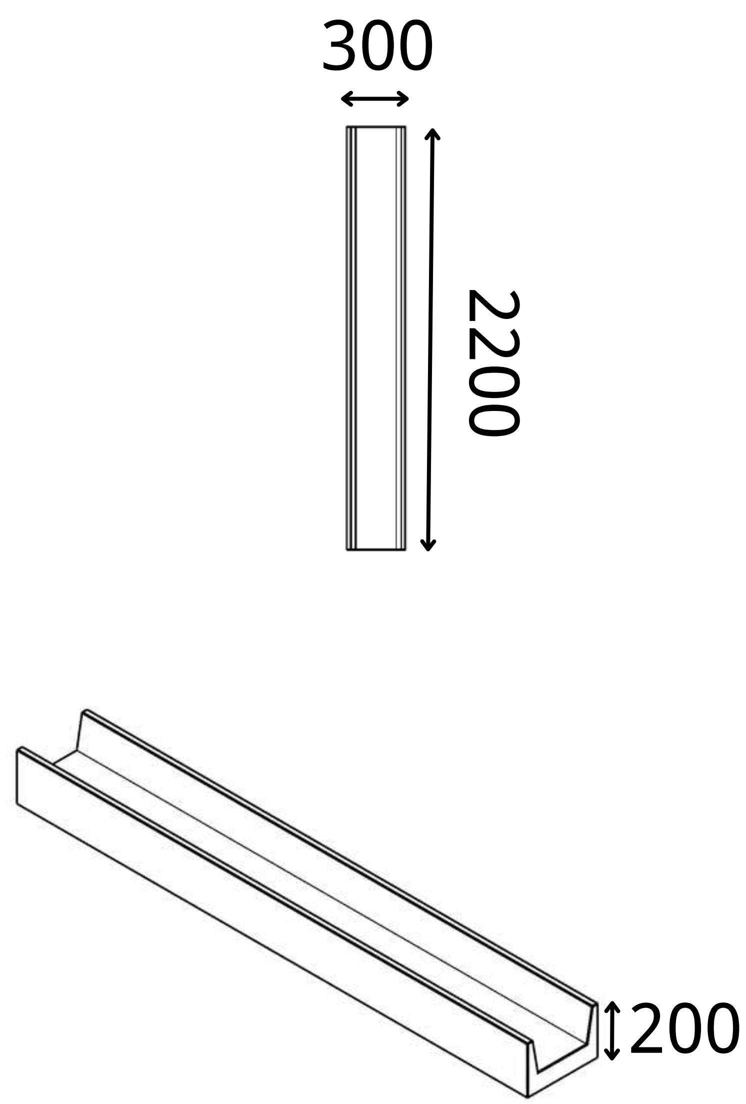
COMPONENTS	**HOLLOW CORE SLAB**	
CODE	HCS1	HCS2
DIMENSIONS (MM)		

6 CONSTRUCTION SCHEDULE

6.3 PREFABRICATED DOORS

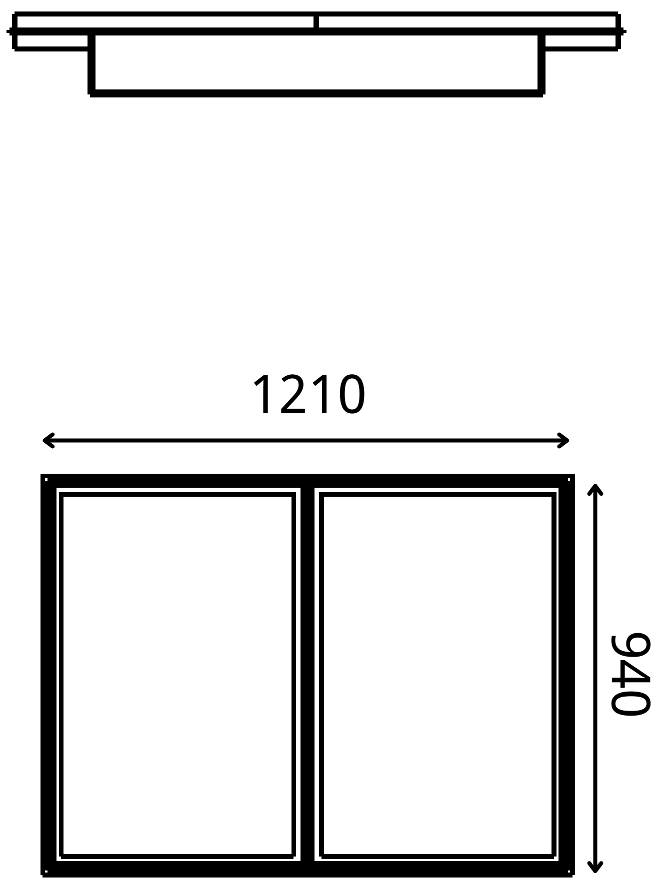
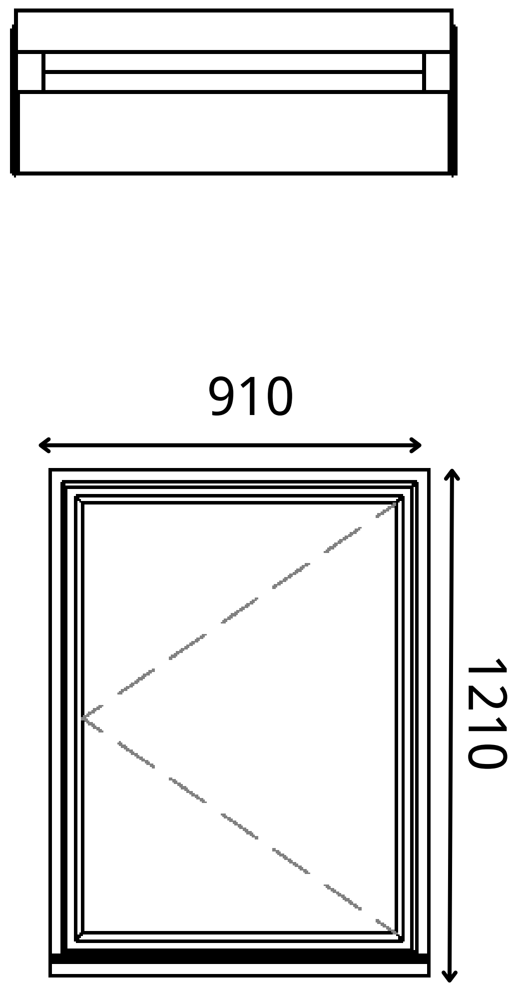
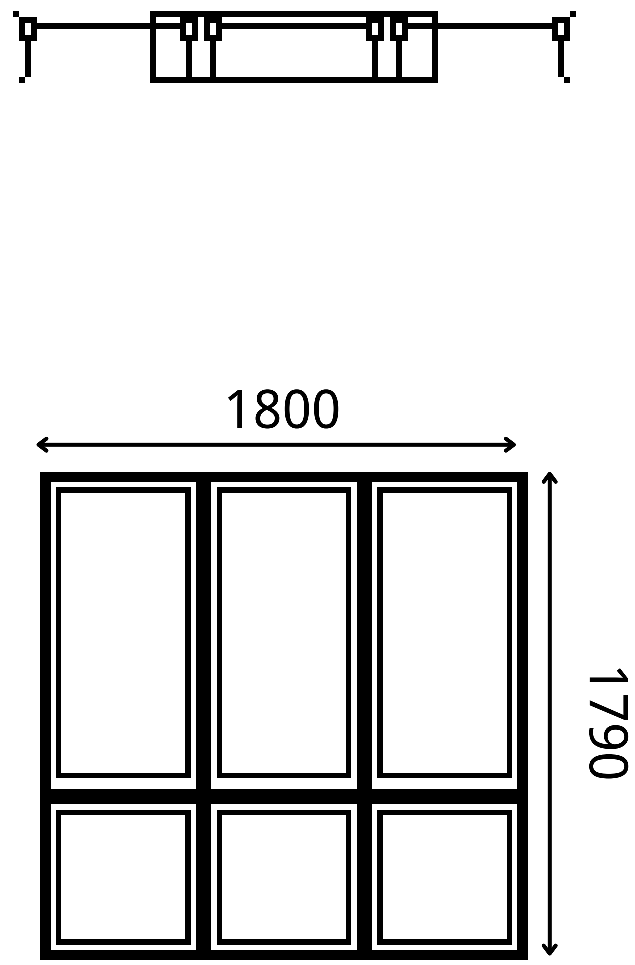
COMPONENTS	DOORS			
CODE	D1	D2	D3	D4
DIMENSIONS (MM)	**Panel Bifold Door** 	**Single Leaf Door** 	**Sliding Door** 	**Sliding Door 2** 
QUANTITY	12	72	24	18

6.4 PRECAST LINTEL

COMPONENTS	LINTEL		
CODE	L1	L2	L3
DIMENSIONS (MM)			

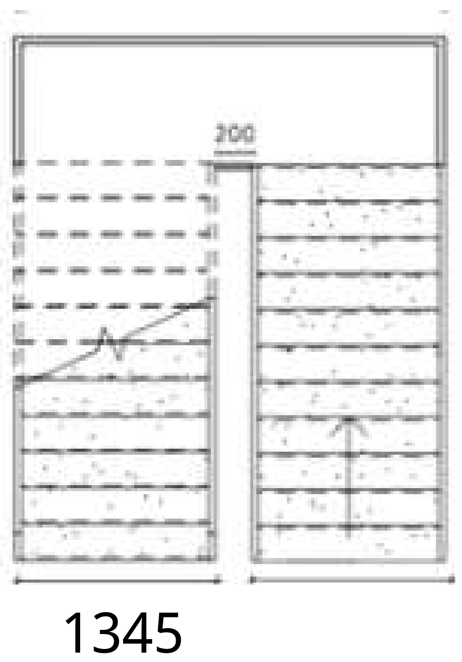
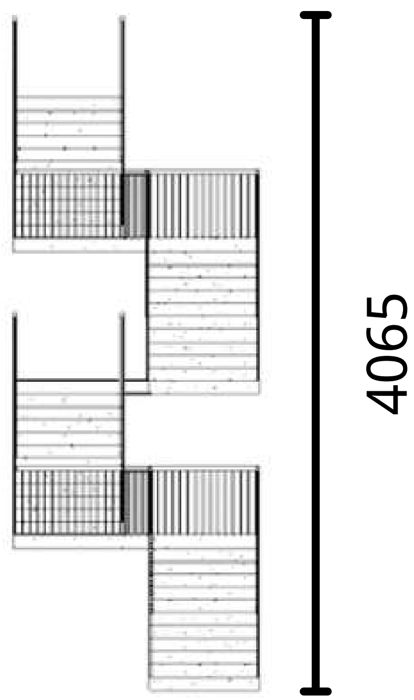
6 CONSTRUCTION SCHEDULE

6.5 PREFABRICATED WINDOW

COMPONENTS	**WINDOWS**		
CODE	W1	W2	W3
DIMENSIONS (MM)			
QUANTITY	36	3	12

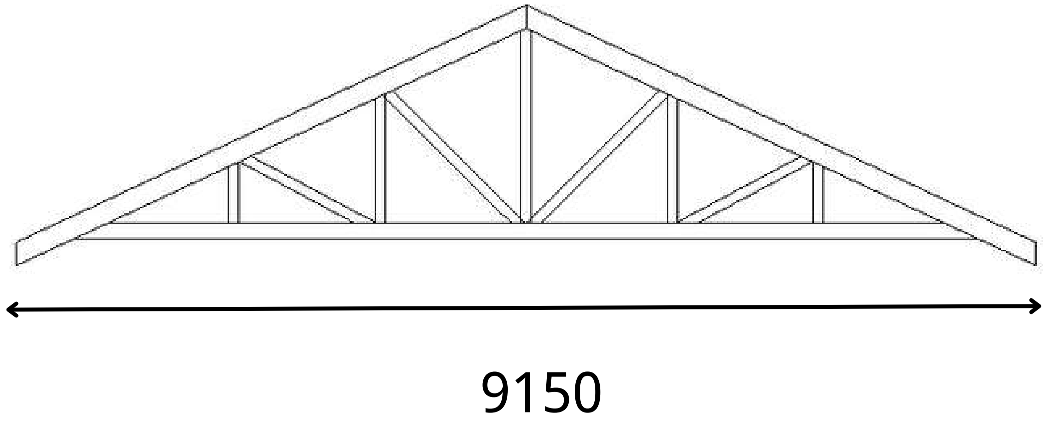
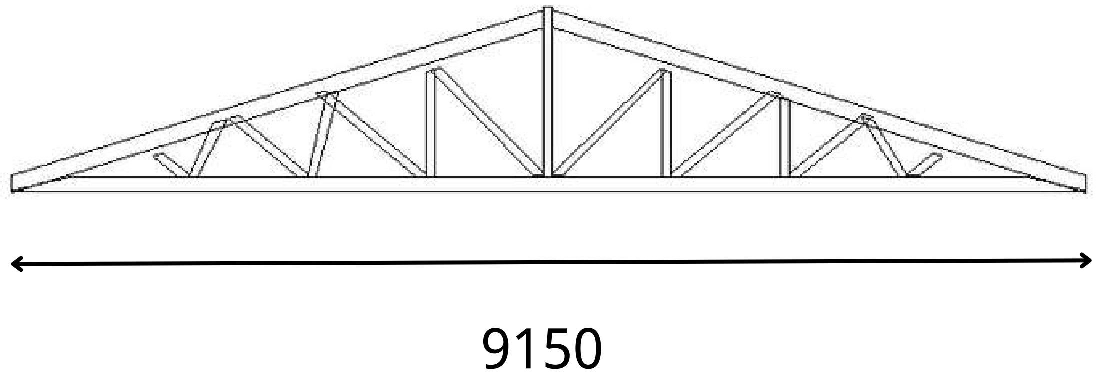
6 CONSTRUCTION SCHEDULE

6.6 PRECAST CONCRETE STAIRS

COMPONENTS	**STAIRS**
CODE	S1
DIMENSIONS (MM)	 
QUANTITY	4

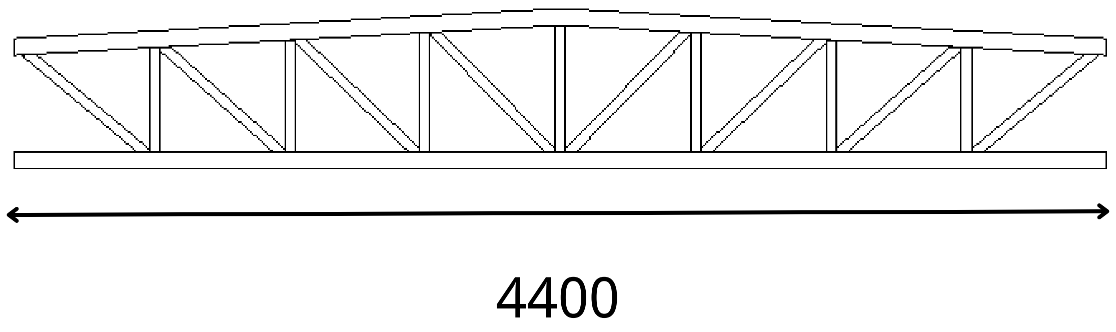
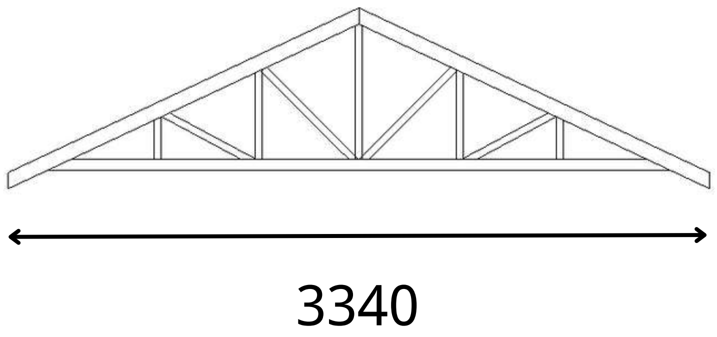
6 CONSTRUCTION SCHEDULE

6.7 STEEL ROOF TRUSS

COMPONENTS	STEEL TRUSSES	
CODE	ST1	ST2
DIMENSIONS (MM)		
QUANTITY	20	2

6 CONSTRUCTION SCHEDULE

6.7 STEEL ROOF TRUSS

COMPONENTS	STEEL TRUSSES	
CODE	ST3	ST4
DIMENSIONS (MM)		
QUANTITY	54	38

7

CONSTRUCTION DETAILS

7.1 WALL TO FOUNDATION CONNECTION

7.2 WALL TO BEAM CONNECTION

7.3 WALL TO SLAB CONNECTION

7.4 WALL TO COLUMN CONNECTION

7.5 WALL TO WALL CONNECTION

7.6 WINDOW TO WALL CONNECTION

7.7 DOOR TO WALL CONNECTION

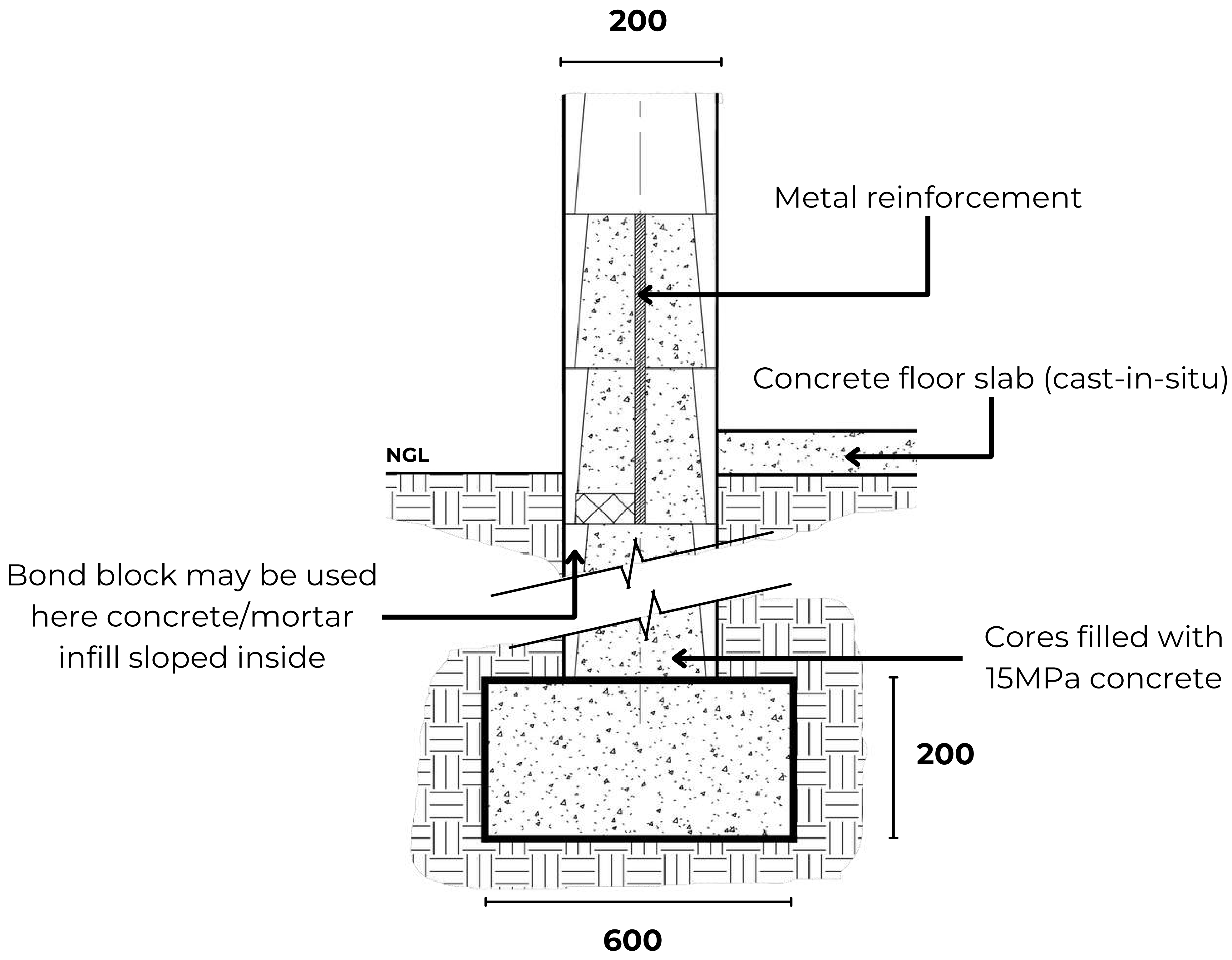
7.8 PRECAST STAIRCASE CONSTRUCTION

7.9 PREFABRICATED LIGHTWEIGHT STEEL ROOF CONSTRUCTION

7.10 ROOF TO BEAM AND WALL CONNECTION

7 CONSTRUCTION DETAILS

7.1 WALL TO FOUNDATION CONNECTION

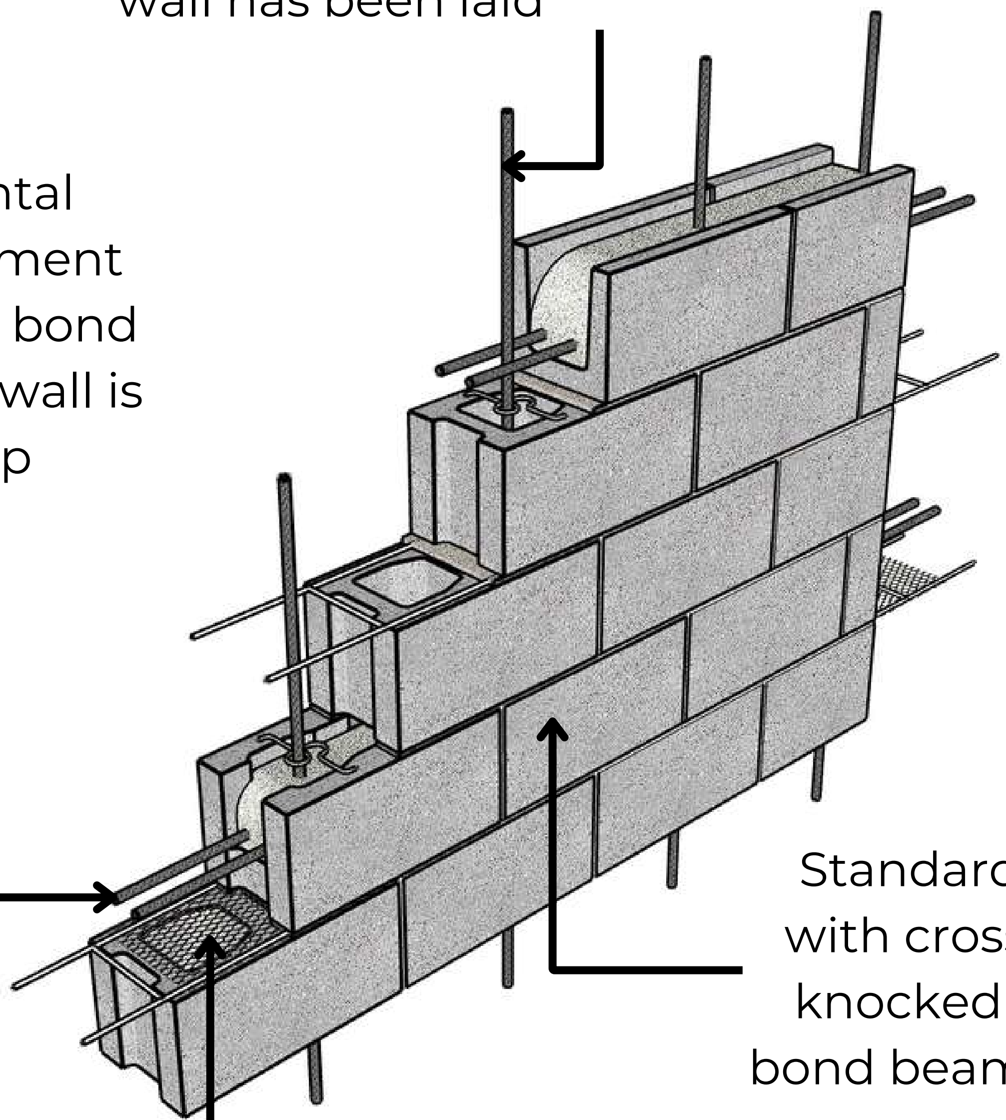


7 CONSTRUCTION DETAILS

7.2 WALL TO BEAM CONNECTION

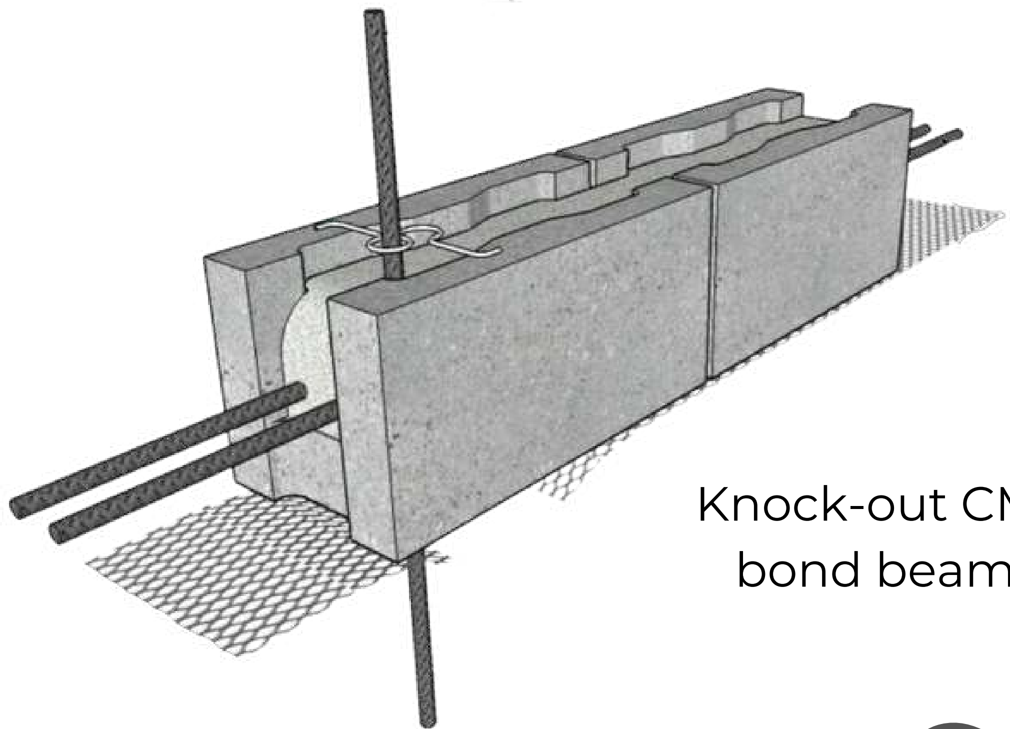
Vertical reinformcement for closed-end concrete masonry units can be set after wall has been laid

Horizontal reinforcement placed on bond beams as wall is laid up



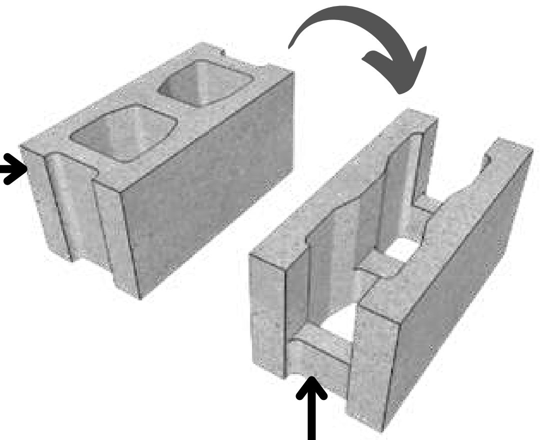
Standard CMU with cross webs knocked out at bond beam course

Metal lath, mesh, or wire screen placed in mortar joints under knockout bond beam courses to prevent filling or ungrouted cells



Knock-out CMU bond beams

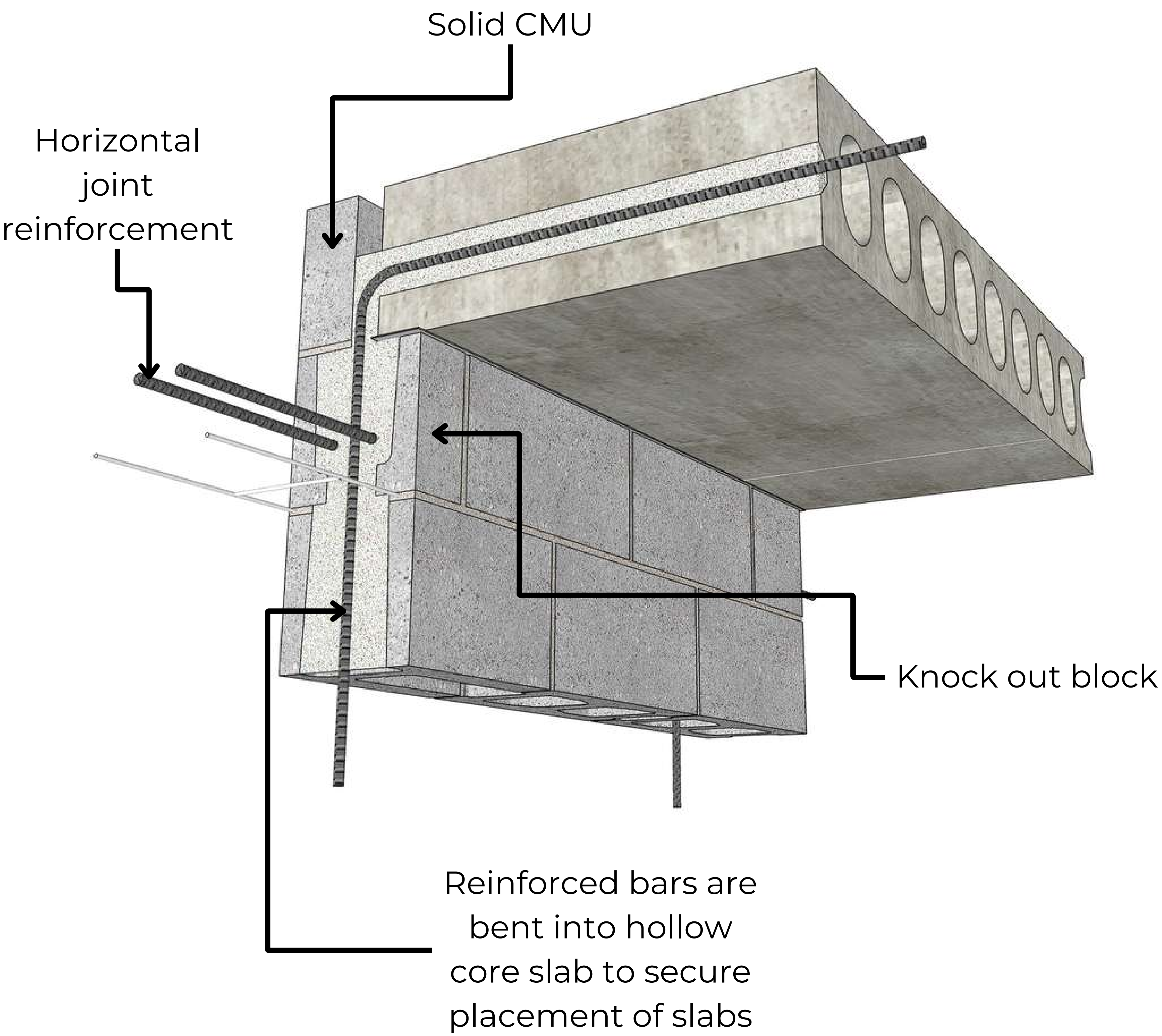
View of standard block before cross webs are knocked out

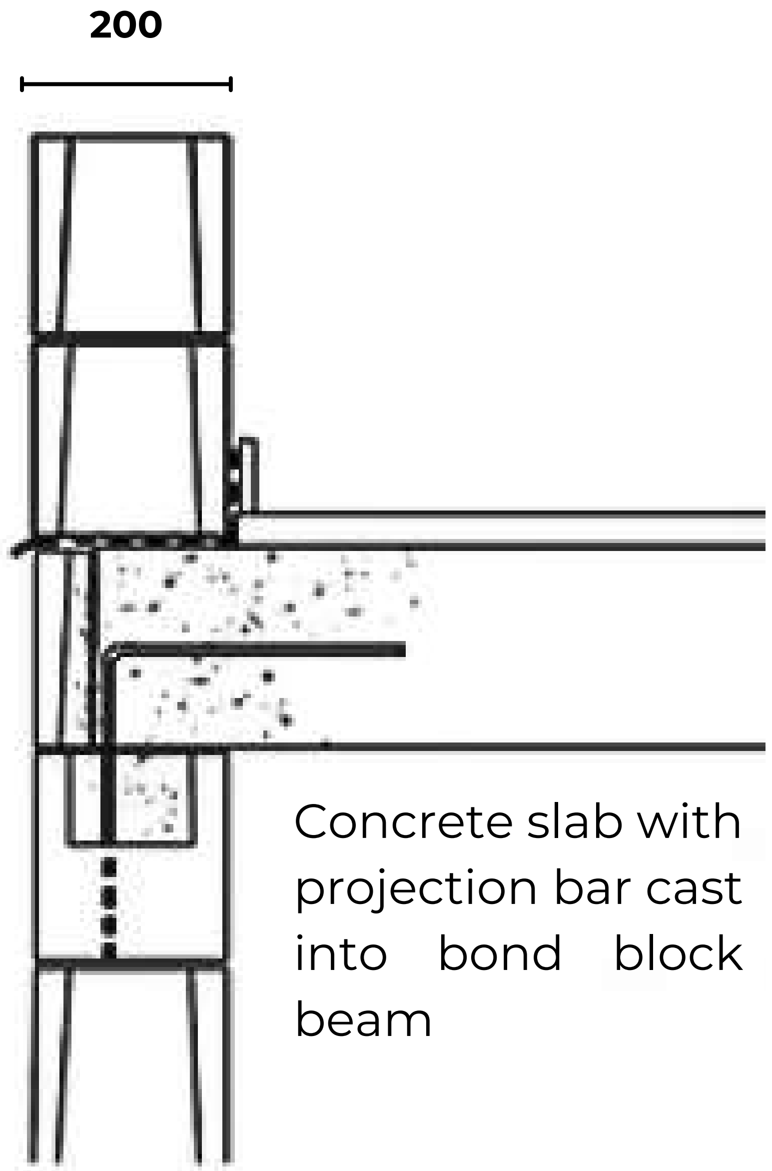


View of standard block after cross webs are knocked out to accomodate horizontal reinforcement

7 CONSTRUCTION DETAILS

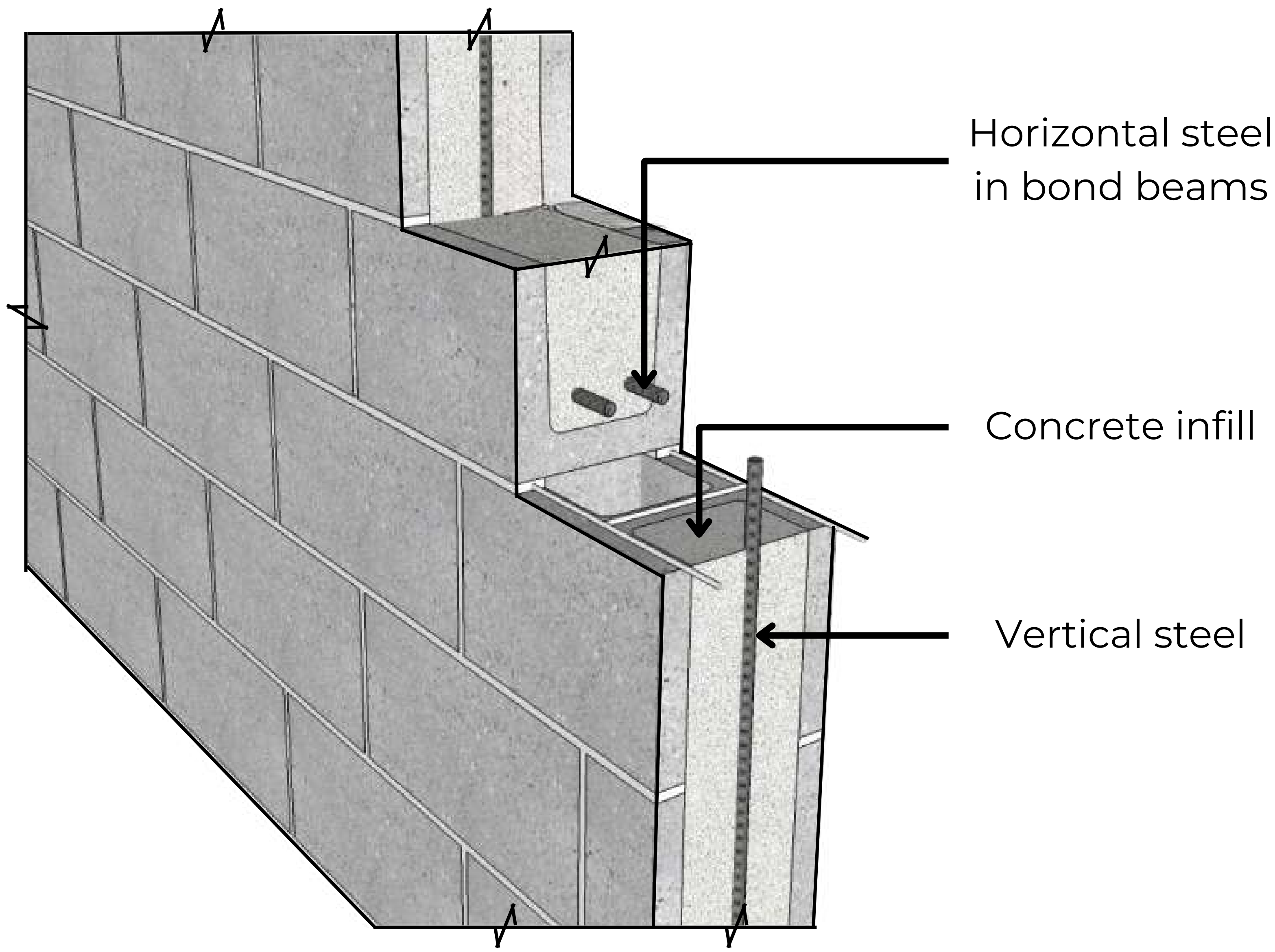
7.3 WALL TO SLAB CONNECTION



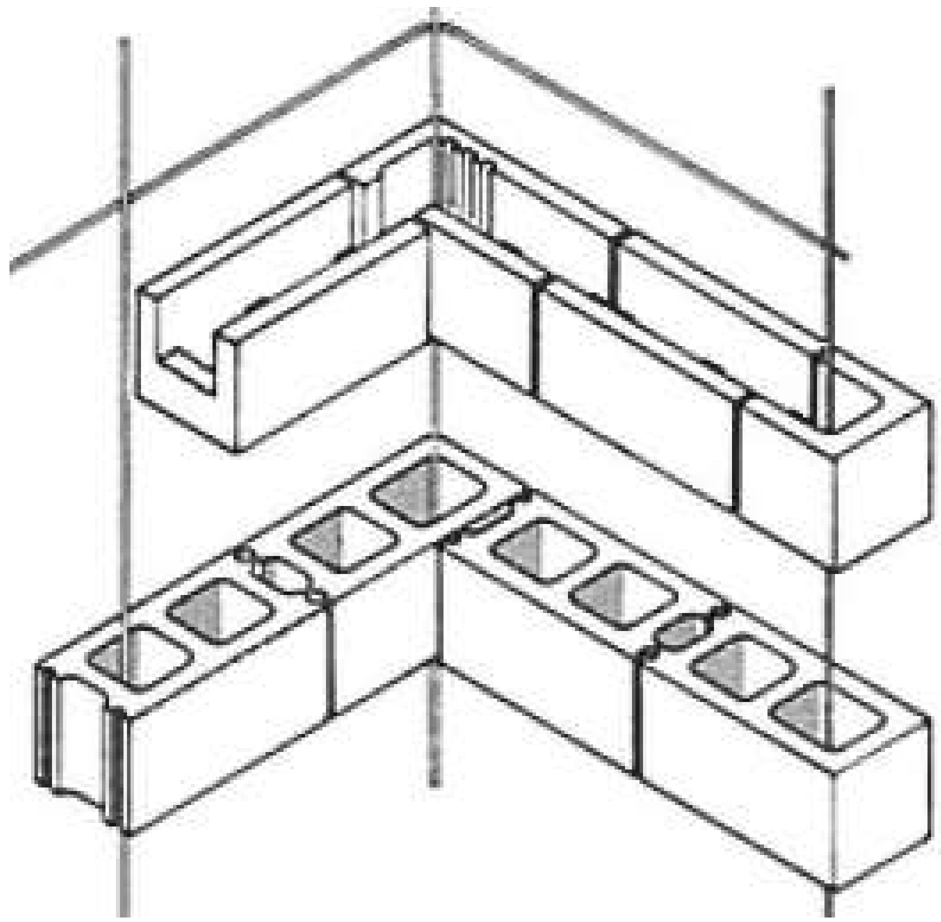


7 CONSTRUCTION DETAILS

7.4 WALL TO COLUMN CONNECTION



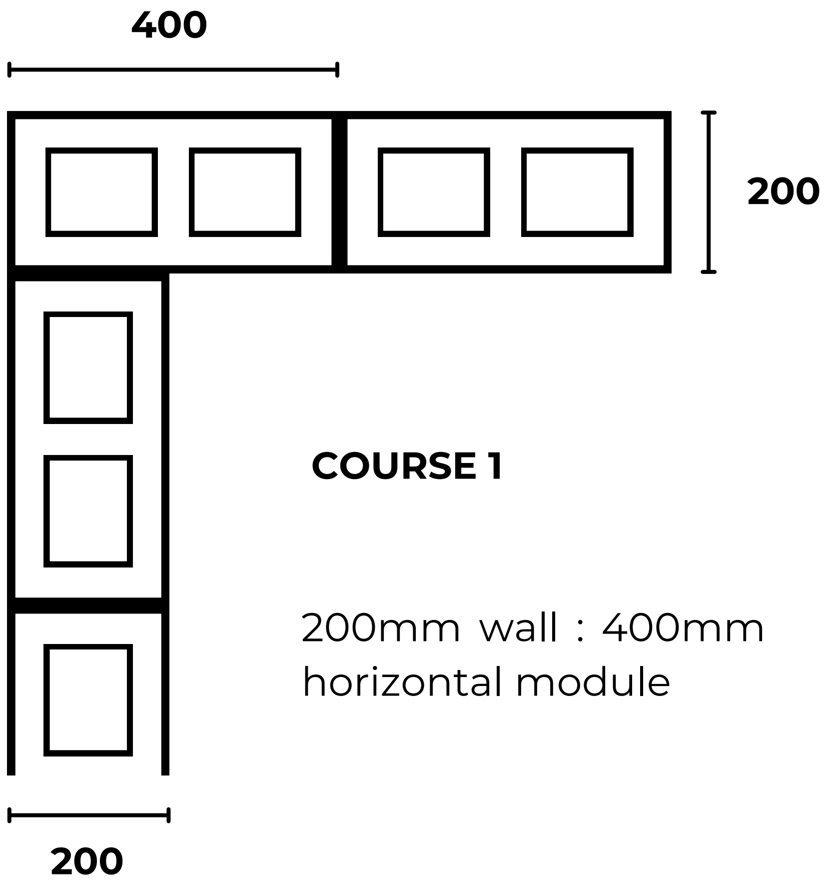
CMU stiffener / column
The hollow core of full blocks are infilled with concrete and reinforced with a steel bar to form a stiffener

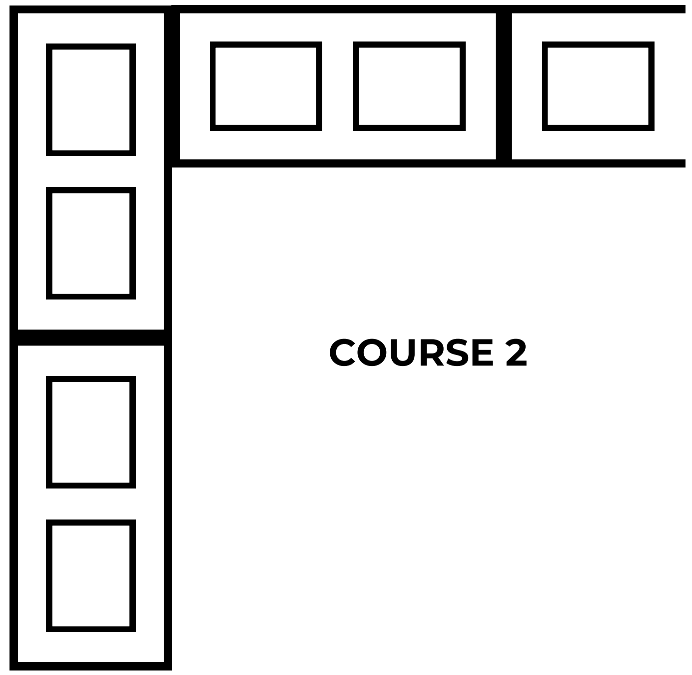


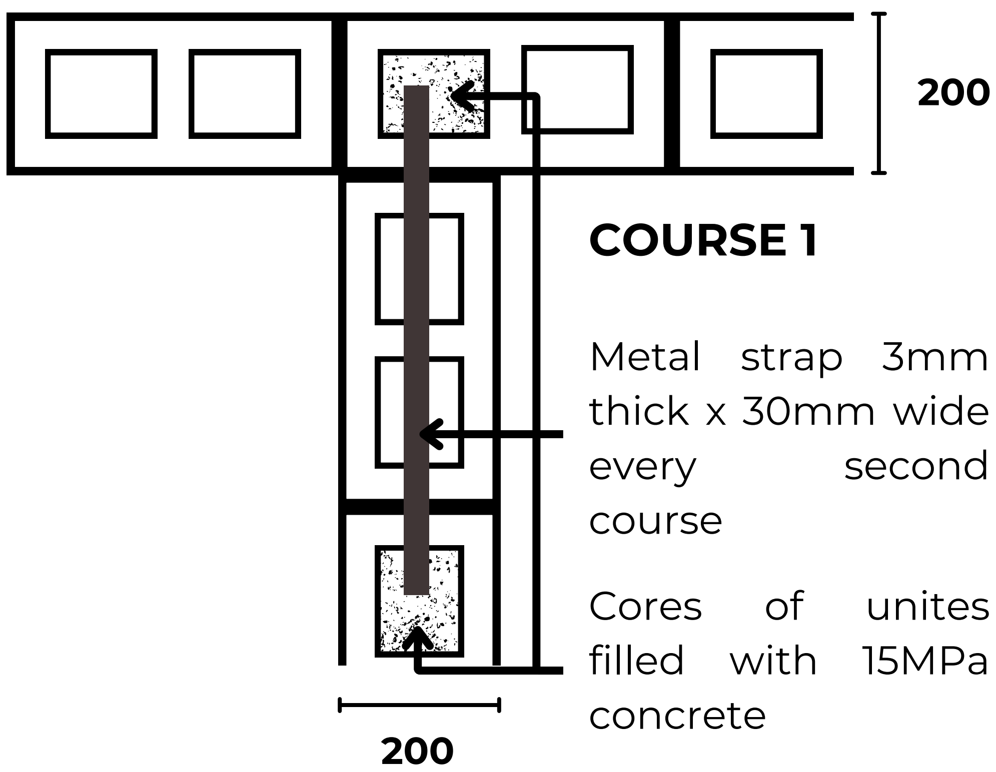
CMU Full Block and Bond Beam when reinforced and infilled with concrete, becomes a stiffener and bond beam to replace conventional column, beam and lintel.

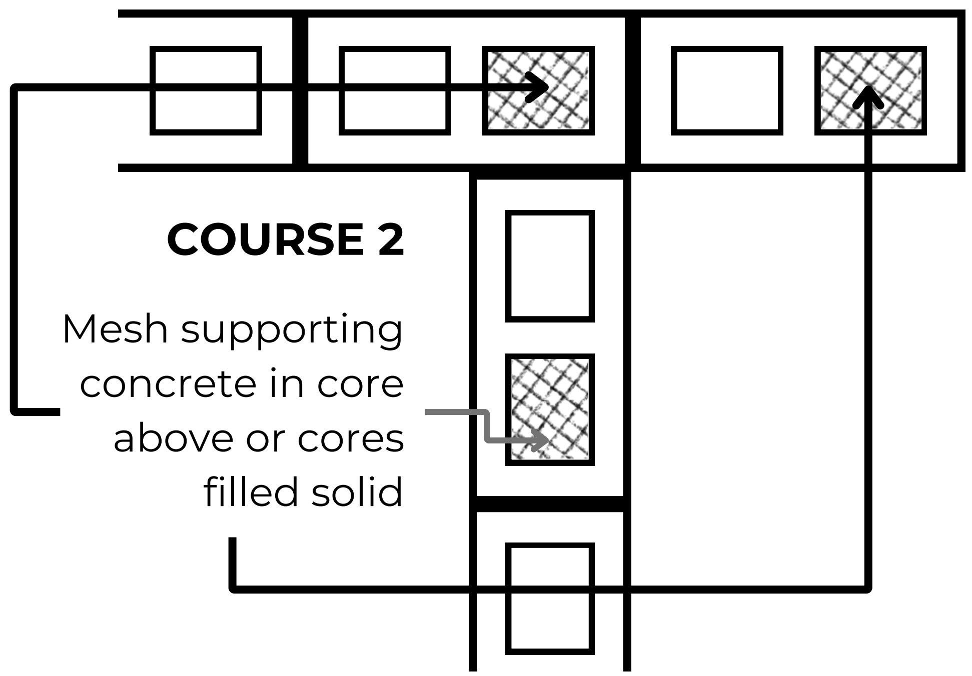
7 CONSTRUCTION DETAILS

7.5 WALL TO WALL CONNECTION



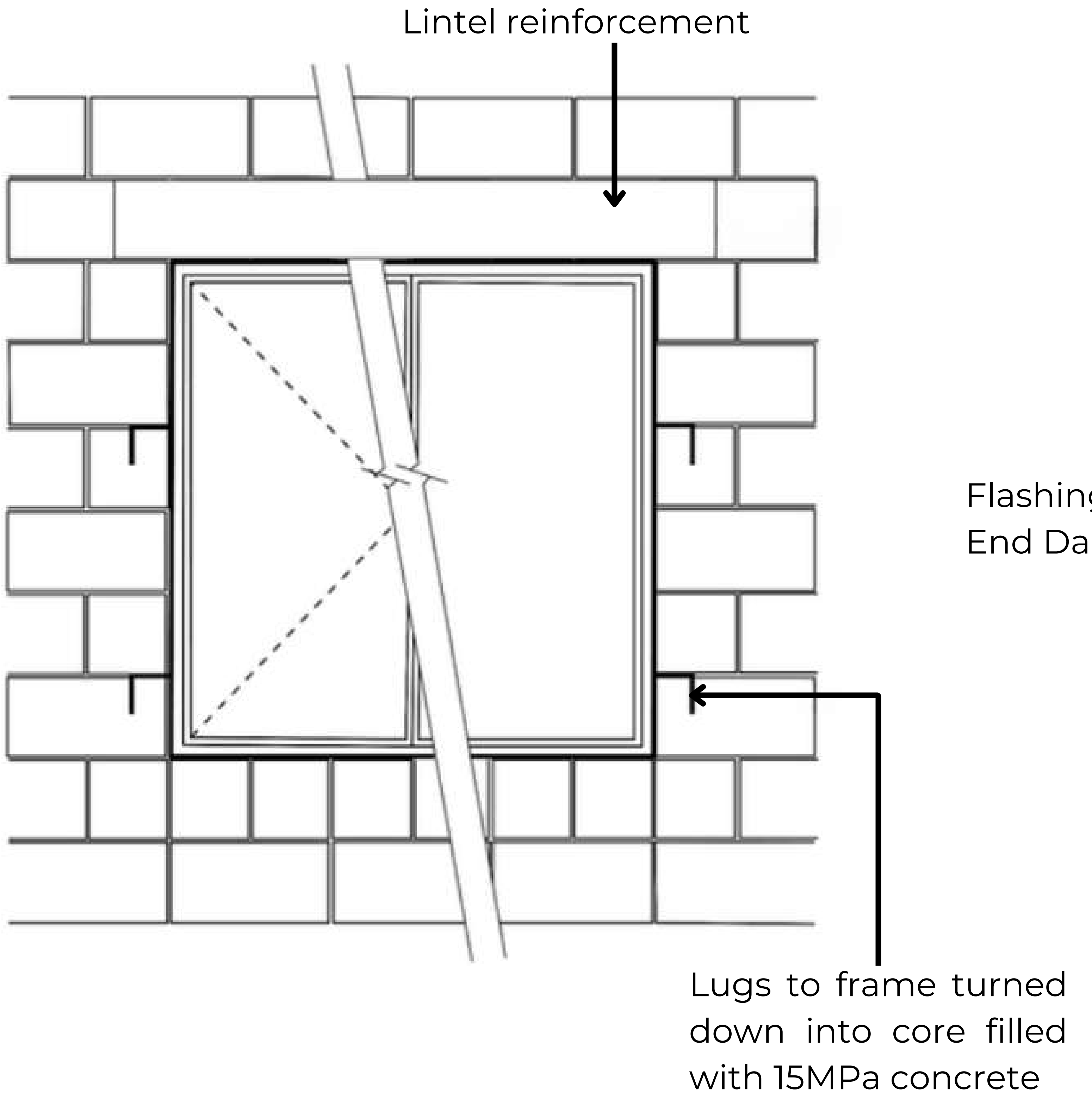


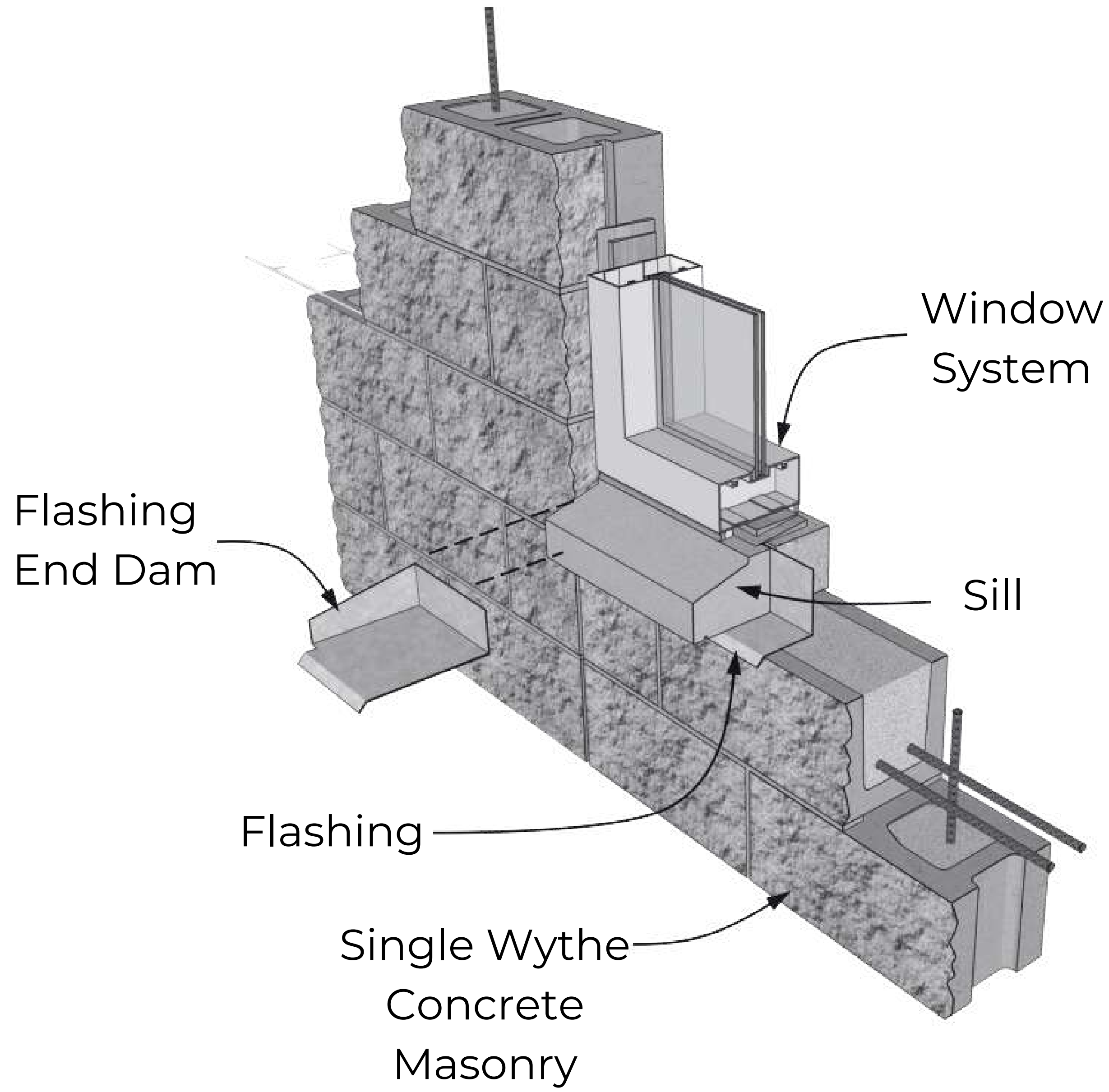




7 CONSTRUCTION DETAILS

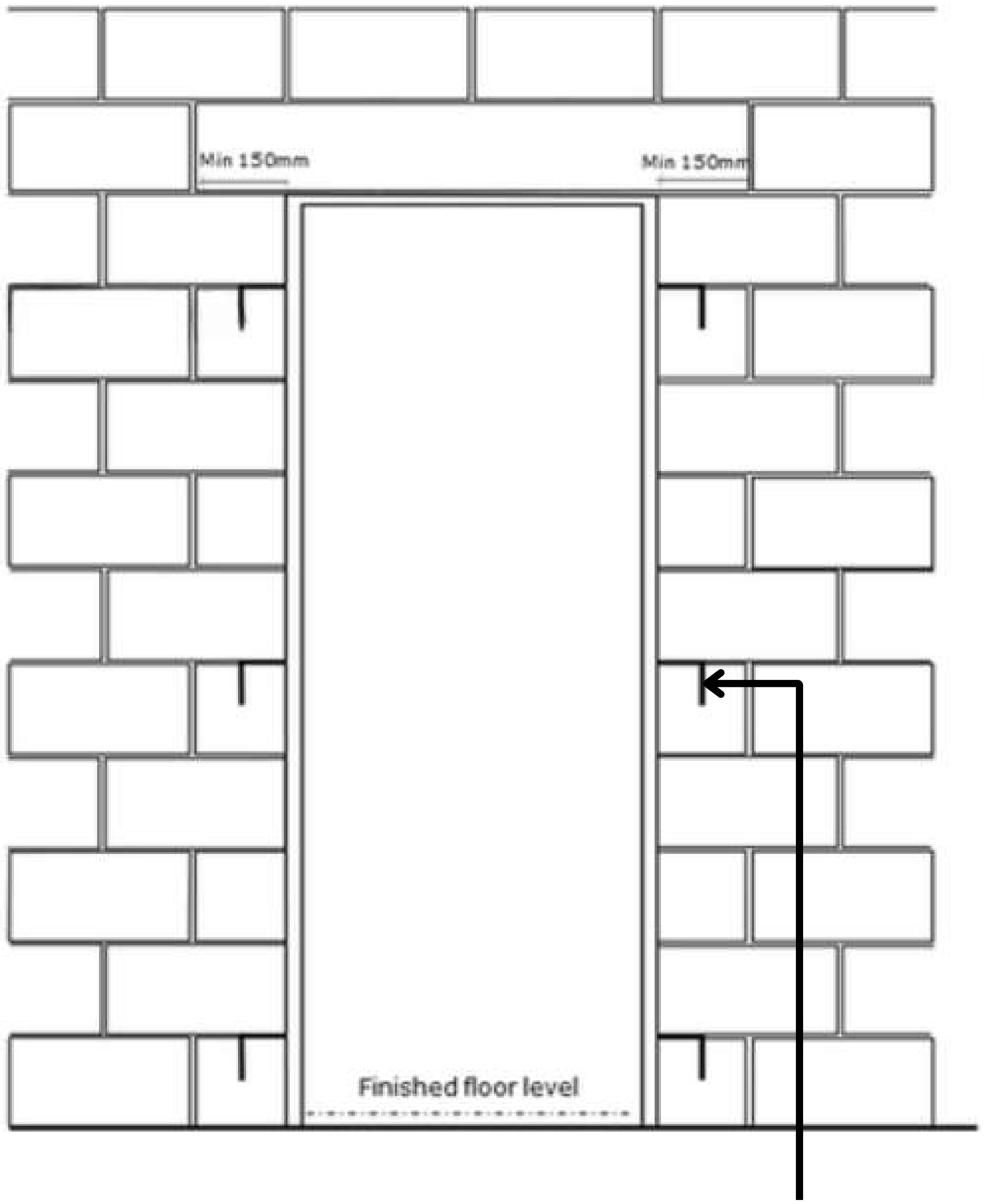
7.6 WINDOW TO WALL CONNECTION





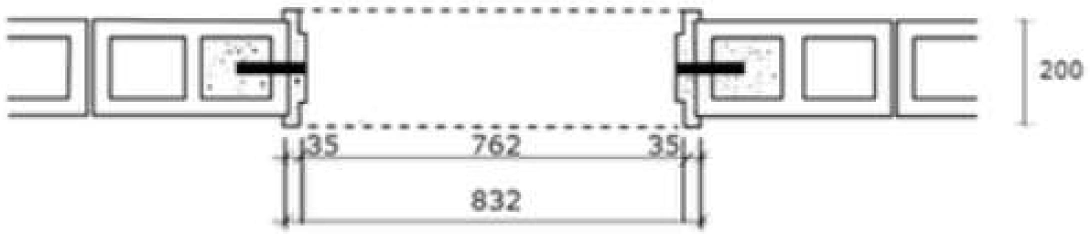
7 CONSTRUCTION DETAILS

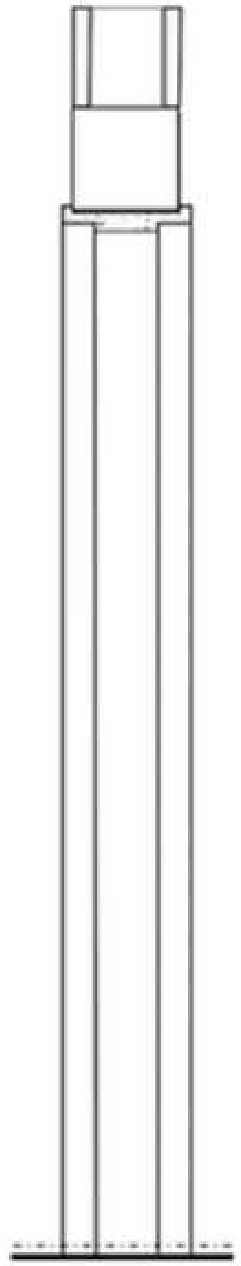
7.7 DOOR TO WALL CONNECTION



Lugs to frame turned down into core filled with 15MPa concrete

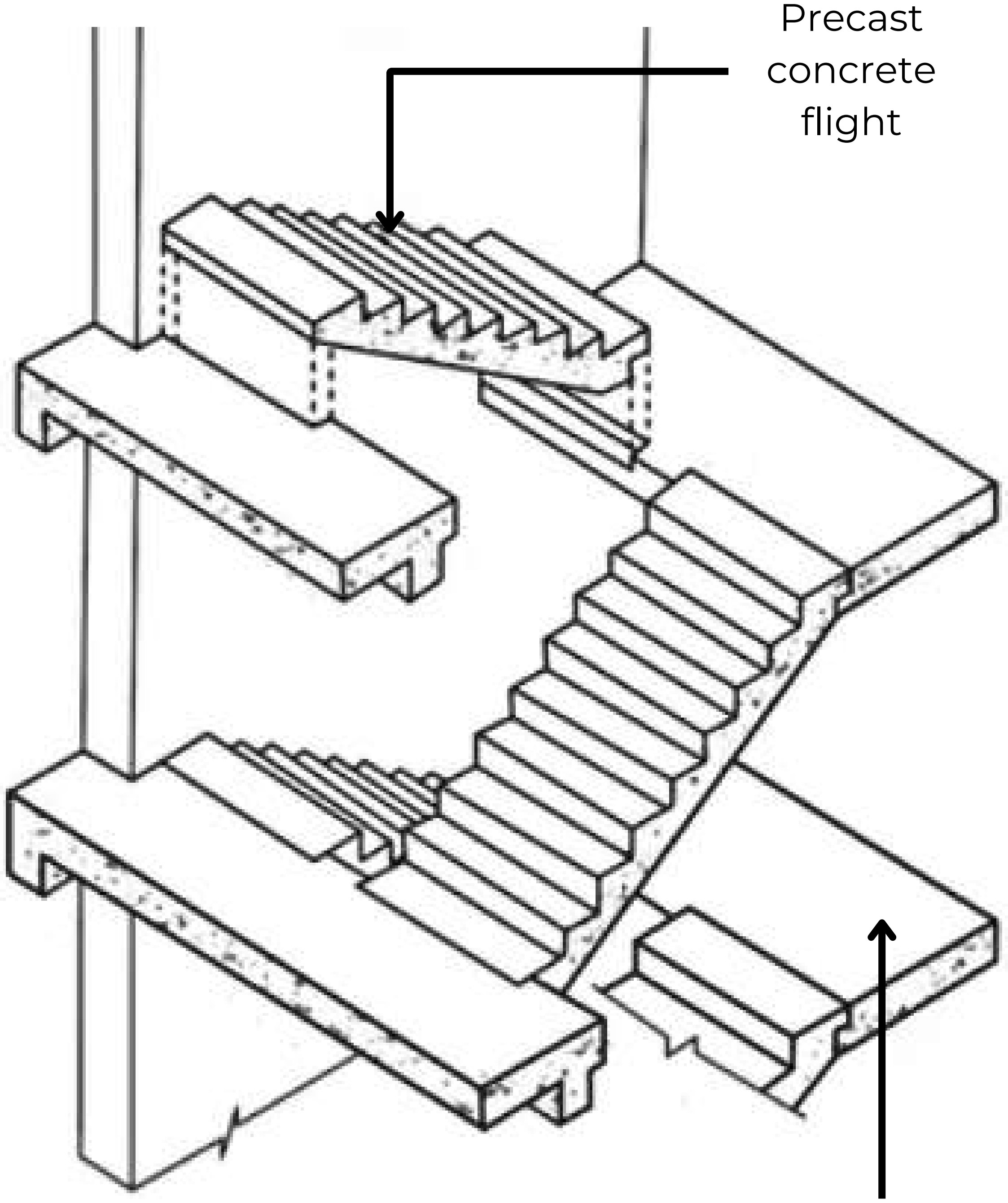
Lintel should be installed with a minimum end bearing of 150mm, bedded on mortar levelled along its length and across its width.



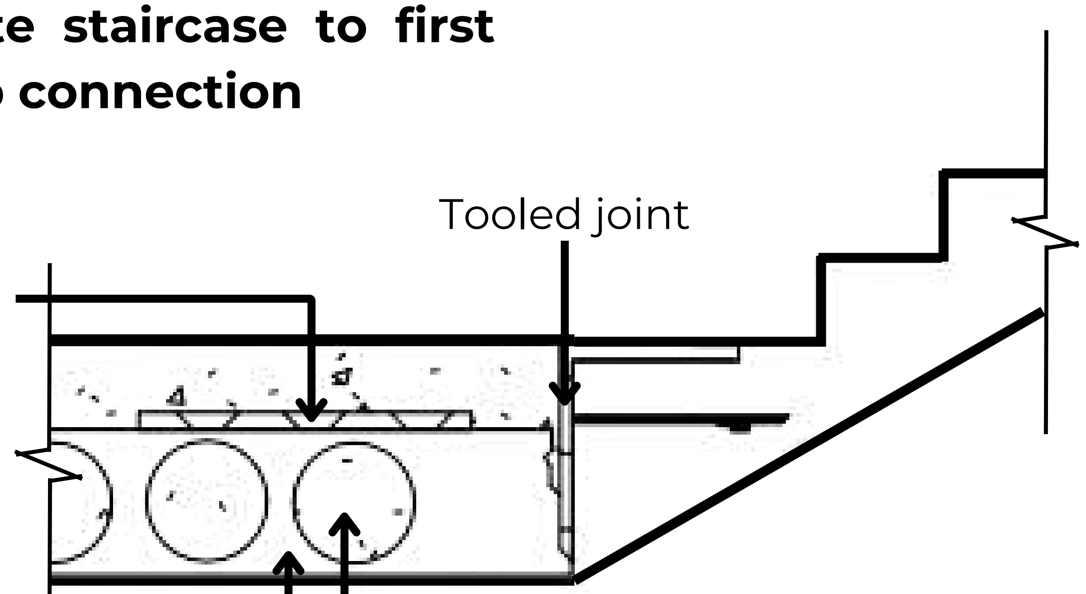


7 CONSTRUCTION DETAILS

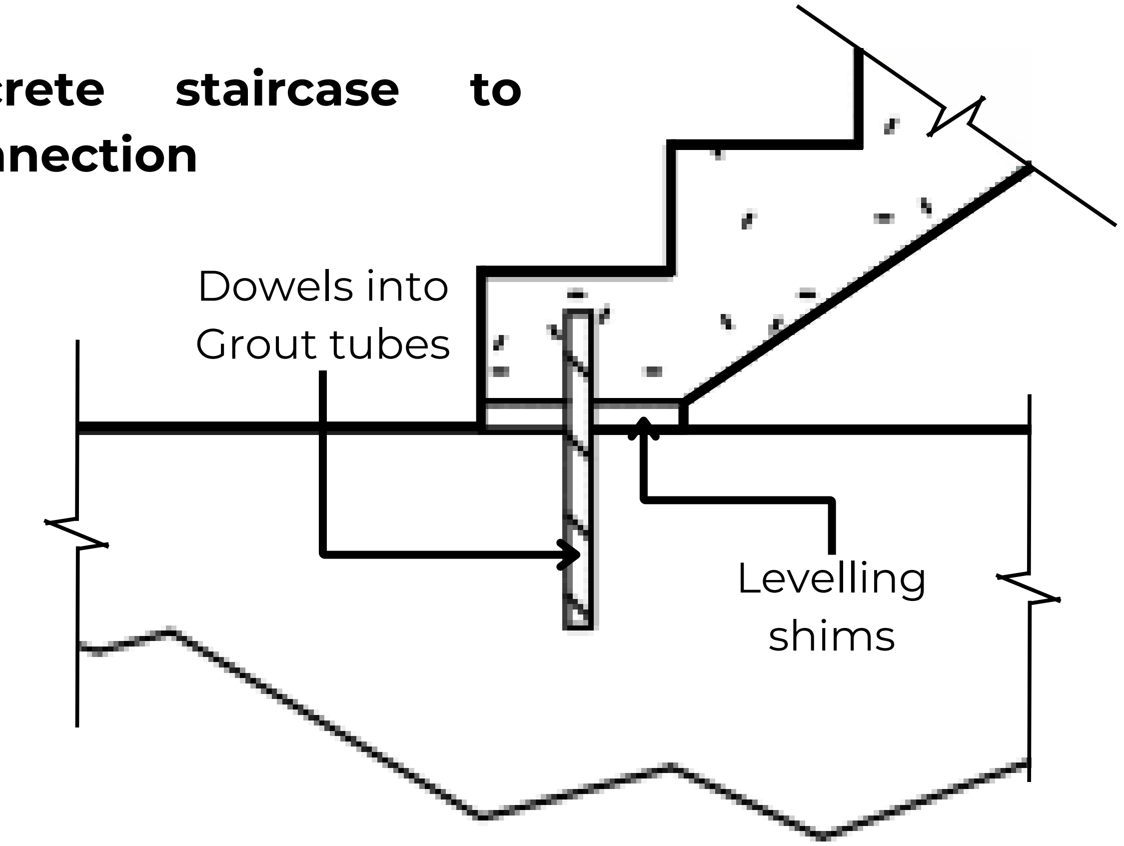
7.8 PRECAST STAIRCASE CONSTRUCTION



Precast concrete staircase to first hollow core slab connection

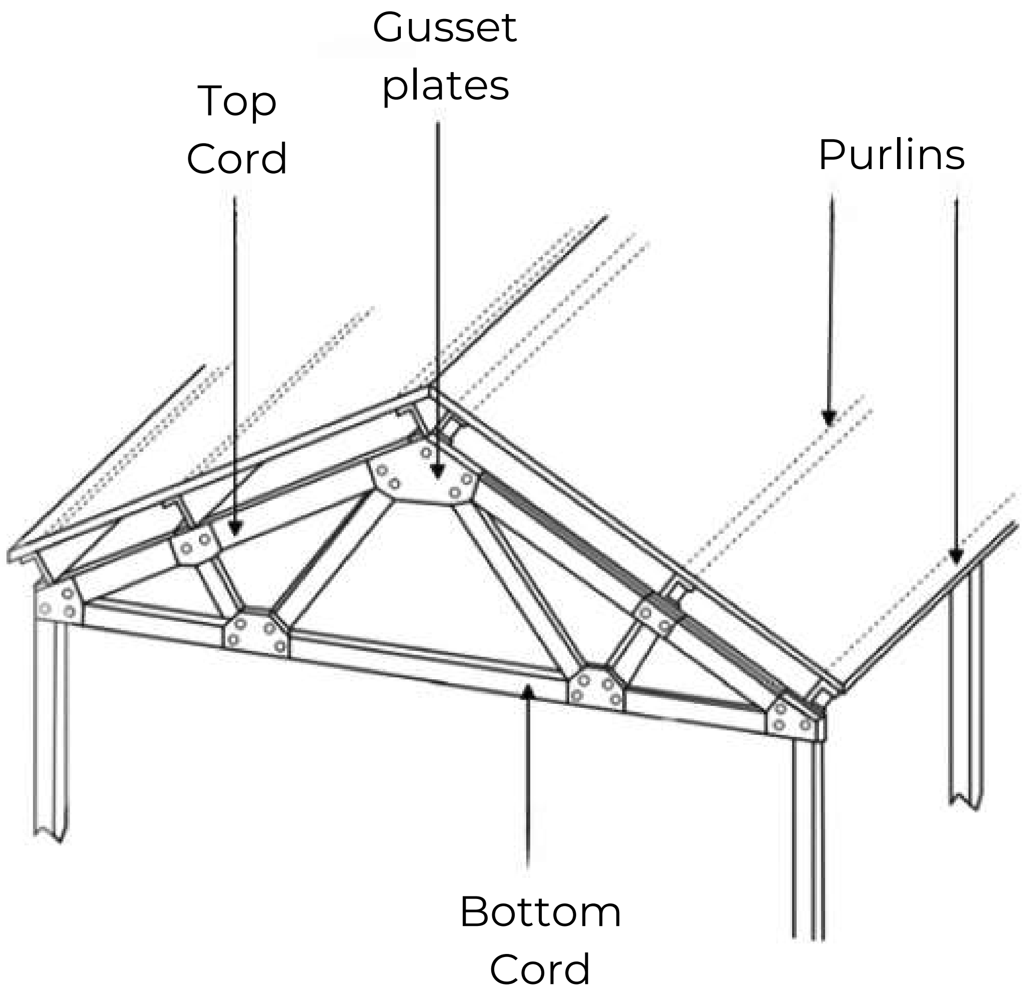


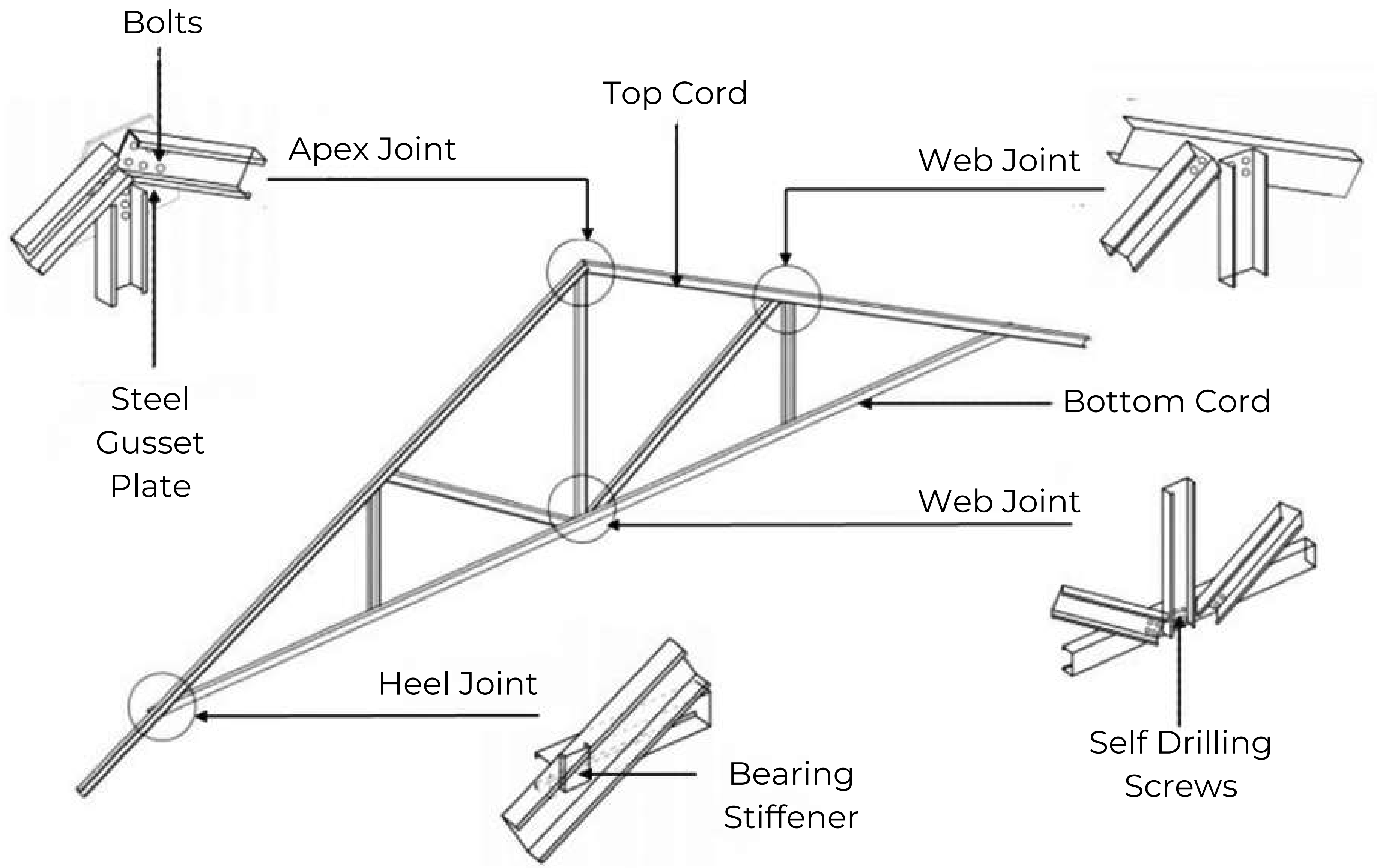
Precast concrete staircase to foundation connection

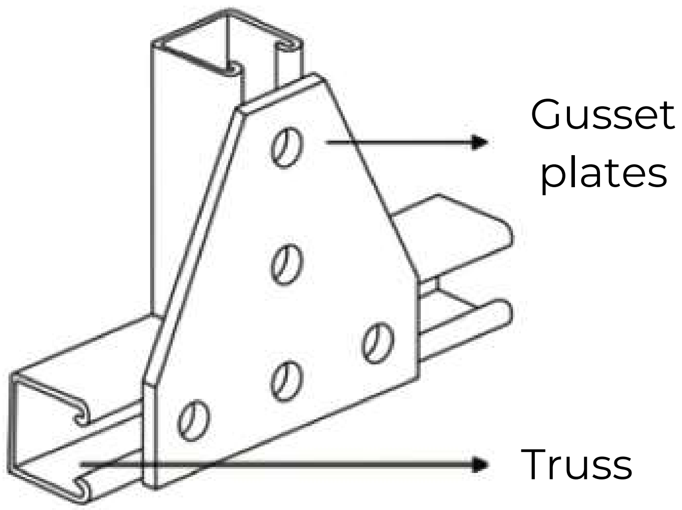


7 CONSTRUCTION DETAILS

7.9 PREFABRICATED LIGHTWEIGHT STEEL ROOF CONSTRUCTION

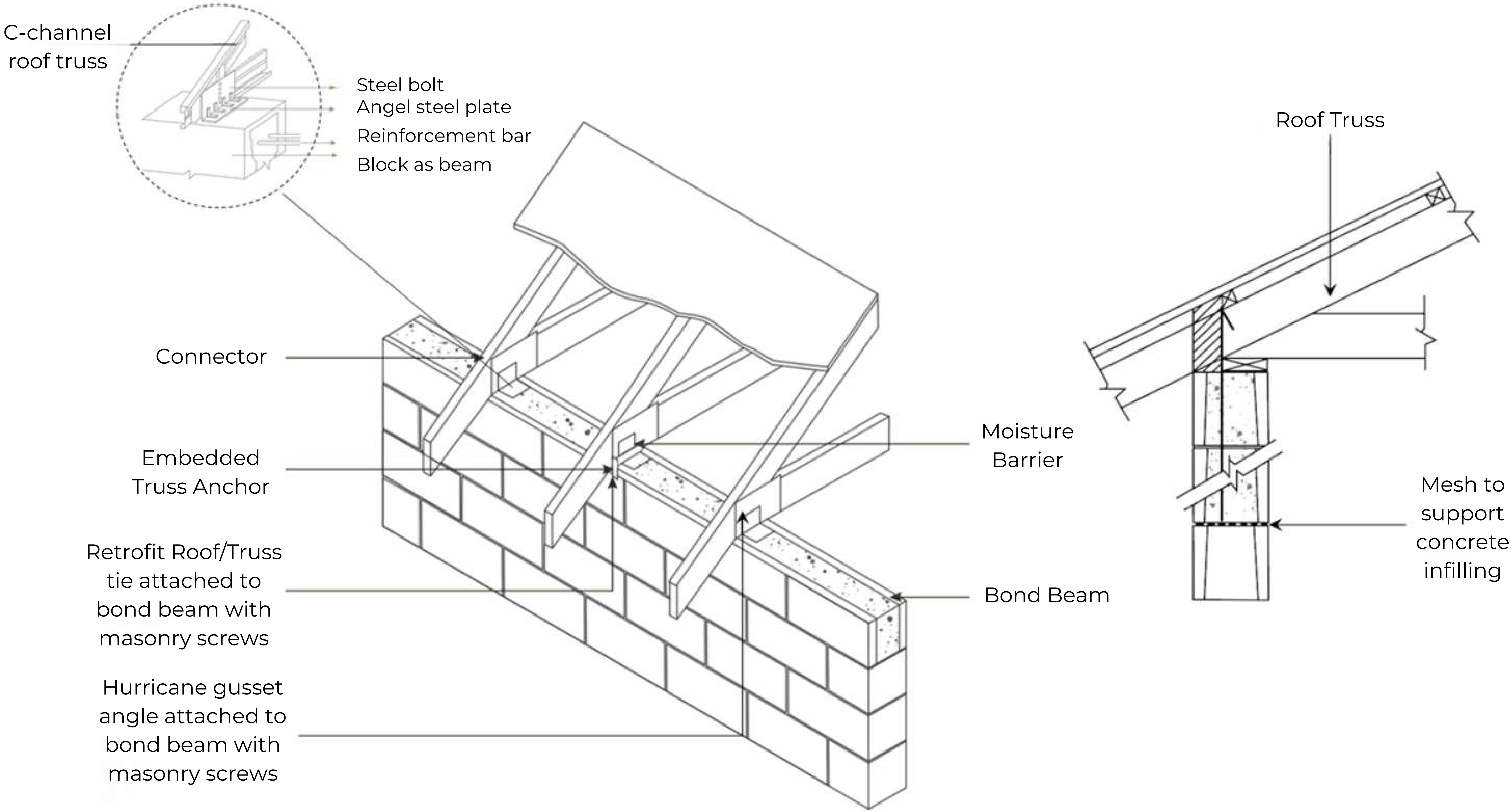






7 CONSTRUCTION DETAILS

7.10 ROOF TO BEAM AND WALL CONNECTION



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CONSTRUCTION SEQUENCE

8 CONSTRUCTION SEQUENCE

1 Levelling The Foundation

Before building the block wall, the foundation must be level and clean, so that the mortar will properly adhere to a firm structure. The foundation should be free of ice, dirt, oil, mud and other impurities that would reduce the bond and possibly make a weaker foundation.

2 Laying Out The Wall

Taking measurements from the foundation and/or floor plan, then transferring those measurements to the foundation, footing or foot slab is the first step in laying out the block wall. Once the two points of measurement are established, corner to corner, a chalk line is marked on the surface of the foundation to establish the line to which the face of the blockwill be laid. Since a chalk line can be washed away by rain, a grease crayon, line paint, nail or screwdriver can mark the surface for key points along the chalk line, and a chalk line re-snapped along these key points. After the entire surface is marked for locations of walls, openings and control joints, a final check of all measurements should be made.

3 Dry Run - Stringing Out The First Course

Starting with the corners, the mason lays the first course without any mortar so a visual check can be made between the dimensions on the floor or foundation plan and how the first course fits the plan. During this dry layout, concrete blocks will be strung along the eintire width and length of the foundation, floor slab and across openings. This will show the mason how bonds will be maintained above the opening. It is helpful to have 3/8 inches (10mm) wide pieces of wood to place between blocks as they are laid dry, to simulate the mortar joints.

4 Laying The Corner Units

Building the corners is the most precise job for the mason as the corners will guide the construction of the rest of the wall. A corner pole can make this job easier, which is any type of post which can be braced into true vertical position and which will hold a taut mason’s line without bending. Corner poles for concrete block walls should be marked every 4 to 8 inches (approximately 100mm to 200mm), depending on the course height and the marks on both poles must be aligned such that the mason’s line is level between them.


1


2


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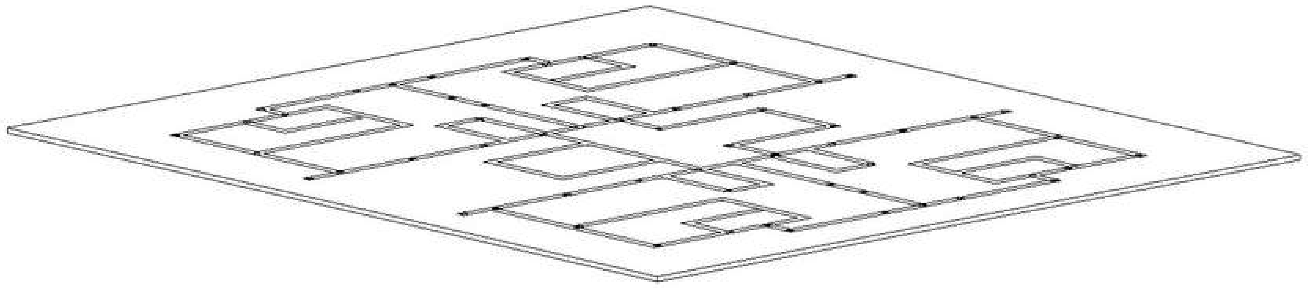
4

8 CONSTRUCTION SEQUENCE

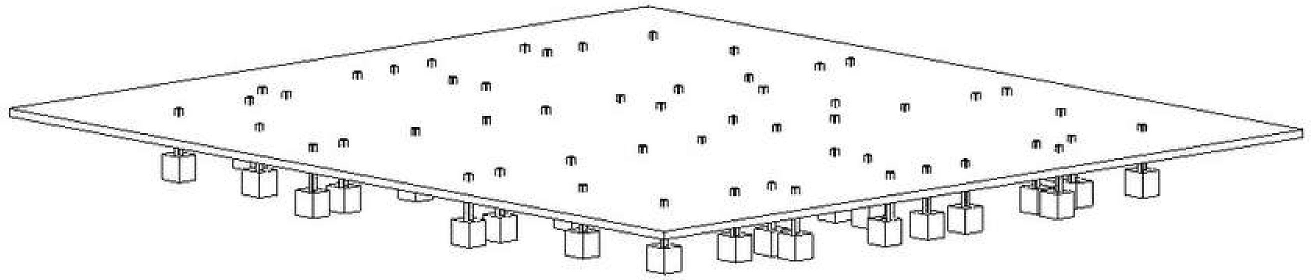
1



EXCAVATION

Setting up of the building should not be less than approximately 1.5m from the plot boundary line.

2

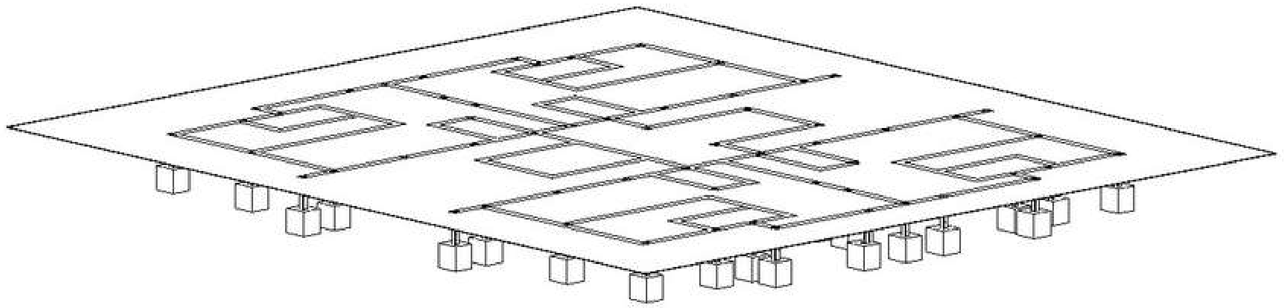


FOUNDATION

Isolated footing foundation is arranged based on the layout after excavation.

8 CONSTRUCTION SEQUENCE

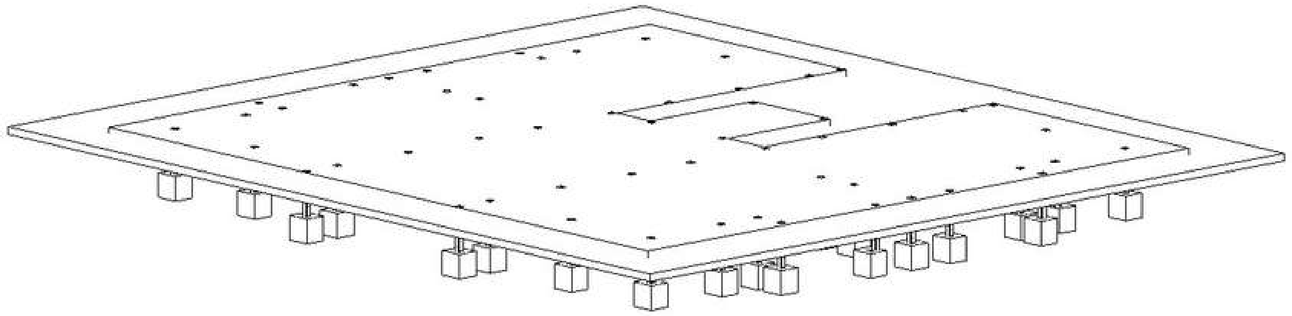
3



GROUND BEAM

A foundation wall built from the concrete isolated footing foundation to the height of the placement of hollow core slab. Besides that, reinforcement bars is applied to the footing to make it stronger.

4



FLOOR SLABS

Ground floor slab is casted on site.

8 CONSTRUCTION SEQUENCE

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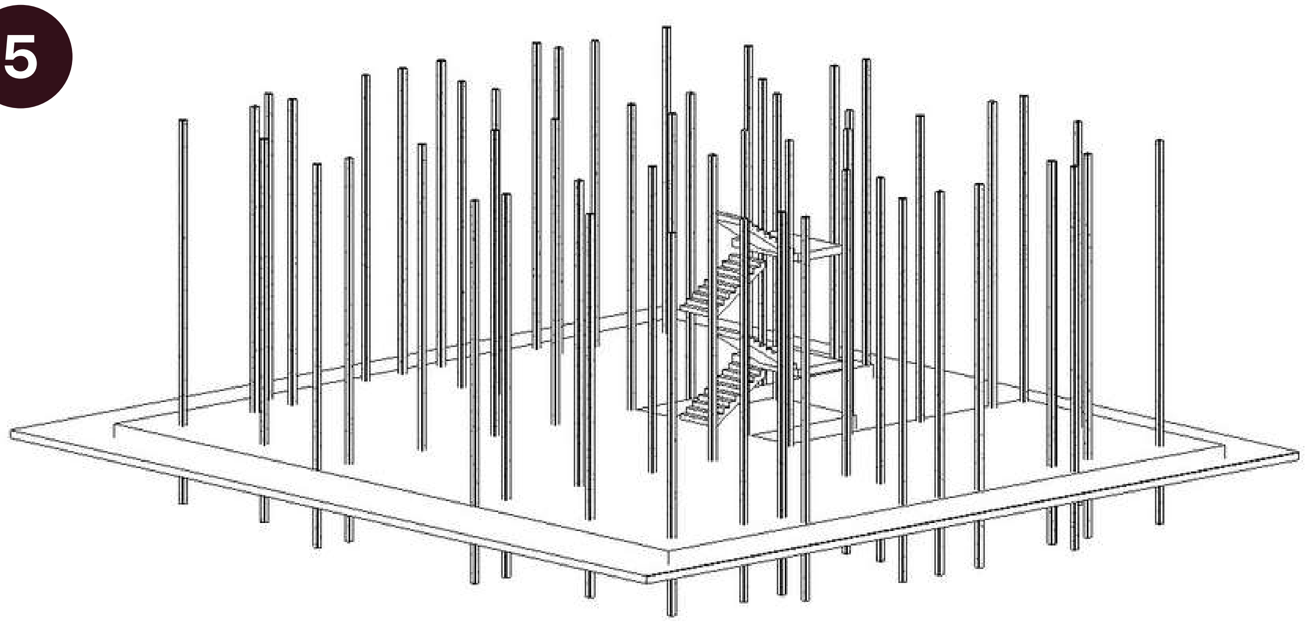

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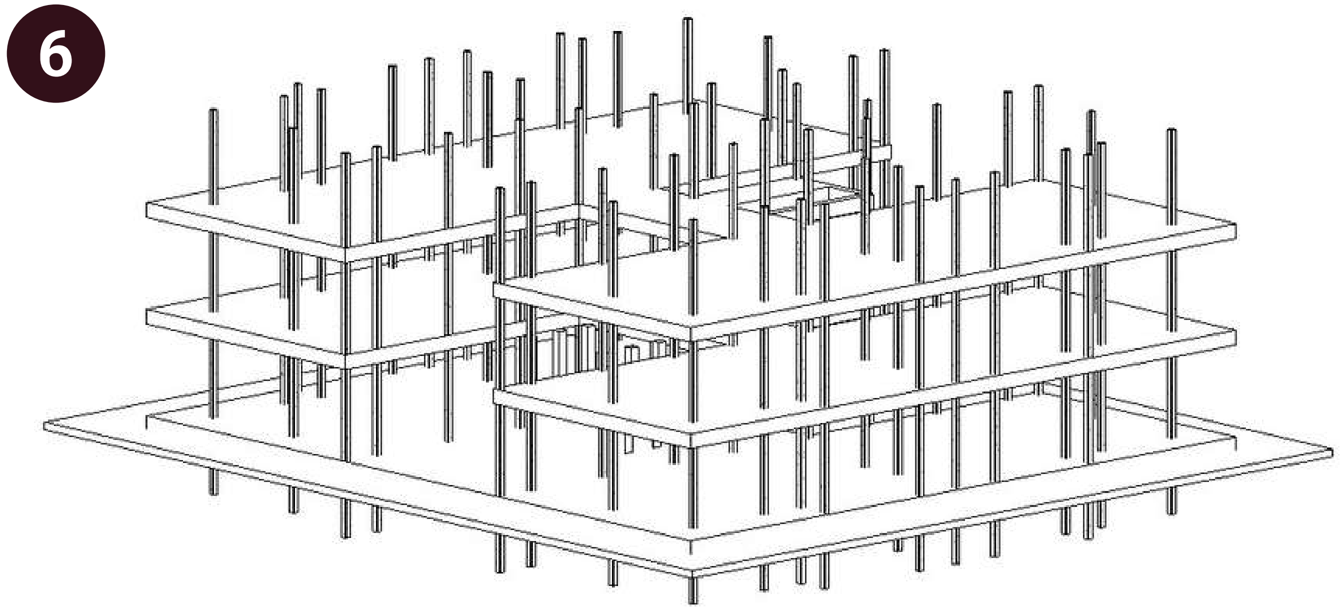


COLUMNS AND STAIRS

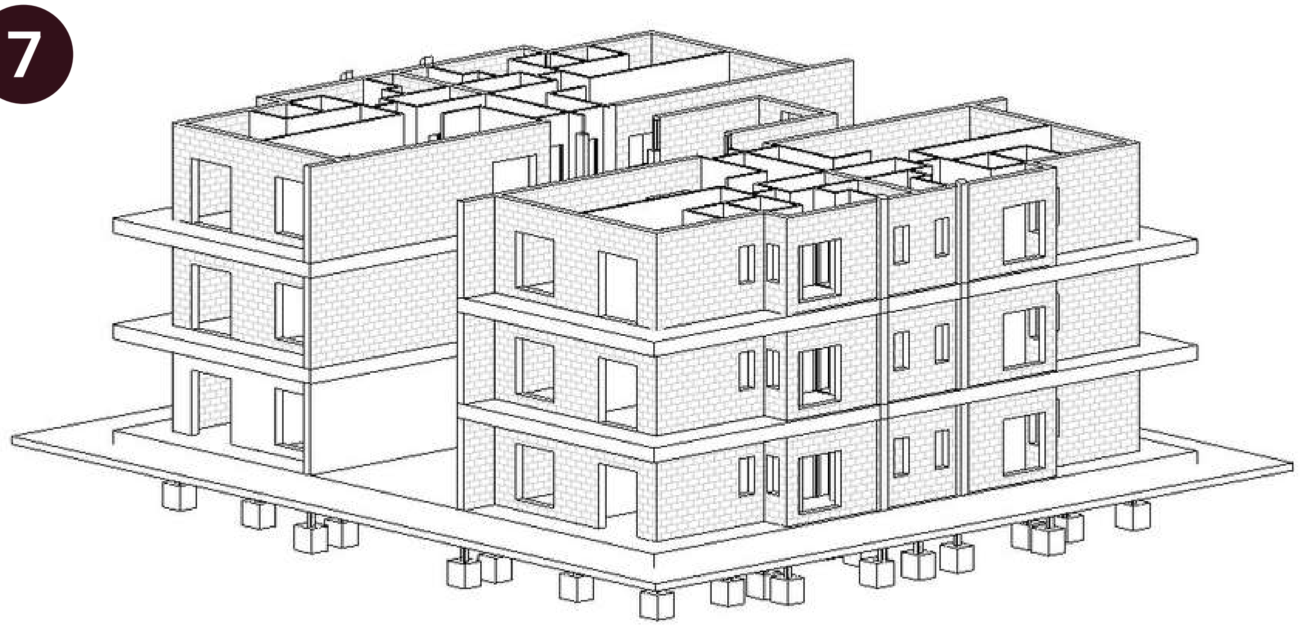
After hollow core slabs are installed, it is attached by reinforcement bars and filled with sand-cement grout. The precast staircases are lifted and constructed within the building.

FLOOR SLABS

Once the columns are erected, the rest of the hollow core slabs are placed onto the horizontal collumns to create the floors and levels of the building.

8 CONSTRUCTION SEQUENCE

7



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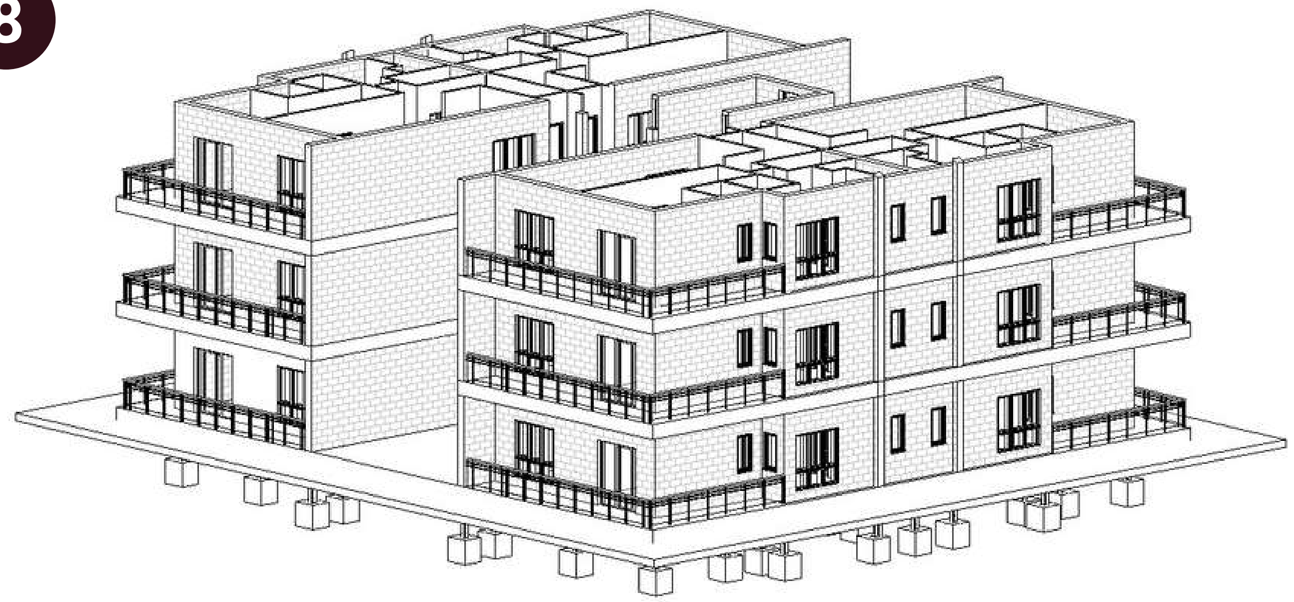


BLOCKWORK

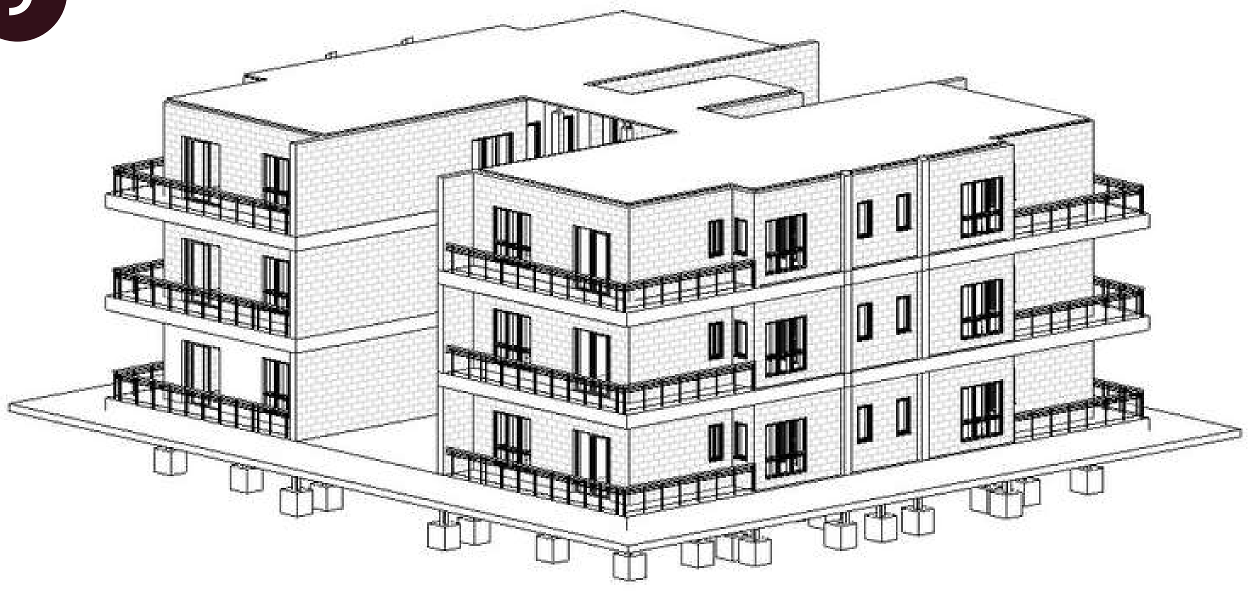
After the slabs are constructed, the block walls are then built on the isolated footing foundation and the hollow core slabs.

DOORS AND WINDOWS

The doors and windows are then installed in the building after the walls are done.

8 CONSTRUCTION SEQUENCE

9



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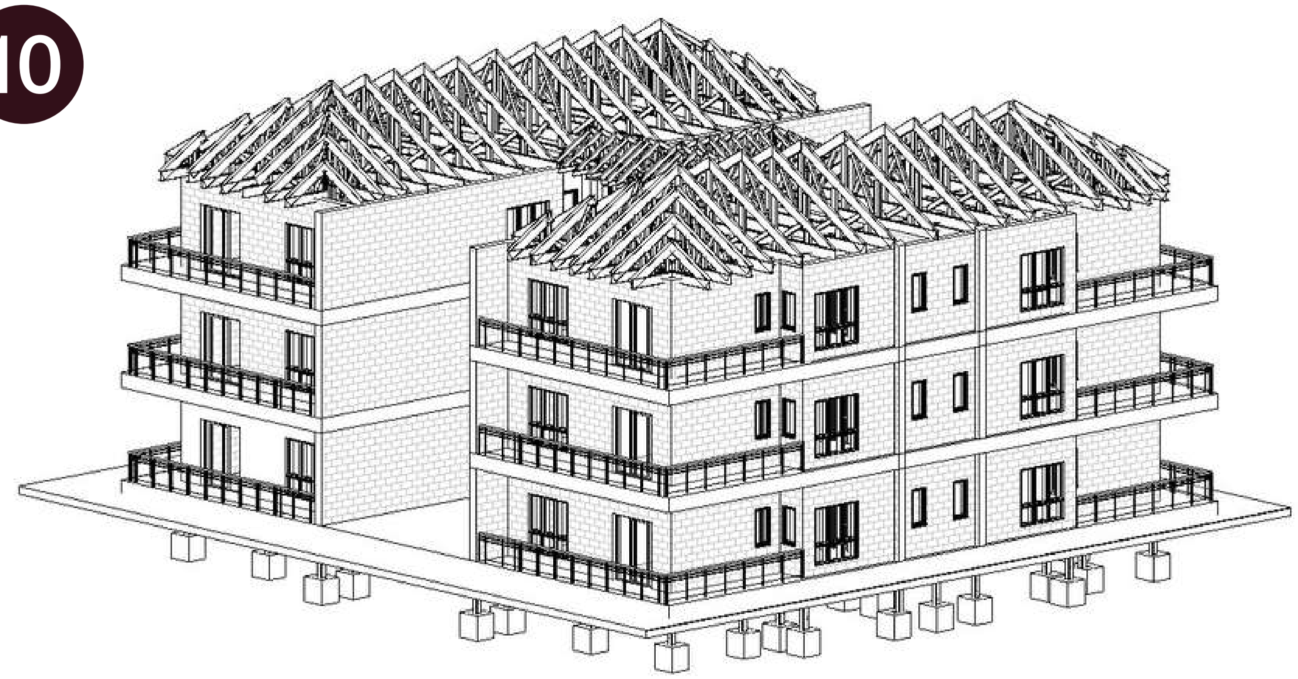


PLASTER CEILING

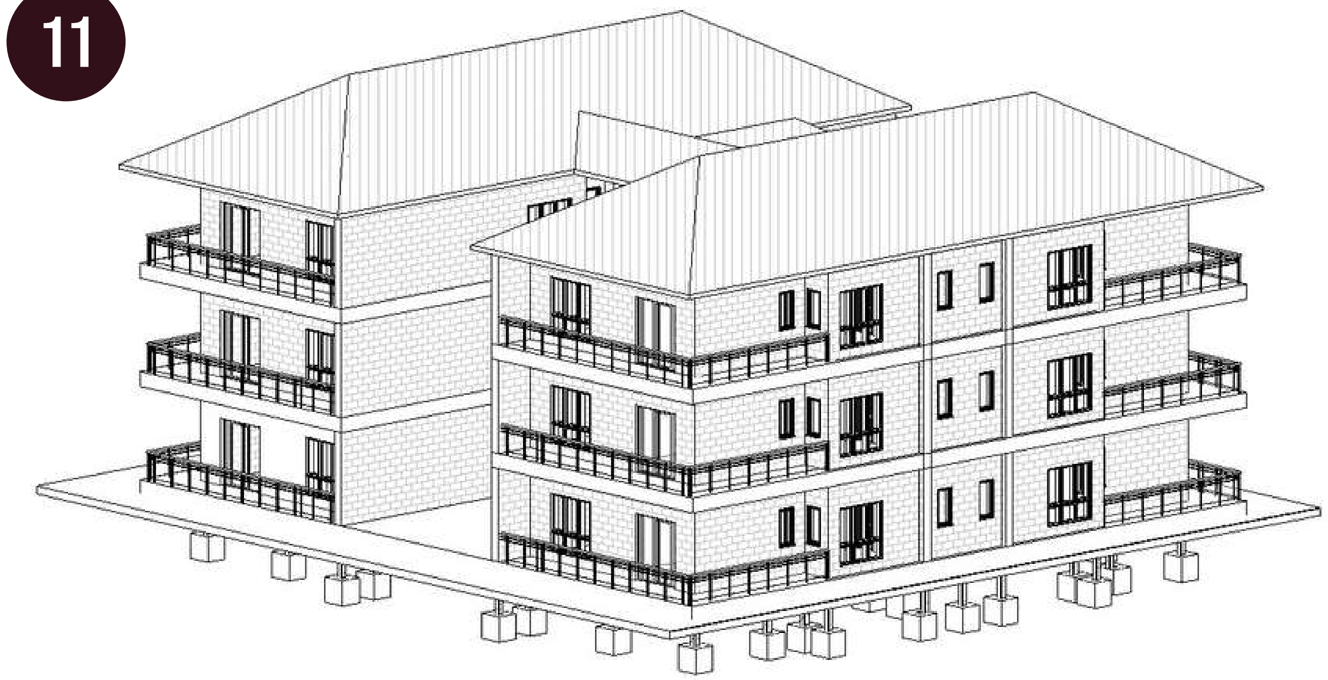
Once the general structure of the building is complete, the top floor is covered with plaster ceiling to cover the view of the roof from inside.

TRUSSES

Steel roof structure is installed on to the beams, which is supported by c-channel, while battens are installed on top of the roof trusses.

8 CONSTRUCTION SEQUENCE

11



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ROOFING

Metal roof sheet and insulation is mounted on the roof trusses.

FINISHES

Floor finishes and dry wall are installed. The CMU blockwork is painted for protection and vanity.

9

IBS SCORING

9 IBS SCORING

Elements	Area (m^2) or Length (m)	IBS Factor	Coverage	IBS Score

Part 1 : Structural System

Ground Floor Load bearing blocks column and beam system with precast concrete floor slab above	528.9	0.8	0.25	10
First Floor Load bearing blocks column and beam system with precast concrete floor slab above	455.2	0.8	0.25	10
Second Floor Load bearing blocks column and beam system with precast concrete floor slab above	455.2	0.8	0.25	10
Roof Roof truss with prefabricated metal roof truss	455.2	1	0.25	12.5
Total	1894.6		1	**42.5**

Part 2 : Wall System

Exterior Wall CMU Blockwork System	430.1	0.5	0.47	4.7
Interior Wall CMU Blockwork System	493.6	0.5	0.53	5.3
Total	923.7		1	**10**

9 IBS SCORING

Elements	Area (m^2) or Length (m)	IBS Factor	Coverage	IBS Score

Part 3 : Other Simplified Construction Solutions

Beam 100% comply with MS 1064 Part 10			100%	4
Columns 100% comply with MS 1064 Part 10			62 / 62 x 100% = 100%	4
Walls 100% comply with MS 1064 Part 10			297 / 297 x 100% = 100%	4
Slabs 0% comply with MS 1064 Part 10			0%	0
Doors 76.2% comply with MS 1064 Part 4			96 / 126 x 100% = 76.2%	4
Windows 94.1% comply with MS 1064 Part 5			48 / 51 X 100% = 94.1%	4
Repetition of floor to floor height 100%			3 / 3 X 100% = 100%	2
Vertical repetition of structural floor layout 100%			2 / 3 X 100% = 66.7%	1
Horizontal repetition of structural floor layout 100%			3 / 3 X 100% = 100%	2
Prefrabricated Staircase 100%			100%	2
Total				**27**
			Total Score (Part 1 + Part 2 + Part 3)	**79.5**

10

CONCLUSION

10 CONCLUSION

This assignment taught us a lot of systematic knowledge about construction. Overall, our apartment achieved an IBS score of **[79.5].** Of course, this is just the beginning of our study of construction, and we will continue to explore more data, details and drawings related to building construction.

Through this assignment, we analyzed the advantages and disadvantages of IBS in terms of labor, construction methods and various aspects. I also learned about the importance of IBS in the Malaysian construction system. We chose a block system to build, so we need to study how it is arranged. And which type should be used? Which size? Only then can we ensure that a perfect building is built.

Overall, the quality of IBS precast elements is much better than traditional methods because of quality assurance in the selection of materials, manufacturing in a controlled environment, and inspection before the elements are sent to site. and allows for faster project completion, cleaner, tidier and safer construction sites, and fewer foreign workers.

11

REFLECTION

11 REFLECTION

LOW WENG FAI 0347303

This assignment and module have gave me a deeper insight on what Industralised Building Systems (IBS) is and its importance in the real world. Throughout the whole process of the assignment, I have learned how to calculate IBS scores in buildings, gained proficiency in using digital modelling tools and enhanced my knowledge on the construction and structure of buildings. The usage of IBS is increasingly popular especially in our rapidly developing world due to its cost and time efficiency. This assignment have given me valuable learning experience as I have deepen my understanding modern construction methods that will further assist me in this field of study in the future.

FOONG JIA YANG 0348101

As we conclude this project, it is evident that IBS is poised to play a pivotal role in the construction industry's future. The knowledge and insights gained from this project will be invaluable as I embark on my career in architecture, town planning, or any related fields in construction. IBS presents an opportunity to revolutionize the way we design and build, making our projects more efficient, sustainable, and cost-effective. In conclusion, the IBS group project was an enriching experience that allowed us to explore the evolving landscape of construction. This project has emphasized the importance of continuous learning, interdisciplinary collaboration, and adapting to emerging technologies and methodologies. I look forward to applying these insights as we work toward a more advanced and sustainable future in architecture and construction.

MI HAO RAN 0346317

Through this task, my understanding of construction has been greatly improved. As an architect, you can not only design a building, but also know how to build it. Building construction is a very real problem. If you only consider the design without considering the construction, this will cause very big problems. IBS can solve most of the problems. Compared to traditional construction methods, industrialized construction systems offer advantages in terms of cost savings, reduced dependence on labor, quality control, environmental friendliness, and less reliance on weather issues. In subsequent studies, I will also learn more about IBS. Not only IBS, I will also consider construction issues in the design, so as to ensure that what I design is not just "paper talk"

NIKHIL ISAAC SELVANANDAM 0349343

This project has be an eye-opening experience for me. It provided an opportunity for me and my group to delve into a topic that is becoming increasingly relevant in the field of construction and architecture. Working with other team members was challenging but ultimately rewarding. This project has expanded our understanding of modern construction techniques, as well as highlighted the potential for IBS to improve construction efficiency, reduce waste, and enhance sustainability. I am utterly proud of my achievements and our produce from this module so far, and I am looking forward to completing the next and final project for this module.

11 REFLECTION

JAYATI GOGIA 0343383

As I reflect, I have understood that this assignment and module have provided me with a profound understanding of Industrialized Building Systems (IBS) and its significance in practical applications. Over the course of this assignment, I have acquired the skills to calculate IBS scores in buildings, honed my proficiency in utilizing digital modeling tools, and expanded my knowledge of construction and building structures. The adoption of IBS is becoming increasingly prevalent, particularly in our swiftly evolving world, owing to its cost and time efficiency. This assignment has offered me a valuable learning experience by deepening my comprehension of modern construction methods, which will undoubtedly benefit my future studies in this field.

12

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12 REFERENCES

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