Stage 4: Written Illustrated Report

ARC517: Technical Design Project

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Friday 30th April 2021

Contents

Appendices

Declaration:

"I declare that this is all my own work and that any material I have referred to has been accurately referenced. I have read the University's policy on plagiarism and understand the definition of plagiarism. If it is shown that material has been plagiarised, or I have otherwise attempted to obtain an unfair advantage for myself or others, I understand that I may face sanctions in accordance with the policies and procedures of the University. A mark of zero may be awarded and the reason for that mark will be recorded on my file."

Student Signature: 

I. Introduction – Project Recap

I.A Project Description, Location Maps and Notes

Purpose of Document

Within this document, the progression of the Sirocco intergenerational housing scheme is presented. The design of this mixed-use building has progressed from an initial design to stage 4 of the RIBA plan of works. Areas that will be covered include, Function and Inclusivity, Buildability and Assembly, Health and Safety, Environment and Sustainability, and Performance and Durability.

Description of Development

In total, this intergenerational housing will contain 180 no. student bedrooms, 21 no. young-old apartments and 16 no. resistant assistant studios. There is also many communal spaces across the building which aim to promote interaction, including games room, social areas, a small gym, and quiet study rooms. Additional to these spaces there is 2 no. external courtyard areas suitable for allotment vegetable growing. These roof spaces is accessible to all residents from the second and eighth floors. There is also several utility spaces present within the building, which are primarily for the residents. These spaces include a laundry room and a bike store.

Site History

The proposed building will be built on a brownfield site, which is partially reclaimed land. Throughout Belfast's history this site has been used for various reasons. Firstly, at the start of the 18th century the site housed glass making facilities, this is the reason why there is a red brick kiln present on the site today. After this the site was the home of various engineering works. Today, the site is empty apart from a temporary car park which is situated at the north entrance.

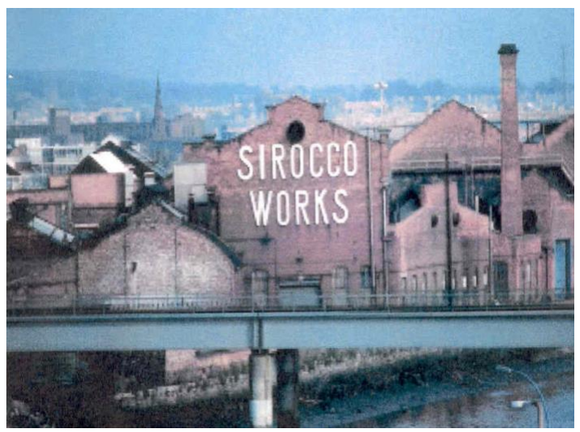


Fig1: Former Sirocco Works,
(Sirocco Masterplan, 2020)

Site Location

Former Sirocco Works Site, Belfast

Co. Antrim

Co-ordinates

54.599746, -5.914619

Fig2 - Sirocco Site (Google Maps, 2021)

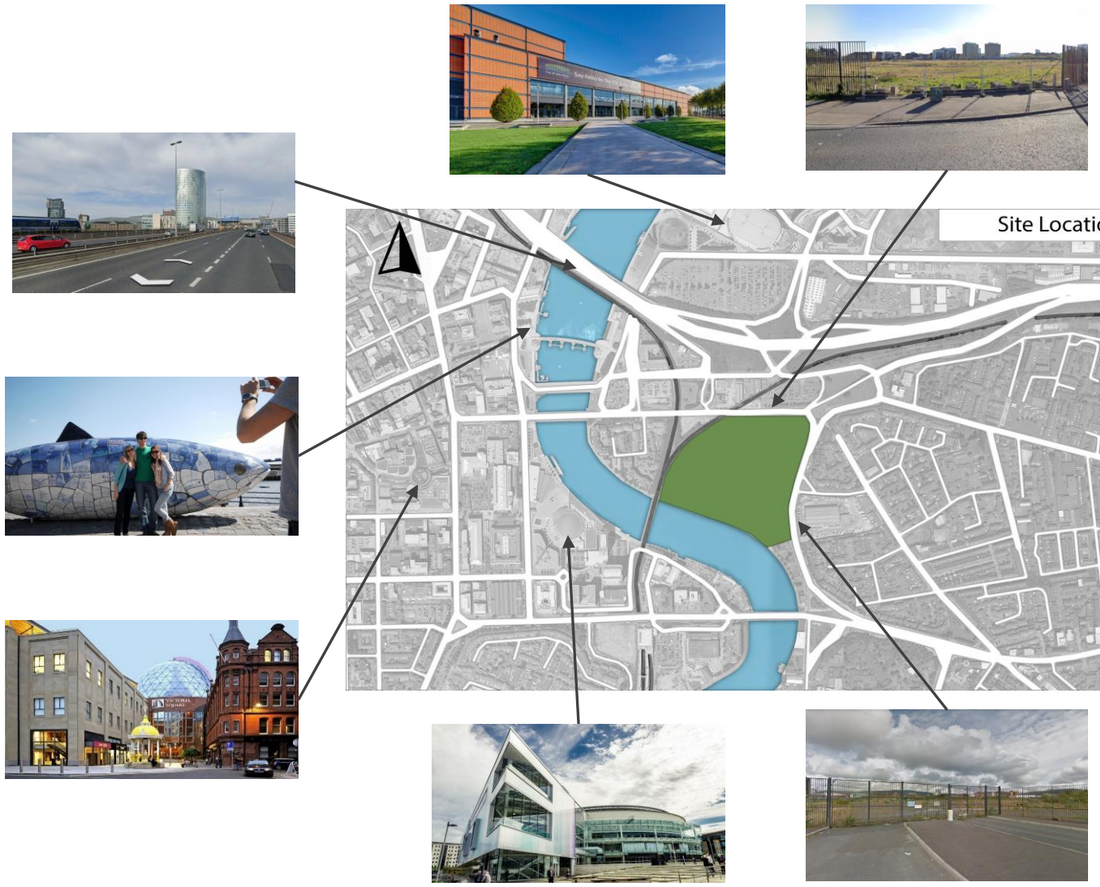


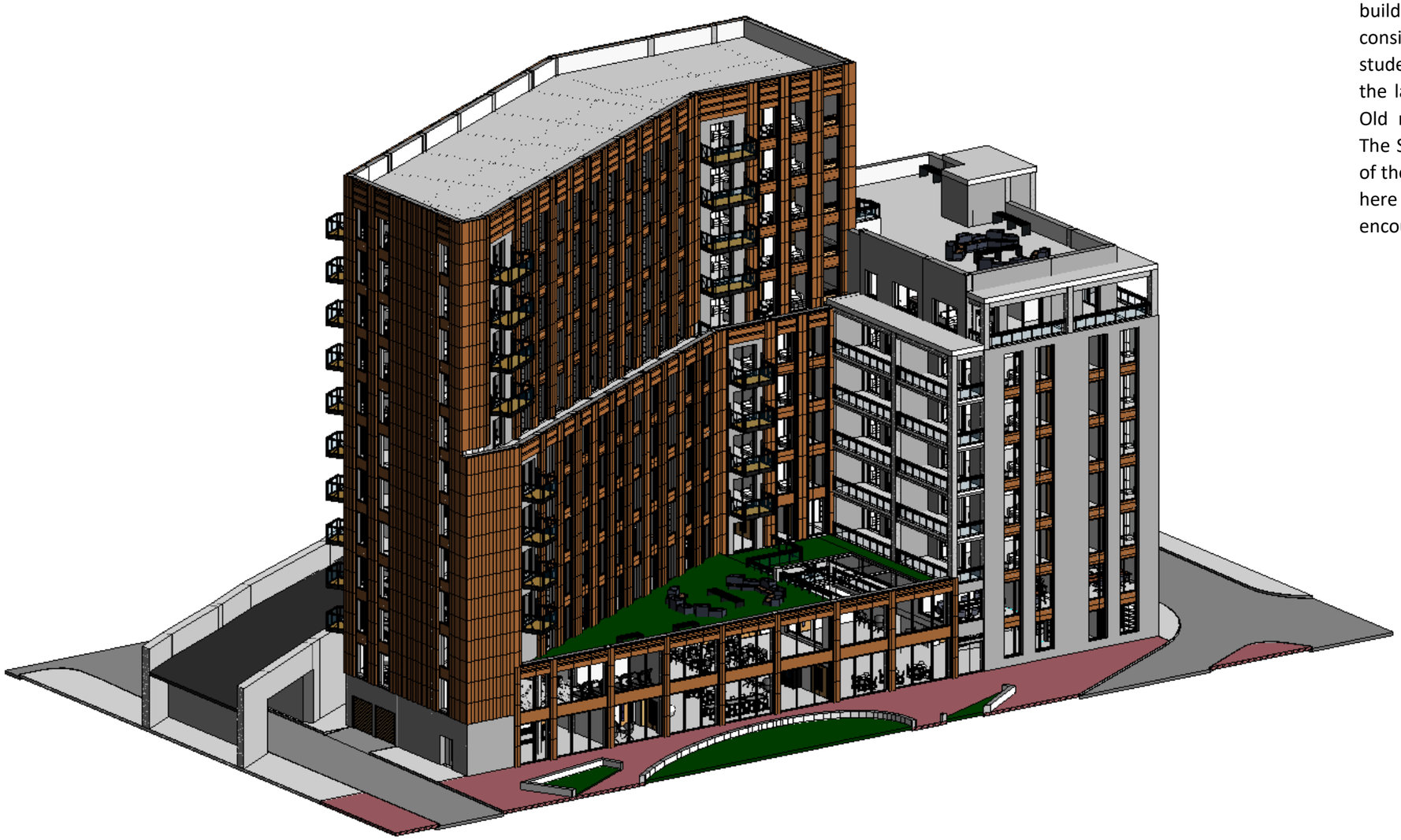
Fig3 - Site Surroundings (Google Maps, 2021)

I.A.1 Enlarged Building Site Context

This intergenerational housing building is a key part of the Belfast sirocco masterplan. As seen within figure 4, it closely neighbours a range of other large buildings, all of which has different uses.

Fig4 - Sirocco Masterplan Massing (Sirocco Masterplan, 2021)

I.A.2 Proposed Building Massing



This is a closer look at the proposed building massing. The building consists of three blocks, with the students primarily located within the larger Block A, and the Young-Old residents situated in Block B. The Smaller Block C is where many of the social spaces are located. It is here where all residents will be encouraged to interact.

Fig5 - Proposed Building Massing
(Author, 2021)

I.B Illustrative Summary of concept and main massing approach

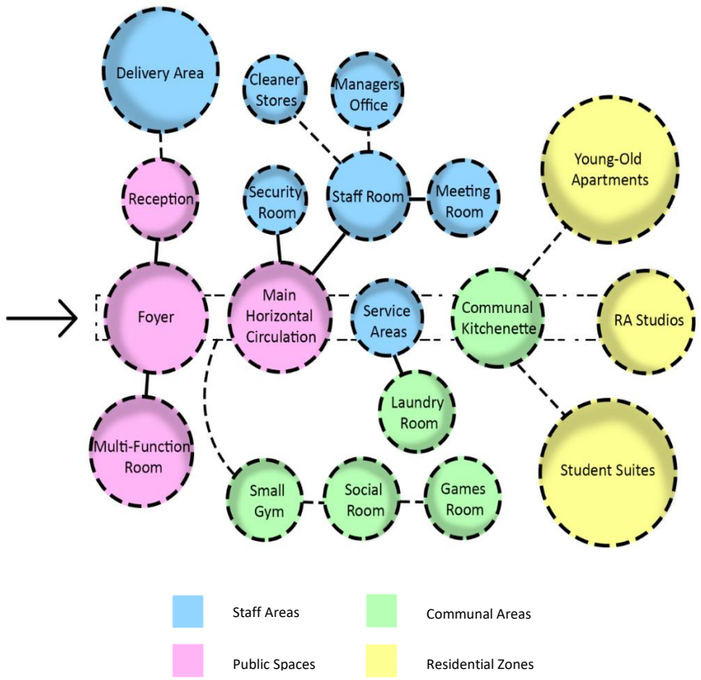


Fig6 - Mind Map (Author, 2020)

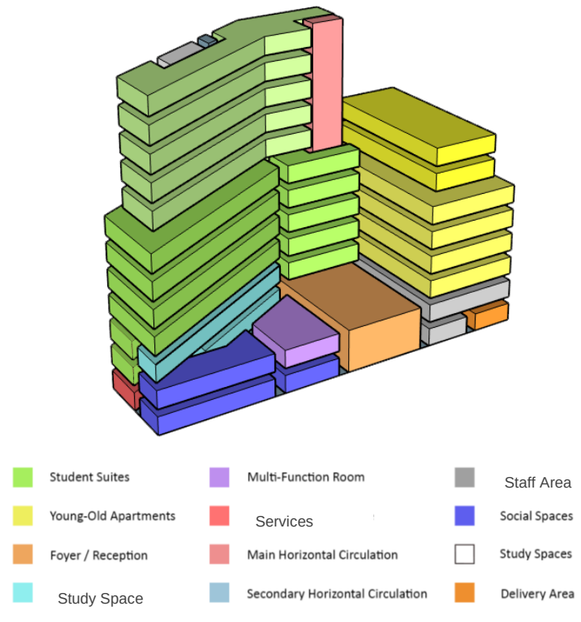


Fig7 - Spatial Model (Author, 2020)

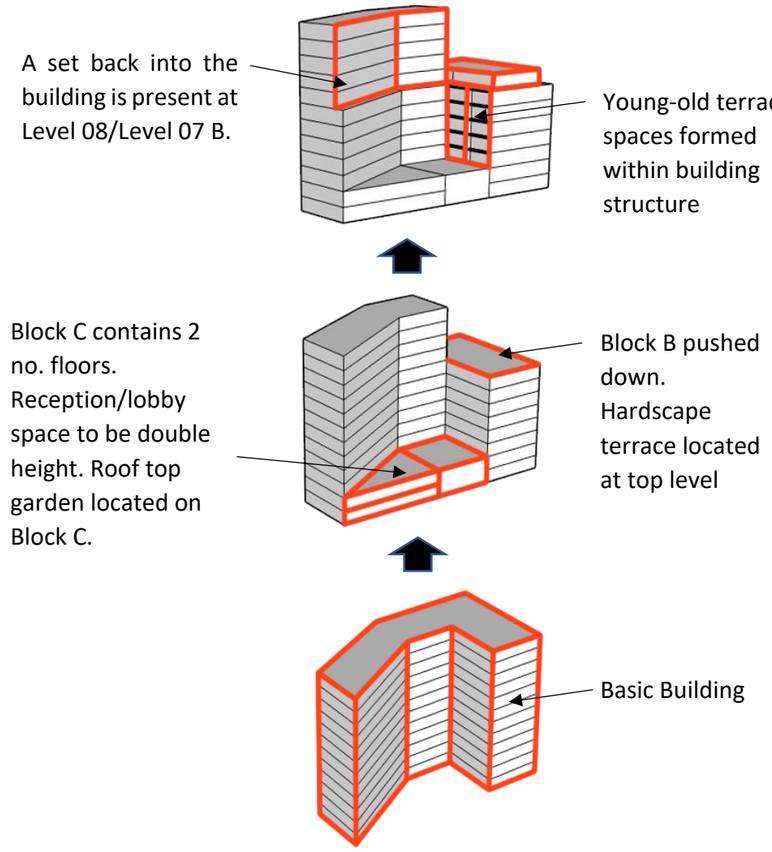


Fig8 - Massing Development (Author, 2020)

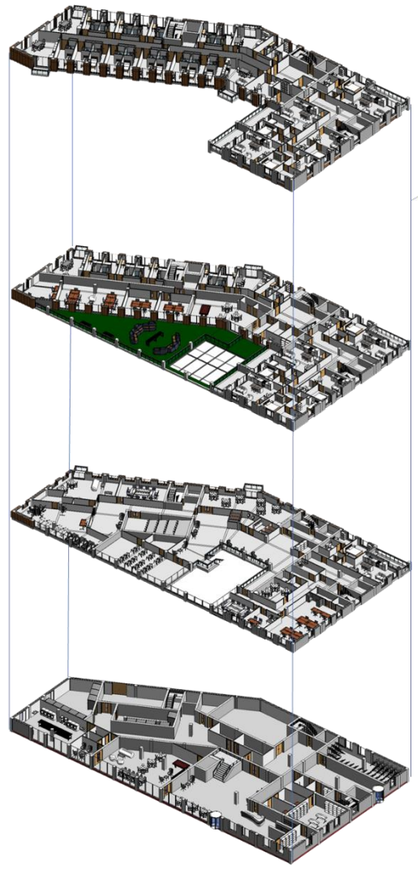


Fig9 - Level Massing (Author, 2021)

From the beginning of the design process, the relationship spaces, within the building, had between each other was highly important. This is a key requirement for any successful project. This is the reason why a mind map was a good starting point. From there the external shape was developed, through simple massing and 3D visualization of spaces. These exercises help develop the design to Stage 3.

I.C Illustrative Summary restating of Project Focus

Fig10 - Fire Compartmentation (Promat, 2020)

Fig11 - Student Accommodation Fire (BBC, 2019)

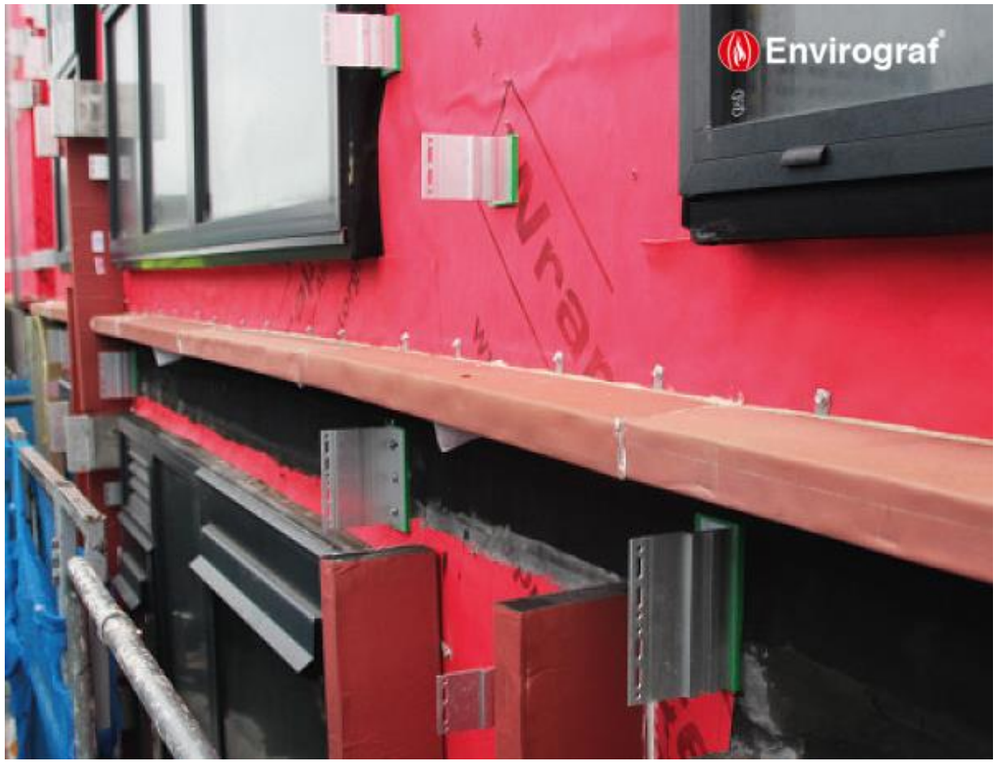


Fig12 – Cavity Barrier (Envirograf, 2021)

Fig13 - Fire Sprinklers (Service Master,

Fig14 - Fire Stair (Ali Glass & Stainless, 2020)

The project focus is fire safety design. During the design process, each component will have their own form of fire protection required. The inclusion of these measures will be seen within the individual component details.

I.D Illustrative Summary restating of Sustainable Aim and three Objectives

As part of the building design, a sustainable aim and 3 following objectives had to be integrated. It was thought that aspects of passive house design could be implemented into this project. The following design components were selected on that basis:

1. Rainscreen Cladding

2. Raised Floor Air Ventilation

3. Intensive Green Roof

Fig15 – Rainscreen Facade (Speedclad, 2019)

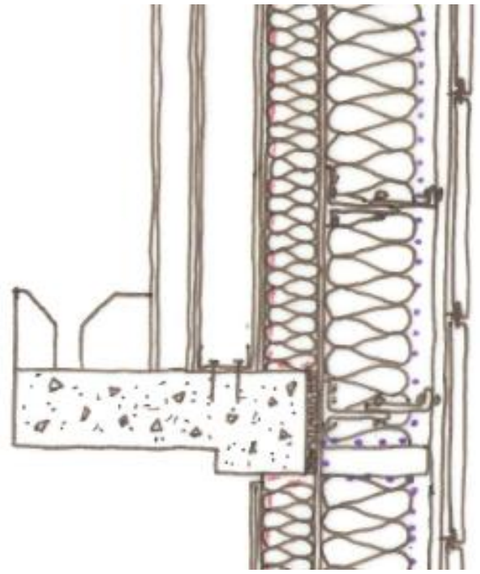


Fig16 - Parapet Sketch (Author, 2021)

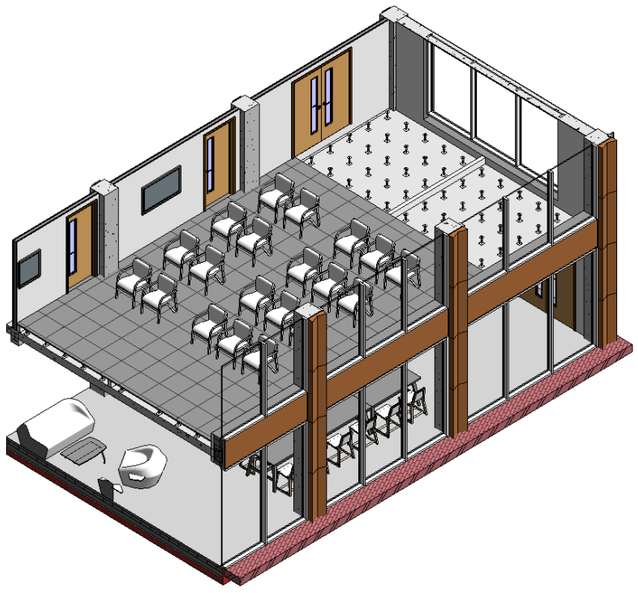


Fig17 - Raised Floor Model (Author,

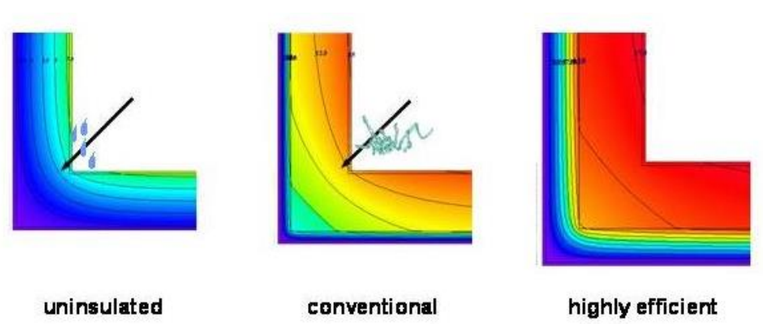


Fig18 - Thermal Bridging (IPHA, 2020)

Fig19 - Green Roof (Bauder, 2021)

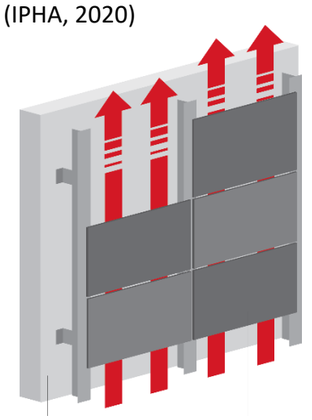


Fig20 - Rainscreen Facade (HVG Facades, 2021)

1.0 Functionality and Inclusivity: Accommodation & Brief compliance

1.A Detailed Schedule of Accommodation

Accommodation		
Name	**Quantity**	**Requested Quantity**
Co-Living Student Suites	180	180-190
Co-Living Independent Young-Old Apartments	18	15
Resident Assistant Studios	16	11

Due to the development of Block B, there was the opportunity to include extra young-old apartments.

Common Areas Shared by Students and Elderly Residents				
Name	**Room Number**	**Level**	**Area**	**Requested Area**
Foyer Area	AG.1	Level 00	169m^2	n/a
Reception	AG.1B	Level 00	20m^2	n/a
CCTV Monitoring	BG.9	Level 00	11m^2	n/a
Consult Room	BG.8	Level 00	11m^2	n/a
Communal Kitchenette	A1.3	Level 01	75m^2	n/a
Library	A2.13	Level 02	65m^2	n/a
Quiet Study	A2.14	Level 02	31m^2	n/a
Mailbox Area	AG.1C	Level 00	11m^2	n/a
Laundry Area	AG.14	Level 00	69m^2	n/a
Multi-Function Room	A1.7	Level 01	82m^2	n/a
Gym	A1.14	Level 01	85m^2	n/a
Common Area	AG.4	Level 00	124m^2	100m^2
Social Room	A2.7	Level 02	65m^2	45m^2

Due to the shape of the common room, on Level 00, it was felt additional space was needed to provide the best possible area for the residents.

Services Consideration				
Name	**Room Number**	**Level**	**Area**	**Requested Area**
Main Storage	BG.7	Level 00	47m^2	n/a
Parcel Store	BG.10	Level 00	18m^2	15m^2
Management Office	B1.8	Level 01	74m^2	70-80m^2
Office Storage	B1.8C	Level 01	4m^2	4m^2
Staff Room	B1.7	Level 01	23m^2	22-25m^2
Staff WC	B1.5	Level 01	5m^2	n/a
Staff WC	B1.6	Level 01	5m^2	n/a
WC + Shower	B1.4	Level 01	10m^2	n/a
Manager's Office	B1.9	Level 01	17m^2	n/a
Comms	AG.13	Level 00	15m^2	10-12m^2
Switch Room	AG.10	Level 00	16m^2	15m^2
Ground Plant Room	AG.11	Level 00	85m^2	80m^2
Bins	AG.16	Level 00	39m^2	36-40m^2
Recycling Bins	AG.16B	Level 00	47m^2	50m^2
Bike Store	BG.3	Level 00	87m^2	n/a
Car Parking	AG.15	Level 00	58m^2	n/a

It was important to keep as close to the requirements as possible when designing the service spaces.

1.B General Arrangement Building Plans & Sections

1.B.1 GA Plans

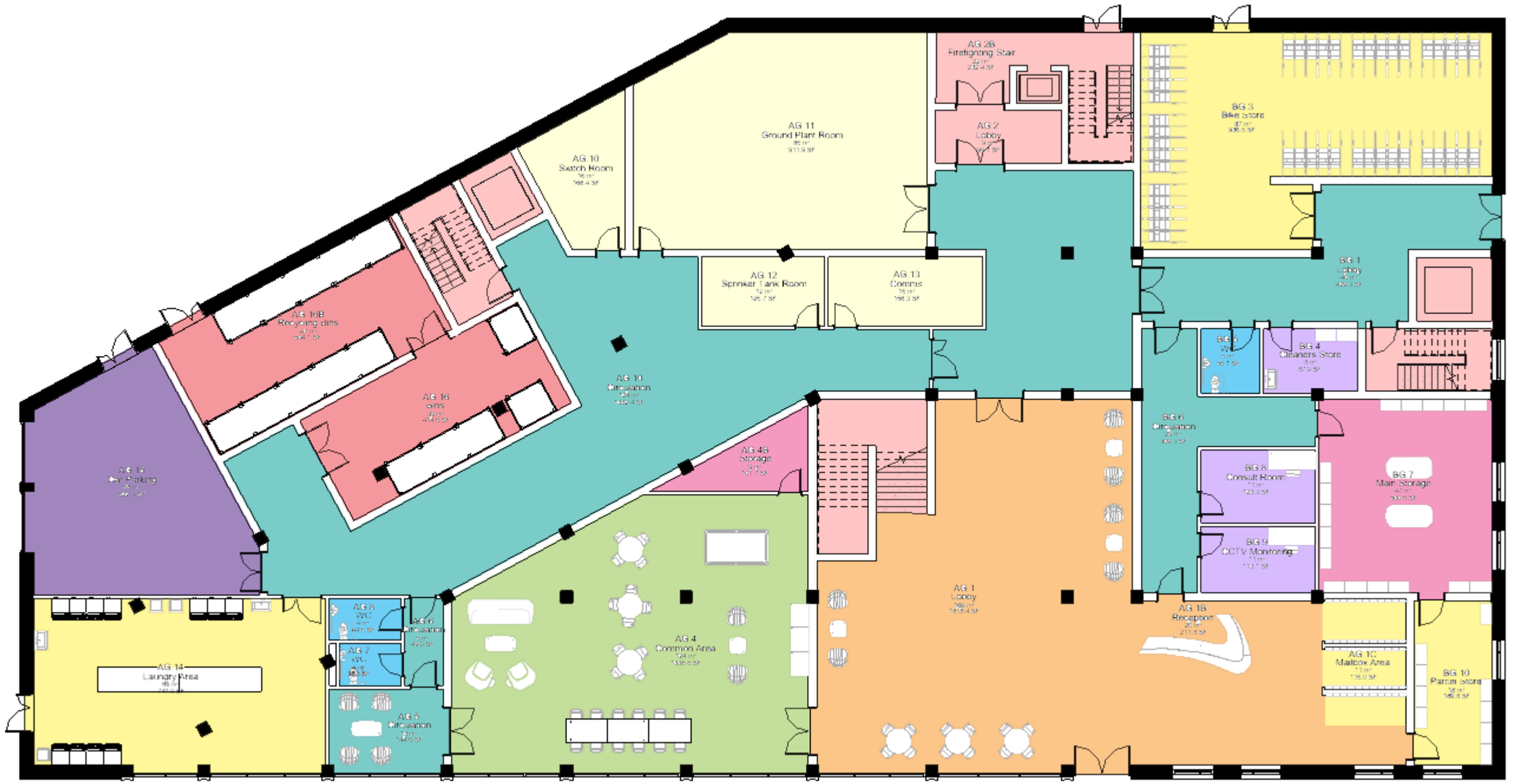


Fig21 - Level 00 (Author, 2021)

Ground Floor

Circulation Percentage: 36%

Circulation
Lobby/Reception
Staff Area
Car Parking
Storage
WC
Bin Storage
Common Area
Utilities
Services
Vertical Circulation

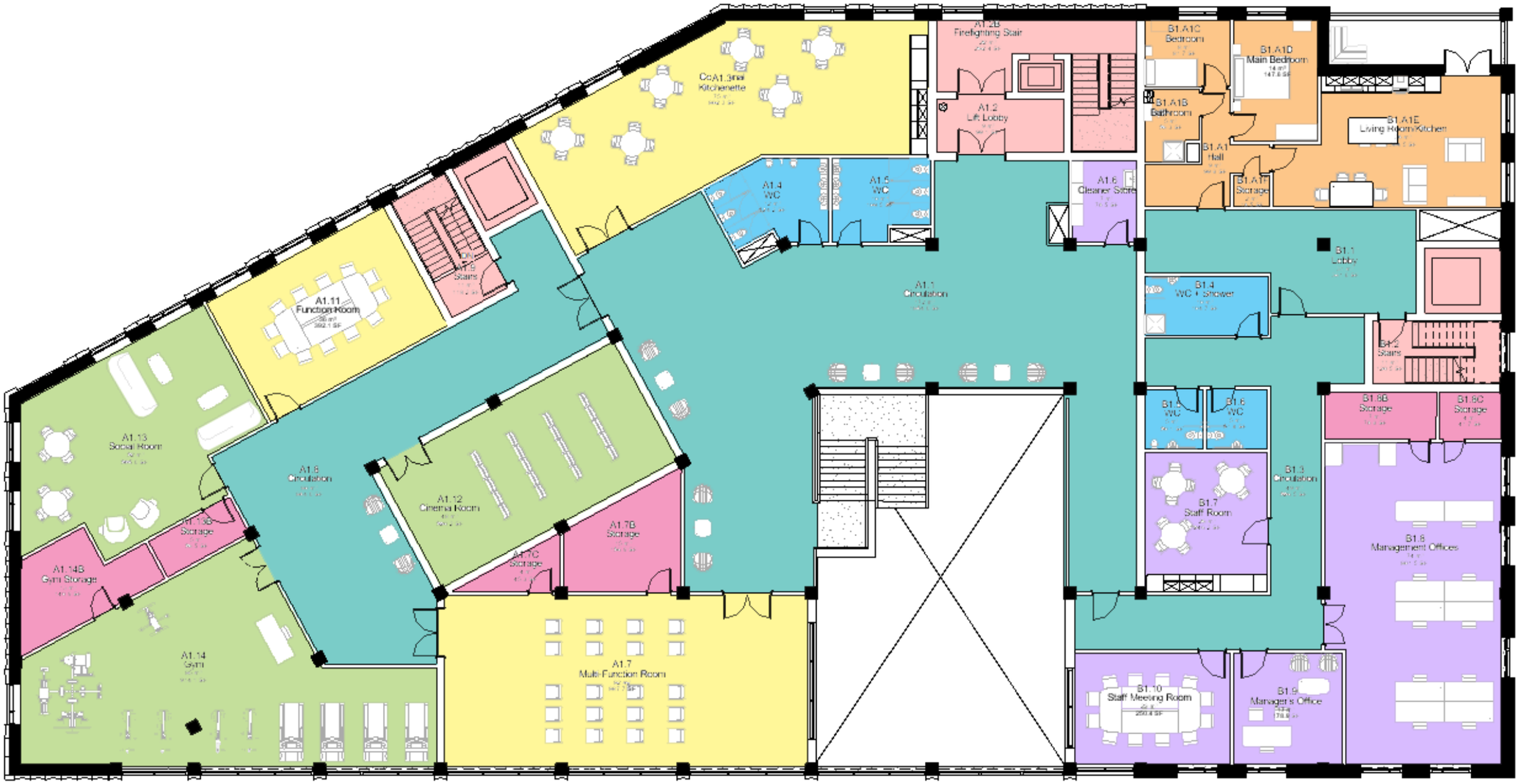


Fig22 - Level 01 (Author, 2021)

1st Floor

Circulation Percentage: 31%

Young-Old Apartment	Staff Area	Circulation	Storage
Common Area	Functional Area	WC	Vertical Circulation

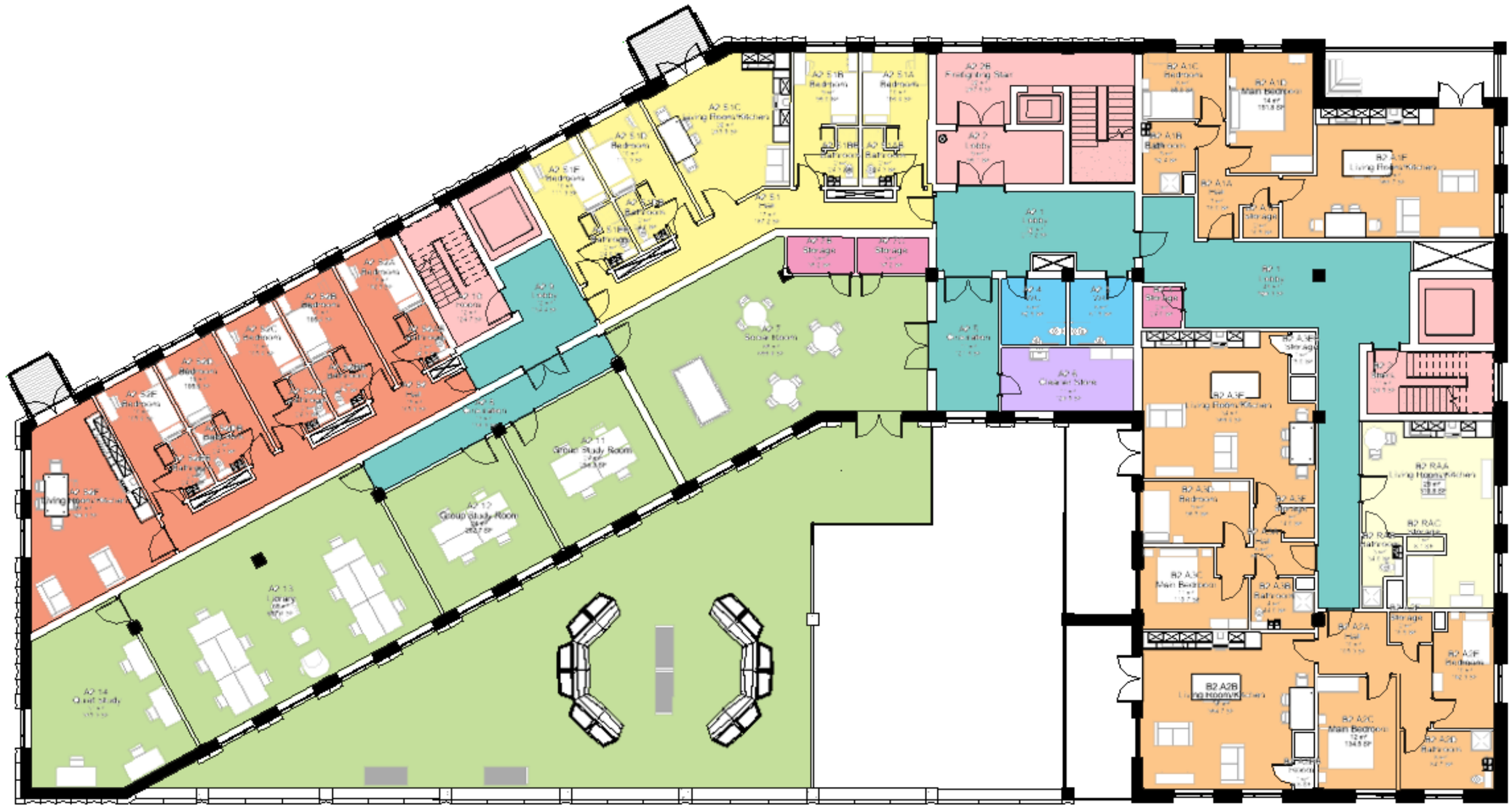


Fig23 - Level 02 (Author, 2021)

2nd Floor

Circulation Percentage: 15%

RA Studio	Young-Old Apartment	Staff Area	5 Bed Student Suite	Storage
Circulation	Common Area	4 Bed Student Suite	WC	Vertical Circulation

Fig24 - Level 03 (Author, 2021)

3rd – 6th Floor

Circulation Percentage: 12%

RA Studio
Young-Old Apartment
Staff Area
5 Bed Student Suite
Circulation
Vertical Circulation
4 Bed Student Suite
6 Bed Student Suite

Fig25 - Level 07 (Author, 2021)

7th Floor

Circulation Percentage: 21%

RA Studio
Young-Old Apartment
Staff Area
5 Bed Student Suite
Circulation
Vertical Circulation
4 Bed Student Suite
Storage

Fig26 - Level 08 (Author, 2021)

Circulation Percentage: 21%

8th Floor

RA Studio	Common Area	Staff Area	5 Bed Student Suite
Circulation	Vertical Circulation	4 Bed Student Suite	

Fig27 - Level 09 (Author, 2021)

9th – 11th Floor Circulation Percentage: 21%

RA Studio	Vertical Circulation	Staff Area
Circulation	5 Bed Student Suite	4 Bed Student Suite

1.B.2 GA Sections

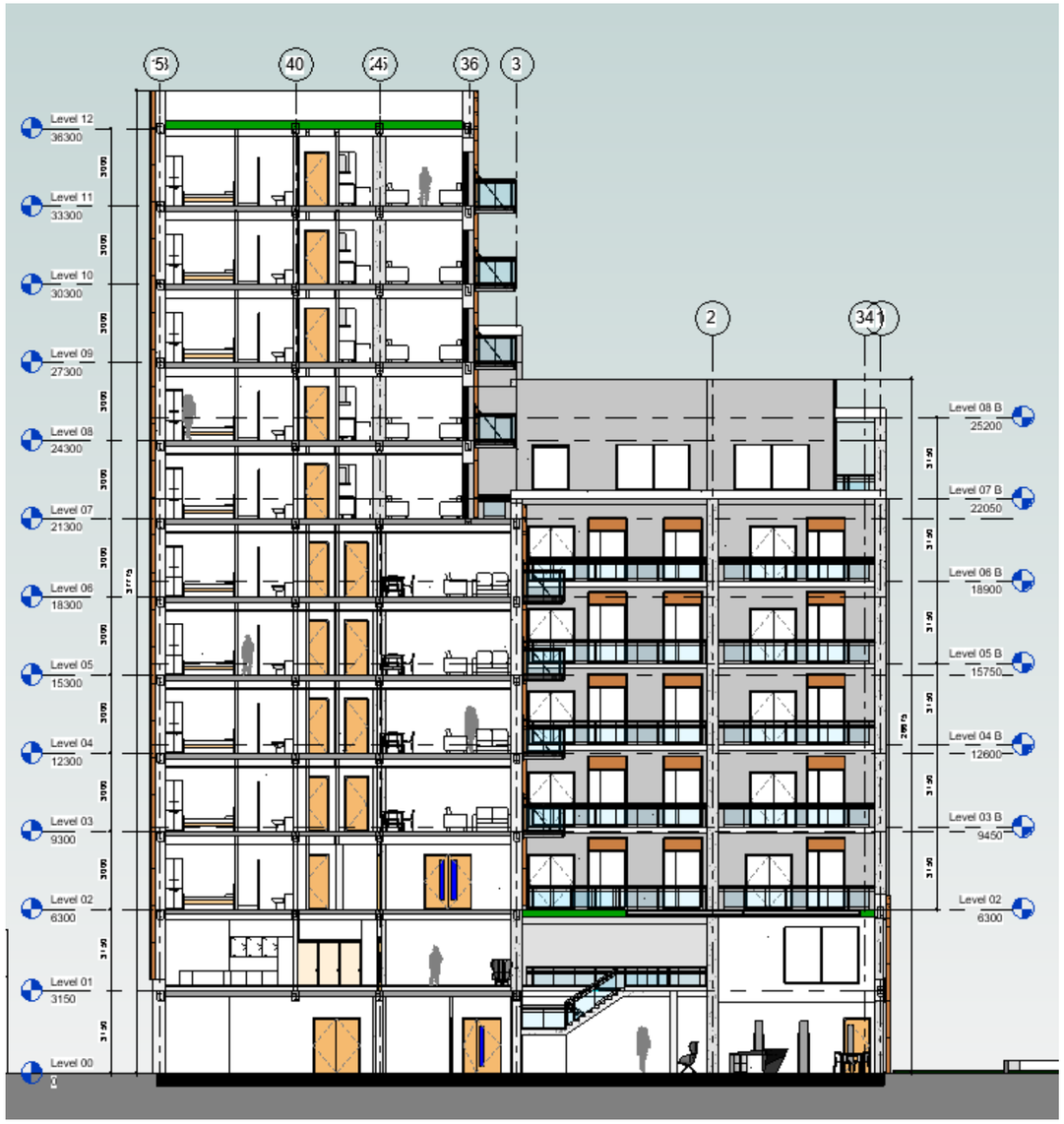


Fig28 - Section 1 (Author, 2021)

Fig29 - Section 2 (Author, 2021)

1.B.3 GA Elevations

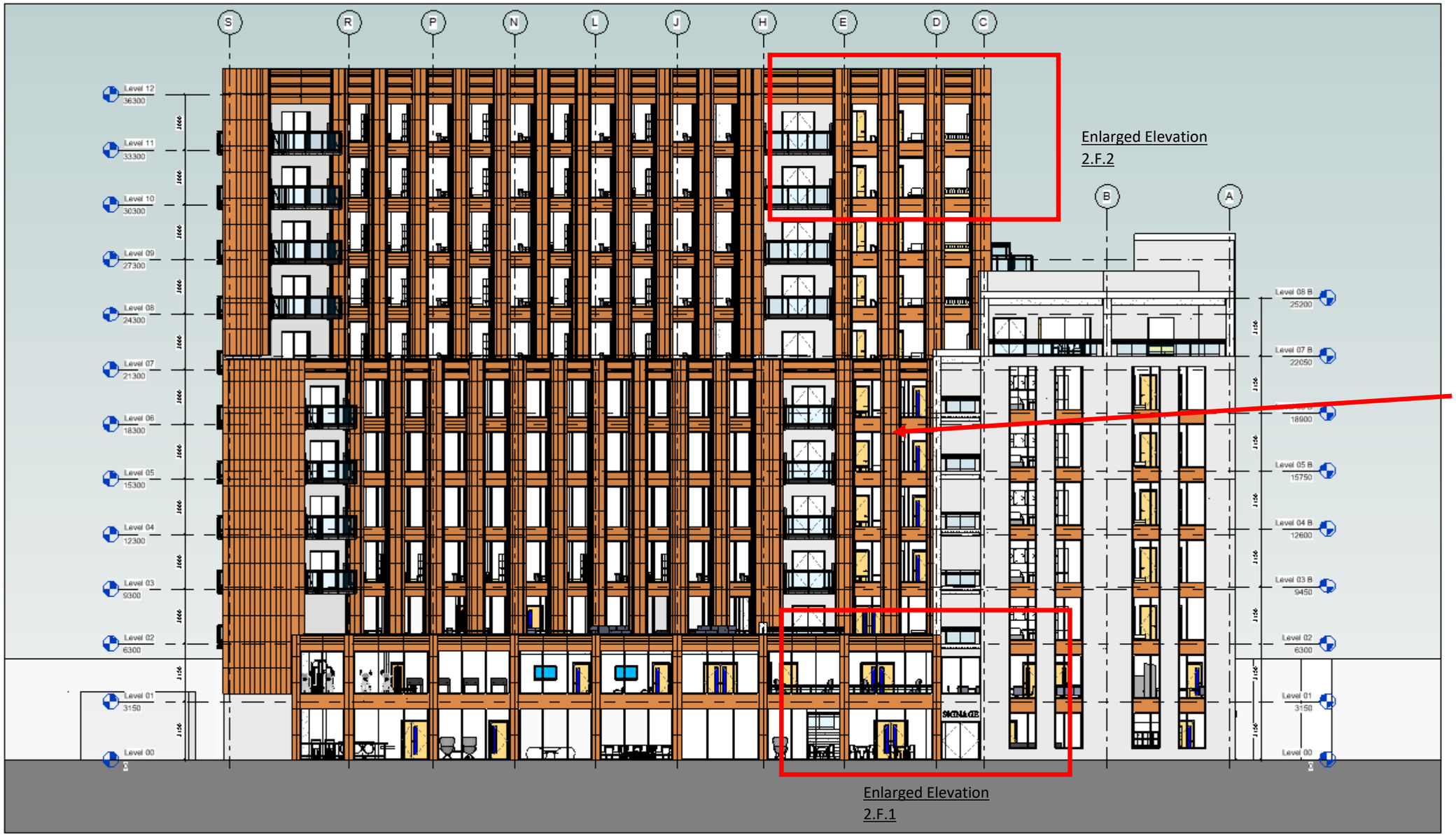


Fig30 - South Elevation (Author, 2021)

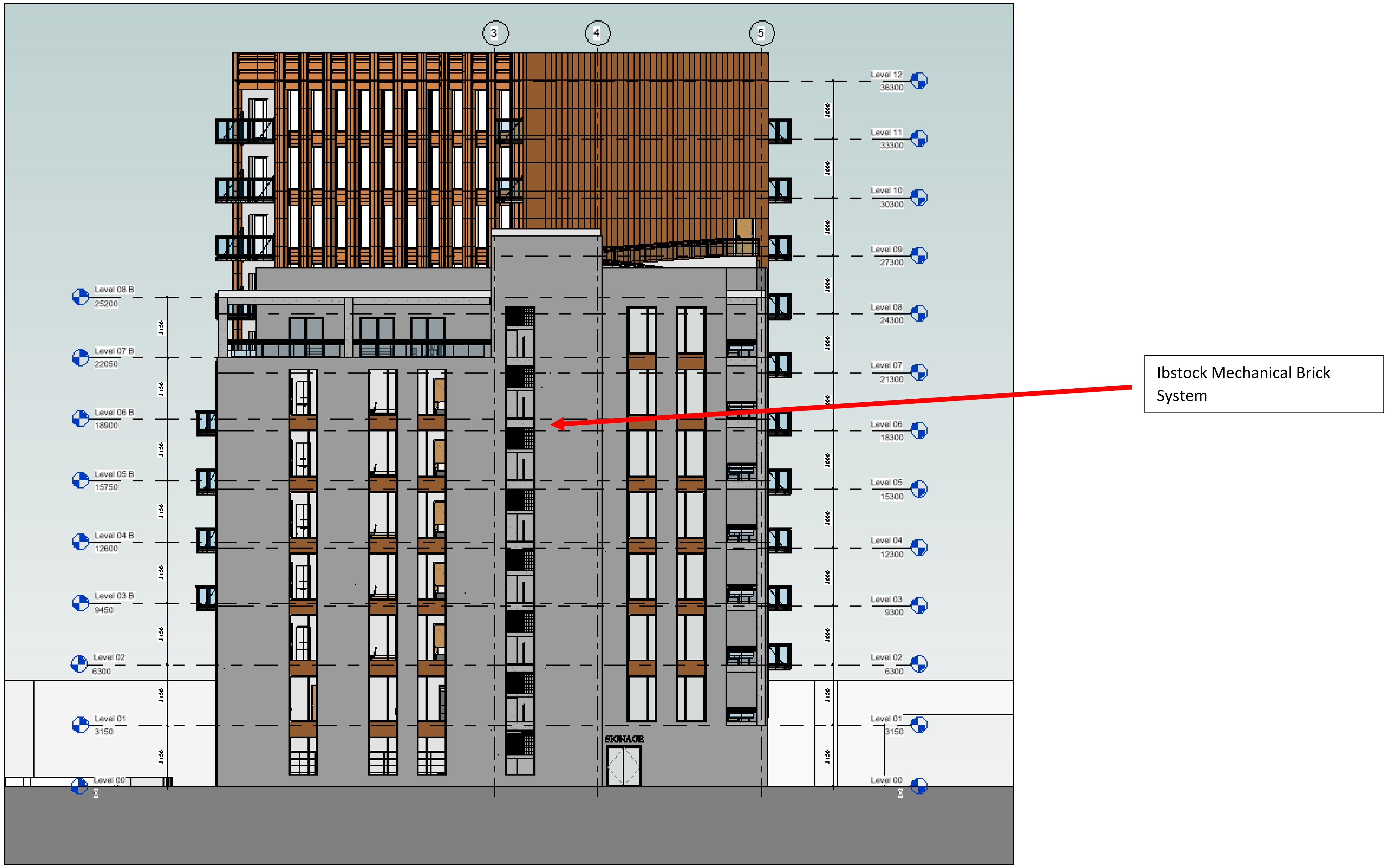
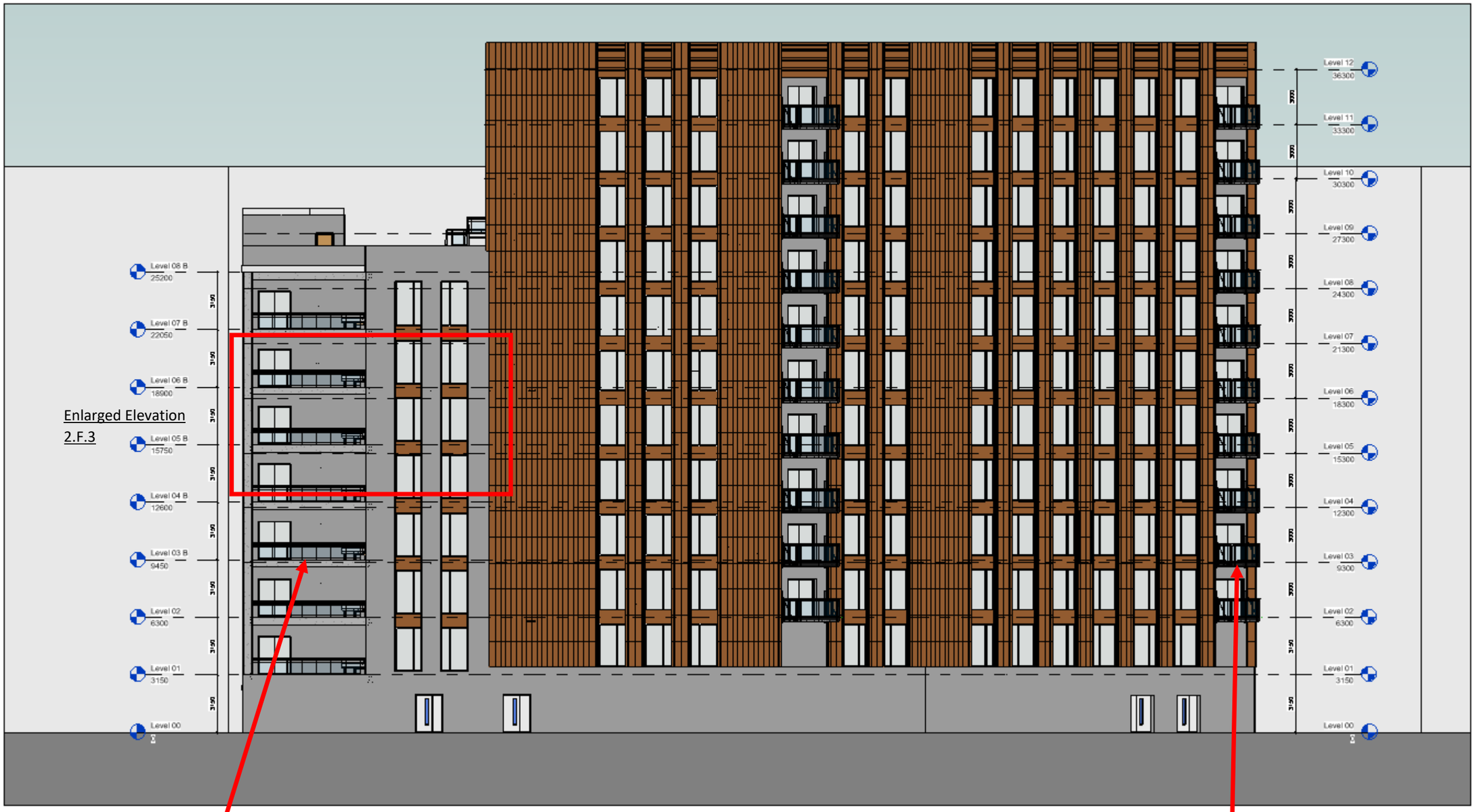


Fig31 - East Elevation (Author, 2021)



Young-old Terrace

Cantilevered Balcony

Fig32 - North Elevation (Author, 2021)

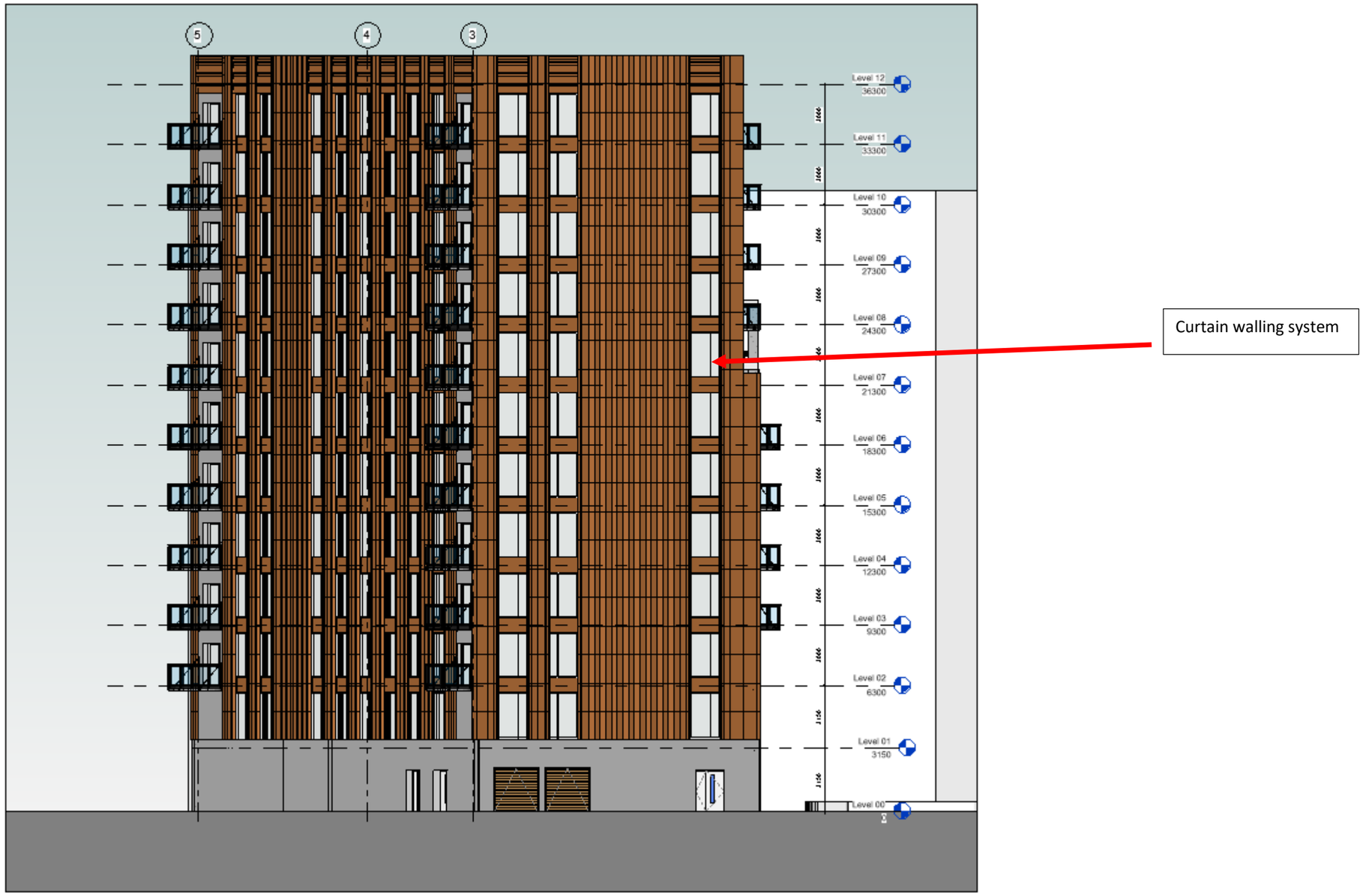


Fig33 - West Elevation (Author, 2021)

1.B.4 Landscape Site Plan

The immediate surroundings of the building are primarily pedestrian orientated. This includes the presence of the Crescent Gardens, which is a green space at ground level for residents of the area. Other large-scale buildings associated with the Sirocco masterplan closely neighbour the intergenerational building. There is two vehicular entrances, to the north side, off the Bridge End Road. One of which is convenient for any car accessing the small car parking provision within the building. A railway also passes the north side, providing views, from the residential balconies, of trains heading in and out of Belfast City Centre.

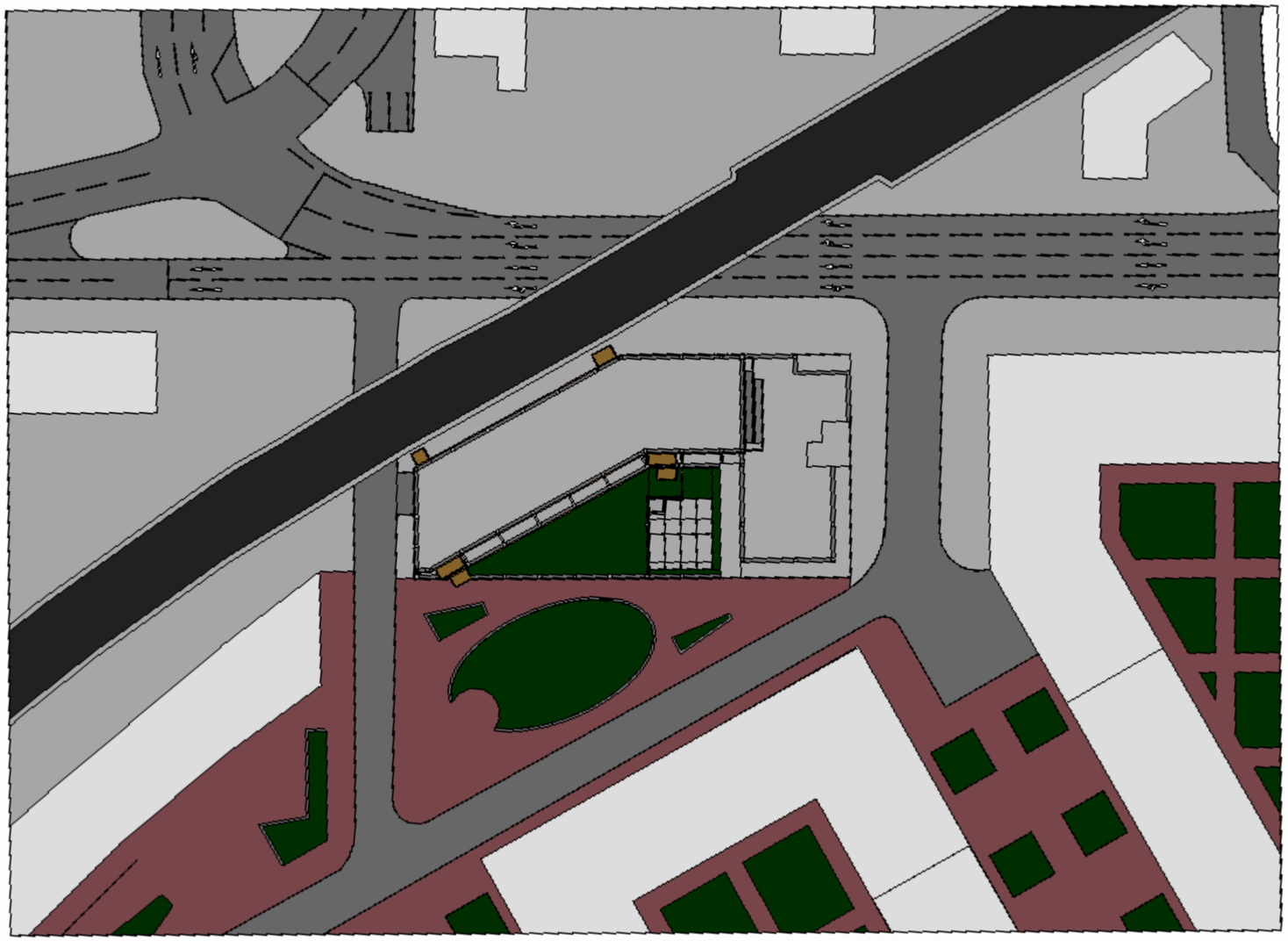


Fig34 - Landscape Site Plan (Author, 2021)

2.0 **Buildability and Assembly**

2.A Project Focus

The overall construction focus of the project is fire safety. General guidance was gained from relevant manufacture information and British Standards, in particular BS 9991:2015. Helpful guidance was also found within Technical Booklet E. The underlined theme of fire safety will be noticeable throughout the design development of each sustainable objective.

Consideration was given to the assembly of various components across the building. Indication of open state cavity barriers and the correct positioning of EPDM around window cills is highly important. As the building has a rainscreen façade, it is important that these elements are correct to avoid any flame from entering the air cavity, where it could then travel across the building.

When considering the external balconies, there is a high attention spent on the eradication of thermal bridges, as this a prime area where they can occur. However, the design will also have to incorporate fire safety measures around this area. This point also applies to the construction of the green roof element.

The raised access floor also bring fire concerns. If measures were not taken, fire and smoke would easily travel from one space to another from underneath the floor panels. The same case applied with the suspended ceiling voids. Adequate fire barriers in these spaces had to be considered.

Fig36 - Fire Barrier (AIM, 2021)

Fig35 - EPDM Membrane (OBEX, 2018)

Fig37 - Balcony System (Schock, 2021)

2.B Overview of Buildability and Assembly Approach

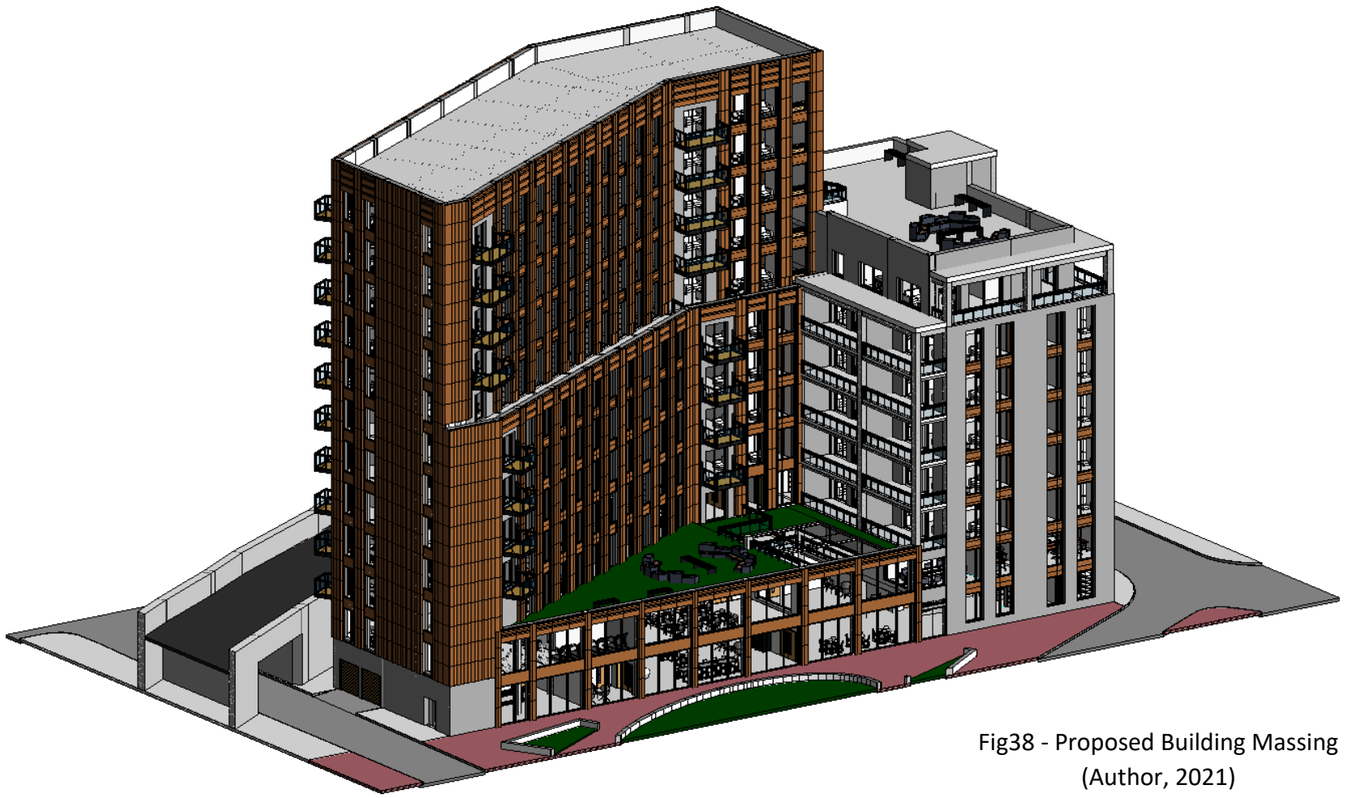


Fig38 - Proposed Building Massing
(Author, 2021)

The key materials proposed include

- NBK Terra Cotta Rainscreen Façade
- Ibstock Mechanical Brick Rainscreen Façade
- Bauder Intensive Green Roof
- Schock Balcony and Terraces
- Kingspan Raised Access Floor

Fig39 - NBK Façade Building
(NBK, 2021)

Fig40 - Ibstock System
(Ibstock Brick, 2021)

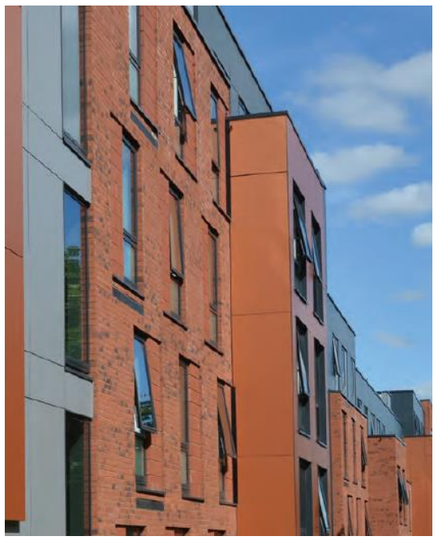


Fig41 - Ibstock Brick Building
(Ibstock Brick, 2021)

Fig42 - NBK Ceramic Elements
(NBK, 2021)

2.C Structural GA Plan

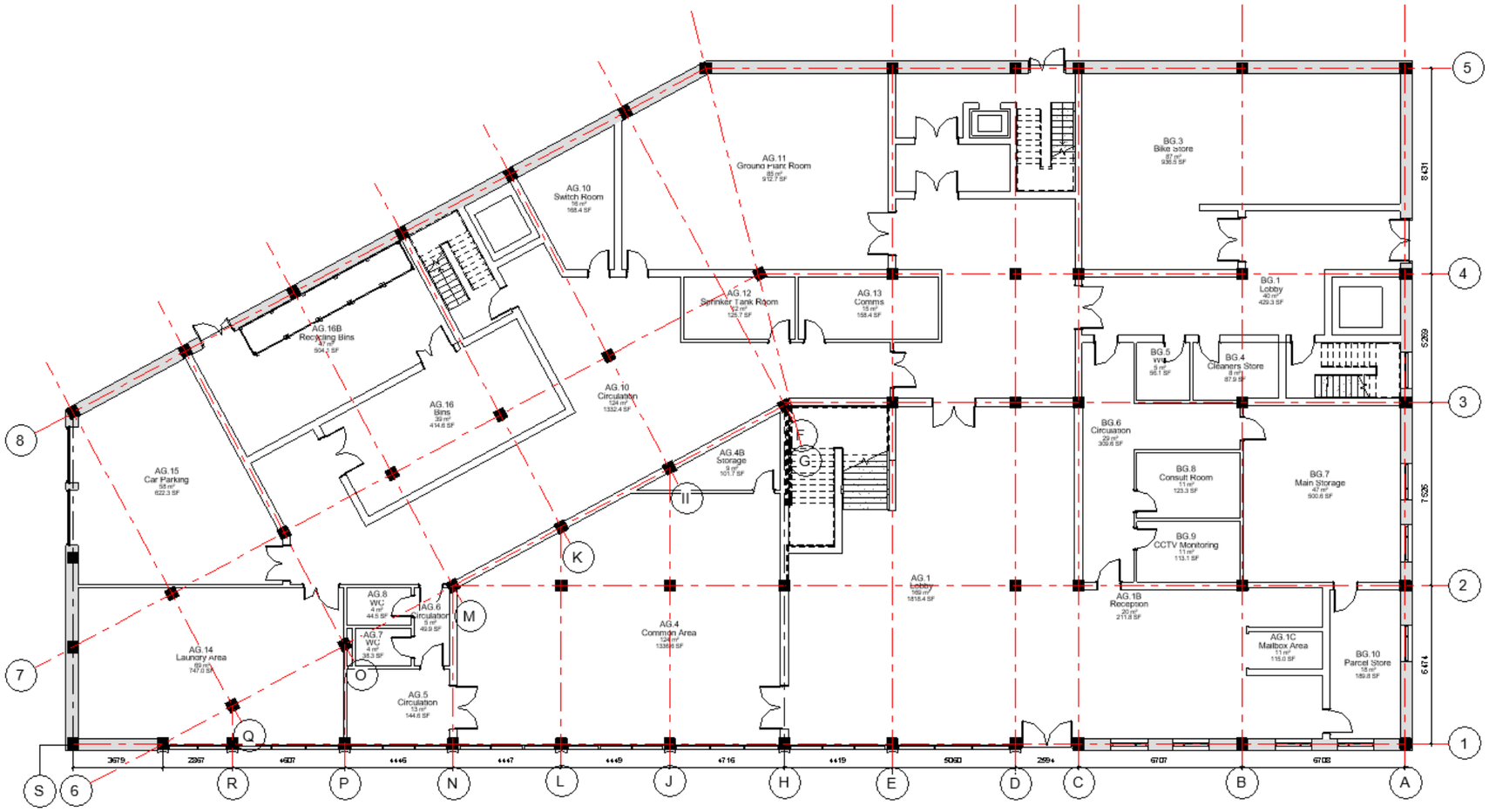


Fig43 - Structural GA Plan (Author, 2021)

The structure of the building was considered from an early point of design. It was important to ensure the structure could be hid behind the rainscreen and mechanical brick façade. This was an important factor as it has the potential to reduce the probability of cold bridging from occurring. A concrete structure was ultimately chosen for its impressive fire attributes and the fact that concrete beams are capable to span distances of 6000 to 9000mm. The typical floor depth across the building is 210mm.

Other benefits which come will come with the concrete structure include:

- High compressive strength
- Locally sourced
- Low maintenance factor
- Less skilled labour required

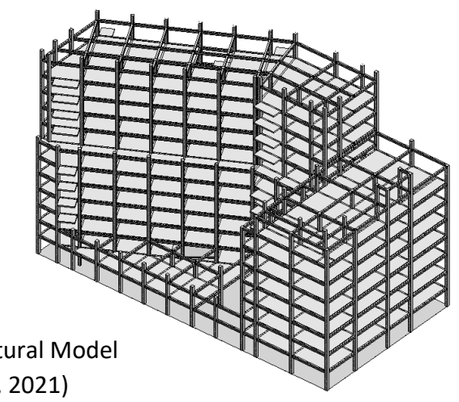
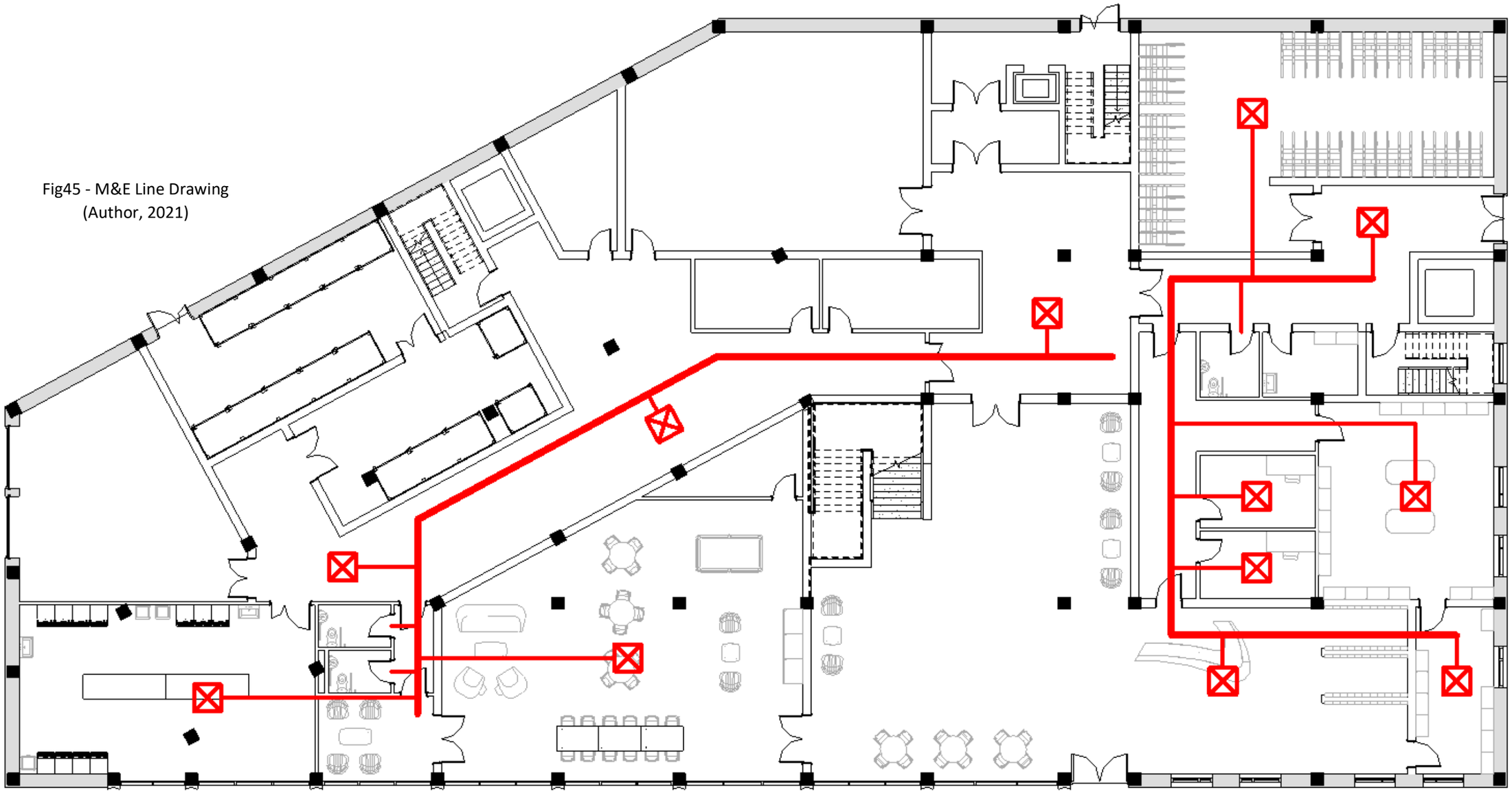


Fig44 - Structural Model (Author, 2021)

2.D Coordinated M&E Overview Line Drawing

Fig45 - M&E Line Drawing
(Author, 2021)



A variable refrigerant Flow (VRF) system will be used to air condition the many spaces within the building. This HVAC system is more sustainable than alternative technologies and is being utilised more regularly. This system controls the temperatures of each space as it knows which evaporators need refrigerant flow and which do not. This provides the building with individual comfort control for residents, simultaneous heating and cooling, and also provides the benefits associated with heat recovery (CED Engineering, 2021).

As the building holds various types of spaces, there will be different indoor units throughout the building serviced from within the suspended ceilings (apart from level 1 which utilises raised floor ventilation). These indoor units will include cassette type fan coil units and ducted indoor units.

Ceiling Mounted Cassette
Fig47 - Daikin (2021)

Fig46 - M&E Line Drawing (Author, 2021)

Ceiling Mounted Duct
Fig48 - Daikin (2021)

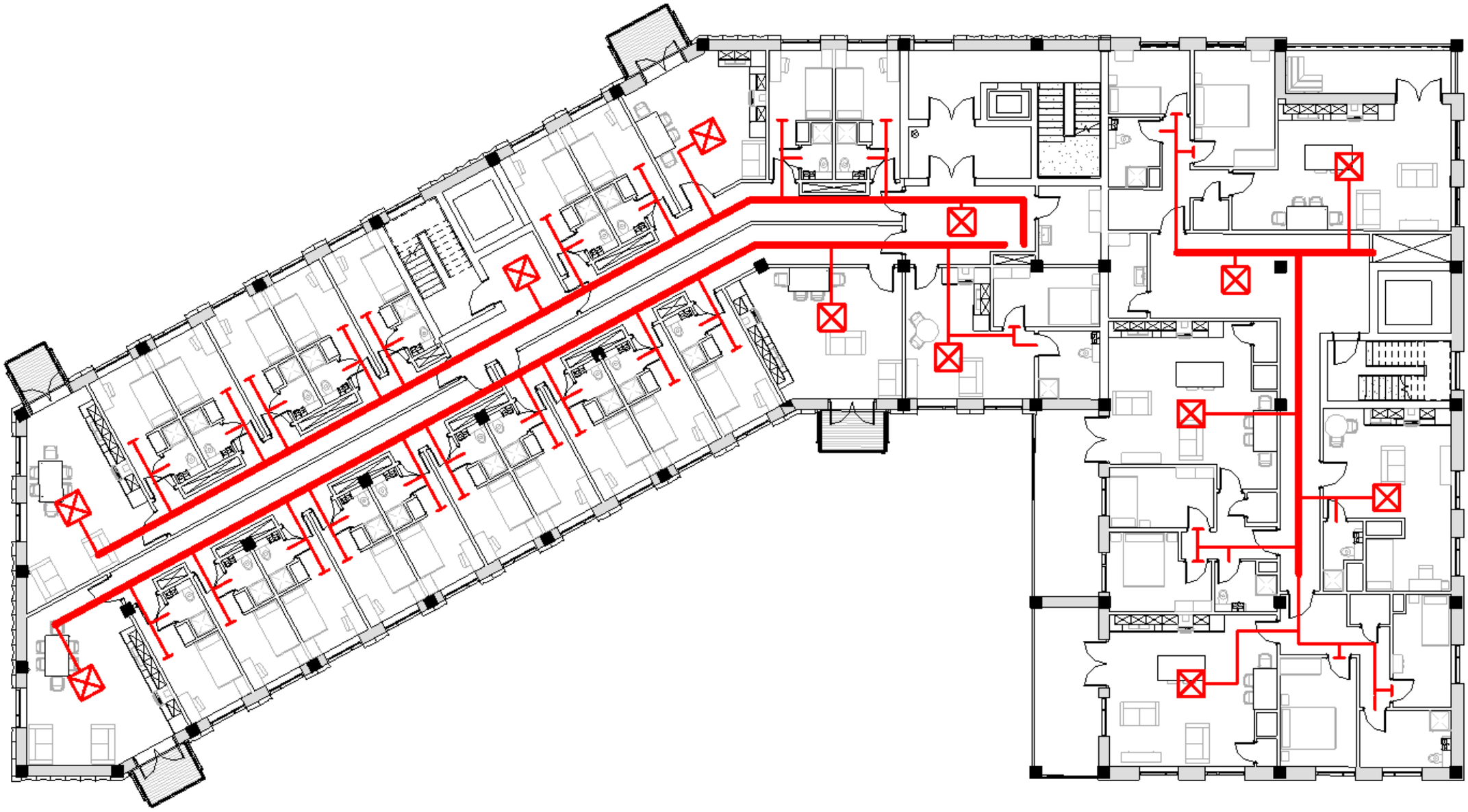
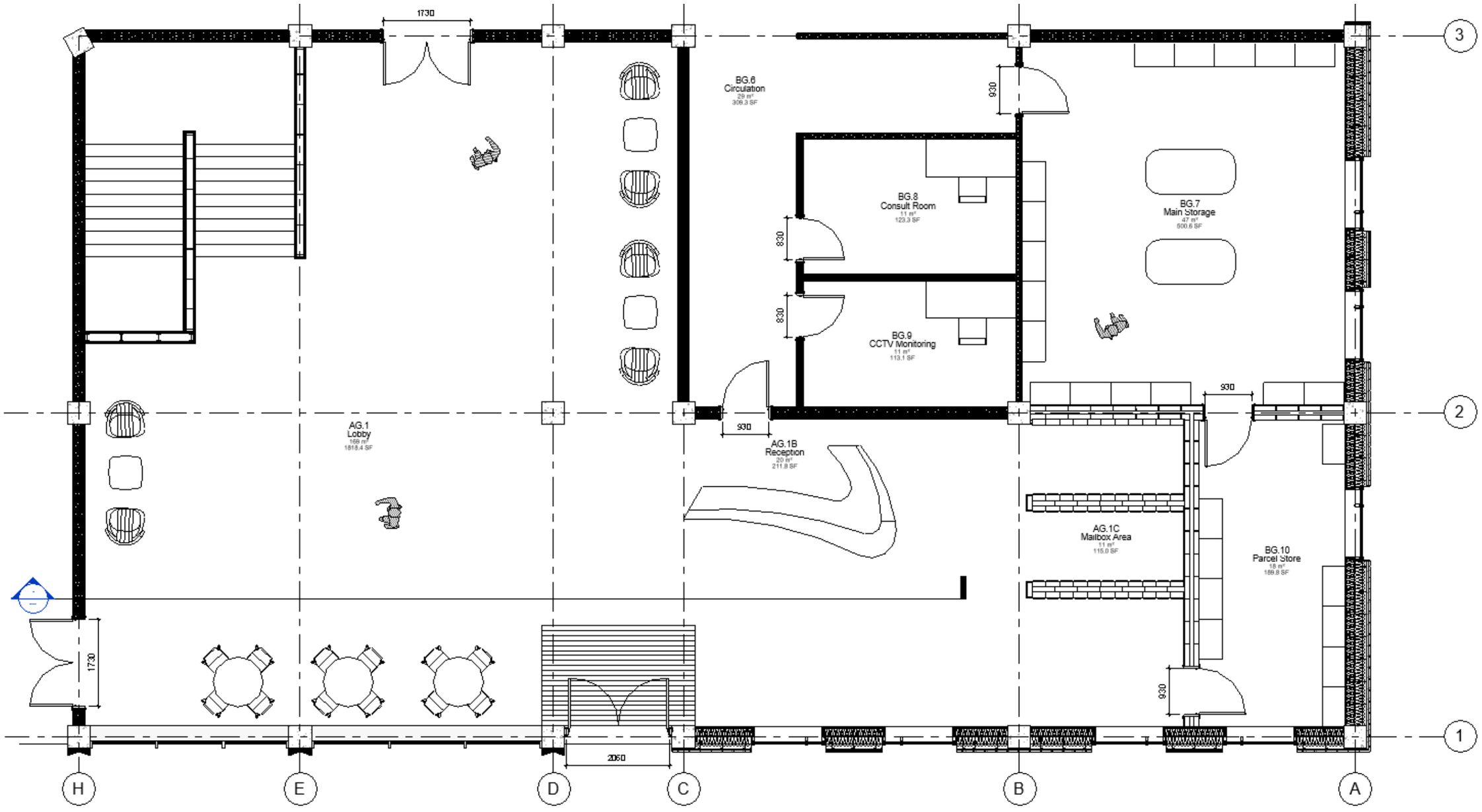


Fig49 - M&E Line Drawing (Author, 2021)

2.E Enlarged Plans and Sections

2.E.1 Typical Entrance Areas



This is a closer look at the main entrance of the building, found on the south side. This space is to be tiled with a Tetra ceramic tile. At the entrance there is a 9mm INTRAluk Ultima matting.

Fig50 - Enlarged Entrance Plan (Author, 2021)

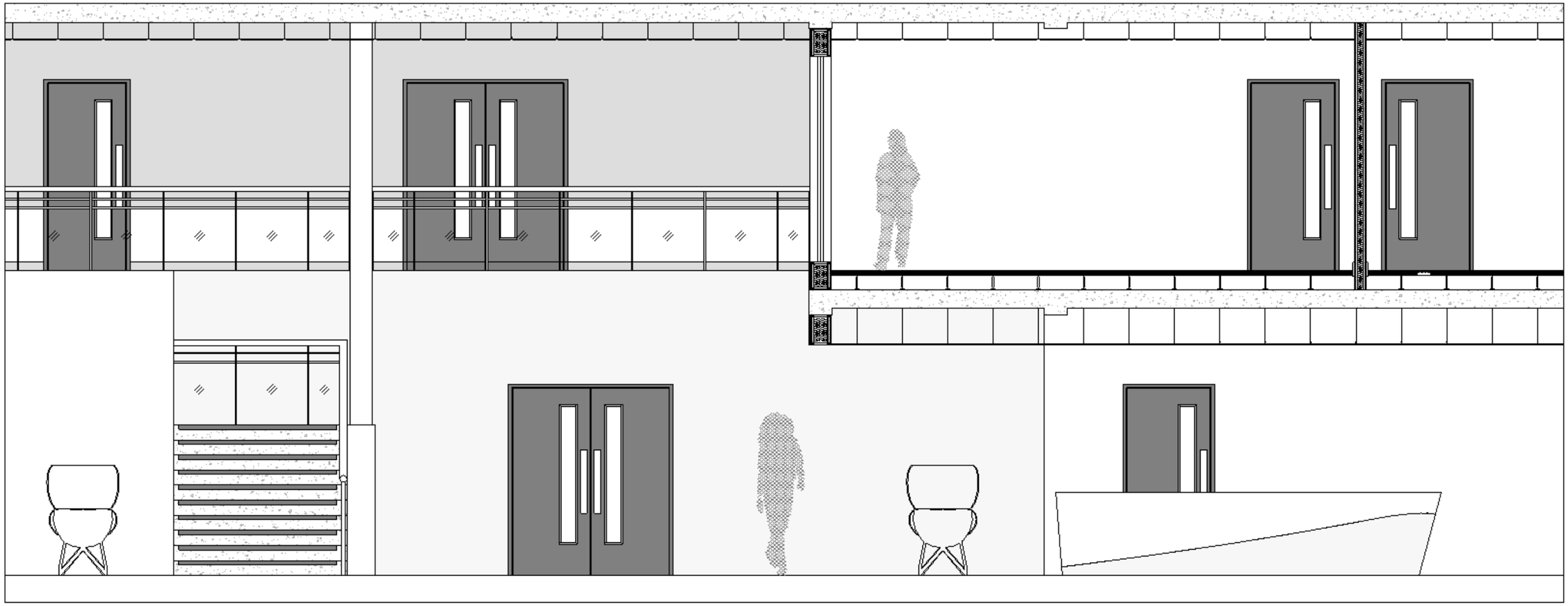


Fig51 - Enlarged Entrance Section (Author, 2021)

Due to the location, a percentage of the walls had to obtain a high fire rating. The British Gypsum FireWall system was specified. These walls are capable to withstand fire for up to 240 minutes. The walls are made up of 2 linings of partition insulation along with Gypframe C studs at 600mm centres and Gyproc Fireline boarding.

The stairs within the foyer space will be precast concrete, with the addition of ani-slip nosings. The stairs will also have a glass panel railing for support, which can also be seen at level 01. These railings will have stainless steel balustrade posts. The partition walling will have a white paint finish within this area.

2.E.2 Shared Spaces internally

2.E.2.1 Multi-Function Room

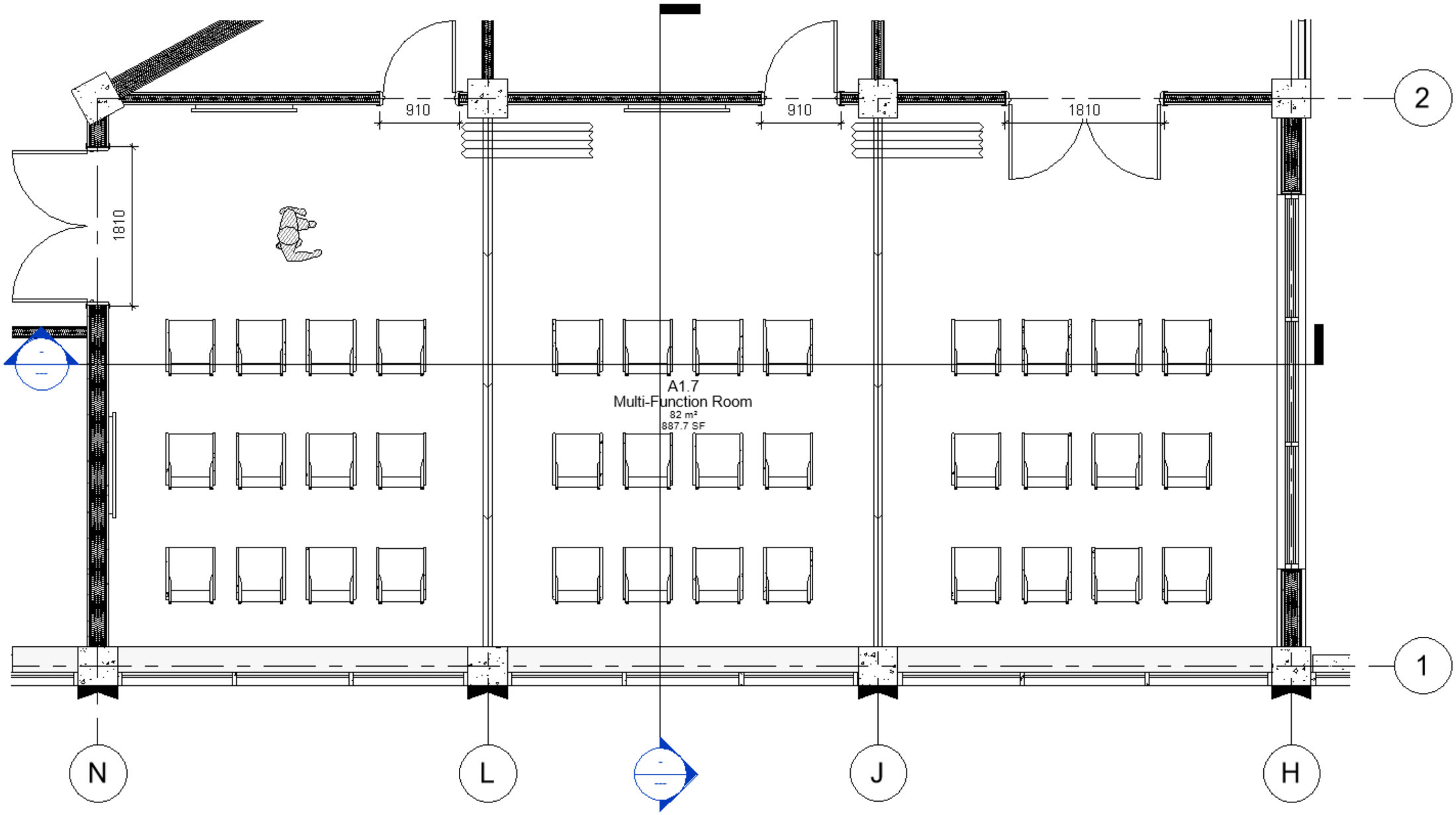


Fig52 - Enlarged Multi-Function Room Plan (Author, 2021)

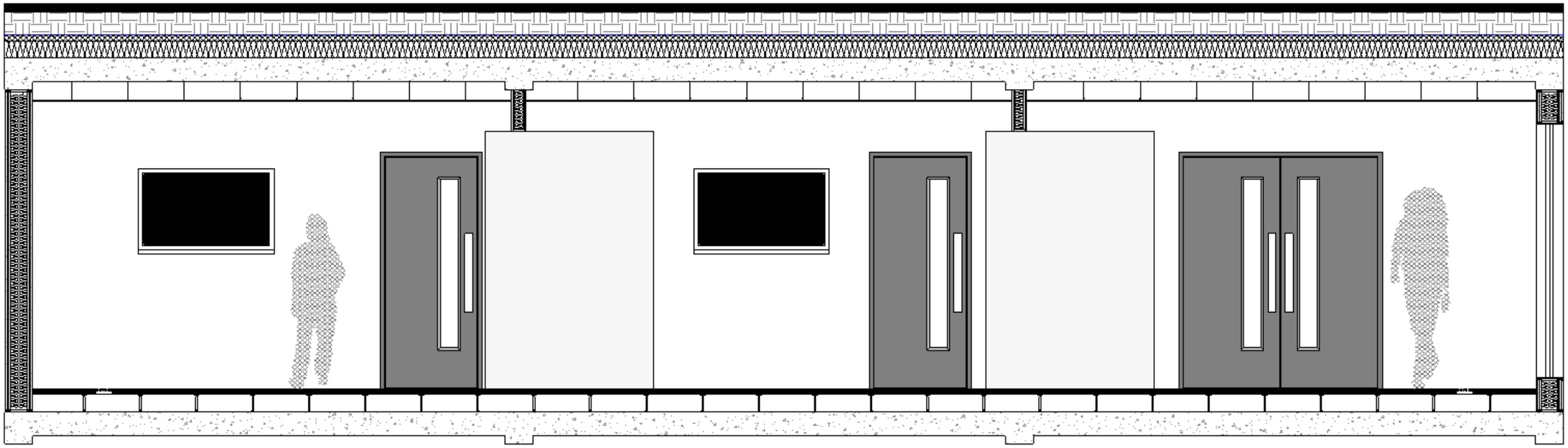


Fig53 - Enlarged Multi-Function Room Section (Author, 2021)

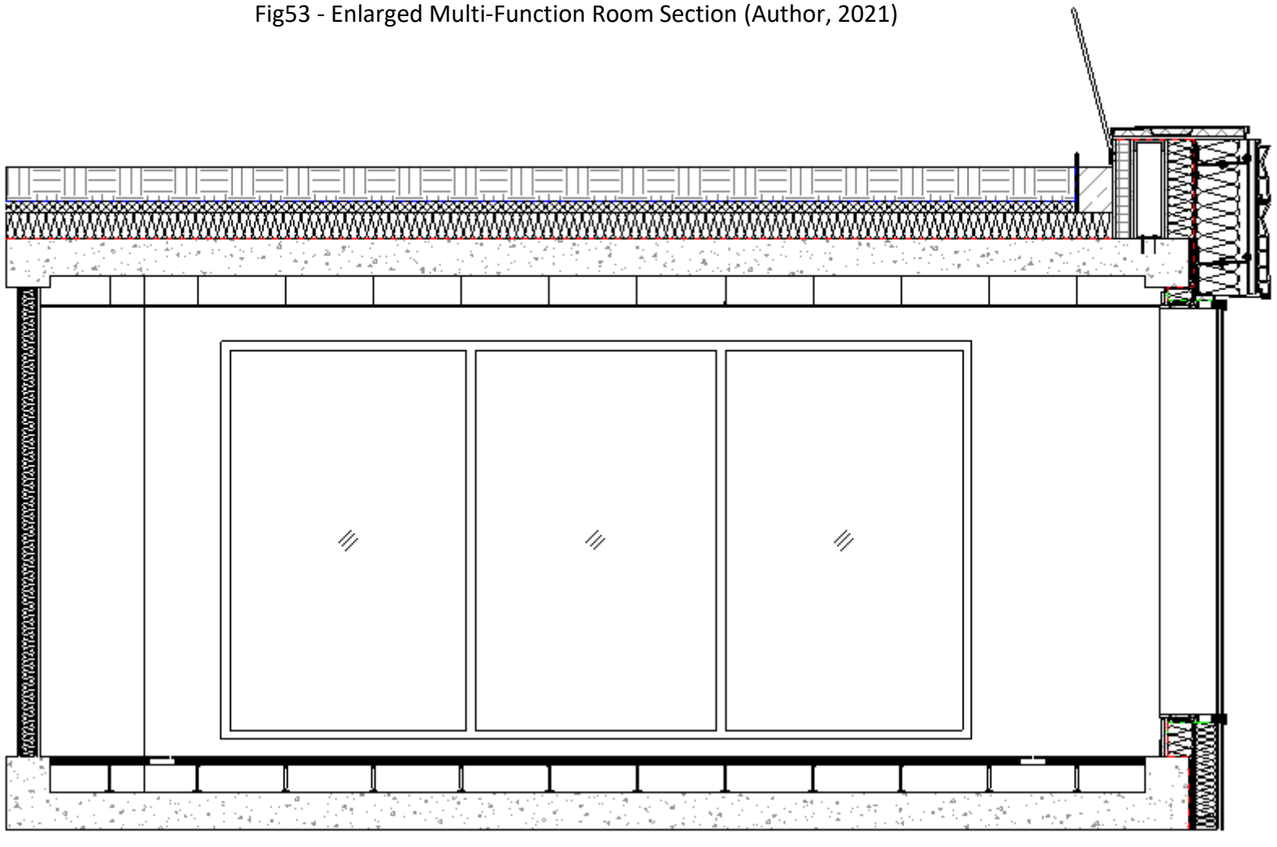


Fig54 - Enlarged Multi-Function Room Section (Author, 2021)

The brief required that this building had a multiple function room. This space will be used for various activities, such as yoga classes. It is located on level 01, which is distanced from any residential spaces. A key requirement for this room was the ability to sub divide the room with easily moveable partitions. As seen in the enlarged sections, the space can be divided into 3 smaller spaces by moving the Kudos Sliding Folding Partitions. These floor supported panels obtain a great acoustic rating of 50db.

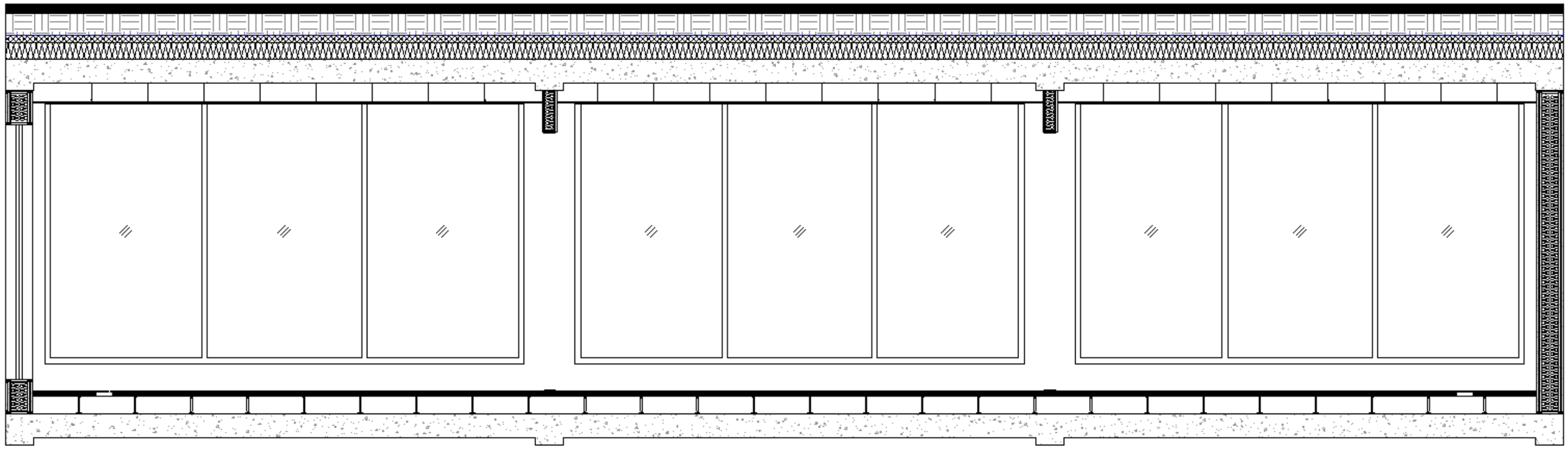


Fig55 - Enlarged Multi-Function Room Section (Author, 2021)

Senior’s architectural system’s SF52 curtain walling system will be used for the front gazing within this space. The anodized aluminium mullions will hold the insulating glass panels into place. The system will be thermally broken in accordance with BS 7619 and the gaskets to BS 3734. Also, in accordance with BS EN 13830, the air permeability, wind resistance and water tightness will all be tested.

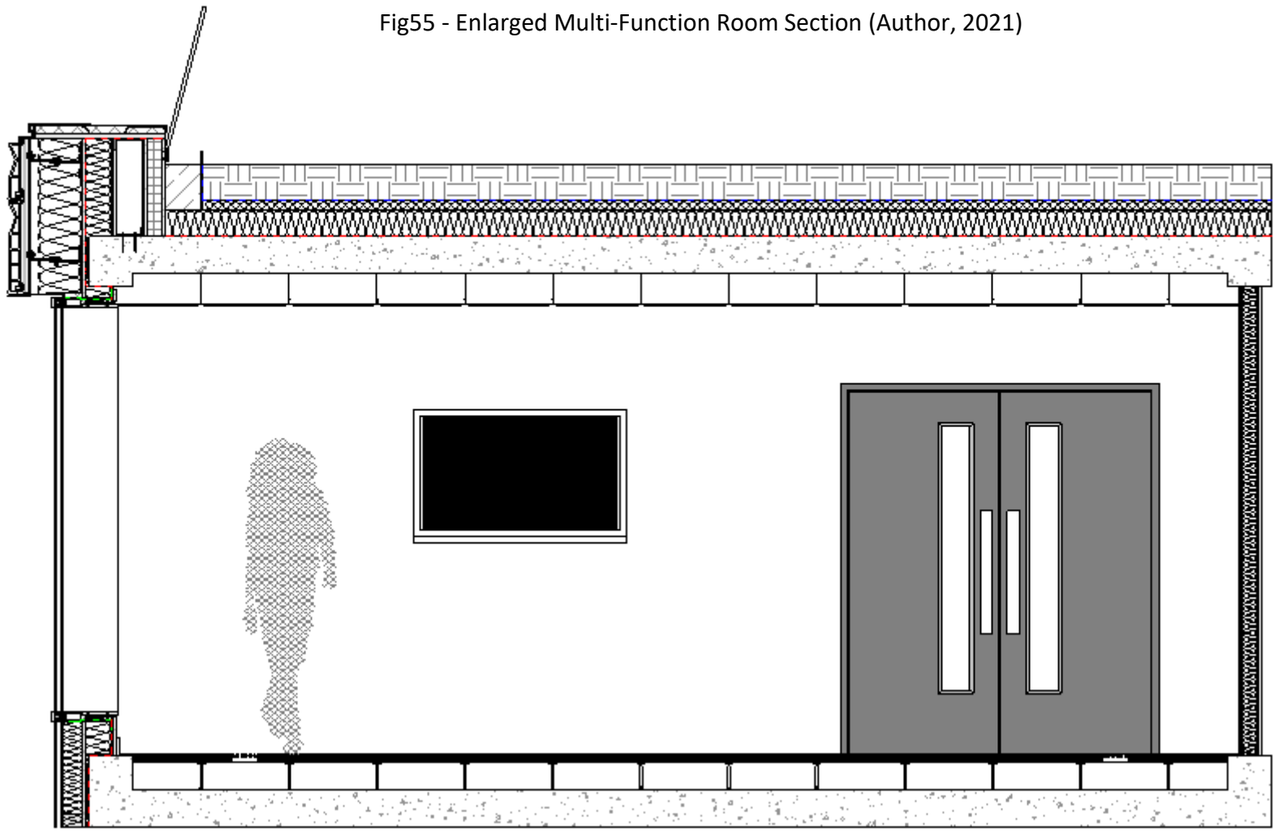


Fig56 - Enlarged Multi-Function Room Section (Author, 2021)

2.E.E.2 Communal Kitchenette

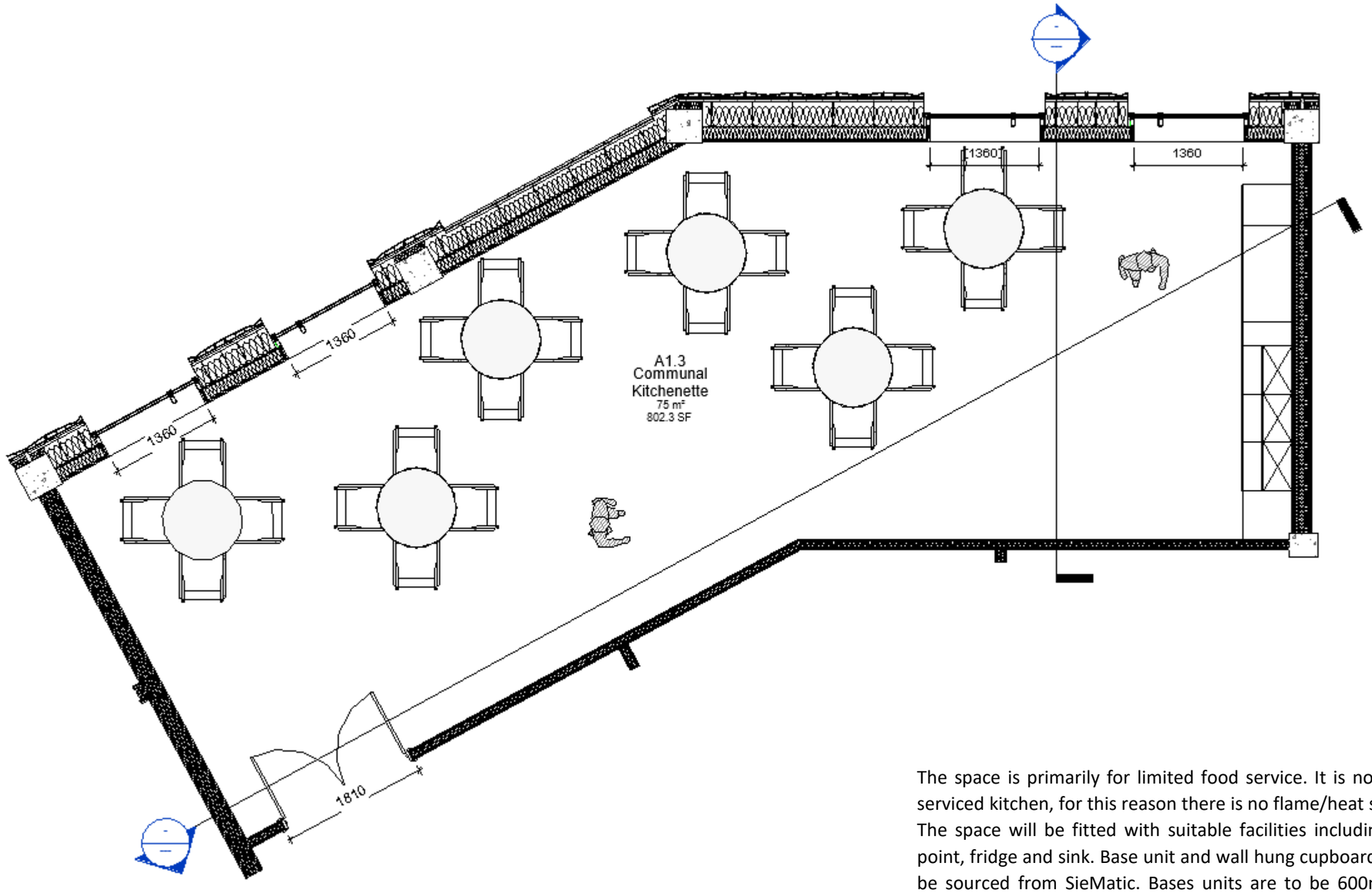


Fig57 - Enlarged Communal Kitchenette Plan (Author, 2021)

The space is primarily for limited food service. It is not a fully serviced kitchen, for this reason there is no flame/heat services. The space will be fitted with suitable facilities including a tea point, fridge and sink. Base unit and wall hung cupboards are to be sourced from SieMatic. Bases units are to be 600mm and come with plinth legs, hinges, and adjustable shelves.

2.E.3 Typical Student Cluster and Room

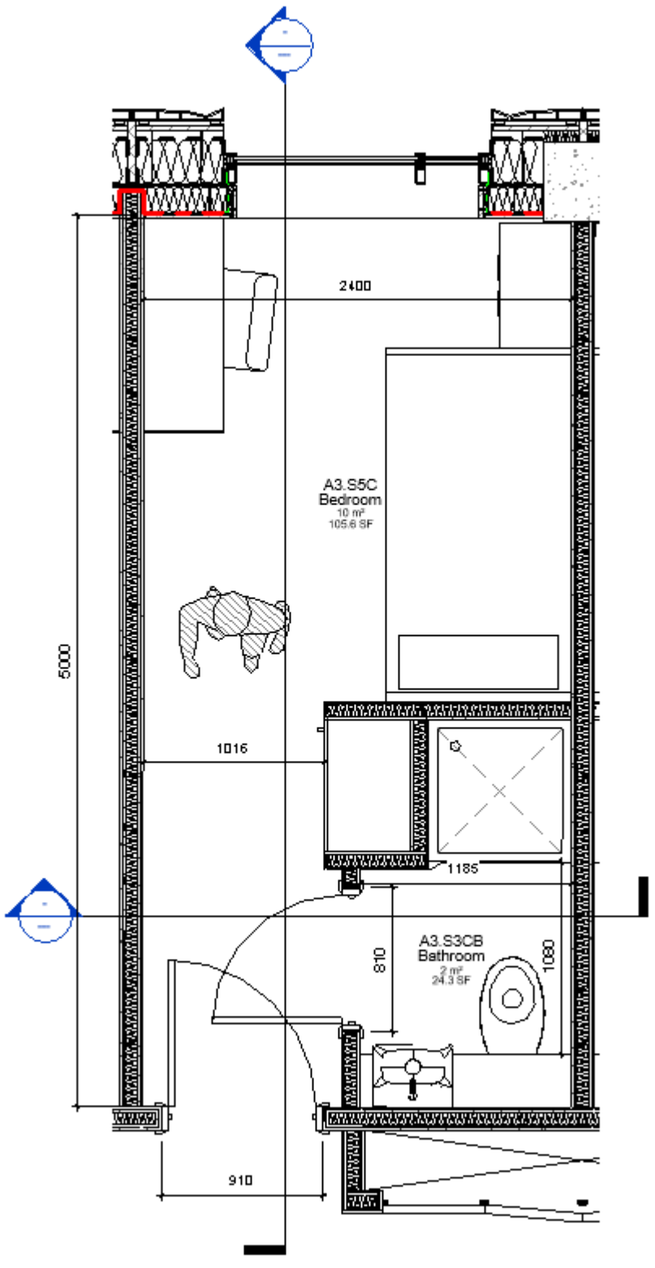


Fig58 - Enlarged Student Room Plan (Author, 2021)

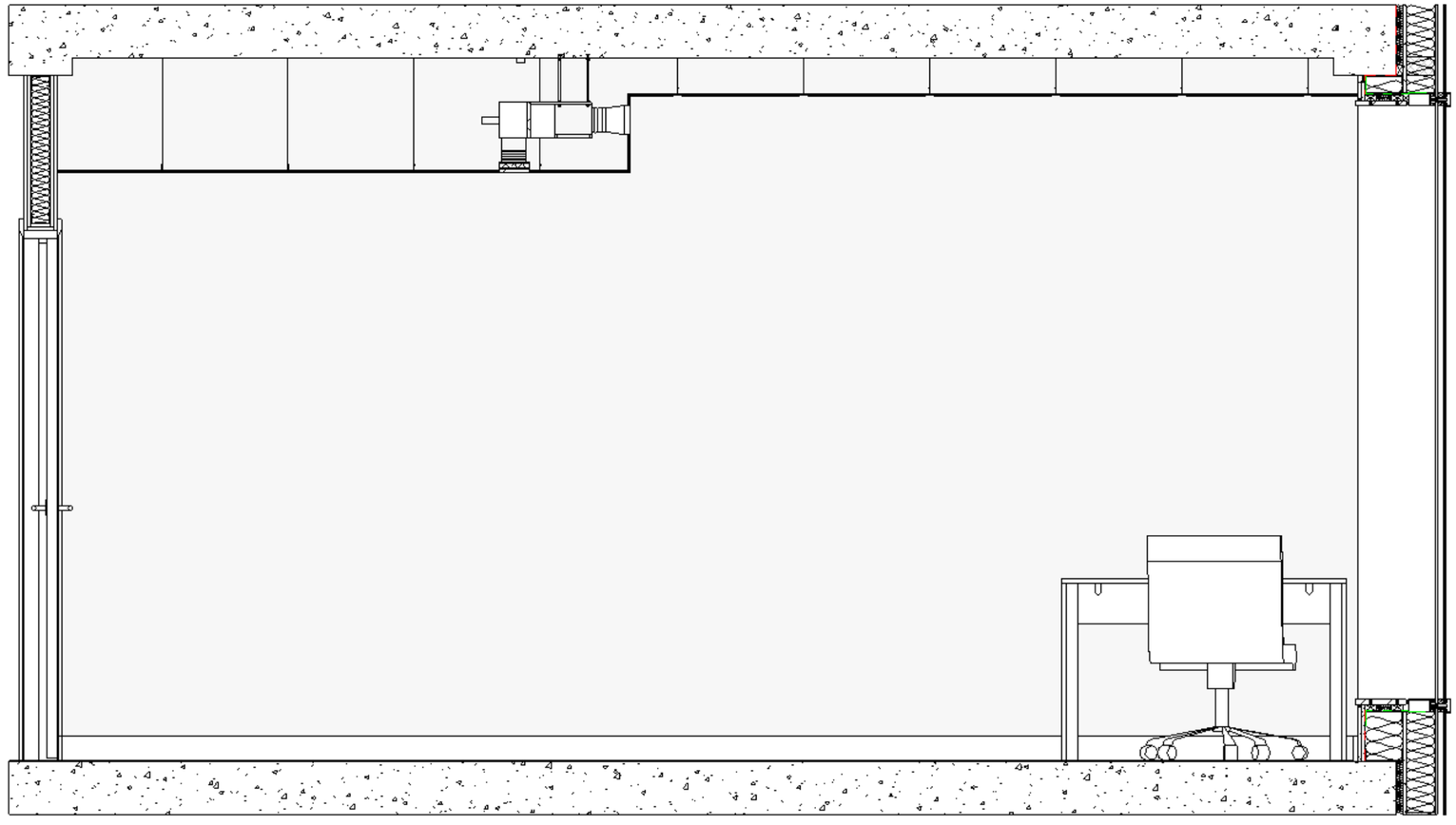


Fig59 - Enlarged Student Room Section (Author, 2021)

This is the standard student bedroom design for across the intergeneration housing scheme. Walls are to be the highly flexible GypWall classic system. This partition wall contain metal C studs at 600mm centres along with Gyproc plasterboard, thistle finish plasters and Isover insulation. In areas where necessary, the Gypframe AcouStuds can be utilised. In terms of services, pre cut holes can be provided which makes their integration easier (British Gypsum, 2021).

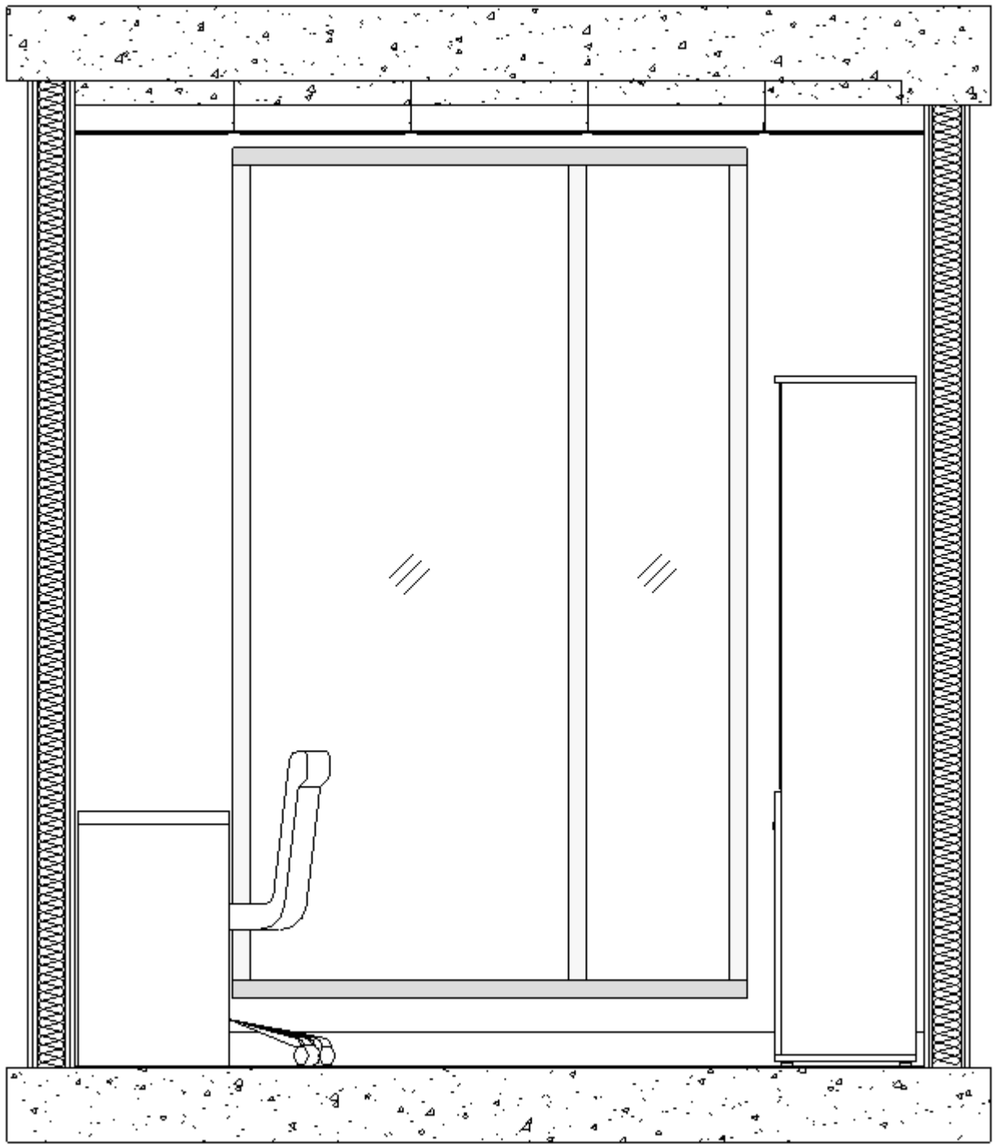


Fig60 - Enlarged Student Room Section (Author, 2021)

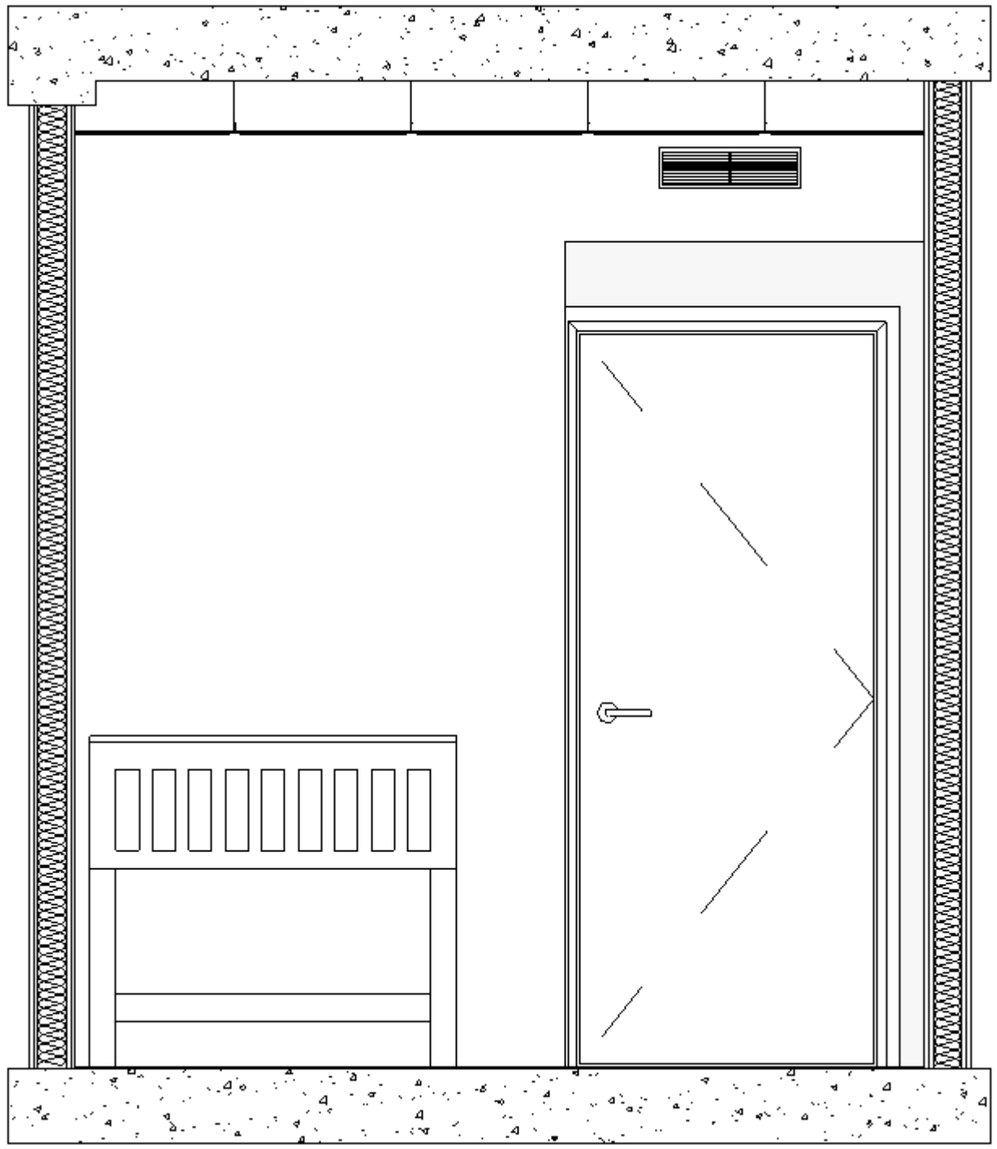


Fig61 - Enlarged Student Room Section (Author, 2021)

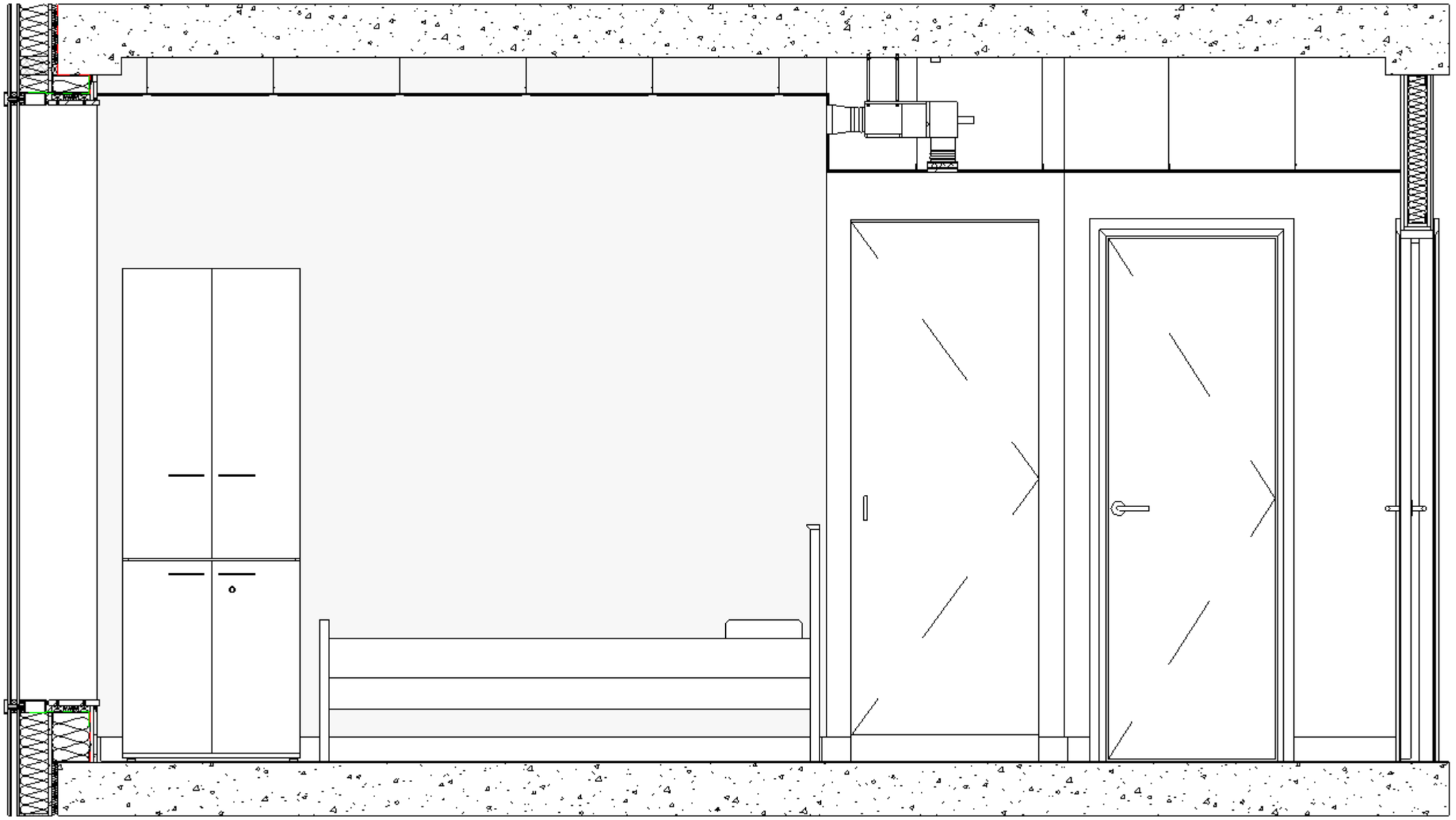


Fig62 - Enlarged Student Room Section (Author, 2021)

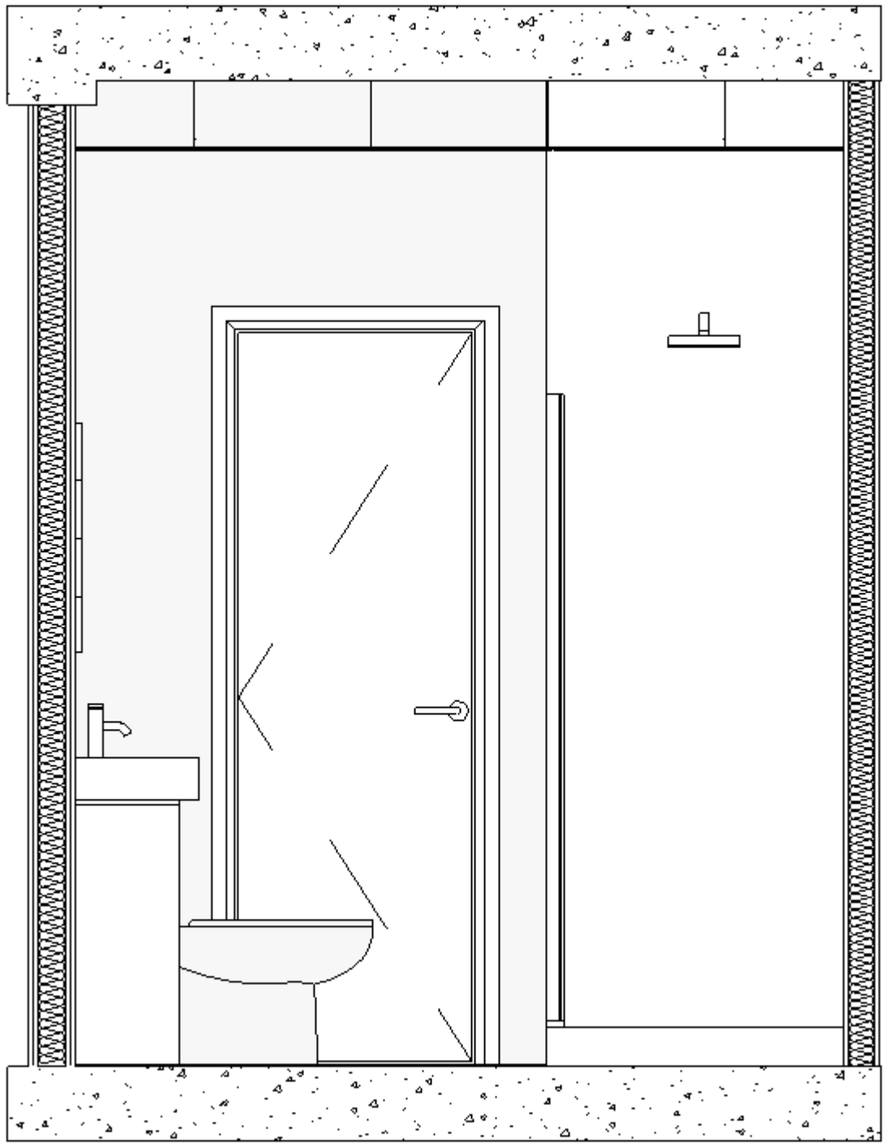


Fig63 - Enlarged Student Bathroom Section (Author, 2021)

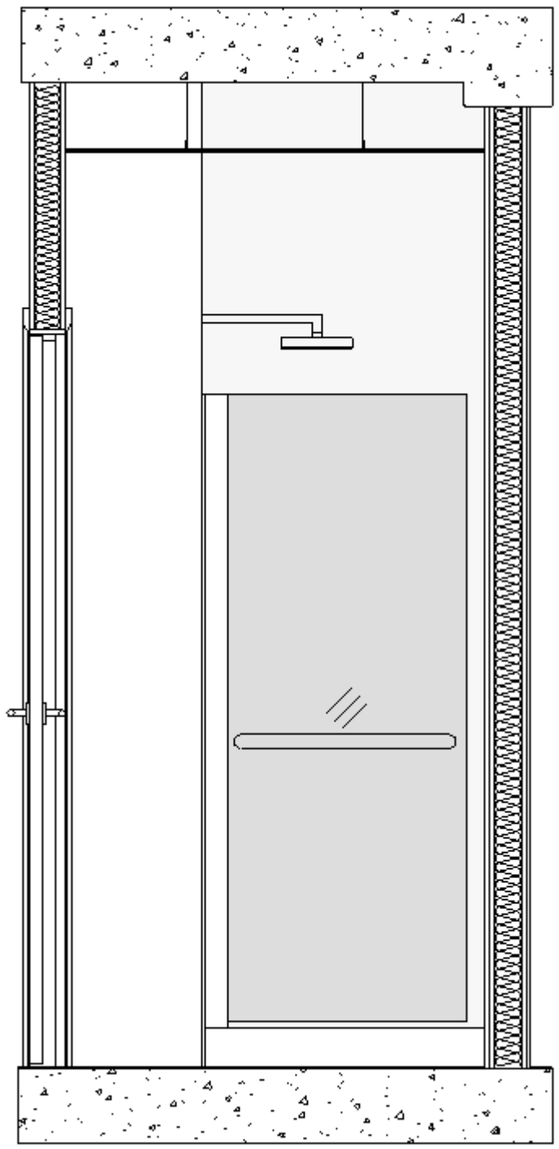


Fig64 - Enlarged Student Bathroom Section (Author, 2021)

For the student bathrooms there had to be a different suspended ceiling specified because of the moisture generated by the shower. The Rockfon Koral ceiling tiles, which are manufactured in accordance with BS 13964, will be used in these spaces due to there impressive resistance to high humidity.

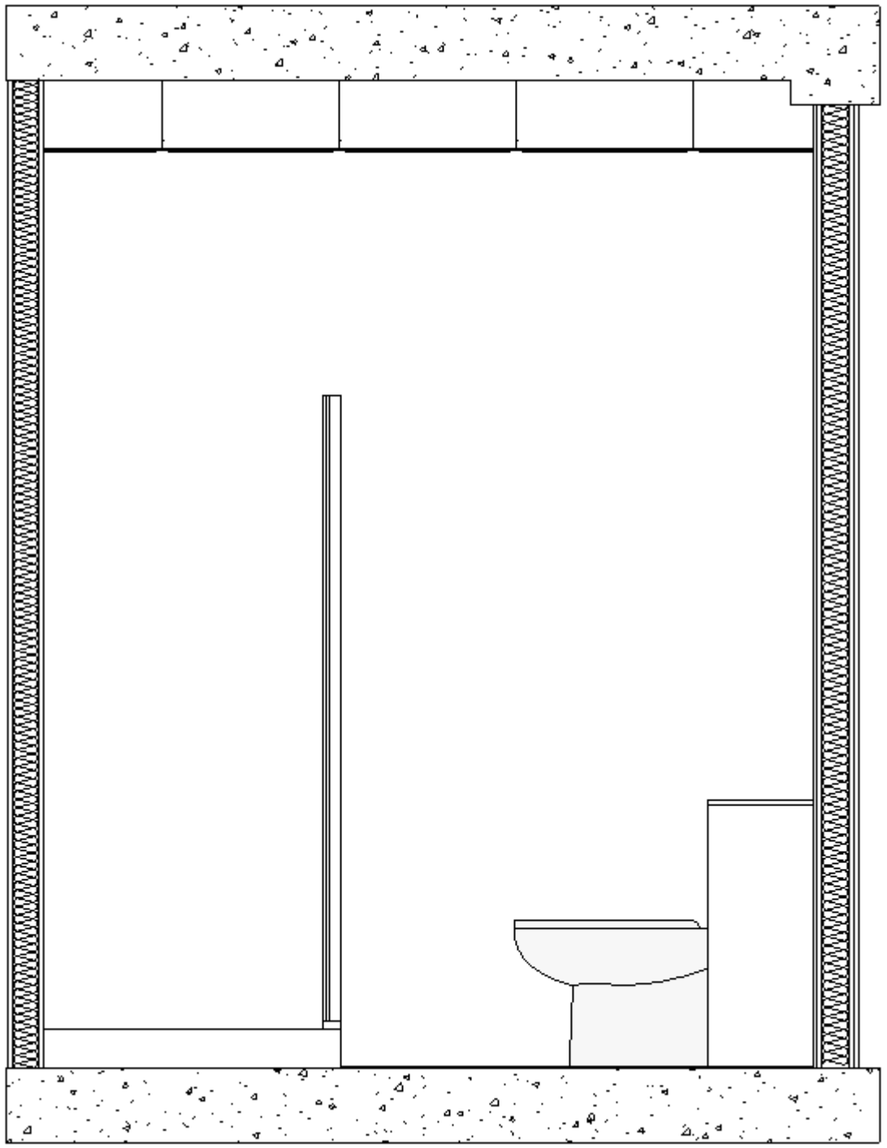


Fig65 - Enlarged Student Bathroom Section (Author, 2021)

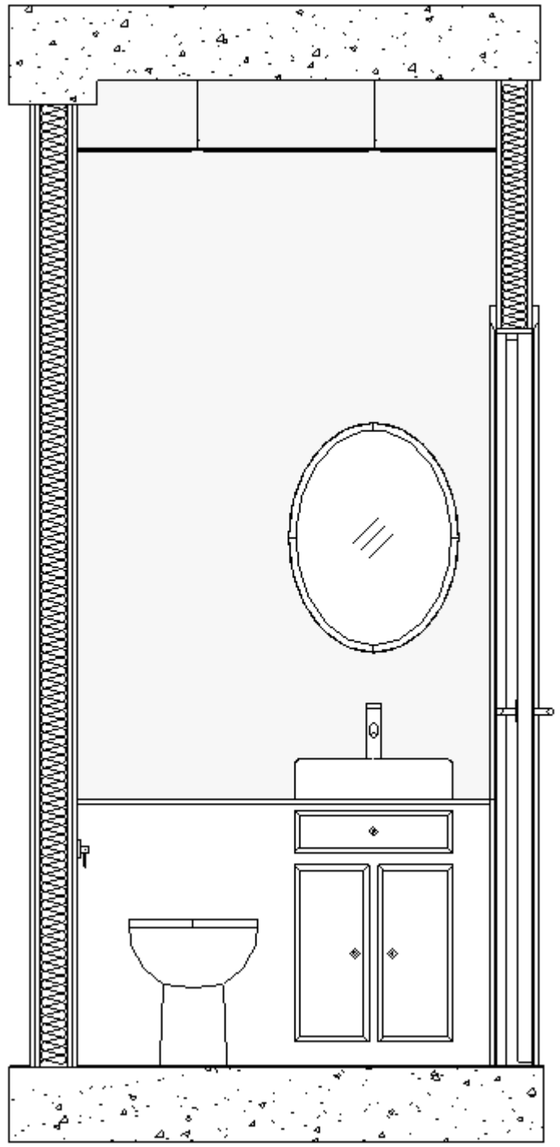


Fig66 - Enlarged Student Bathroom Section (Author, 2021)

2.E.4 Elder Residential Typical Apartment

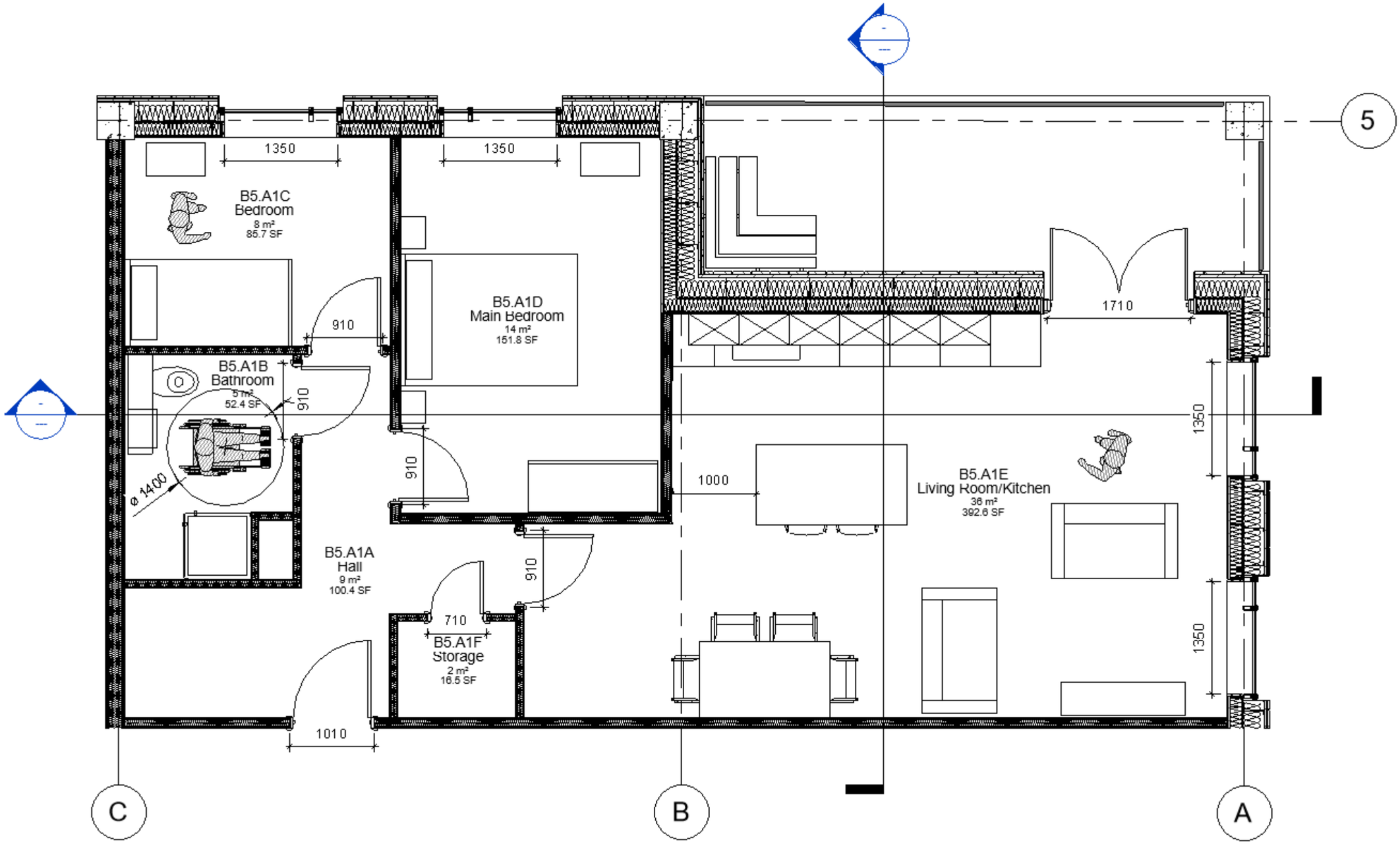


Fig67 - Enlarged Young-Old Apartment Plan (Author, 2021)

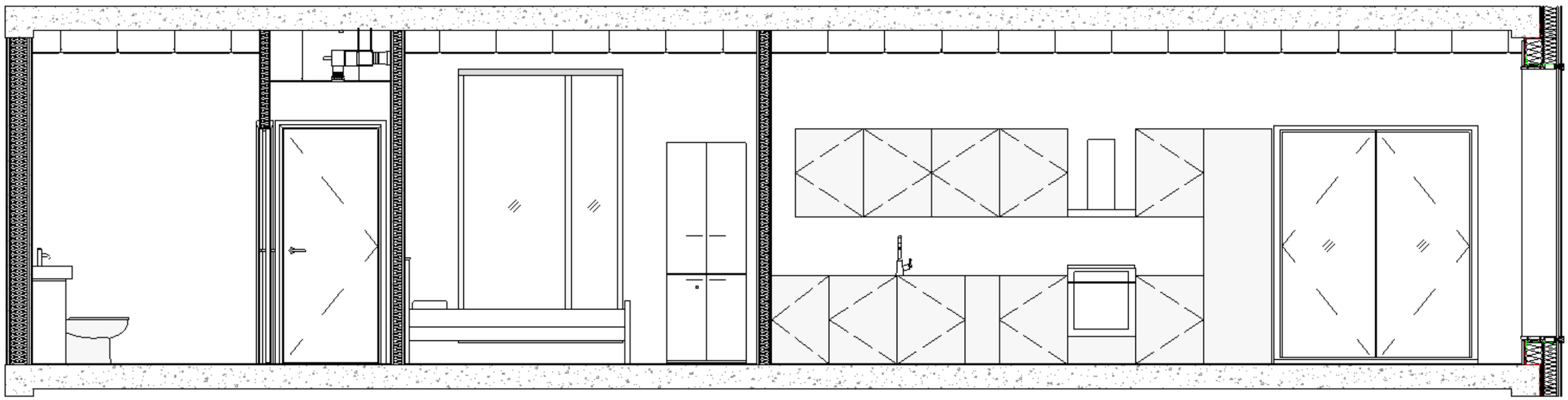


Fig68 - Enlarged Young-Old Apartment Section (Author, 2021)

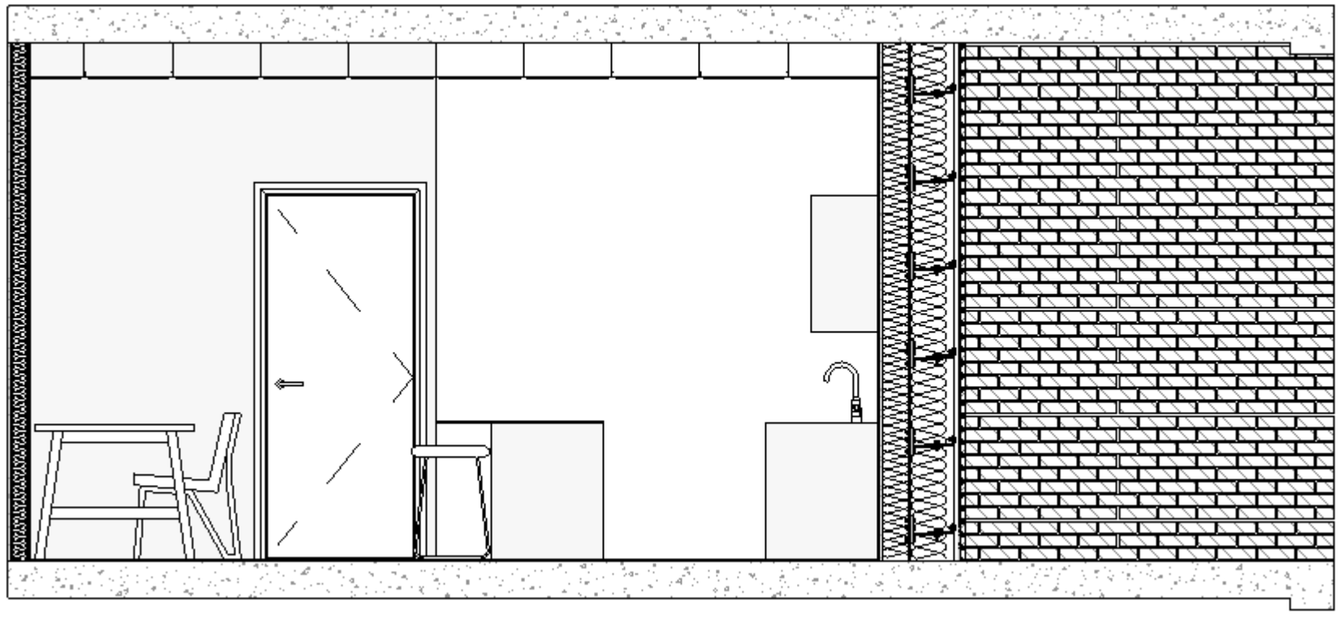
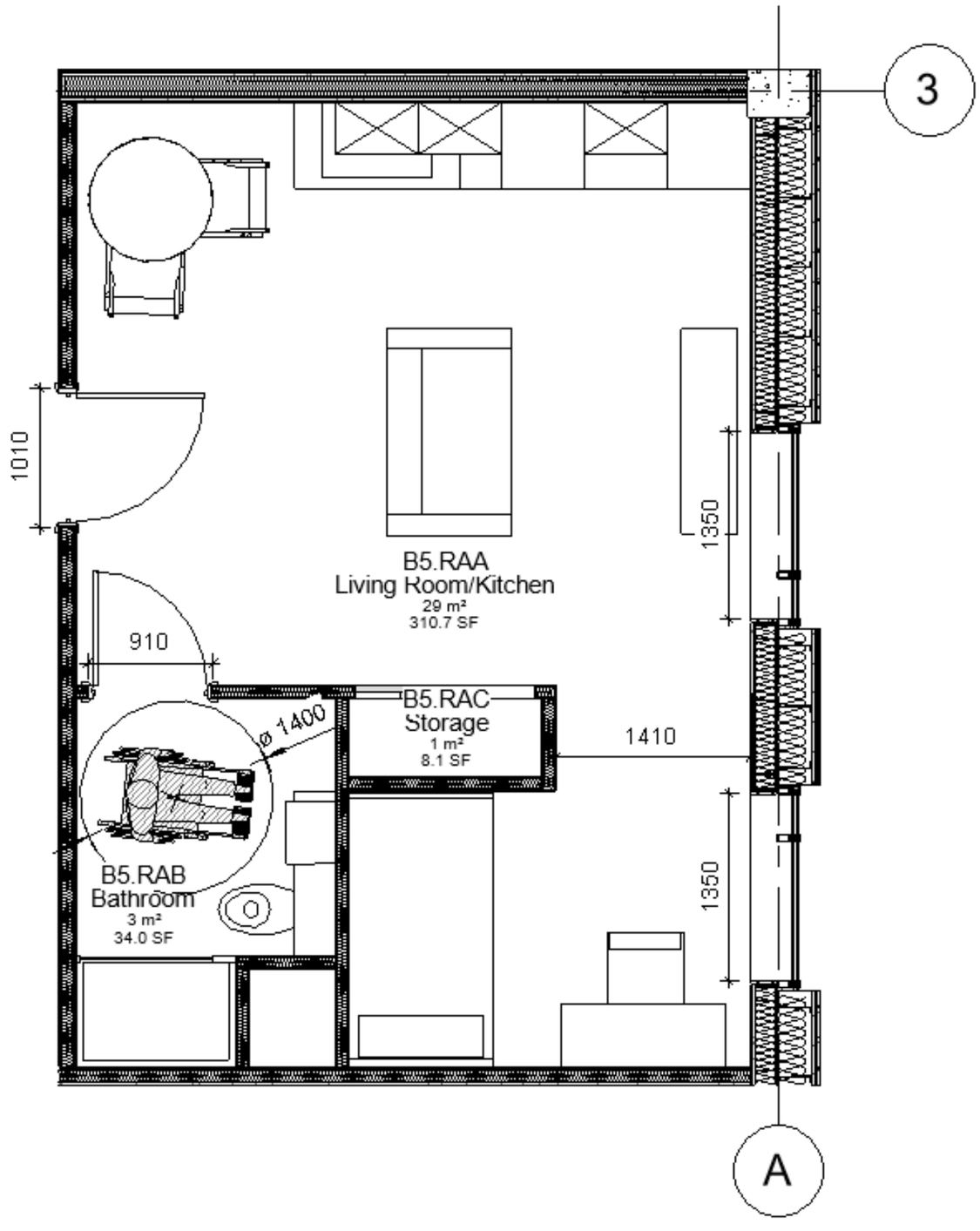


Fig69 - Enlarged Young-Old Apartment Section (Author, 2021)

The floor finishes of each young-old apartment are to be the same. The hall and bedrooms are to be fitted with 6.5mm Nylon Burmatex Tivoli carpet tiles. These spaces will also have planted softwood timber skirting running along the perimeter. The bathroom and living room/kitchen will be fitted with differing non-slip vinyl. The edges of the bathroom will have a coved skirting.

2.E.5 Typical Studio as Wheelchair Accessible



As requested within the project brief, the RA studio has a sleeping alcove within its semi open floor plan. The bed will be surrounded by the versatile GypWall system, as mentioned previously. There is also a storage cupboard provided behind a sliding door.

Fig70 - Enlarged RA Studio Plan (Author, 2021)

2.F Enlarged Elevations

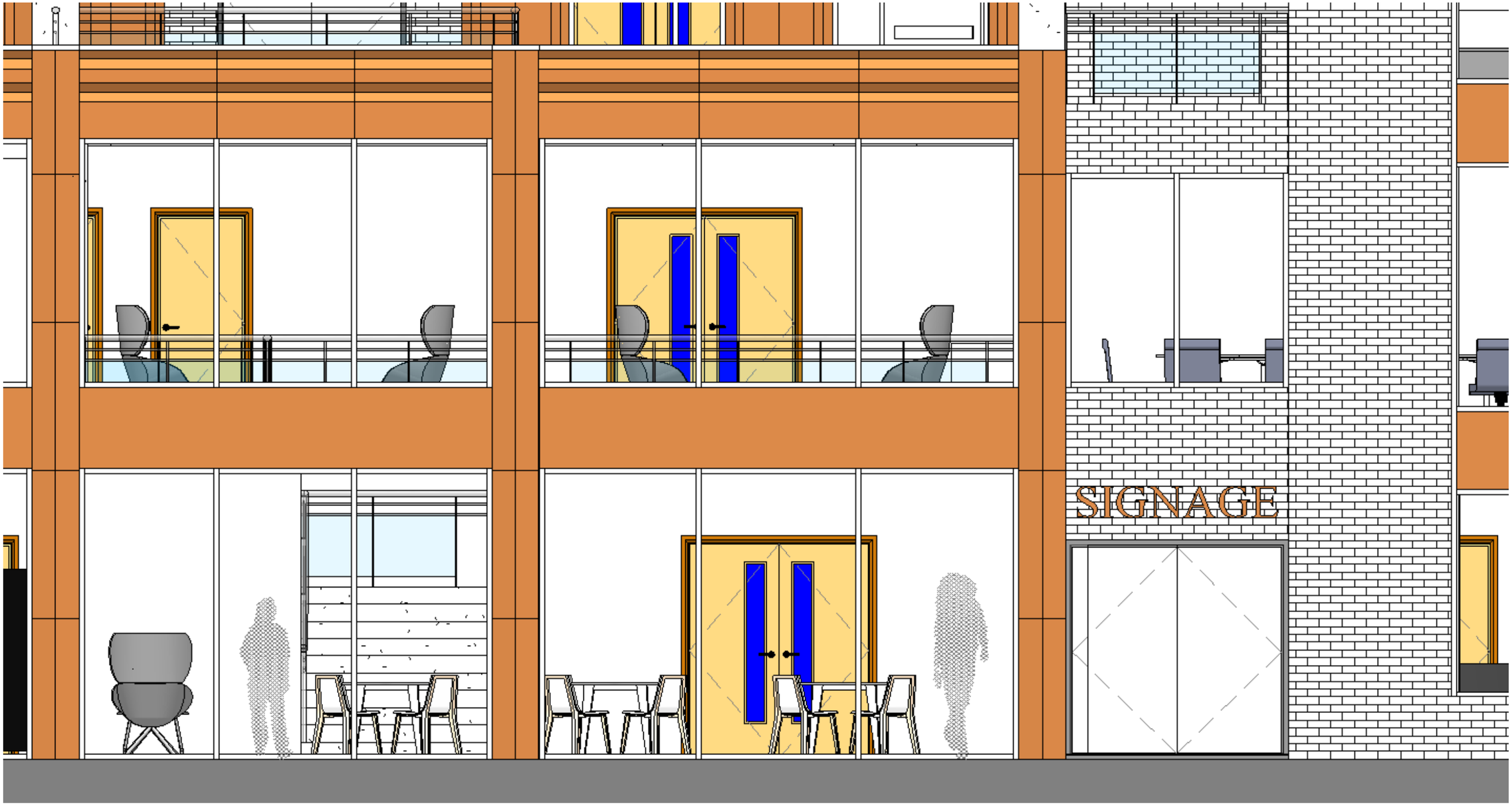


Fig71 - Enlarged Entrance Elevation (Author, 2021)

Fig72 - Enlarged Façade/Balcony Elevation (Author, 2021)

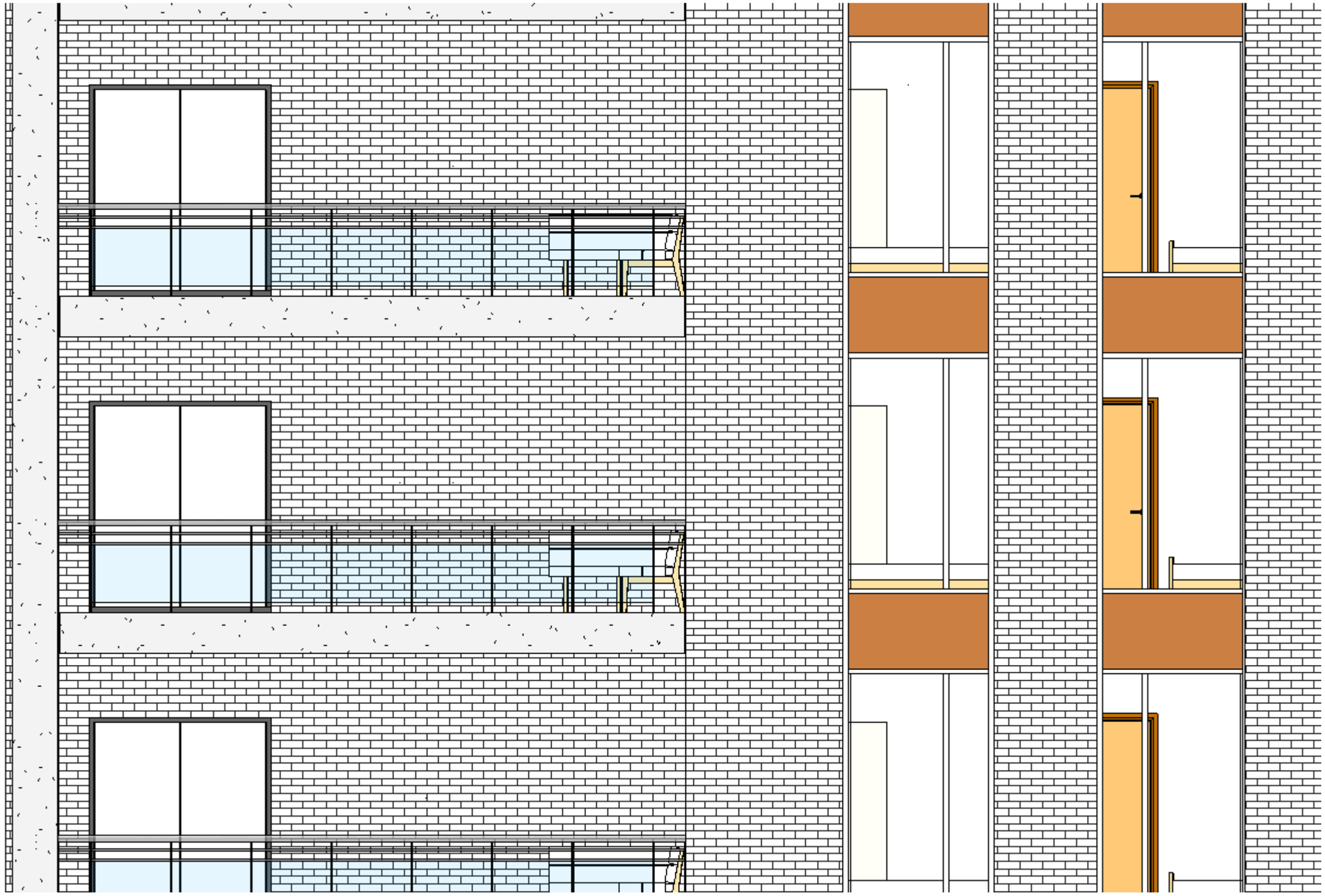


Fig73 - Enlarged Terrace Elevation (Author, 2021)

2.G Four Independently Developed Plan-Section-3D Components

2.G.1 External Cladding and Glazing

The glazing used within this system will be the Schuco AWS70 PPC aluminium window system. It will be supported off SFS metal studs. Around the window there will be 18mm thick birch veneered plywood window linings and sill boards. The overall glazing system must achieve uniformly distributed loads in accordance with BS EN 1991-1-1:2002. Additionally, there will be EDPM fully lapped and fixed back by a vapour control layer around these structural openings.

The rainscreen façade has many various elements that has to be designed correctly in order for the system to perform as intended. The façade is a terra cotta ceramic, supplied from NBK, that will be held in place by support plates which are clamped to a horizontal rail system. The railing system is supported by adjustable rainscreen bracketry fixed back to SFS metal studs. Also, within the wall makeup, there will be two layers of mineral wool insulation, each side of a CP board. On the internal side there will be 2 layers of soundbloc plasterboard which will be taped and sealed.

In terms of fire design, there will be an open state cavity barrier present at each floor level as well as horizontal cavity barriers between compartment zones. All cavity barriers should be placed correctly in these instances. If they were incorrectly placed the barriers would fail to carry out their purpose. Detailed information can be found within BS 8414 regarding the fire performance of external cladding systems.

Fig74 - Ceramic Façade Elements (NBK, 2019)

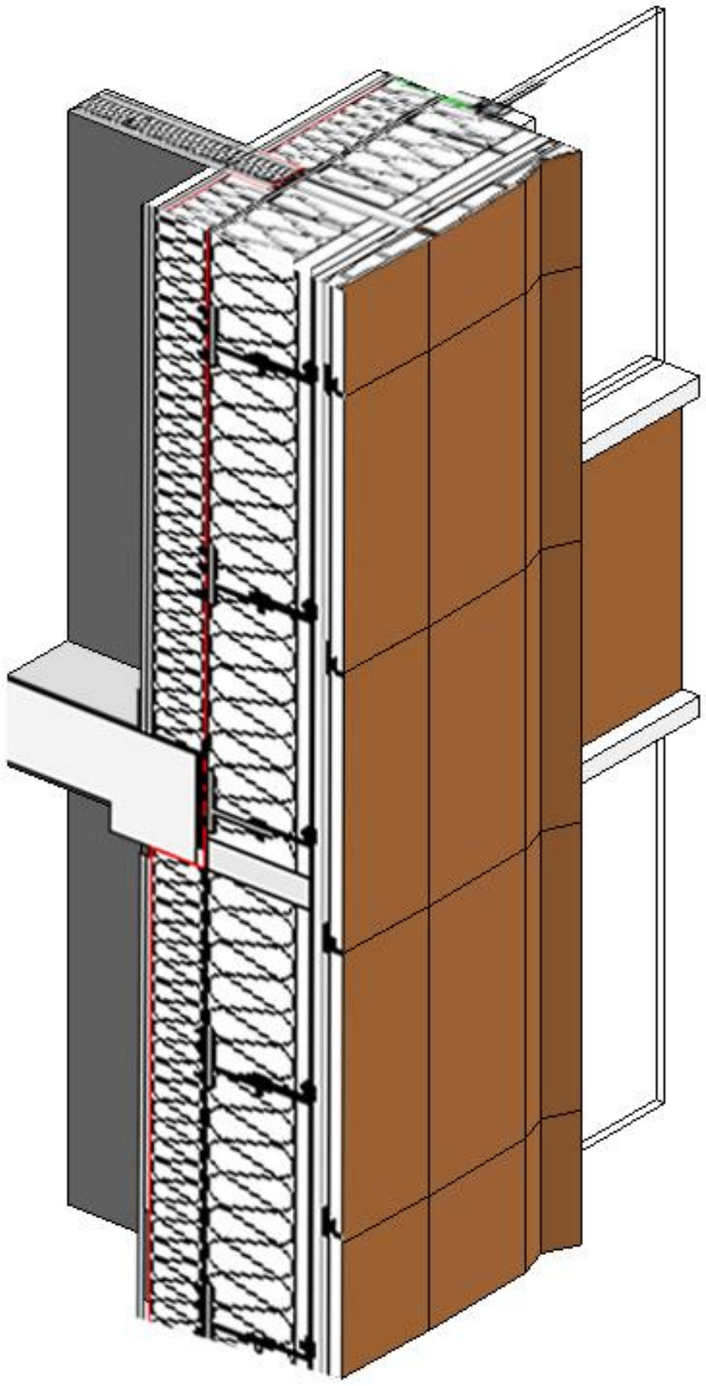


Fig75 - 3D External Façade and Glazing (Author, 2021)

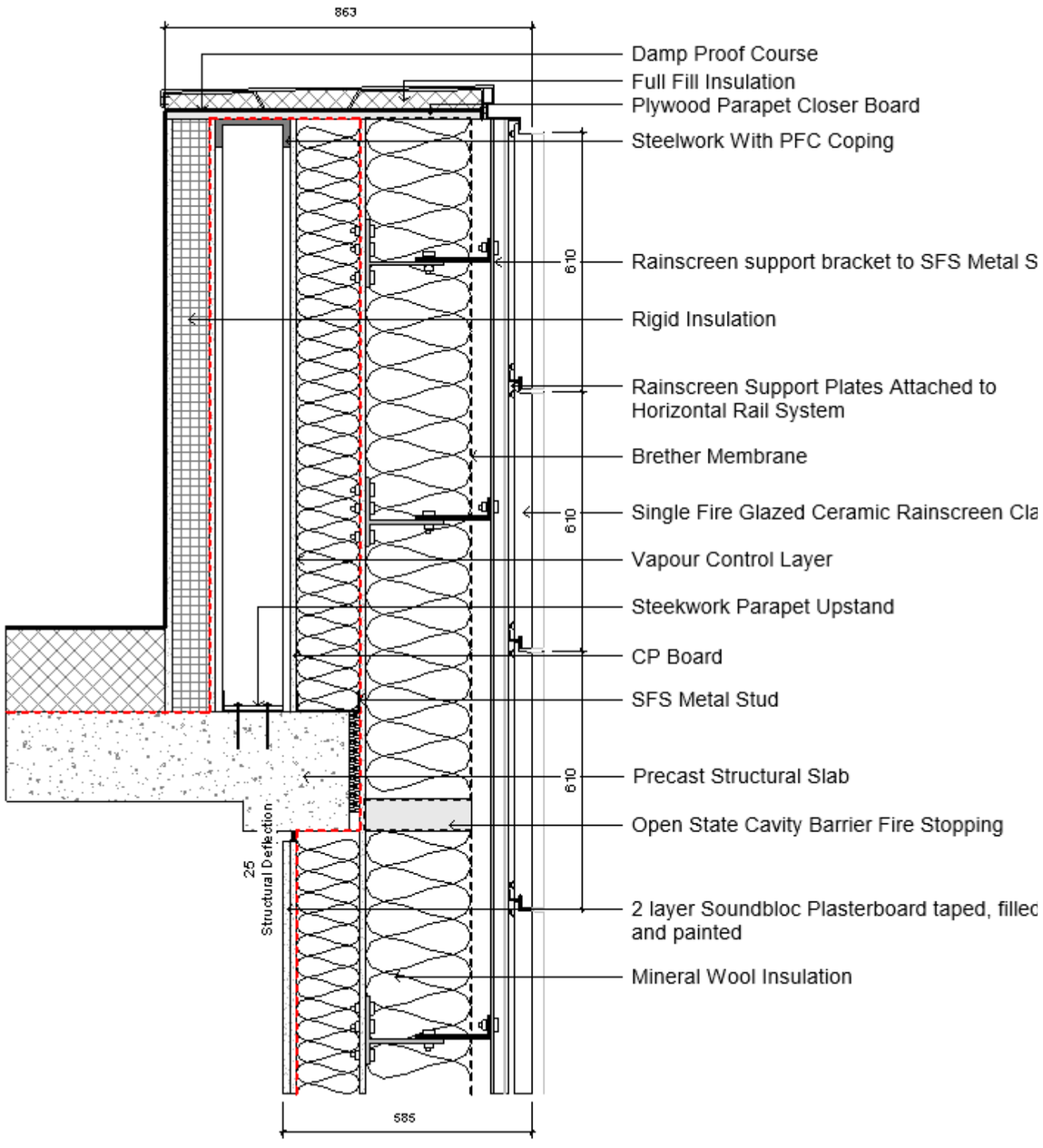


Fig76 - Parapet Detail (Author, 2021)

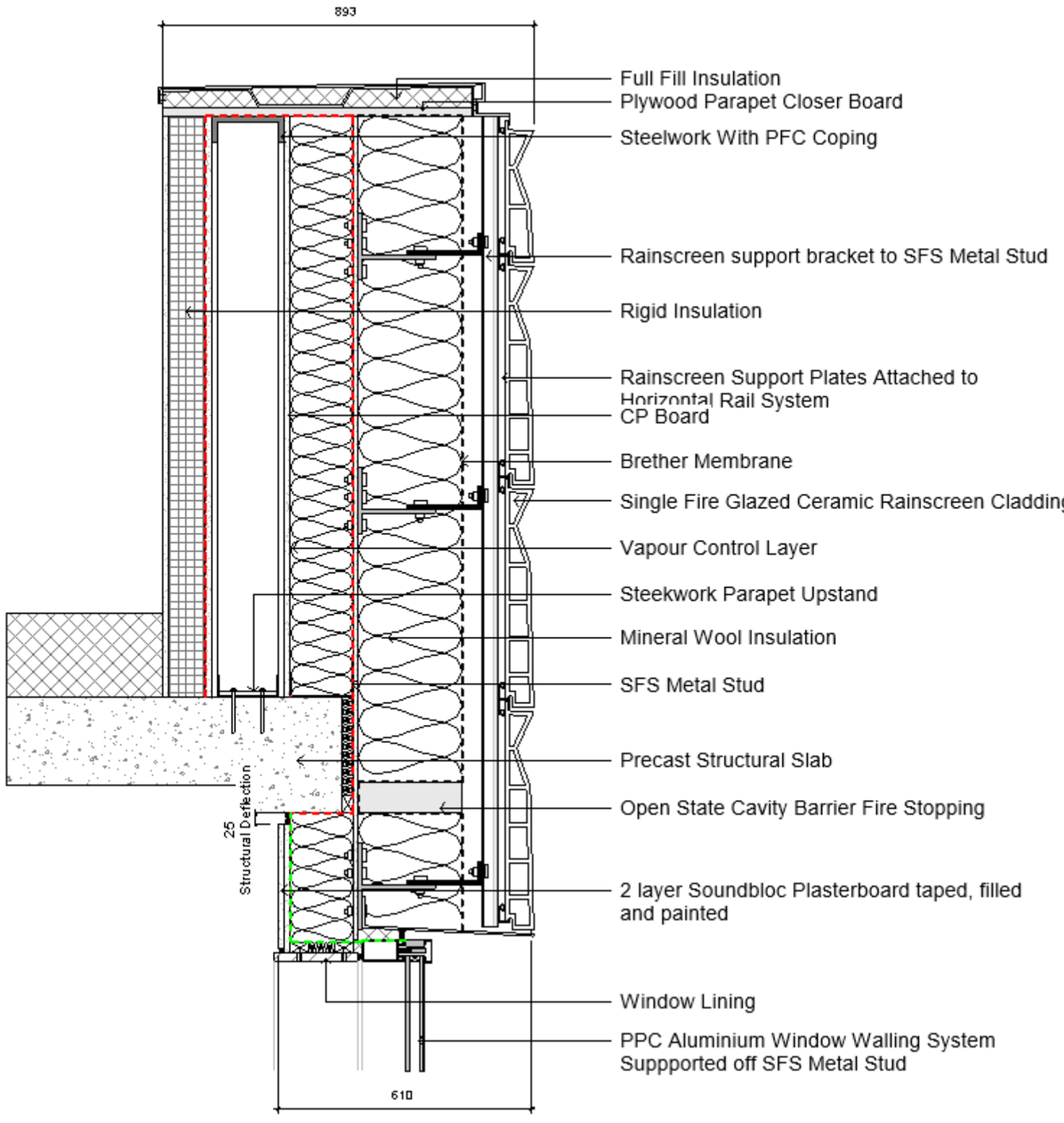


Fig77 - Parapet Detail 2 (Author, 2021)

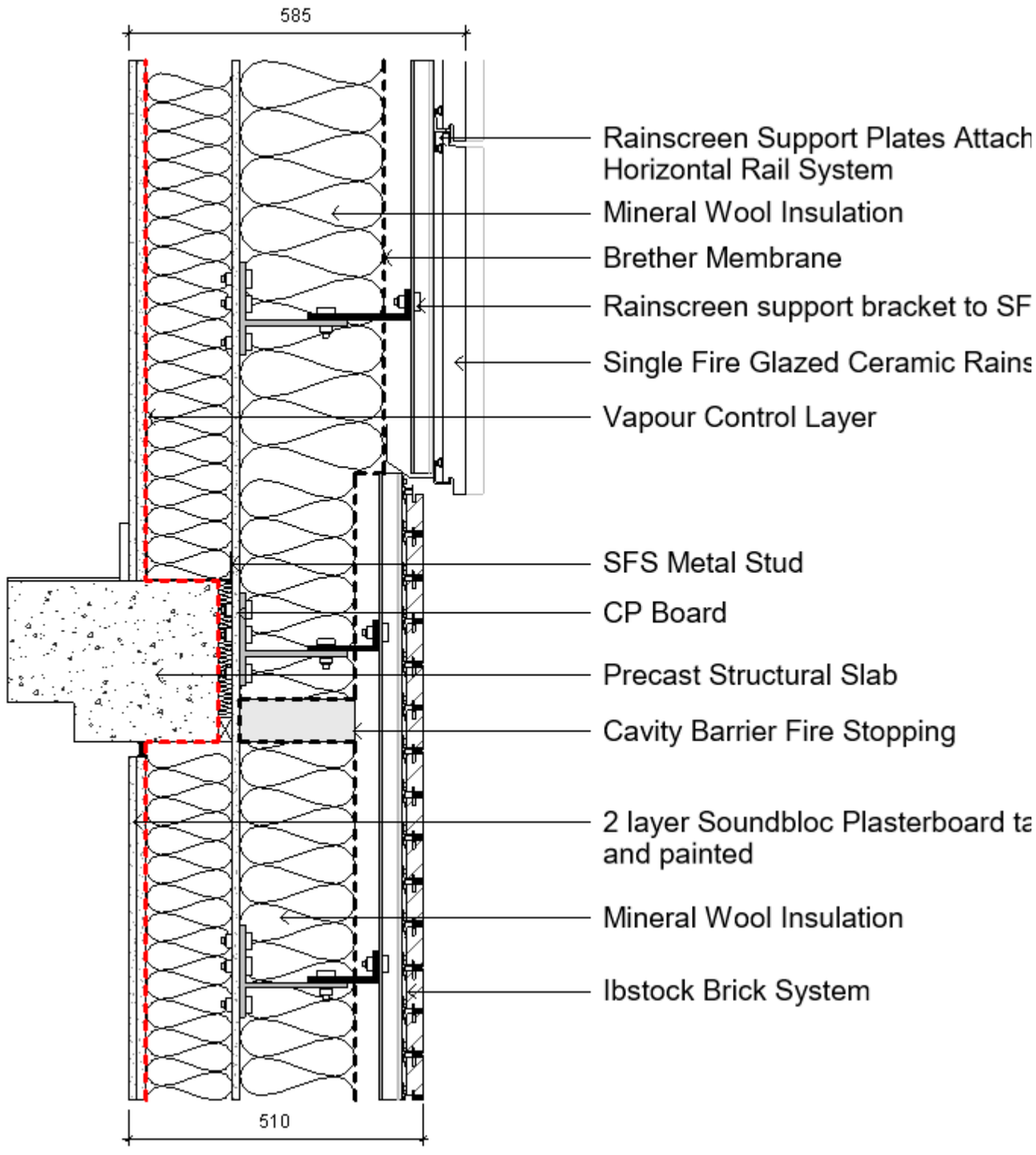


Fig78 - Facade Detail (Author, 2021)

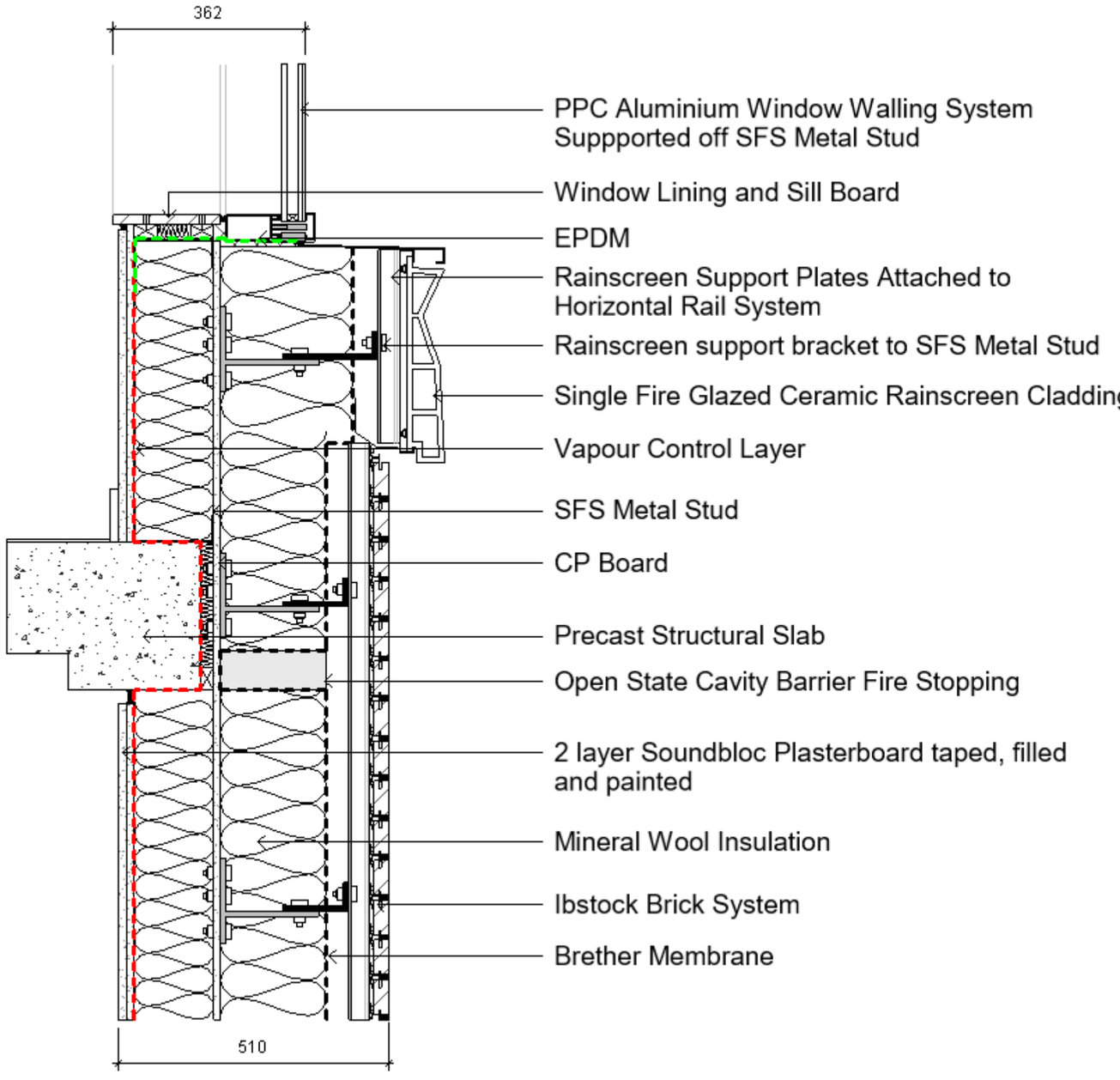


Fig79 - Facade Detail 2 (Author, 2021)

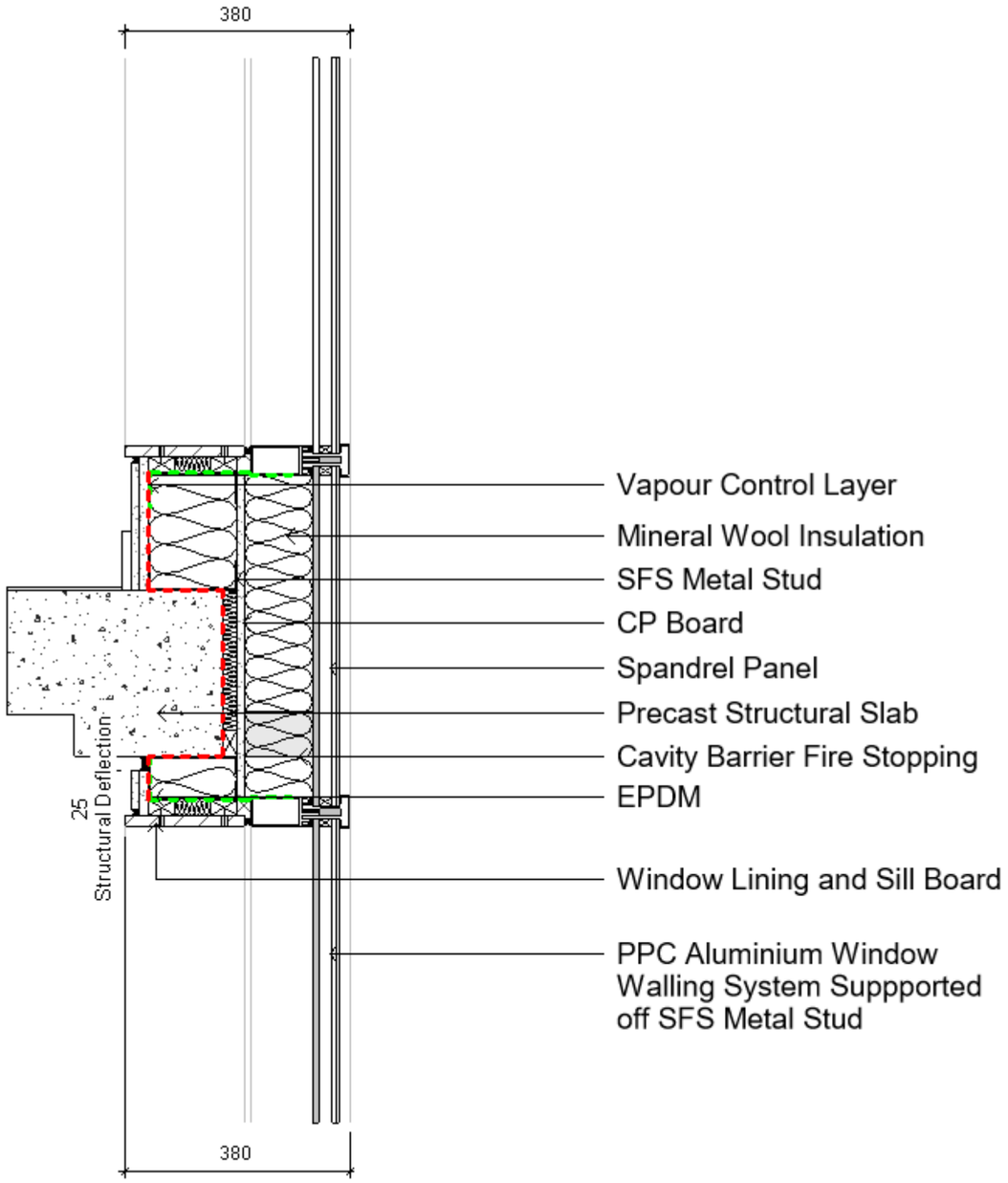


Fig80 - Spandrel Panel Detail (Author, 2021)

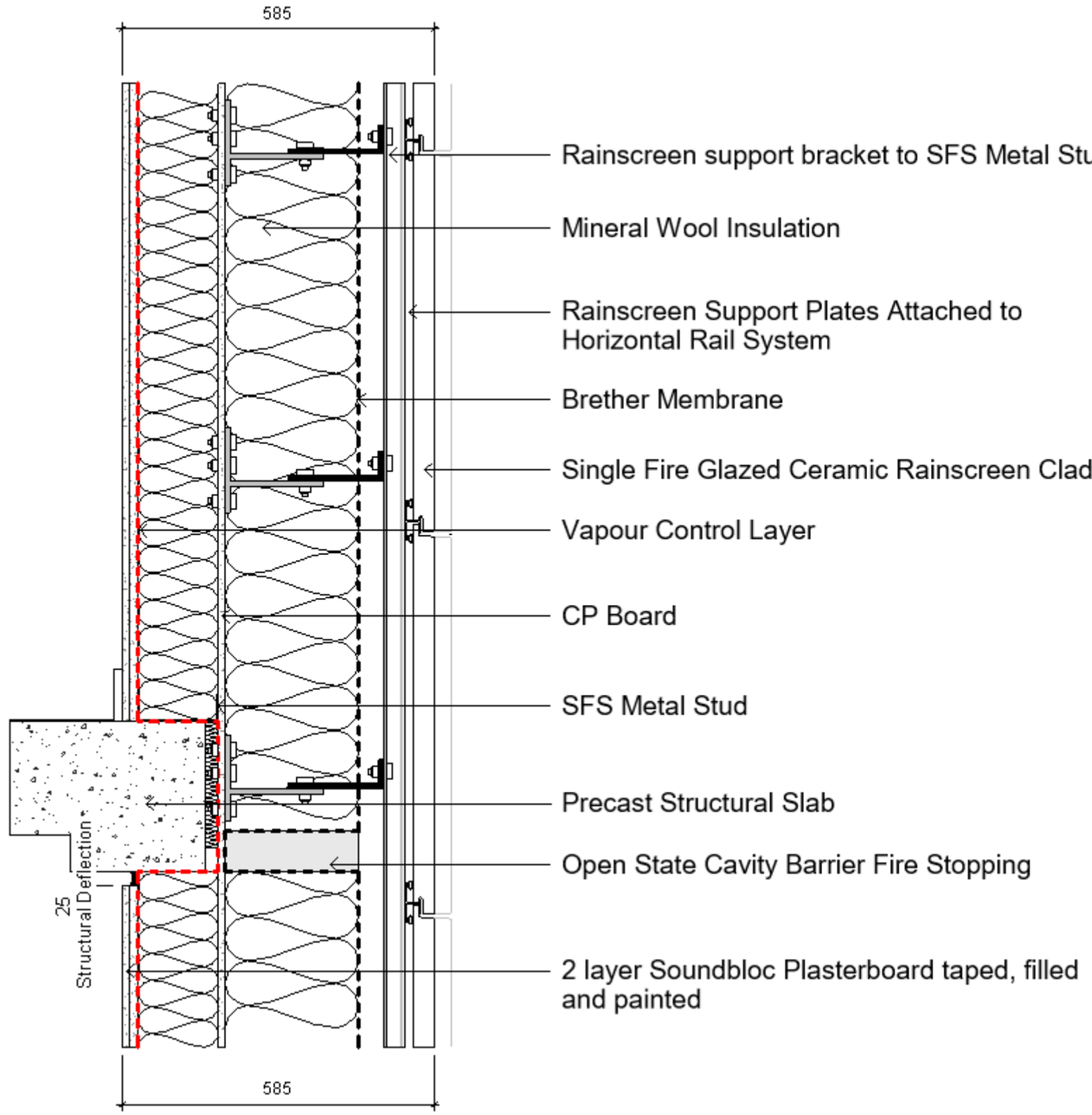


Fig81 - Facade Detail (Author, 2021)

2.G.2 Balcony and Terrace Components

Each student residential suite must have access to an external balcony from their common living room/kitchen. With external balconies come a range of design issues. The Schock Isokorb T type sk steel balcony system was specified because of its unique approach to dealing with these issues. The materials that are used in most balconies have higher thermal conductivity values. If a balcony has direct contact with the building structure, serious thermal bridging will occur. This system has 80mm of thermal insulation in between these two surfaces, which provides the area with a thermal break.

This system has several working parts. Product elements include the insulation element, a load plate, tension, shear and compression bars and levelling shims. The loads and deflection rates should be calculated by a structural engineer. There is a host of British standards which must be following when installing this system. Firstly, when calculated evenly distributed loads, BS EN 1991-1-1-1 should be referred to. The amount of concrete cover should match the requirements set my BS EN 1992-2-2. Calculation of deflection rates should be in accordance with BS 8500 (Shock, 2020).

The finishes of the balcony are as follows. There will be a grooved Ecodek Reversible Composite decking board laid on top of the steel structure. There will also be a royal chrome anodized Balconette glass balustrade orbit system running along the permitter of the balcony (Balconette, 2021).

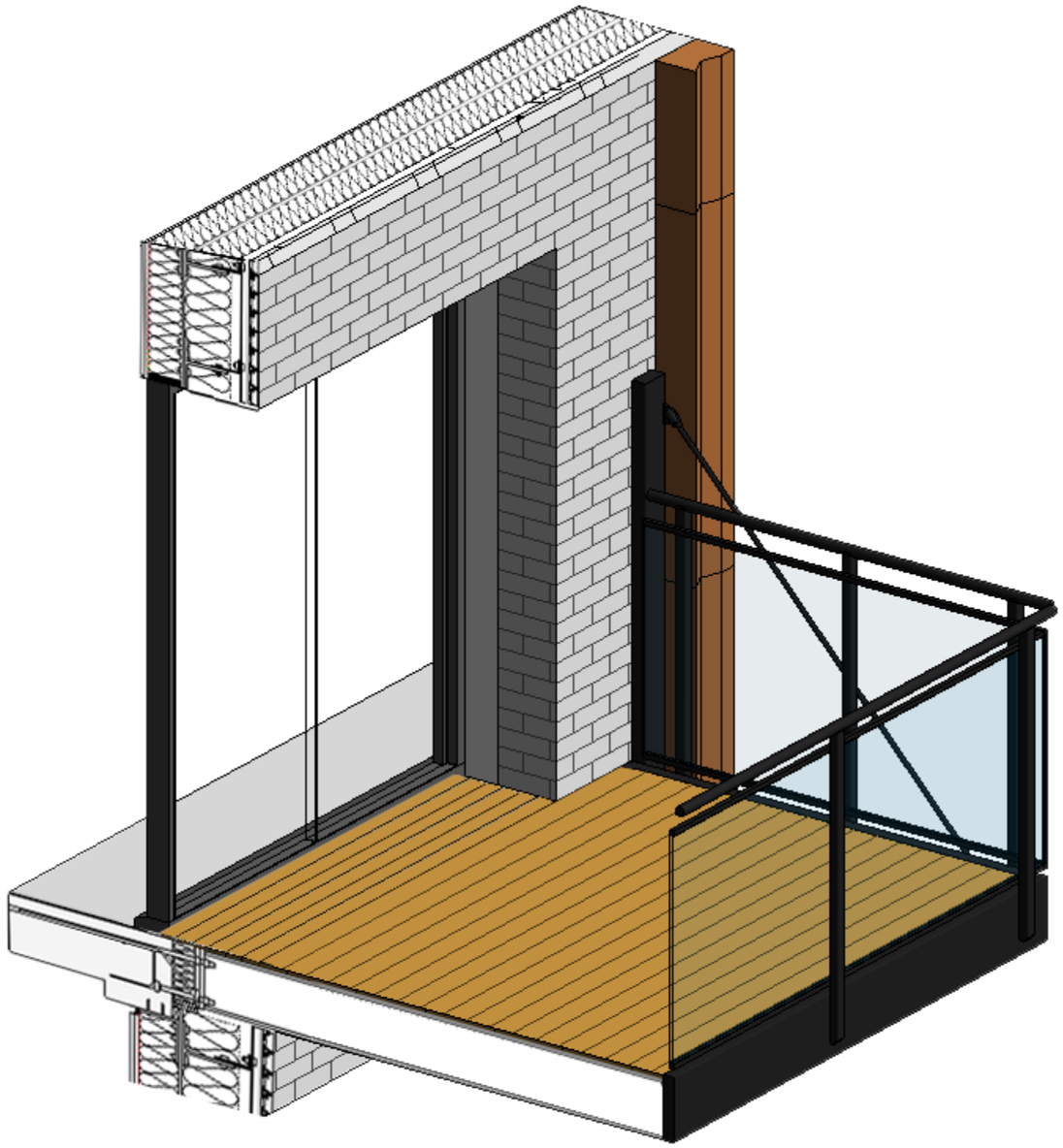


Fig82 - 3D Balcony (Author, 2021)

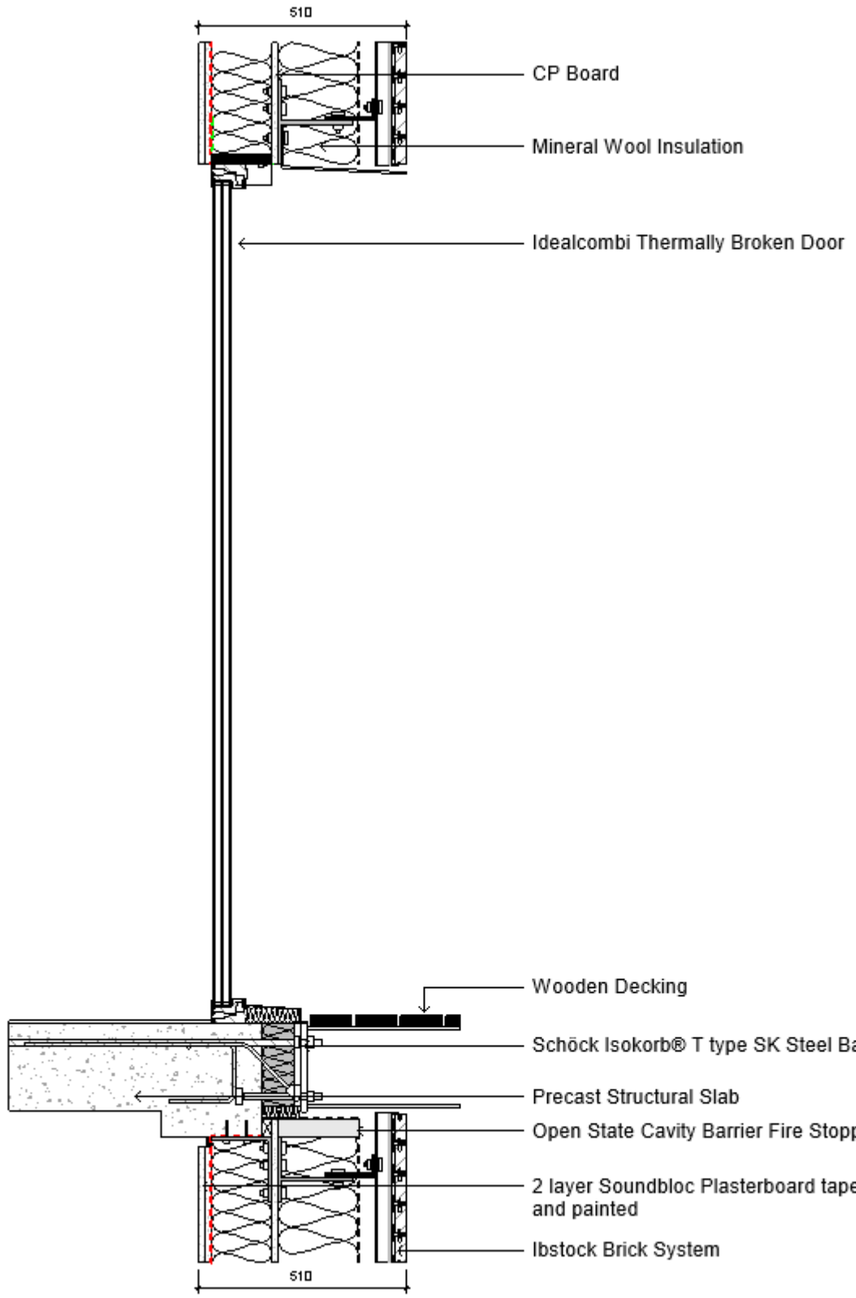


Fig83 - Balcony Detail (Author, 2021)

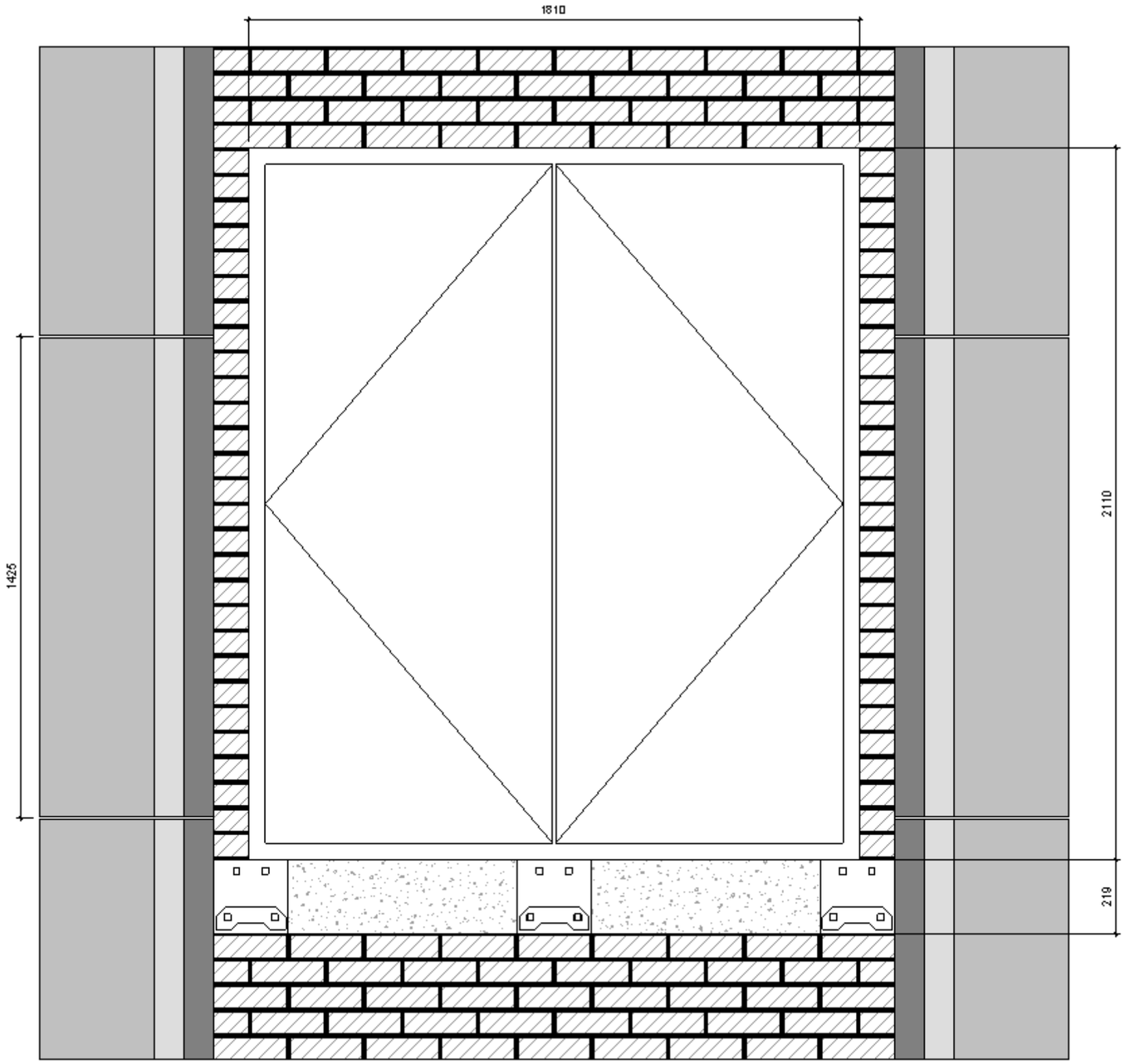


Fig84 - Balcony Elevation (Author, 2021)

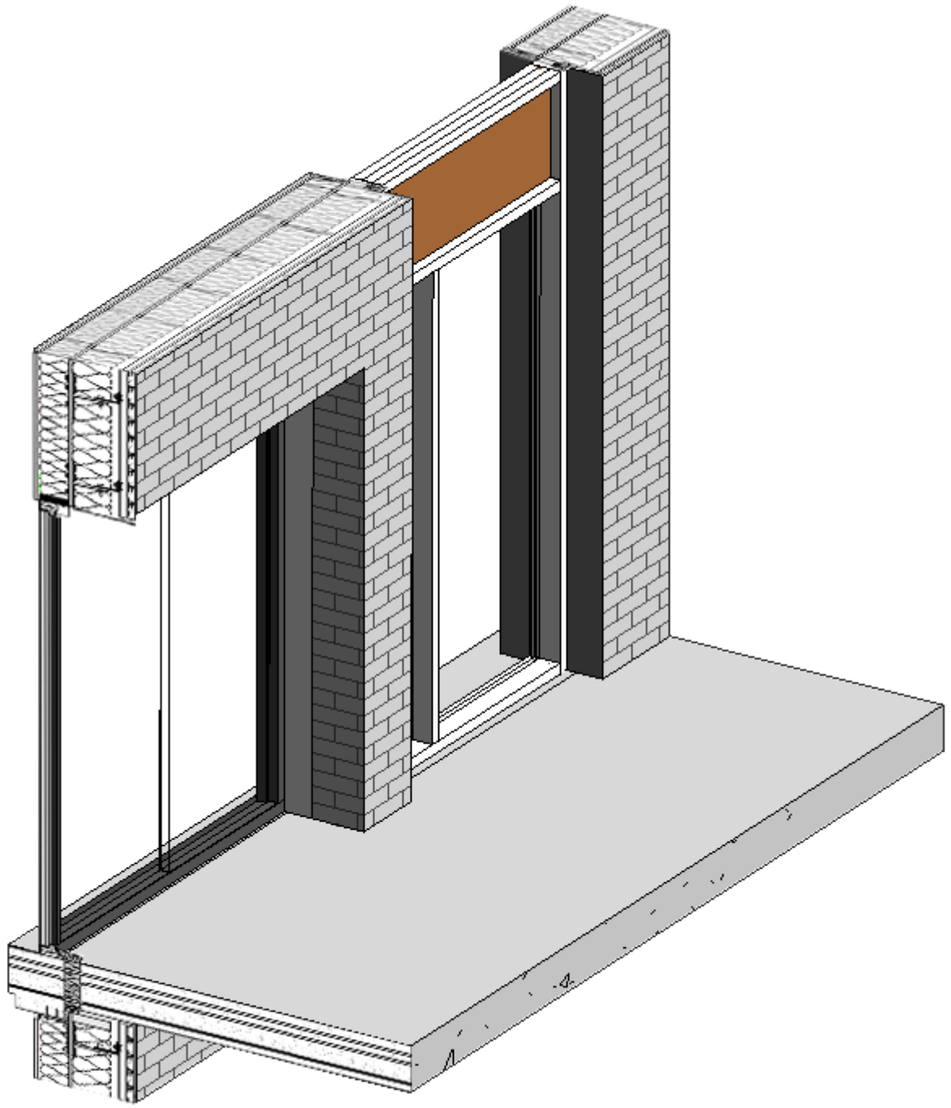


Fig85 - 3D Terrace (Author, 2021)

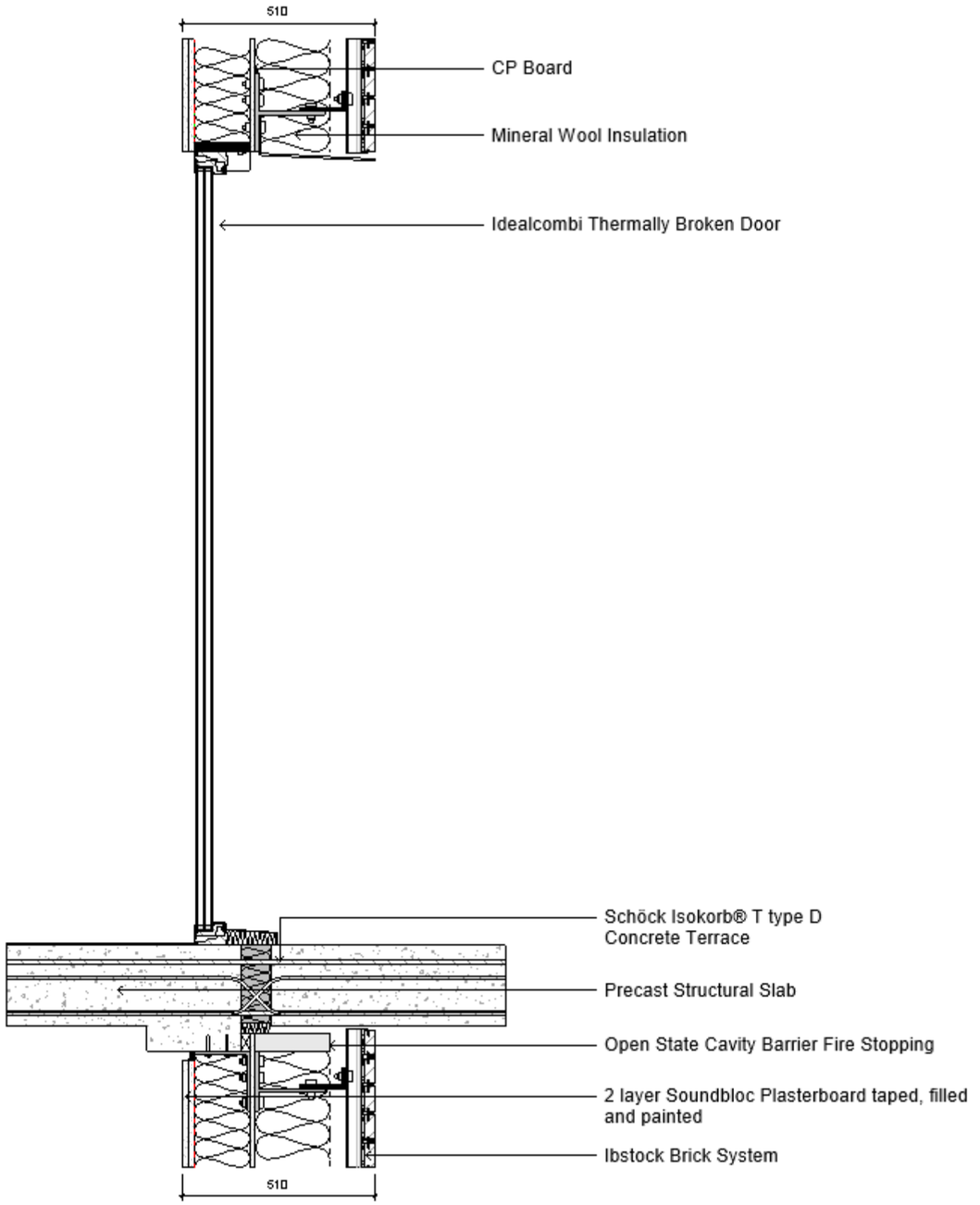


Fig86 - Terrace Detail (Author, 2021)

Each young-old apartment within the building requires their own covered terrace space. Due to the increased size of these, compared to the student balconies, and the fact that they are more built into the building, it was decided that a concrete structure would work best. Therefore, the Schock Isokorb T type D was specified. This system has the same thermal benefits as the type sk. However, it enables the terrace to be a continuous concrete floor, with the inclusion of an 80mm insulated thermal break. Both systems are BBA certified and have a fire resistance class of REI120 (Schock, 2020).

2.G.3 Specialist External Area

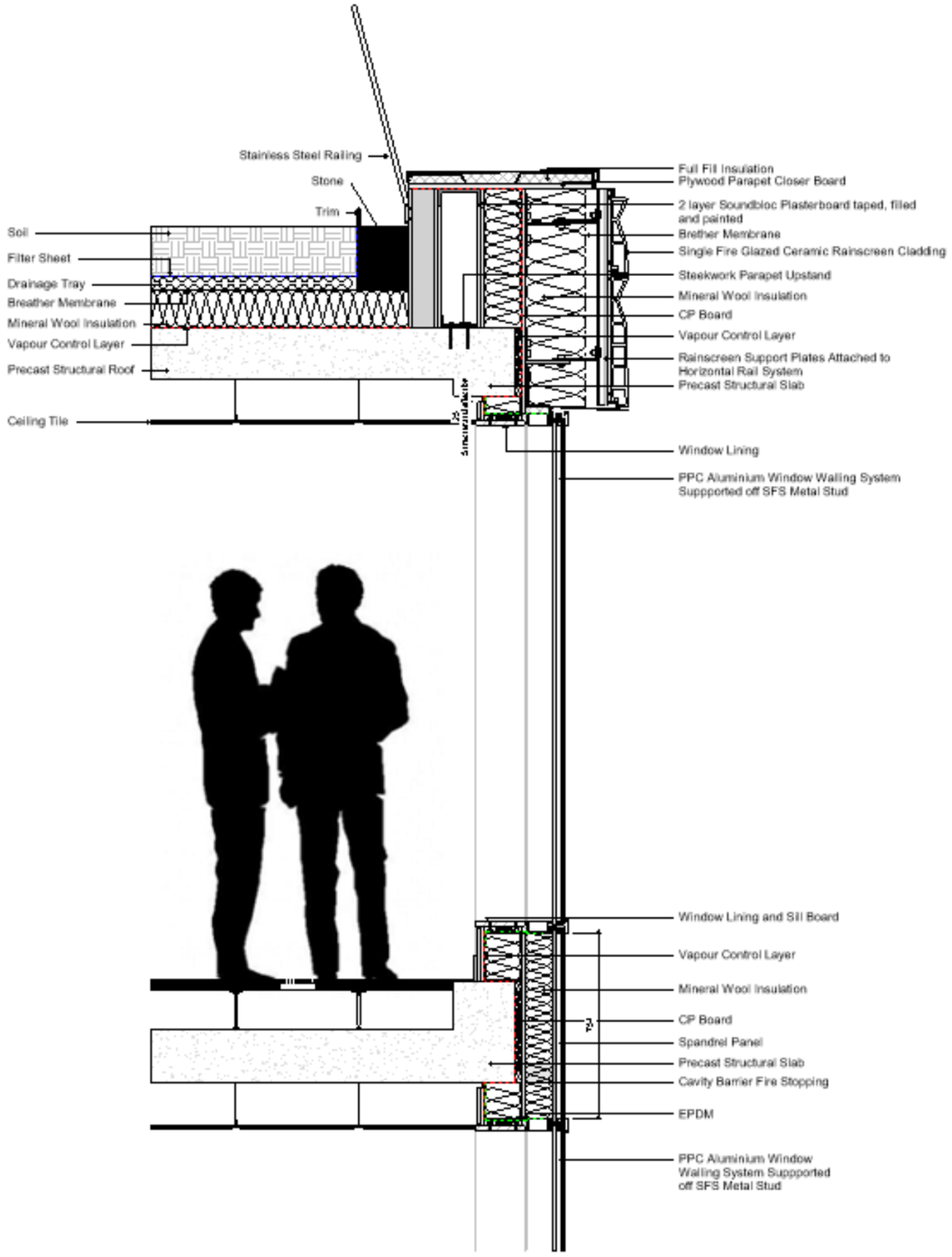


Fig87 - Green Roof Detail (Author, 2021)

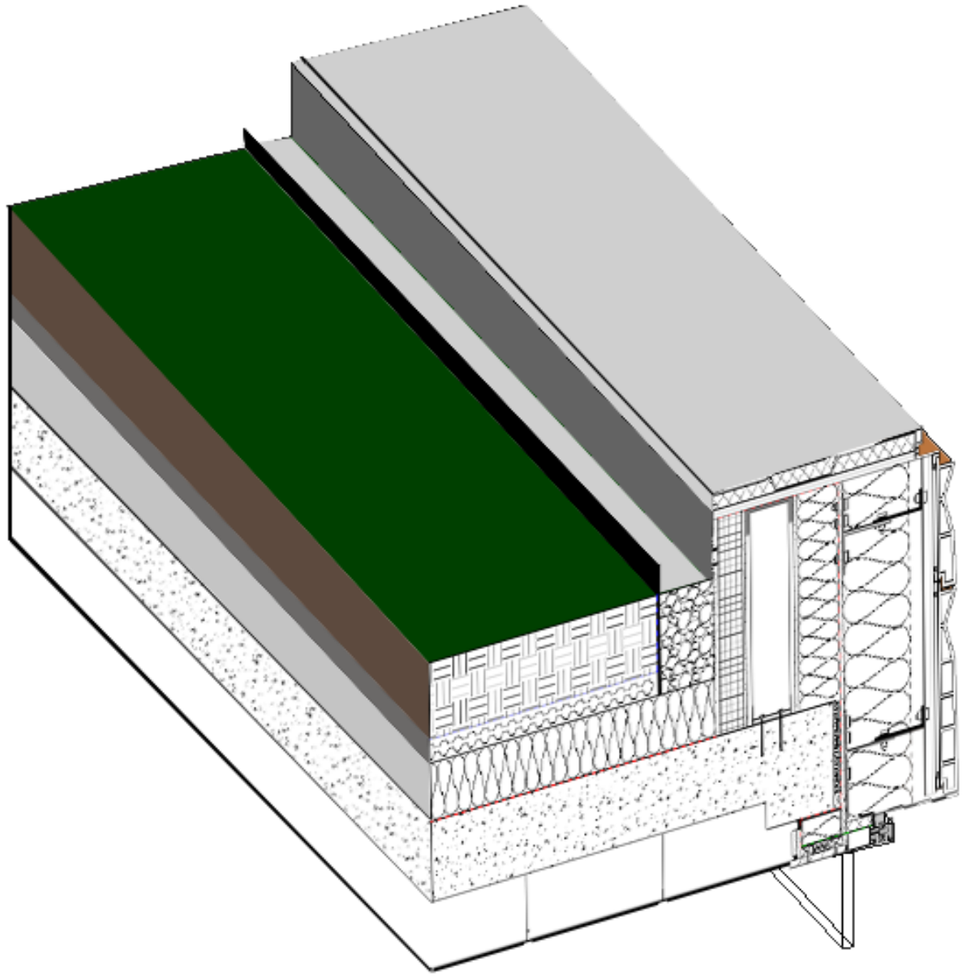


Fig88 - 3D Green Roof (Author, 2021)

The building has an intensive green roof on level 02, which residents can access. When designing this aspect, it was important that the meeting of the green roof and façade system was properly thought out. The Bauder turfed intensive green roof system was specified. As seen within the details, there are various parts to this system, one of which is the drainage tray which enables storm water management. Along with the environmental benefits, such as the natural insulation this system provides, all the protection, filtration layers, drainage boards and substrates can utilise recycled materials (Bauder, 2021).

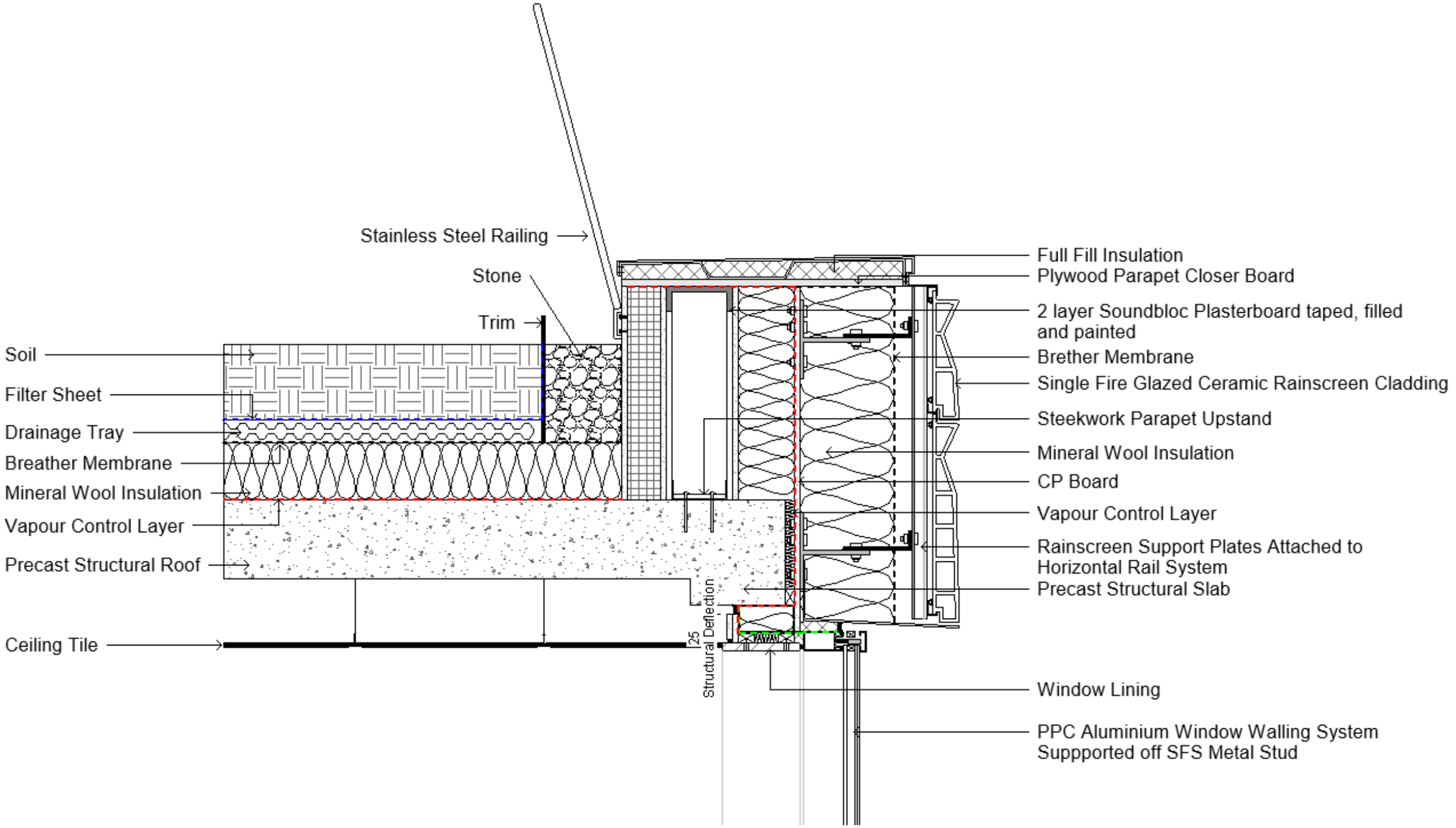


Fig89 - Green Roof Enlarged Detail (Author, 2021)

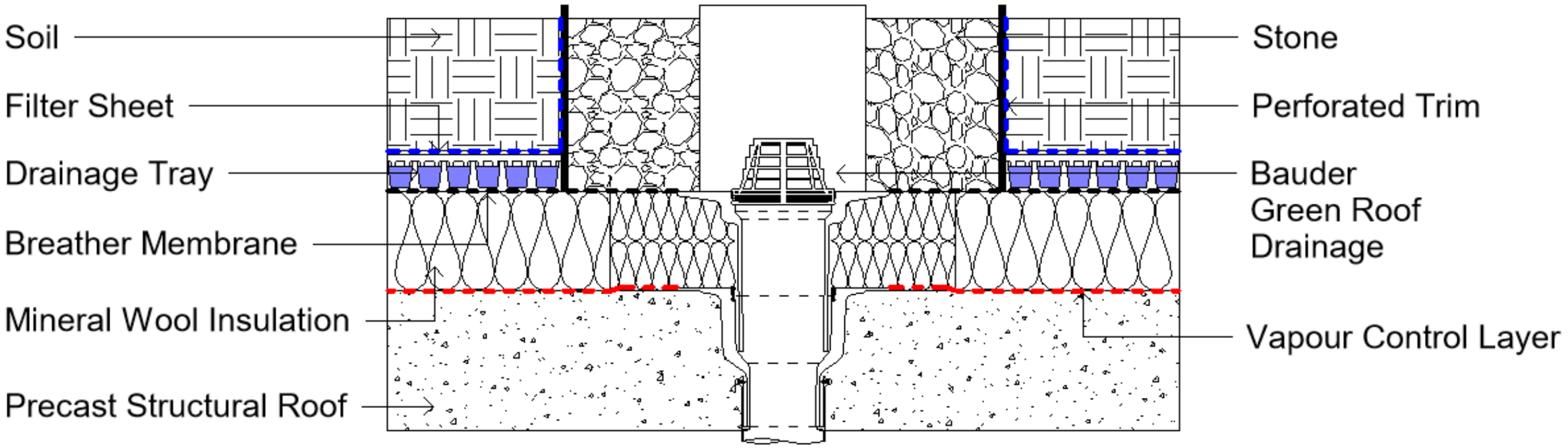


Fig90 - Drainage System (Author, 2021)

As mentioned, within the green roof there is a grey water drainage system. This detail gives a closer look at how that will be installed. The drainage runs through the floor slab and heads towards a commercial scale grey water treatment system stored within the large ground plant room. This system will provide a host of environmental benefits including, freshwater conservation, less water wastage and reduced energy consumption (Conserve Energy Future, 2021).

2.G.4 Specialist Internal component

The office spaces and social areas located on the first floor will utilise an underfloor ventilation system. The Kingspan RMG600 Raised access floor panels will be specified in these areas. The design of this flooring should be in accordance with EN13501 Parts 1 and 2. With raised floors comes the challenge of proper fire design. This system has a class 0 BS476 fire rating.

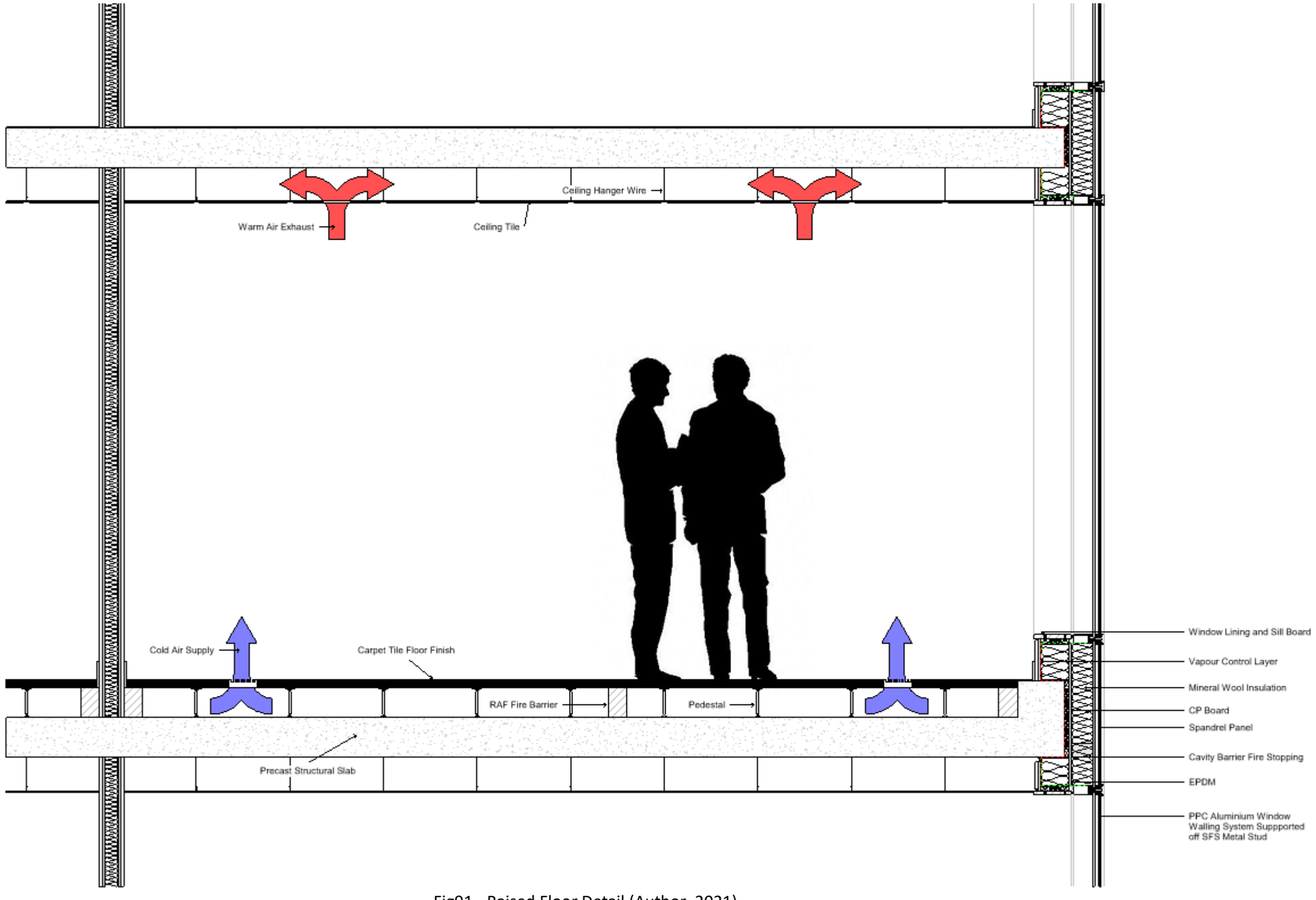


Fig91 - Raised Floor Detail (Author, 2021)

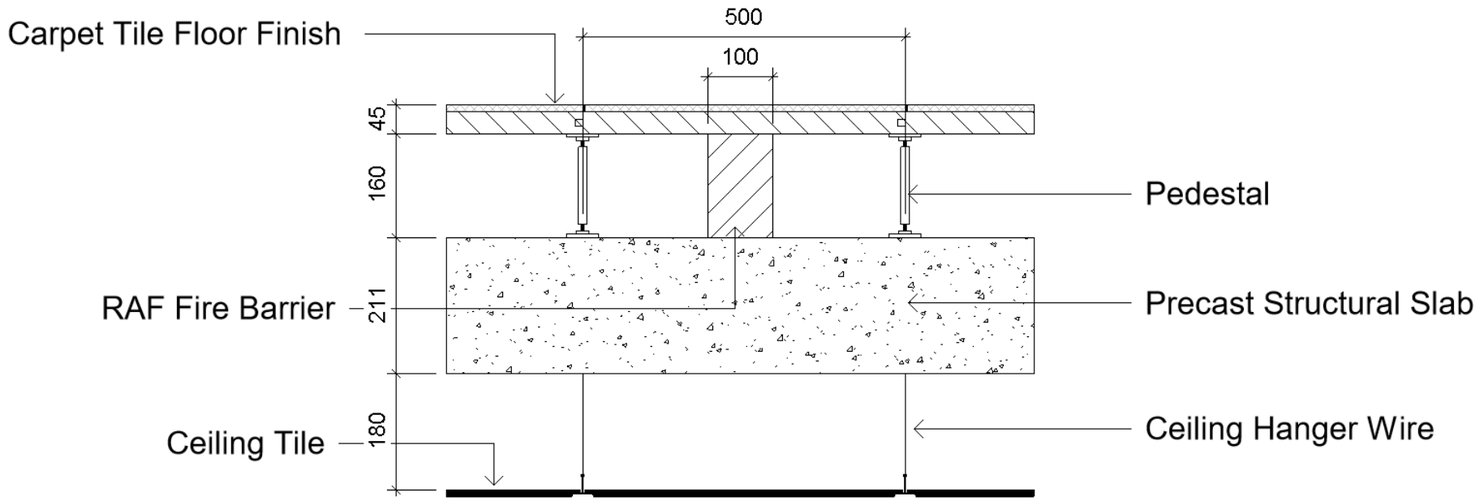


Fig92 - Fire Barrier Detail (Author, 2021)

Within raised access floor systems, it is important to ensure that sufficient fire barriers are installed. A foiled faced Rockwool fire and smoke barrier will be placed. These barriers will provide up to 2 hours of fire protection and will reduce airborne sound transmission within the spaces. They fully comply with BS 476.

The Kingspan RMG600 Raised Access system has been tested for fire performance. The system was tested against in accordance with BS476-6 & BS476-7 (Kingspan. 2021).

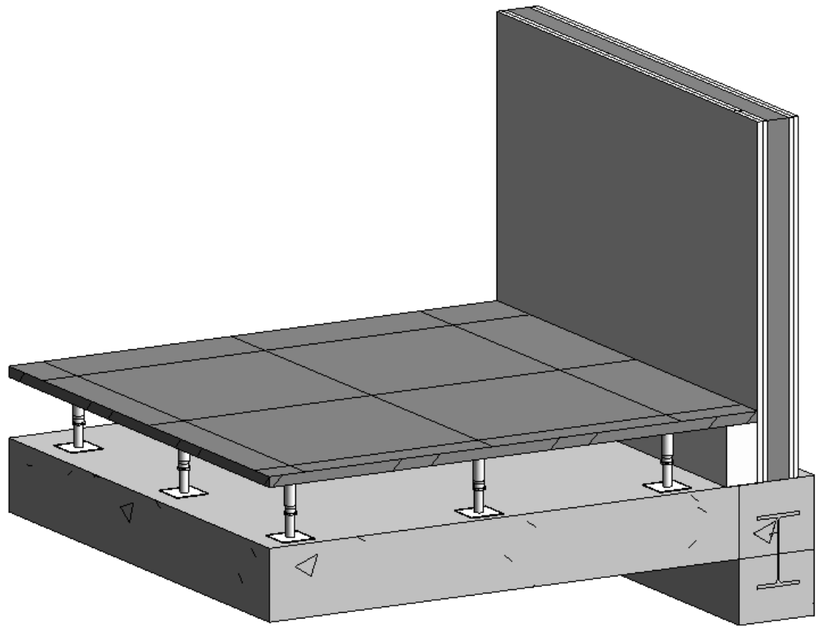


Fig93 - 3D Raised floor (Author, 2021)

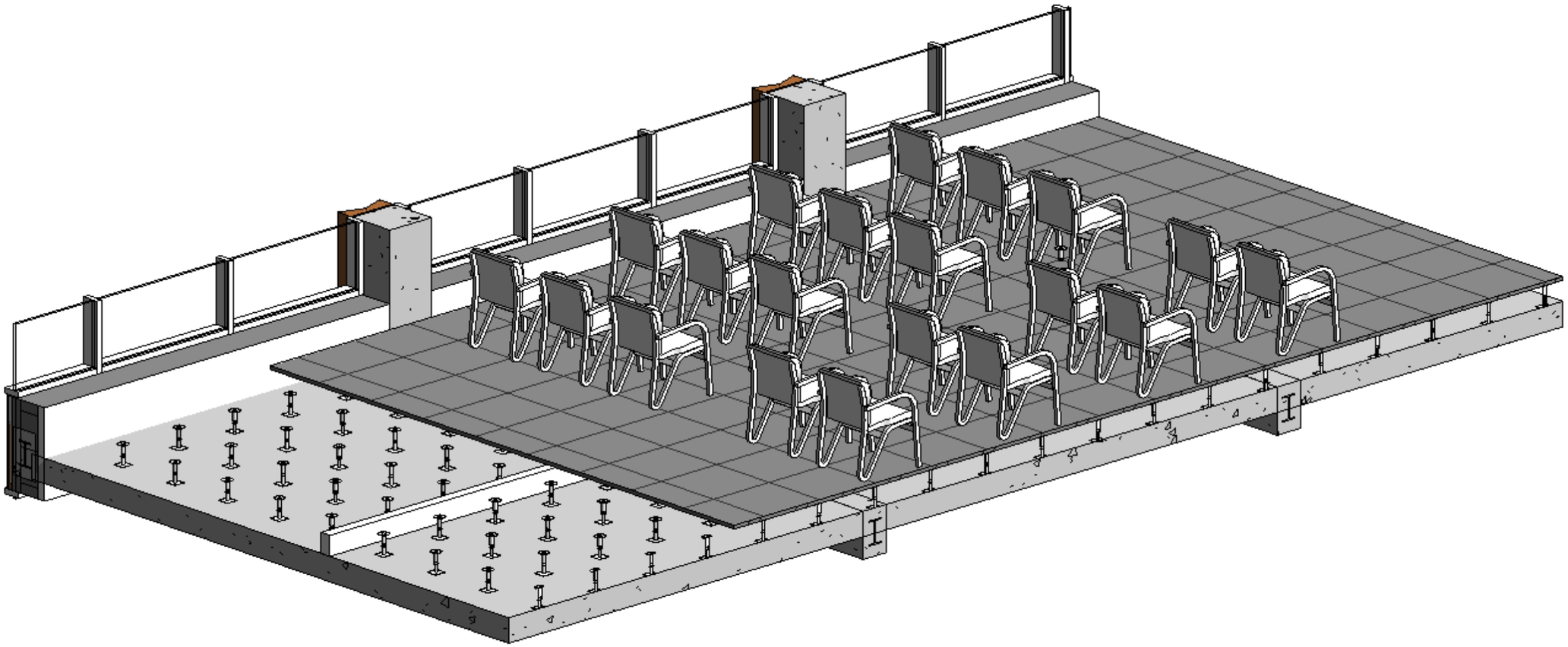


Fig94 - 3D Raised floor (Author, 2021)

3.0 **Health and Safety**

When considering fire design, the key regulations are to be found within **BS 9991: 2015**. This document fully sets out the four different aspects of fire design, which are:

- Means of Escape
- Internal Fire Spread
- External Fire Spread
- Access/facilities for fire fighting

Additional guidance on these aspects can also be found within **Technical booklet E**. Typical design considerations which has affected the approach of the overall building design include:

- Height of Building
- Building use
- Building location

Within the design of the intergenerational housing scheme there are many aspects which require proper fire consideration. Within each section of this report, references has been made to relevant challenges and the necessary building regulations which relate to the various elements.

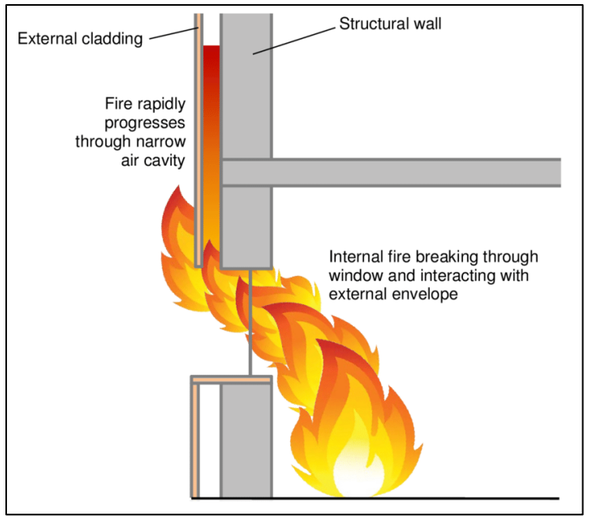


Fig95 - Rainscreen Fire Egress (FSC1, 2021)

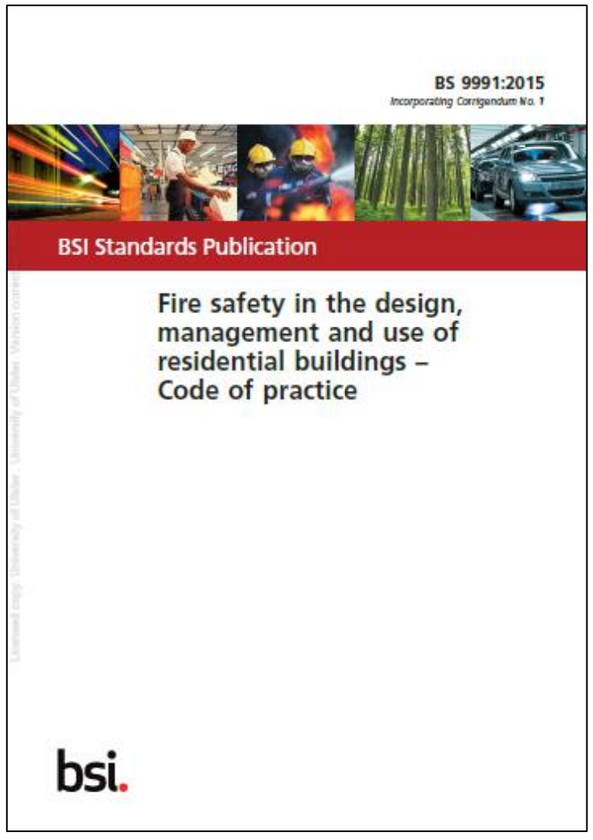


Fig97 - BS 9991:2015 (British Standards, 2015)

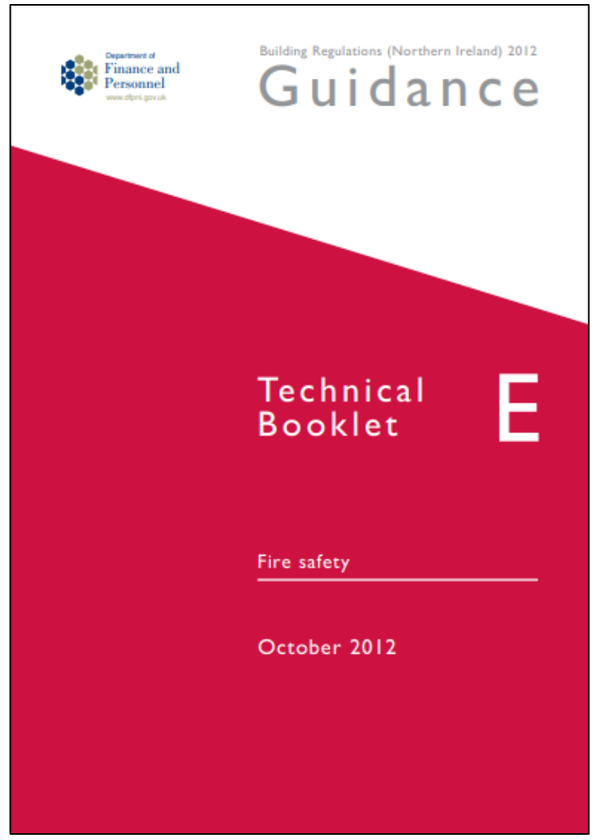


Fig96 - BS 9991:2015 (British Standards, 2015)

Fig98 - Building Fire (Designing Buildings Wiki, 2021)

3.A GA Fire Egress Drawing

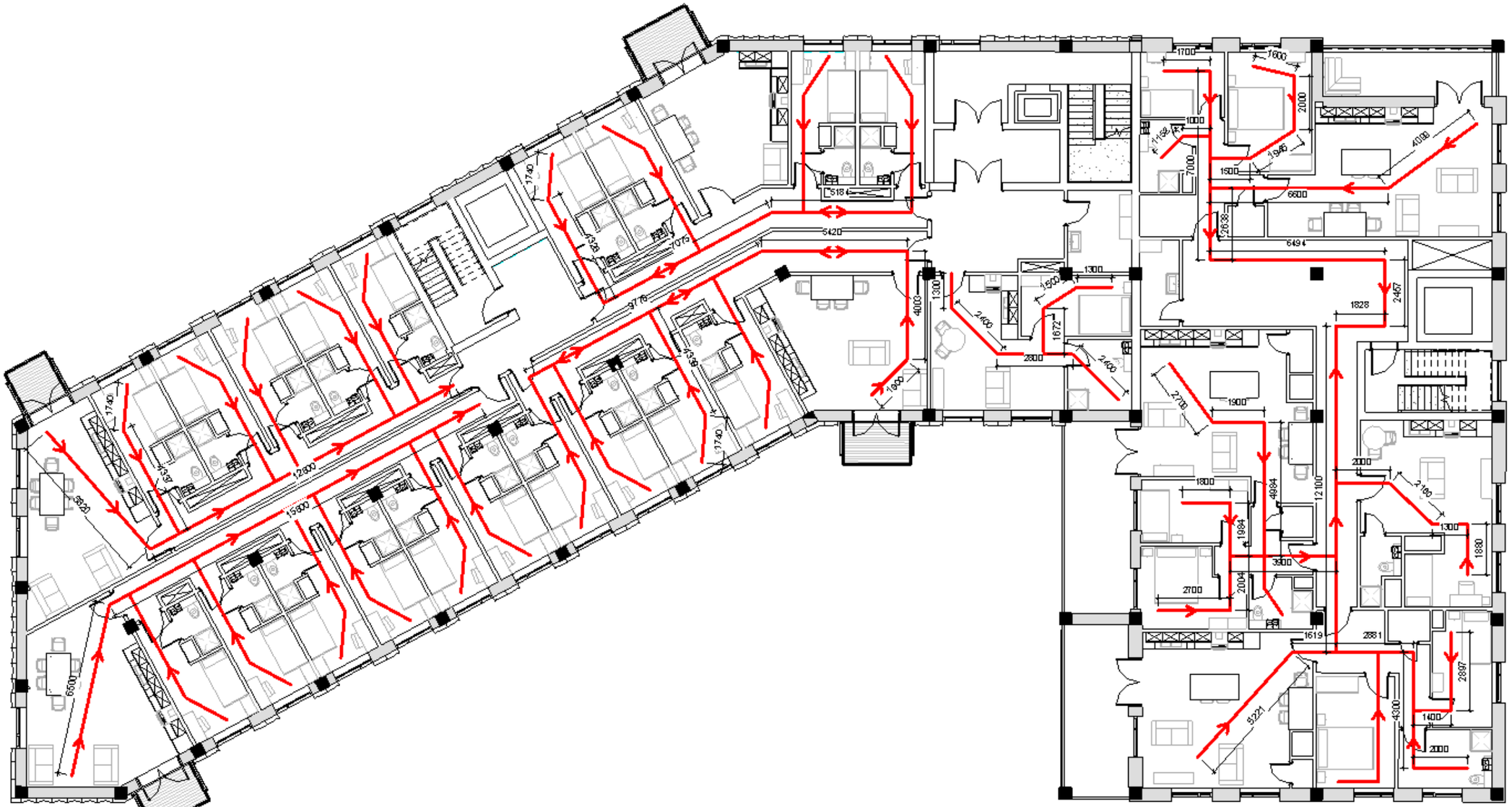


Fig99 - GA Fire Egress Plan (Author, 2021)

This is the typical residential floor plan of the building. Distances to the fire protected lobbies, from the furthest points, have been noted.

3.B Enlarged Fire Lift Core Plan & Sections

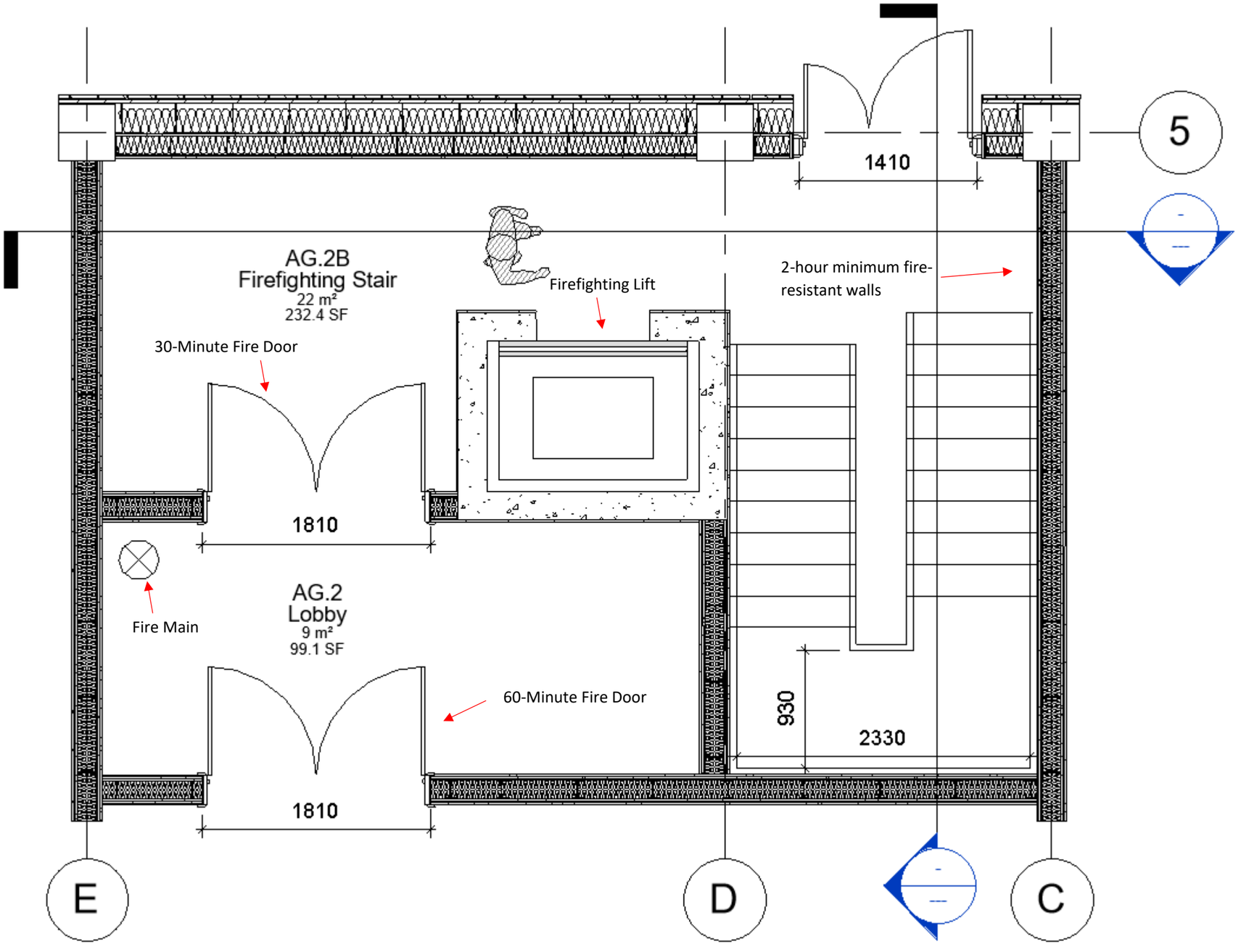


Fig100 - Enlarged Fire Core Plan (Author, 2021)

When designing the fire lift core, BS 9999:2017 was referred to. Within this space there had to be a firefighting lift along with an escape stair. The floor plan provided shows the protected area at access level, north side of the building. This layout was informed by figure 24 within BS 9999: 2017. Required elements include:

- 60-minute fire door with a smoke seal which provides access to the circulation space within the building
- 30-minute fire door with a smoke seal which provides access to the fire lobby
- Fire main provided within lobby
- Firefighting lift
- 2-hour minimum fire-resistant walls

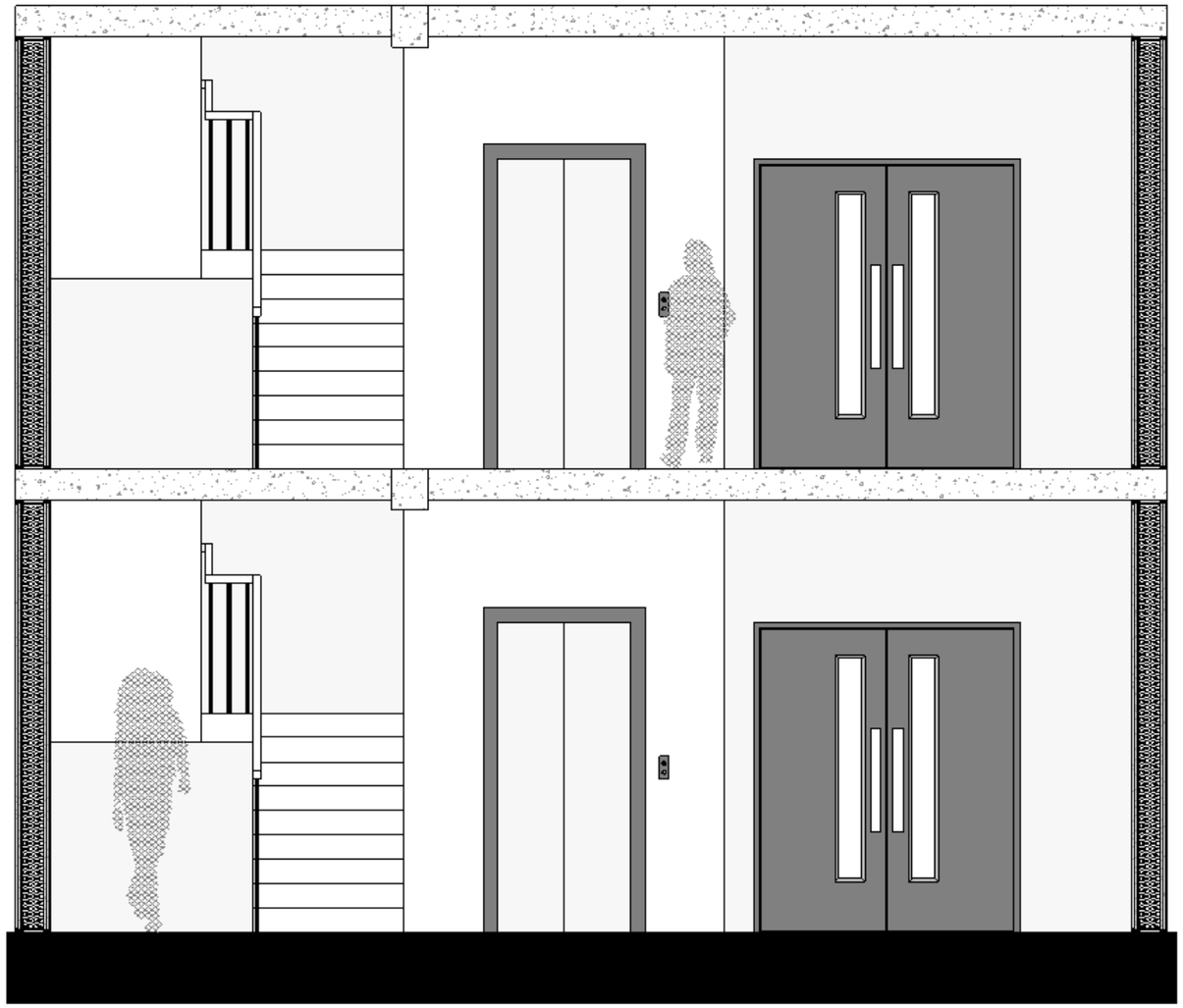


Fig101 - Enlarged Fire Core Section (Author, 2021)

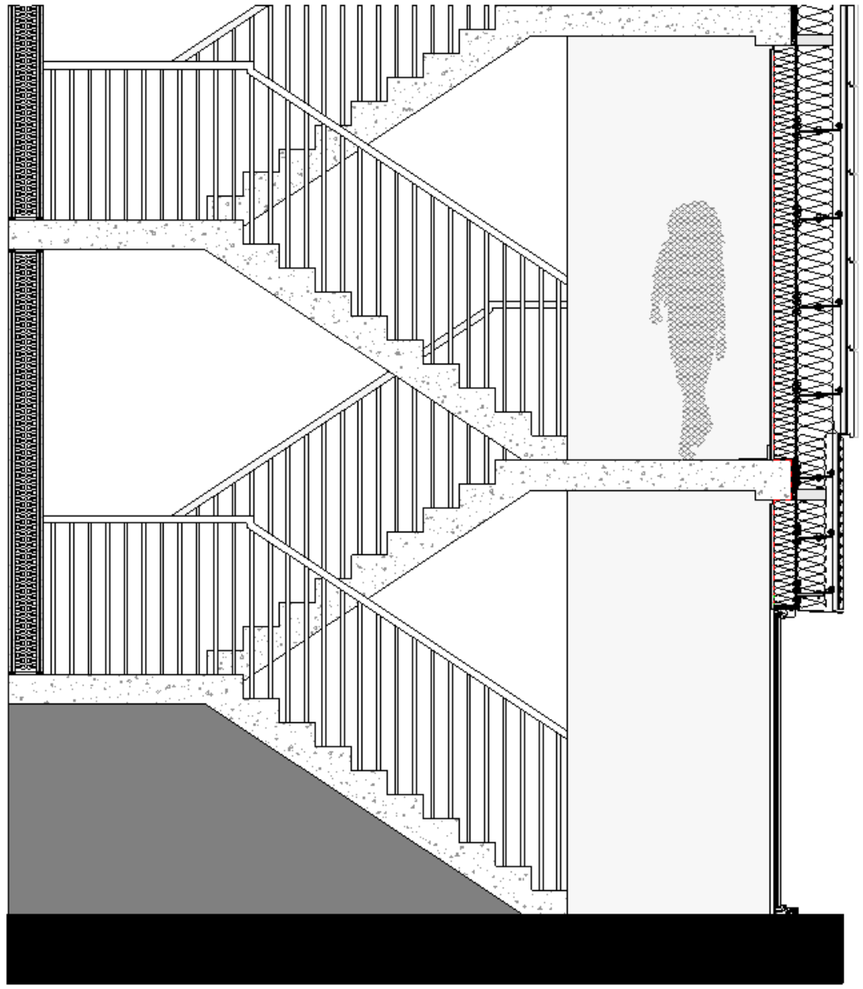


Fig102 - Enlarged Fire Core Section (Author, 2021)

4.0 **Environment and Sustainability**

4.A Overview of Applicable Sustainable Elements

Green Roof

The natural insulation green roofs provide will have a positive effect to the building's energy costs. The grey water drainage is also a sustainable feature within this system.

Rainscreen Façade

The rainscreen ceramic and brick façade will allow the thermal insulation to be fixed to the outside of the building. This will decrease the chances of any thermal bridges from occurring, which will prevent mould and condensation. This will ultimately improve the buildings thermal performance.

Raised Floor System

The raised floor ventilation system, which is incorporated into the design of the first floor, will require less air volume, fan power and the temperature of supply air can also be lower than traditional methods.

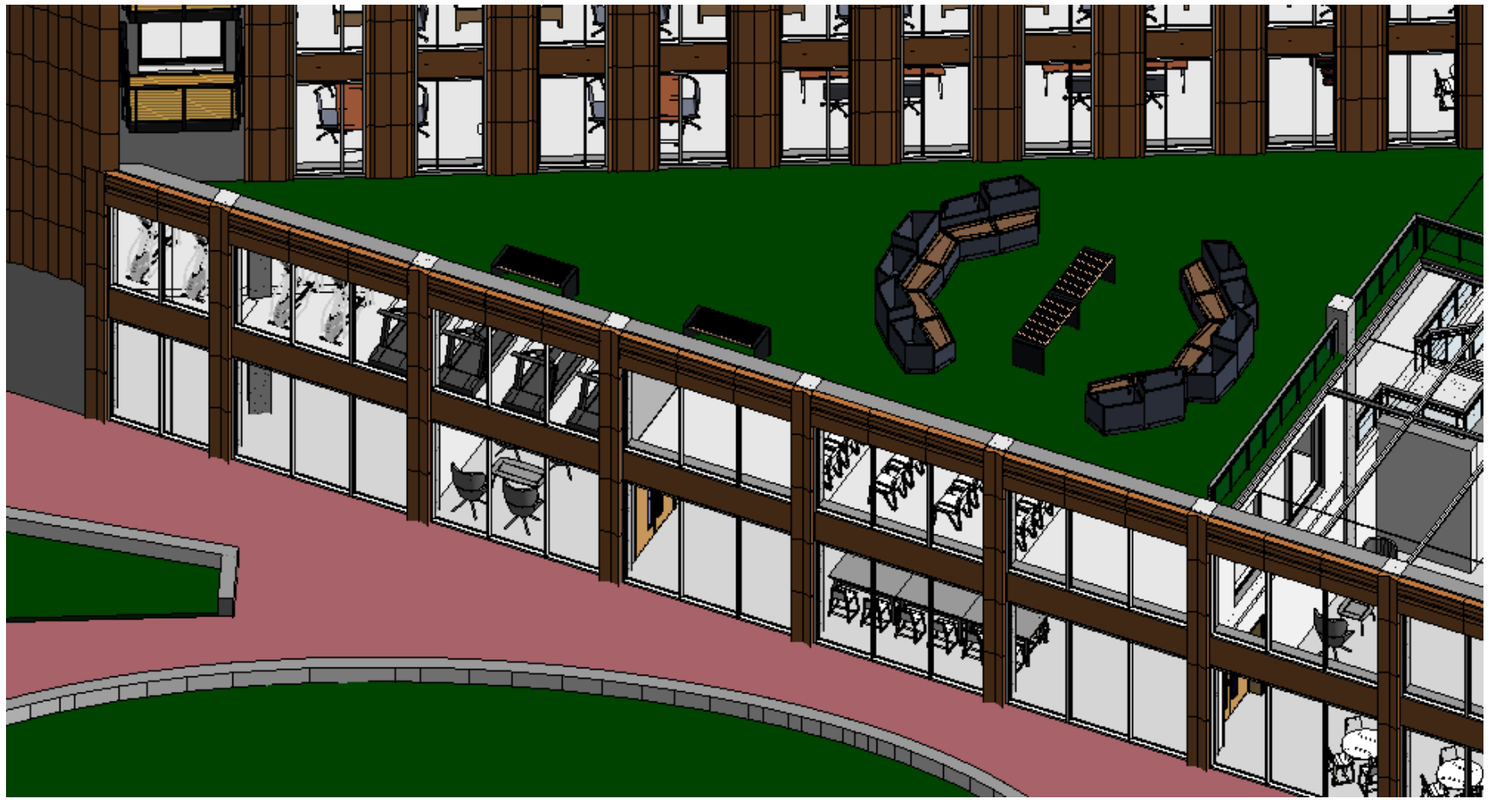


Fig103 - Green Roof Model (Author, 2021)

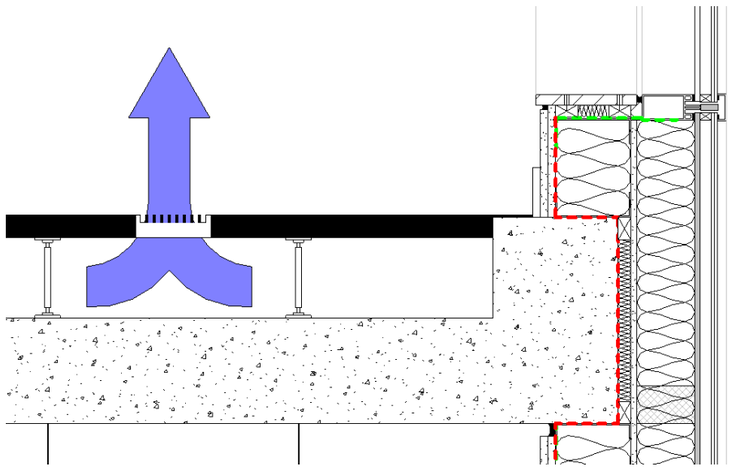


Fig104 - Raised Floor Detail (Author, 2021)

Fig105 - Balcony/façade Model (Author, 2021)

4.B Evidence of Research and Testing

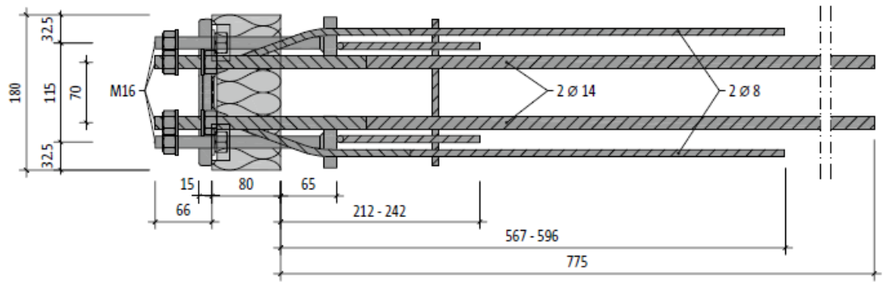


Fig106 - Isokorb T type SK (Schock, 2021)

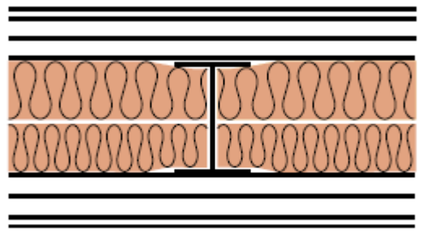


Fig107 - FireWall (British Gypsum, 2021)

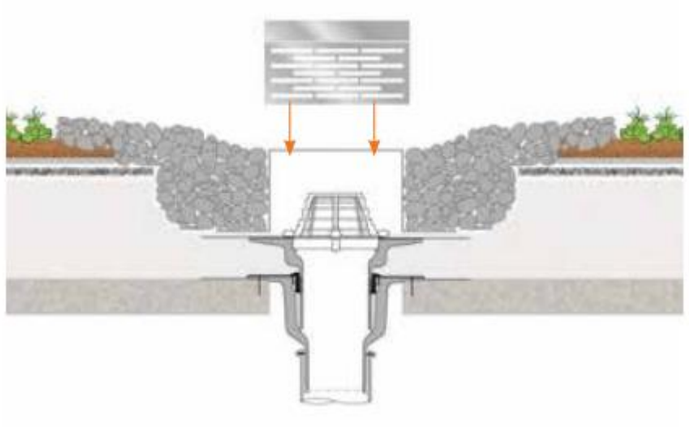


Fig108 - Inspection Chamber (Bauder, 2021)

Fig109 - Mechslip System (Ibstock Brick, 2021)

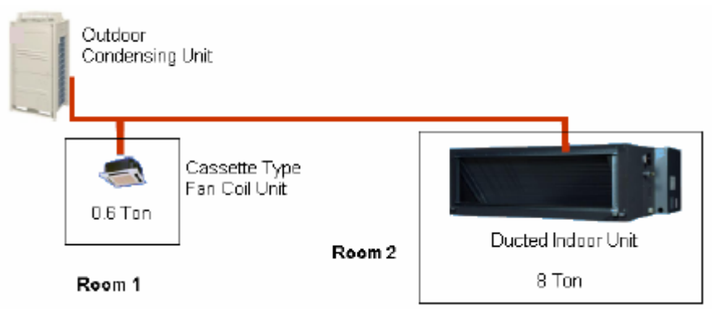


Fig110 - VRF System (CED Engineering, 2014)

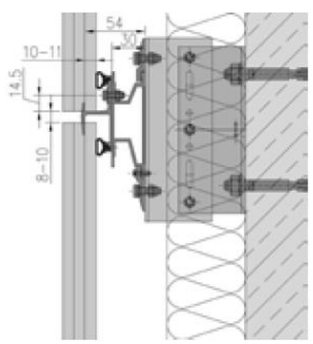


Fig111 - Vertical Installation (NBK, 2021)

Several manufacturers literature was referred to when designing components across the building. Their documentation was read to gain an understanding of the products. This helped when implementing them into technical details.

Documentation used for research include:

- Technical Information Schock Isokorb T type SK
- Technical Information Schock Isokorb T type D
- White Book C04 S02 GypWall Classic
- White Book C05 S03 Specialist Partitions FireWall
- Bauder Green Roof System Brochure
- CED Engineering HVAC Variable Refrigerant Flow Systems
- Ibstock Mechslip Technical Guide
- NBK Architectural Terra Cotta

4.C Illustrated Statement on Services and Specifications

Before Specifying a product for the project, a review of their environmental and sustainable attributes was undertaken. This involved sourcing product technical booklets and, in some cases, inspecting Environmental Product Declaration (EPD) documentation. All EPD documentation published by manufactures must be in accordance with ISO 14025 and EN 15804. With the information which they provide, it gave the designer a better understanding of what environmental impacts will occur from the specification products.

12. Recycling

Despite the potential longevity of fired clay products, they are sometimes demolished well before the end of their useful life.

The following are possible uses for recycled clay building materials:

- Reclaim and re-use.
- Filling and stabilising material for infrastructure works.
- Aggregates for in-situ and precast concrete and mortars.

The majority of the aluminium used in carrier and support rail extrusions is from recycled sources and can be recycled by a licenced company.

'Adaptable building' is used to describe a structure that has the ability to be modified or extended at minimum cost to suit the changing needs of the people using the structure. Thoughtful design can provide the flexibility for these needs to be met without requiring expensive and energy intensive renovations. The ease of assembly and disassembly of the MechSlip system components means a structure can be re-shaped or extended incorporating the re-use of the MechSlip system.

Fig112 - Mechslip Recyclability (Ibstock Brick, 2021)

LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

Production stage			Phase of the erection of the building		Use stage							Disposal stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the manufacturer to the place of use	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² TERRART façade panel including sub-construction (67.07 kg/m²)

Parameter	Unit	A1-A3	C3	C4	D
Global warming potential	[kg CO_2-Eq.]	90.51	0.00	1.52	-16.07
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	8.69E-9	0.00E+0	1.70E-11	4.74E-9
Acidification potential of land and water	[kg SO_2-Eq.]	2.03E-1	0.00E+0	6.39E-3	-7.05E-2
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.74E-2	0.00E+0	8.79E-4	-4.69E-3
Formation potential of tropospheric ozone	[kg ethene-Eq.]	1.50E-2	0.00E+0	6.00E-4	-4.43E-3
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	2.76E-4	0.00E+0	3.92E-7	-6.08E-5
Abiotic depletion potential for fossil resources	[MJ]	1266.10	0.00	13.73	-170.74

RESULTS OF THE LCA - RESOURCE USE: 1 m² TERRART façade panel including sub-construction (67.07 kg/m²)

Parameter	Unit	A1-A3	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	125.55	0.00	0.00	0.00
Renewable primary energy resources as material utilization	[MJ]	2.32	0.00	0.00	0.00
Total use of renewable primary energy resources	[MJ]	127.87	0.00	1.41	-62.90
Non-renewable primary energy as energy carrier	[MJ]	1360.44	0.00	0.00	0.00
Non-renewable primary energy as material utilization	[MJ]	1.46	0.00	0.00	0.00
Total use of non-renewable primary energy resources	[MJ]	1361.90	0.00	14.31	-215.05
Use of secondary material	[kg]	19.30	0.00	0.00	0.00
Use of renewable secondary fuels	[MJ]	0.00	0.00	0.00	0.00
Use of non-renewable secondary fuels	[MJ]	0.00	0.00	0.00	0.00
Use of net fresh water	[m³]	2.20E-1	0.00E+0	3.71E-3	-1.38E-1

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² TERRART façade panel including sub-construction (67.07 kg/m²)

Parameter	Unit	A1-A3	C3	C4	D
Hazardous waste disposed	[kg]	3.32E-4	0.00E+0	4.45E-6	-5.98E-5
Non-hazardous waste disposed	[kg]	6.15	0.00	65.12	-3.41
Radioactive waste disposed	[kg]	3.80E-2	0.00E+0	2.29E-4	-1.75E-2
Components for re-use	[kg]	0.00	0.00	0.00	0.00
Materials for recycling	[kg]	0.00	2.07	0.00	0.00
Materials for energy recovery	[kg]	0.00	0.00	0.00	0.00
Exported electrical energy	[MJ]	0.00	0.00	0.00	0.00
Exported thermal energy	[MJ]	0.00	0.00	0.00	0.00

Fig113 - Ceramic Façade EPD (NBK, 2016)

Certificate

valid until 31.12.2021

Passivhaus Institut
Rheinstraße 44/46
D-64283 Darmstadt

Balcony connection

Low Thermal Bridge Construction — **Schöck Isokorb®T Typ SQ und SK 220 mm slab thickness**

Manufacturer: Schöck Bauteile GmbH
Vimbucher Str. 2 76354 Baden-Baden

The following criteria were used in awarding this certificate:

Efficiency Criterion

In two typical applications*), the construction achieves the requirement of

$\Delta U_{WB} < 0.025$ W/(m²K)

Comfort Criterion

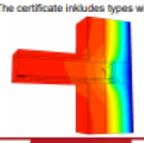
The inner surface must be warm enough to prevent mould as well as uncomfortable down-drought and radiation losses.

$\theta_{i,min} > 17.00$ °C

Following heat transmission coefficients (Ψ [W/(mK)])

Schöck Isokorb® Type	Min. temperature of the inner surface θi,min [°C]	Thermal bridge coefficient χ [W/K]
T Typ SQ-V2 220	18.67	0.081
T Typ SQ-V3 220	18.64	0.085
T Typ SK-M1V1 220	18.52	0.100
T Typ SK-MM2VV1 220	18.14	0.139

*) The criterion was validated on both, a row house and a apartment dwelling
The certificate inkludes types with minor statical performance.



PHI Low Energy Component

Fig114 - Passive House Certificate (NBK, 2021)

ENVIRONMENTAL INDICATORS AND INTERPRETATION

Environmental indicator results for the A1 - A3 modules on an aggregated basis are shown in the four following tables for the declared unit of 1m² of RMG Alpha V Raised Access Flooring System, with and without stringers.

Parameter – Environmental Impacts	Unit	Modules A1 - A3	
		without stringers	with stringers
Global warming potential* (GWP)	kg CO_2-eq	5.20E+01	5.80E+01
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11-eq	4.35E-06	4.75E-06
Acidification potential of land and water (AP)	kg SO_2-eq	6.93E-01	7.53E-01
Eutrophication potential (EP)	kg PO_4^{3-}-eq	1.34E-01	1.45E-01
Formation potential of tropospheric ozone photochemical oxidants (POCP)	kg ethene-eq	2.74E-02	3.10E-02
Abiotic depletion potential for non-fossil resources (ADPE)	kg Sb-eq	3.17E-03	3.39E-03
Abiotic depletion potential for fossil resources (ADPFF)	MJ	8.04E+02	8.87E+02

*Does not include biogenic CO_2 taken up in wood; see additional information

Parameter – Resource Use	Unit	Modules A1 - A3	
		without stringers	with stringers
Renewable primary energy as energy carrier (PERE)	MJ	9.78E+01	1.03E+02
Renewable primary energy resources as material utilization (PERM)	MJ	1.90E+02	1.90E+02
Total use of renewable primary energy resources	MJ	2.88E+02	2.93E+02
Non-renewable primary energy as energy carrier (PENRE)	MJ	7.15E+02	7.85E+02
Non-renewable primary energy as material utilization (PENRM)	MJ	3.31E+01	3.31E+01
Total use of non-renewable primary energy resources	MJ	7.48E+02	8.18E+02
Use of secondary material (SM)	kg	7.96E+00	8.25E+00
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00
Use of non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00
Use of net fresh water (FW)	m^3	1.05E+00	1.14E+00

Parameter – Waste	Unit	Modules A1 - A3	
		without stringers	with stringers
Hazardous waste disposed (HW)	kg	8.15E+00	9.59E+00
Non-hazardous waste disposed (NHW)	kg	4.18E+01	4.86E+01
Radioactive waste disposed (RW)	kg	2.05E-03	2.21E-03

Fig115 - Raised Floor EPD (Kingspan, 2021)

5.0 **Performance and Durability**

5.A Outline Specification

The following is a selection of products specified within the project and mentioned within this report.

Product Type:	Product Name:	NBS Reference:	Uniclass Code:
Floors	Tetra Ceramic Tile	45-895/310	Pr_35_93_96_19
	INTRAlux Ultima Entrance Matting	45-35-35/410	Pr_35_57_11_26
	Burmatex Tivoli carpet tiles	45-20-15/380	Pr_35_57_11_62
	Ecodek Reversible Composite Decking Board	45-45-95/385	n/a
	Kingspan RMG600 Raised Access Floor Panels	45-45-00/320	Pr_25_71_42_70
	Siderise RF Fire Stop for Raised Access Floors	45-45-70/427	Pr_25_80_81_51
Ceilings	Rockfon Koral ceiling tiles	45-80-40/330	Pr_35_93_13_53
	Rockfon Blanke Activity	45-80-40/330	Pr_35_93_13_53
Doors	Kudos Sliding Folding Partition	25-50-20/185	Ss_25-30-_20_80
	Postformed Double Swing Doorset	45-25-28/342	Pr_30_59_24_16
	Postformed One and Half Pair	45-25-28/342	Pr_30_59_24_16
	Postformed Single Doorset	45-25-28/342	Pr_30_59_24_16
Glazing	SF52 Curtain Wall System	n/a	Ss_25_10_20_85
	Schuco AWS70 PPC Aluminium Window System	n/a	n/a
Facade	NBK Terrart Large Ceramic Facade	n/a	n/a
	Ibstock Mechslip Grey clay Brick System	45-80-50/316	Pr_20_93_52_15
Green Roof	Bauder Intensive Landscaping System	40-40-45/140	Ss_45_40_47_40
Balcony	Schock Isokorb T type sk Steel Balcony System	n/a	n/a
	Schock Isokorb T type D	n/a	n/a
Kitchen Units	SieMatic Base Unit Cupboard	45-35-80/340	Pr_40_30_78_45
	SieMatic Wall Cabinet with Hinge Door	45-35-80/340	Pr_40_30_78_45
	SieMatic Sink Base Unit with Cupboard Doors	45-35-80/340	Pr_40_30_78_45

5.B Testing and other Information

The specified materials had to have a positive effect on the energy and fabric performance of the building. The integration of a rainscreen façade will drastically reduce energy costs. This is mostly thanks to the air cavity within the wall, which creates a chimney effect. When the outside air temperature is high, the warm air is lifted through the cavity and cooler air enters through the bottom. During colder periods, the air is not lifted upwards. This helps the insulation layer keep the warmed air within the building (Cupa Pizarras, 2019). Additionally, the insulation layer is fixed to the external, preventing thermal bridges from occurring. This will also benefit the buildings energy performance.

Multiple attempts to undertake a full energy performance analysis of the building, using Insight, Fenestra Pro and Formit, were made. Due to hardware restrictions these attempts were unsuccessful.

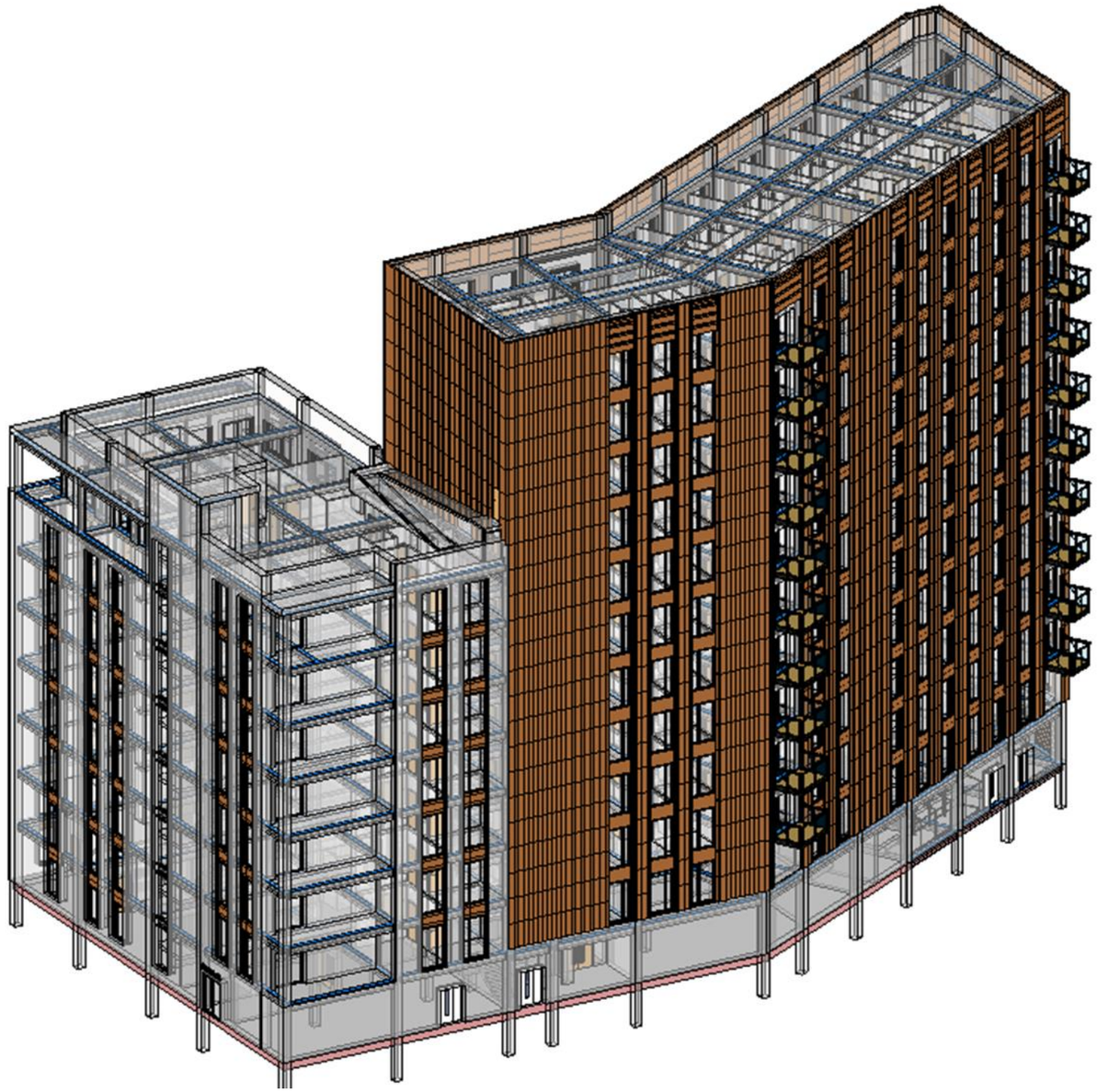


Fig116 - Building Model (Author, 2021)

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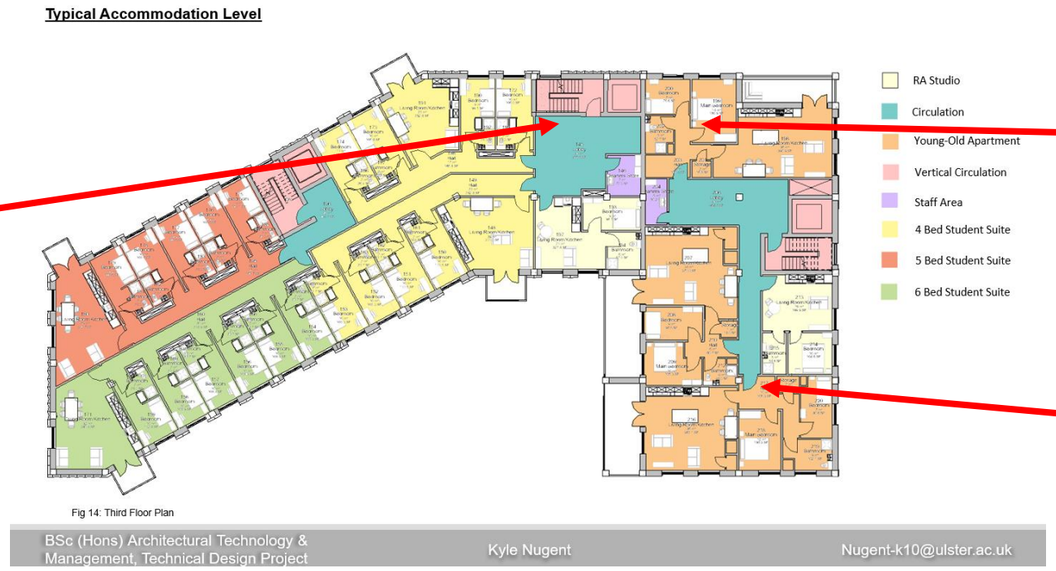
Appendices

1.0 **RIFF Reflection from Week 6**

A comment was made regarding the thickness of the members within the glazed atrium space. The design of these members was then changed to match the specifications provided by the manufacture.

Fig117 - Slide 1 (Author, 2021)

When reviewing the buildings floor plans it was noted that there was not a sufficient firefighting shaft within the building which met the related building regulations. The floor plans were altered to incorporate this facility.



It was said that the layout of the Young-old apartments worked well, however the bathroom door within these spaces should open outwards. This advice was taken, and the plans were changed to reflect this.

The colours at door thresholds between rooms was commented on. Changes were made to the floor plans to ensure that the colours stop at threshold rather than going into the door swing.

Fig118 - Slide 2 (Author, 2021)

A comment regarding the placing of cavity barriers was made. After this presentation it was ensured that there was sufficient cavity barriers between apartments and around structural openings such as the curtain wall system.

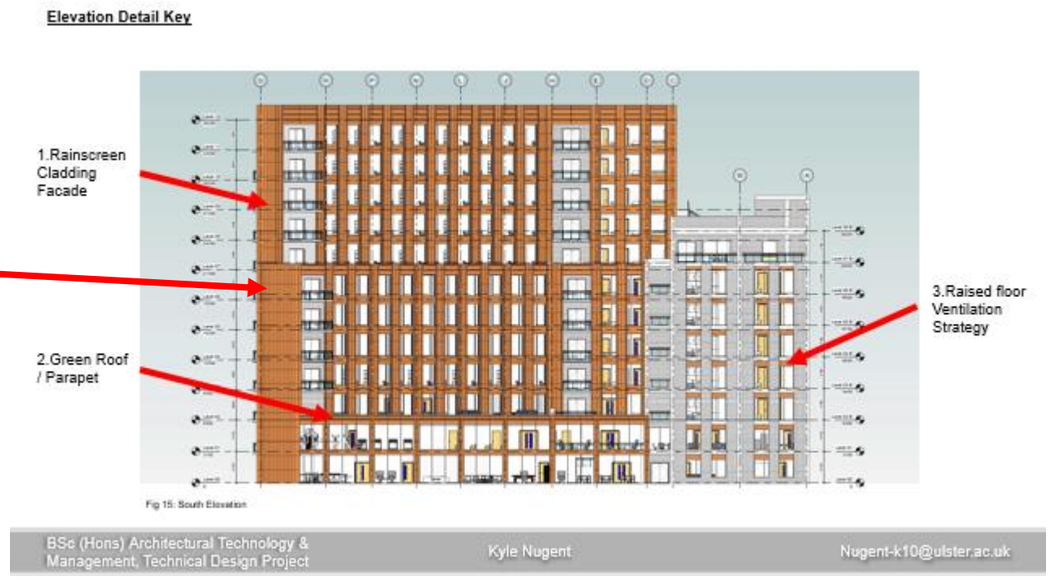


Fig119 - Slide 3 (Author, 2021)

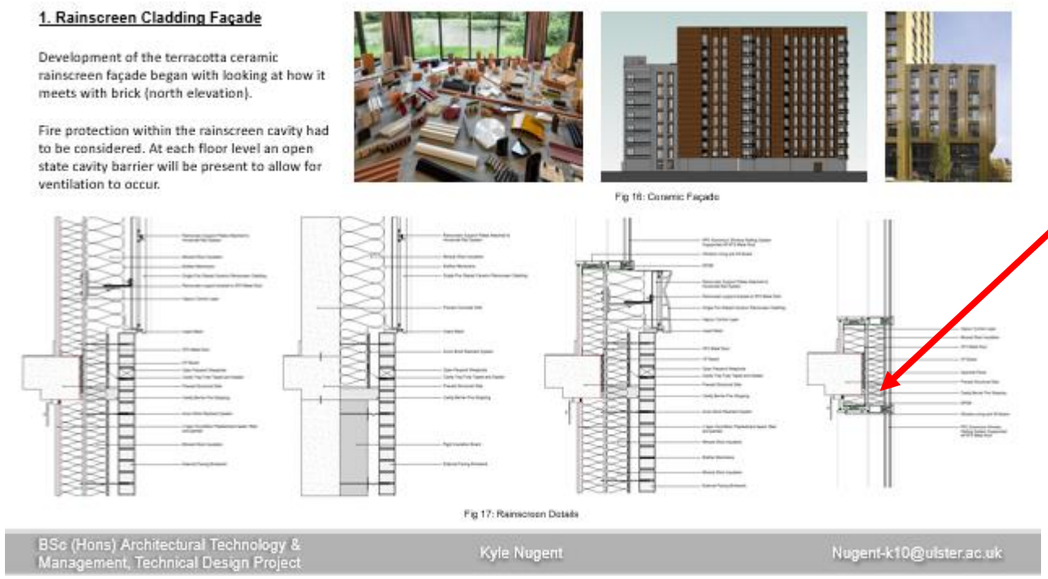


Fig120 - Slide 4 (Author, 2021)

It was suggested that all the details were not fully consistent to each other within the RIFF presentation. After this event, a detailed look at the façade details was undertaken. This involved a greater look into the presence of upstands and downstands.

It was directed that a handrail would need to be fitted to the upstand of the structure. A stainless-steel railing was then incorporated into the design of the green roof parapet. It was set at 15 degrees off the 90. This angle ensured that the railing would not be visible from ground level whilst also keeping people, located on the level 02 green space, back from the edge.

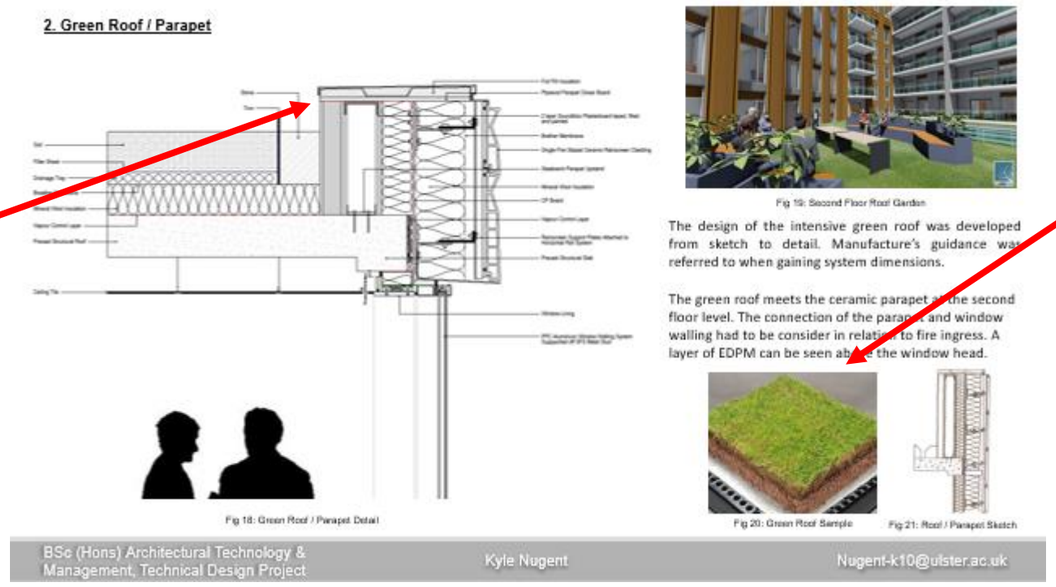


Fig121 - Slide 5 (Author, 2021)

It was mentioned that further research into water drainage from the green roof could be done. As seen within the report, this aspect was addressed with the inclusion of a grey water drainage system.

It was suggested that the Robust detail document would be useful for the design of the raised floor system. After reading this document it informed how the acoustics would be managed, for example a fire barrier, which has great acoustic properties, was later specified within the design.

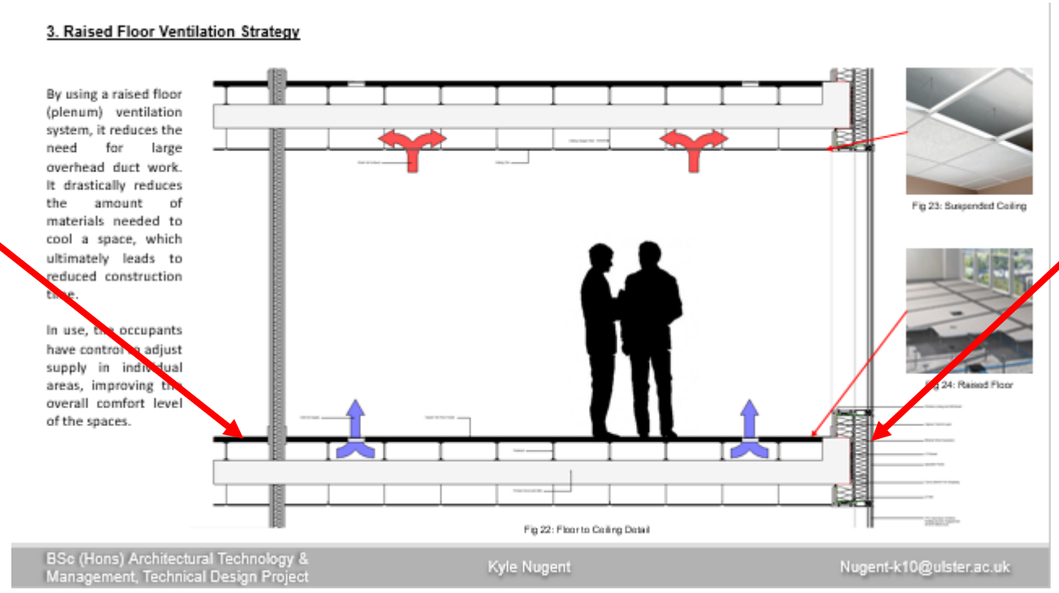


Fig123 - Slide 6 (Author, 2021)

At the time of the presentation, the underfloor heating system was intended to be used across the building, including residential spaces. However, feedback from this presentation indicated that it should only be installed within the office and social spaces on the lower floors due to a number of reasons. With that change of design, a new approach was needed for the residential spaces, which can be seen within this report.

2.0 Process Work

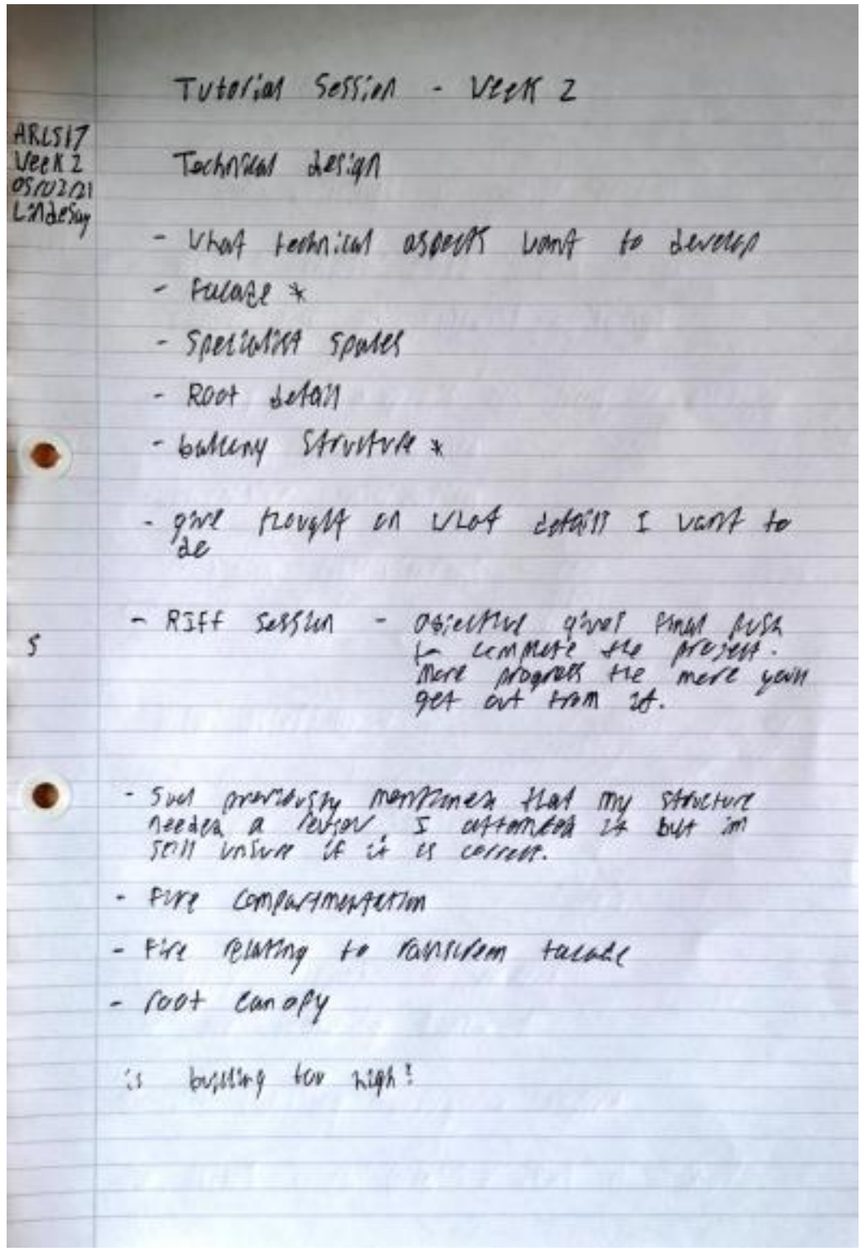


Fig124 - Week 2 Tutorial Notes (Author, 2021)

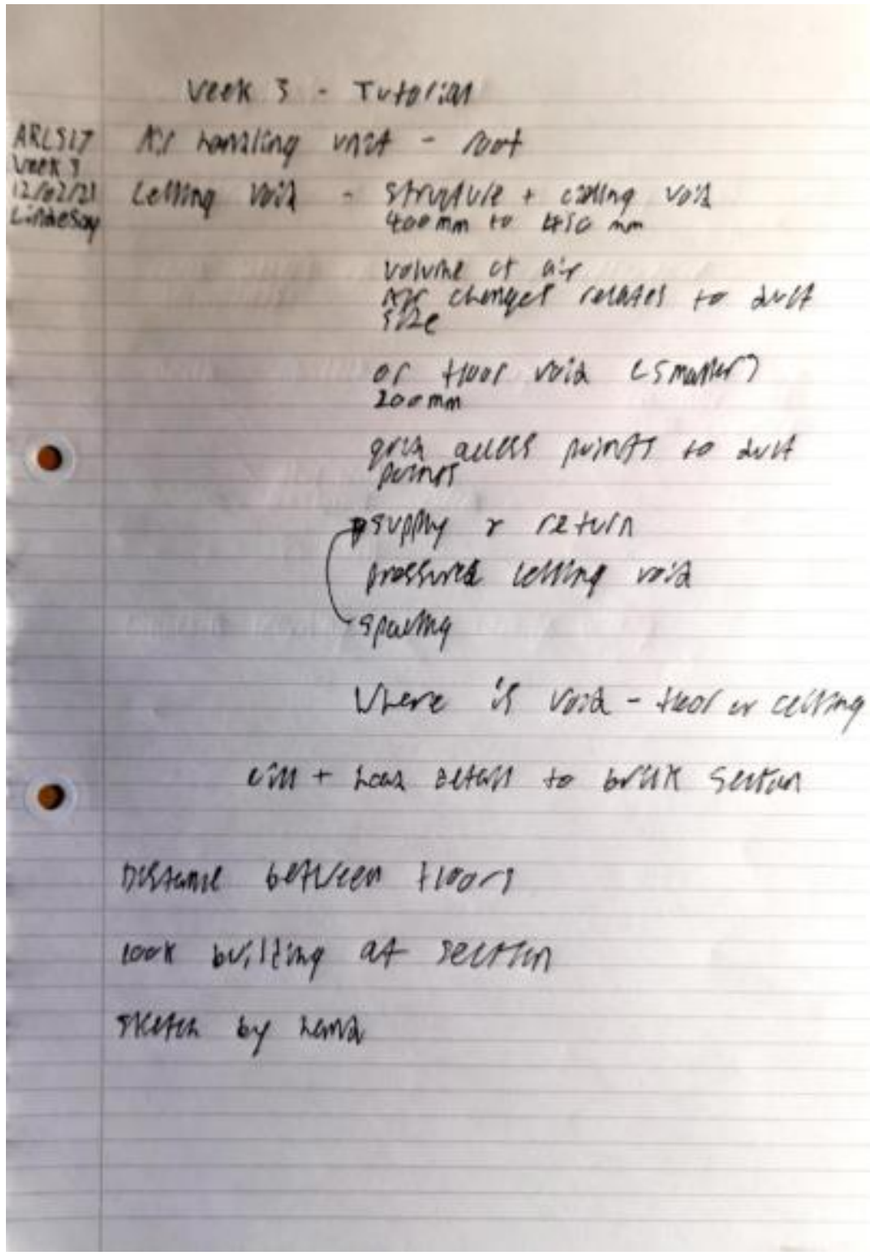


Fig125 - Week 3 Tutorial Notes (Author, 2021)

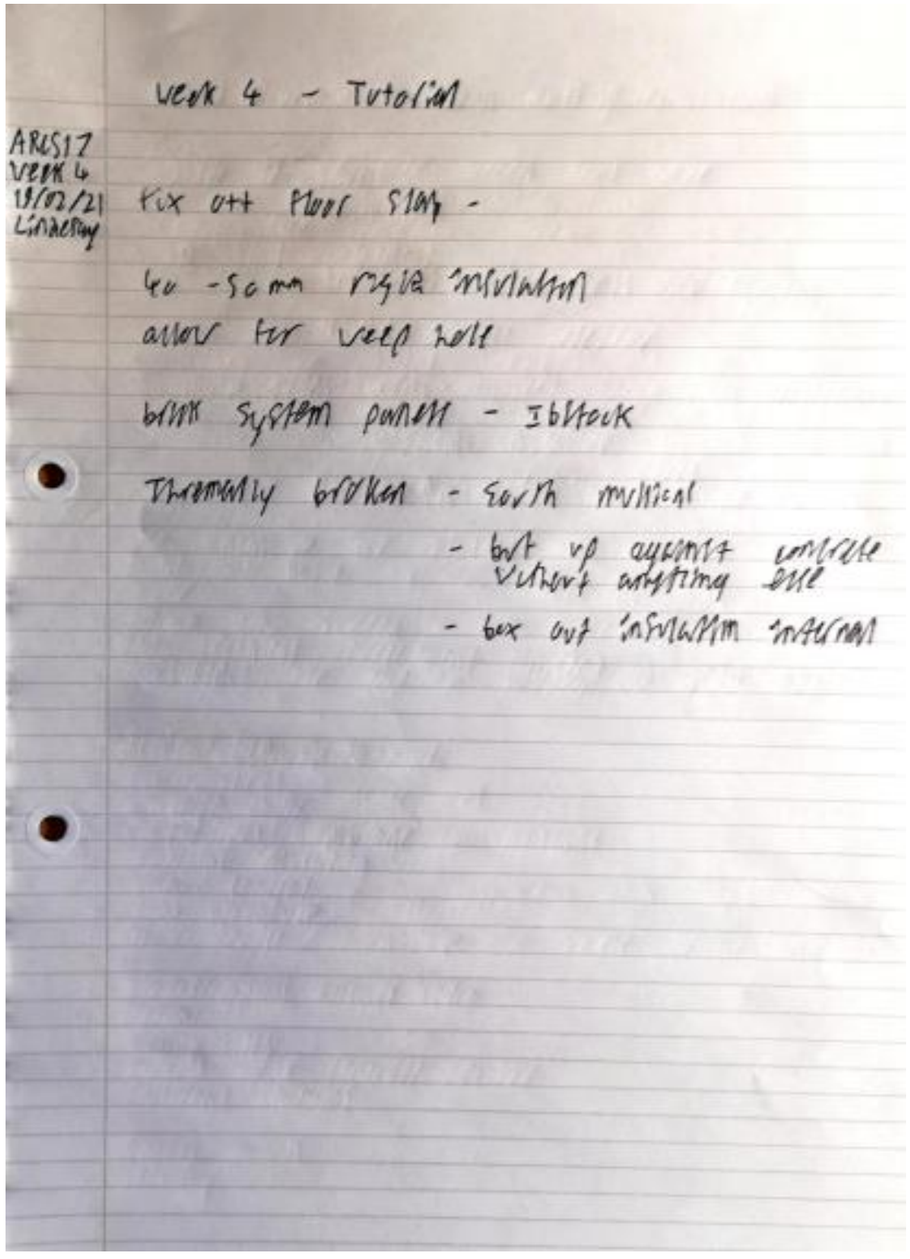


Fig126 - Week 4 Tutorial Notes (Author, 2021)

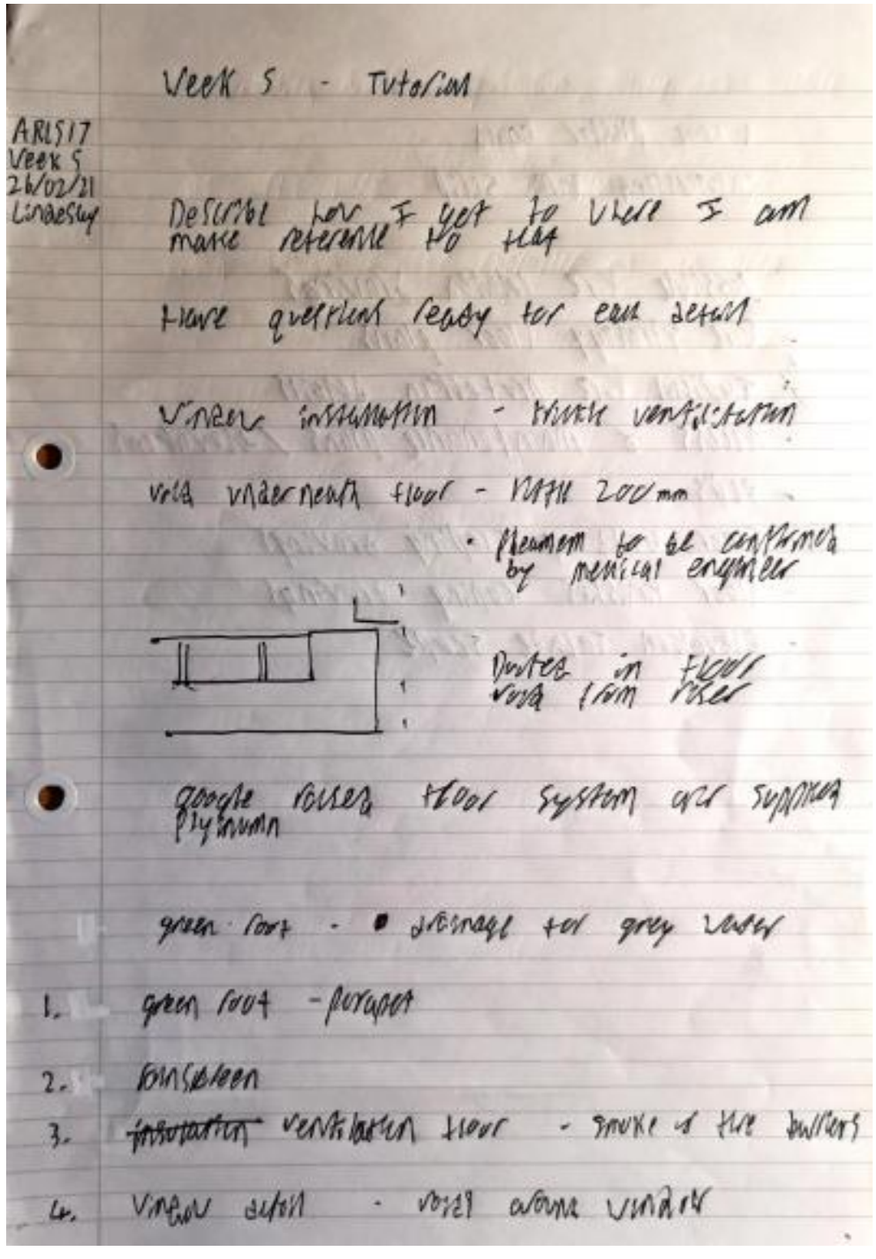
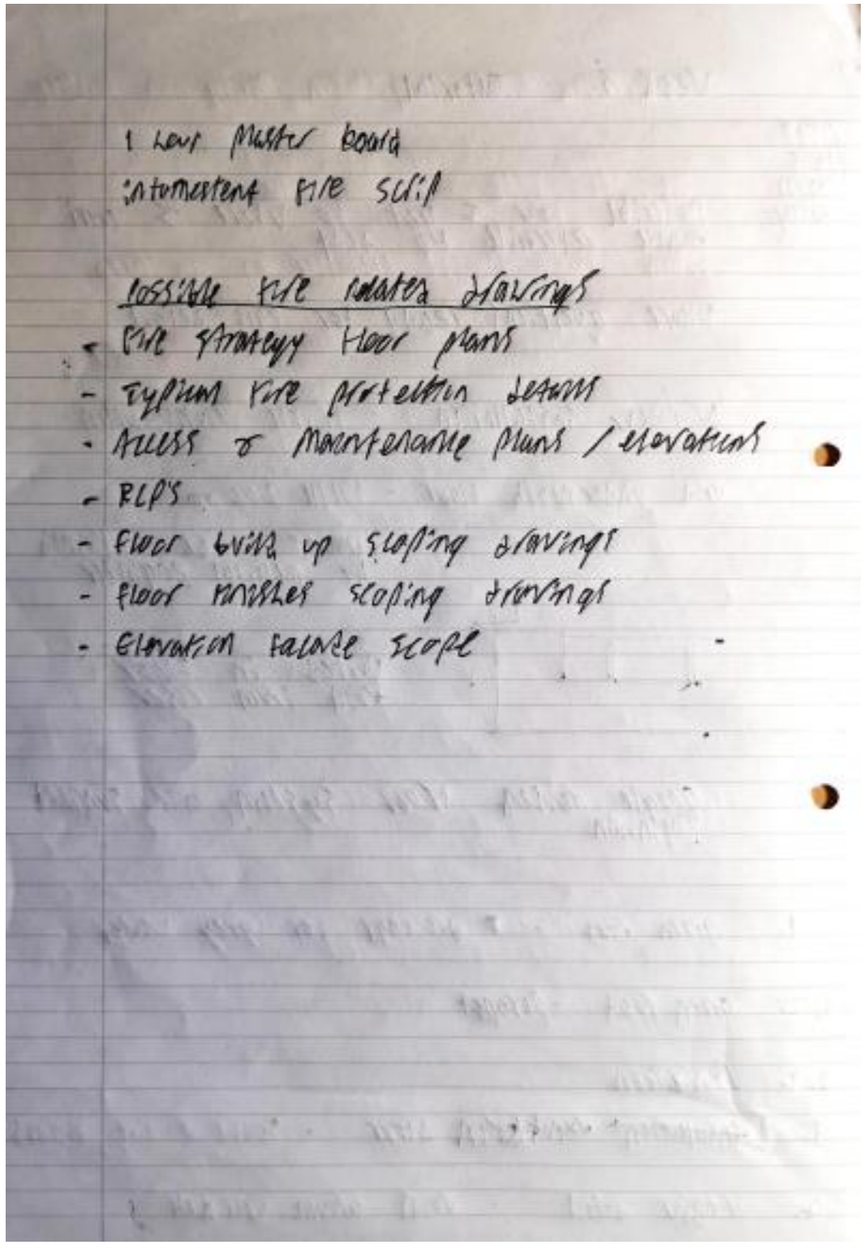
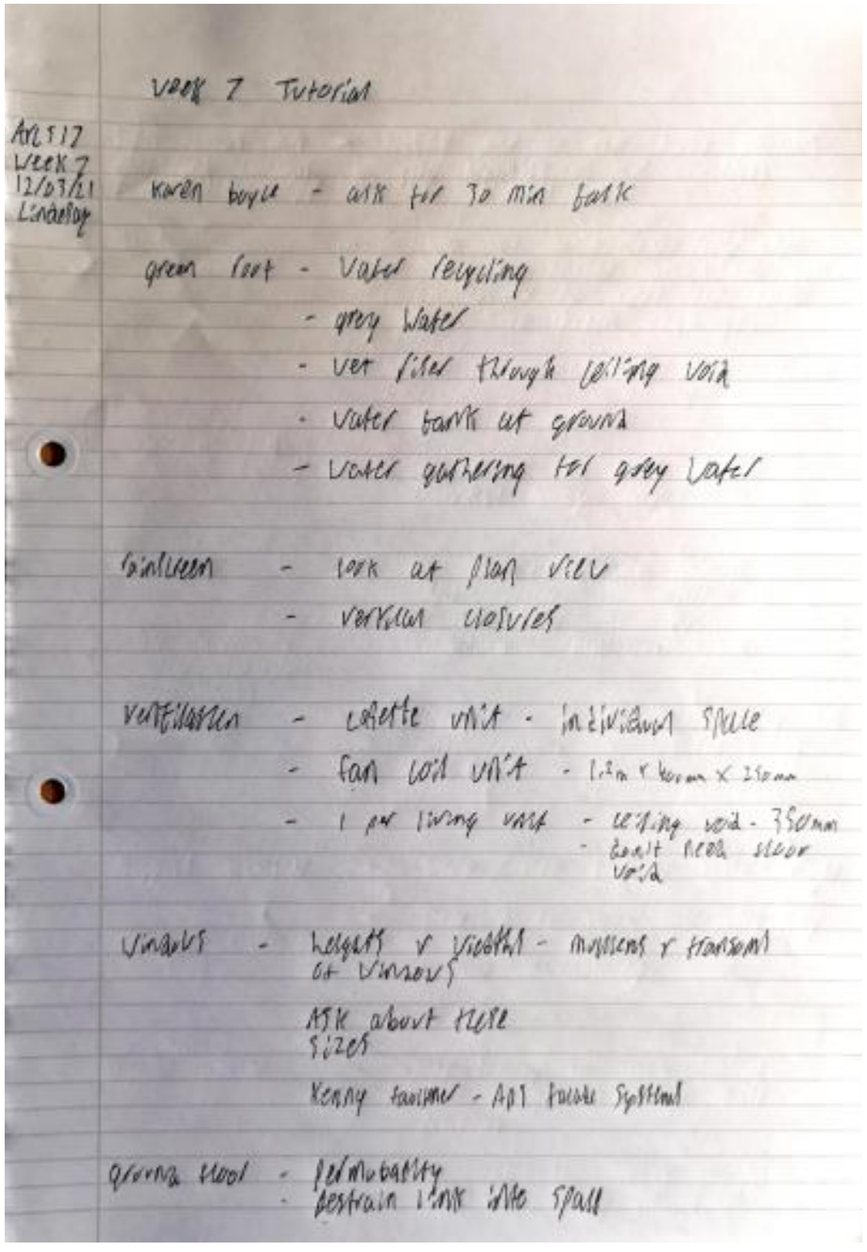


Fig127 - Week 5 Part 1 Tutorial Notes (Author, 2021)


1 hour master board
intermittent fire alarm

Possible fire related drawings
- Fire strategy floor plans
- Typical fire protection details
- Access & Maintenance plans / elevations
- RLP's
- Floor build up sloping drawings
- Floor finishes sloping drawings
- Elevation balcony scope

Fig128 - Week 5 Part 2 Tutorial Notes (Author, 2021)


Week 7 Tutorial

ARC517
Week 7
12/03/21
Lindsay

Karen Boyle - ask for 30 min book

green roof - Water recycling
- grey water
- Wet filter through ceiling void
- Water tank at ground
- Water gathering for grey water

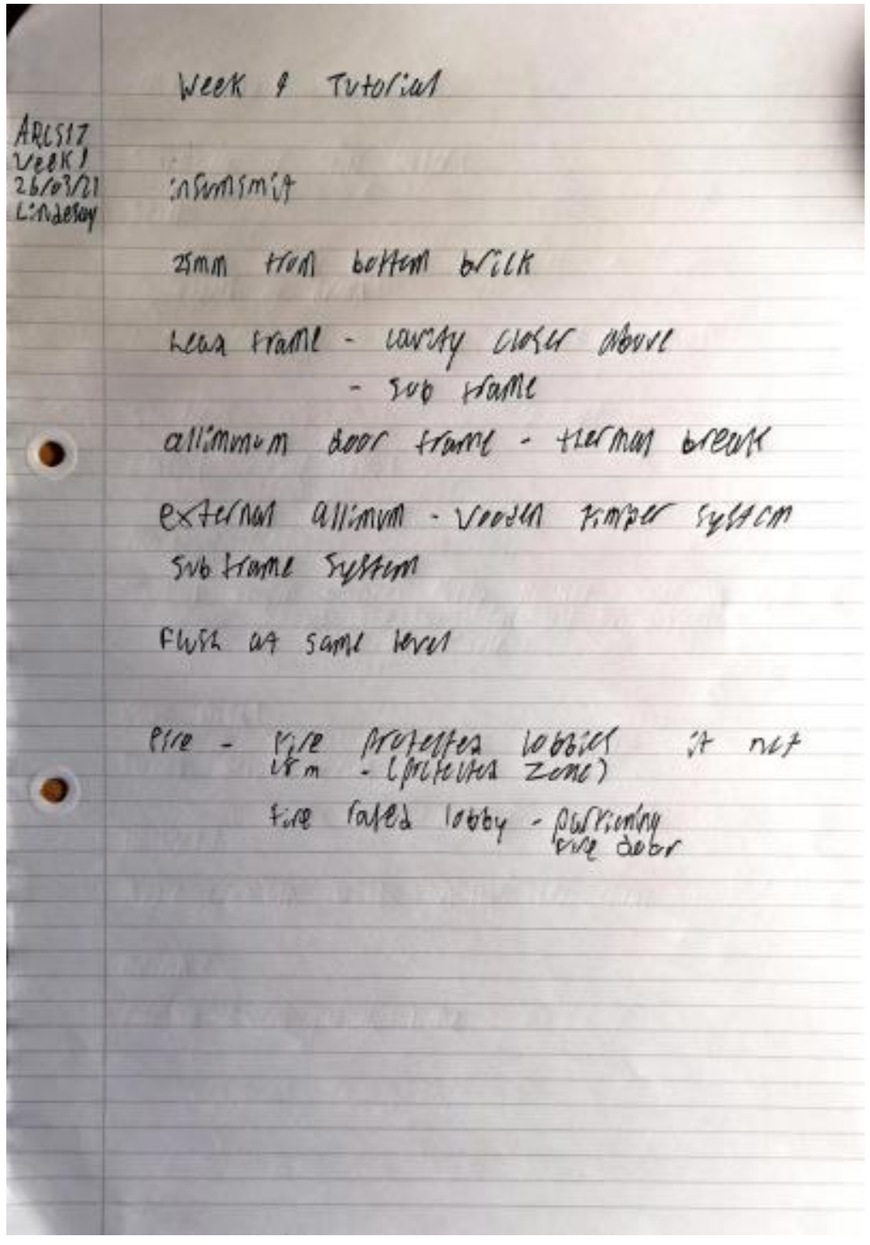
Bathroom - look at plan view
- Vertical closures

Ventilation - cassette unit - individual space
- fan coil unit - 1.2m x 600mm x 250mm
- 1 per living unit - ceiling void - 350mm
- Exit from floor void

Windows - heights & widths - mullions & transoms of windows
Ask about these sizes
Kenny Faulkner - API facade systems

Green roof - permeability
- Restrain limit into spall

Fig129 - Week 7 Tutorial Notes (Author, 2021)


ARLS17
Week 9
26/03/21
Lindsay

Week 9 Tutorial

insulation

25mm from bottom brick

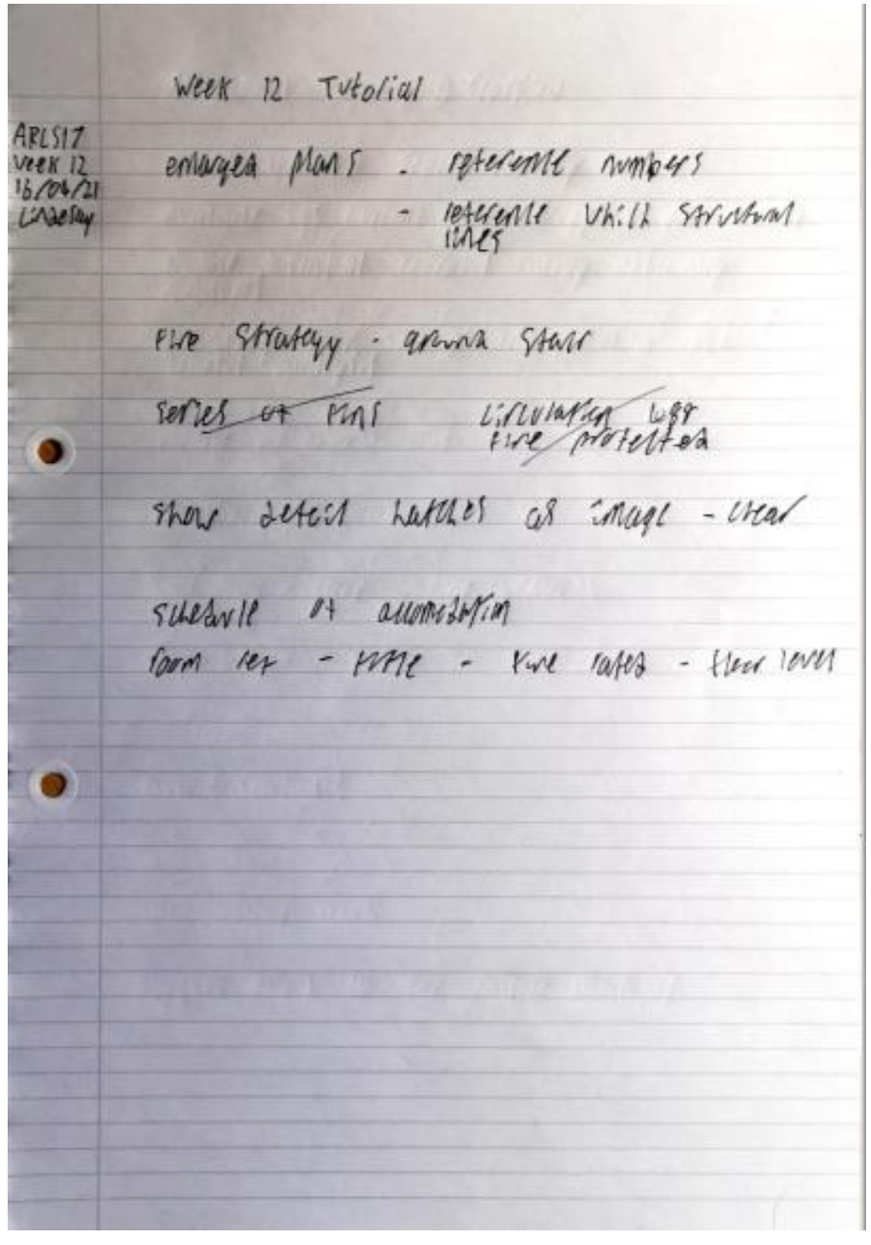
Lead frame - cavity closer above
- sub frame

aluminum door frame - thermal break

external aluminum - wooden timber system
sub frame system

flush at same level

fire - fire protected lobbies if not
lift - (protected zone)
fire rated lobby - sprinkler
fire door


ARLS17
Week 12
16/04/21
Lindsay

Week 12 Tutorial

enlarged plans - reference numbers
- reference with structural lines

Fire strategy - arrows stairs

series of exits circulation lobby
fire protected

show detect heaters or smoke - clear

schedule of accommodation
room ref - title - fire rated - floor level

Fig130 - Week 9 Tutorial Notes (Author, 2021)

Fig131 - Week 12 Tutorial Notes (Author, 2021)

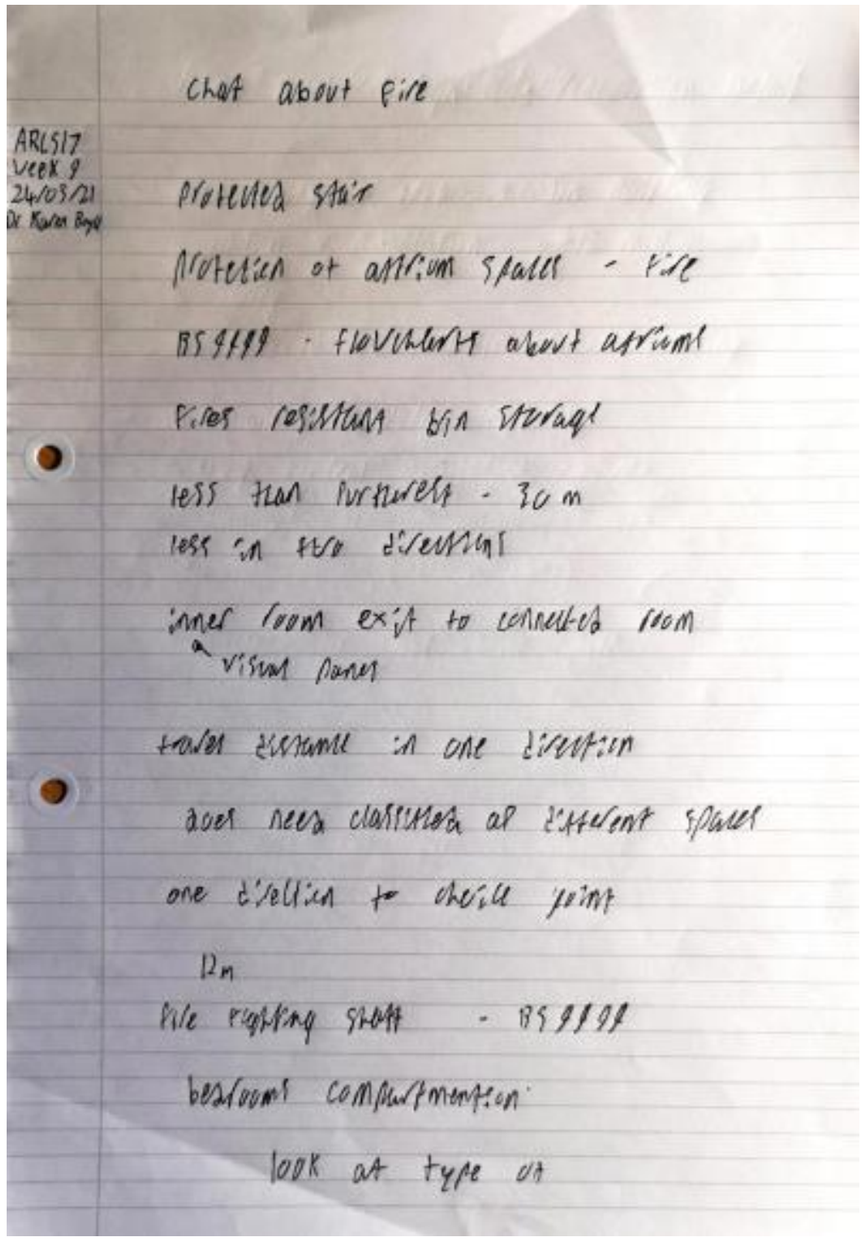


Fig132 - Conversation with Dr Karen Boyce Notes (Author,

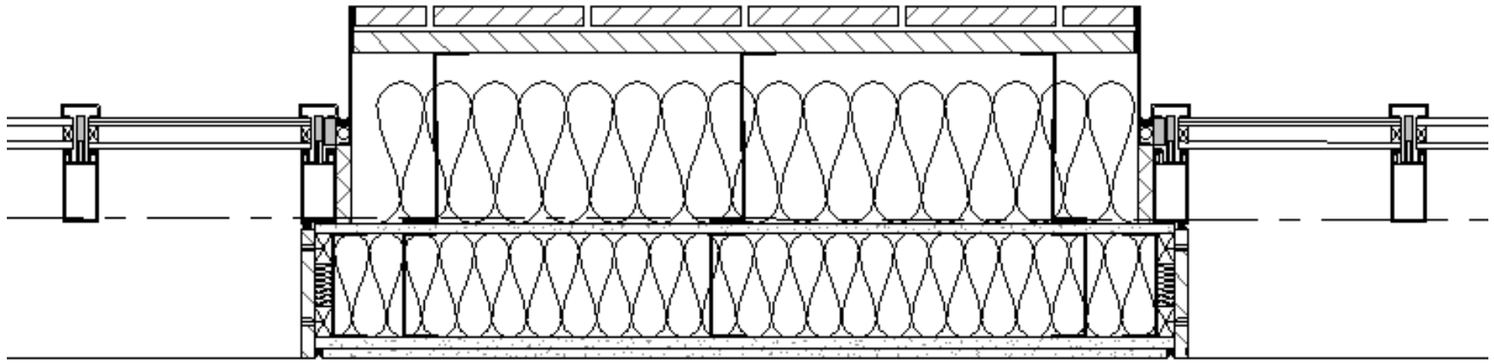


Fig133 - Rainscreen Brick Plan Detail (Author, 2021)

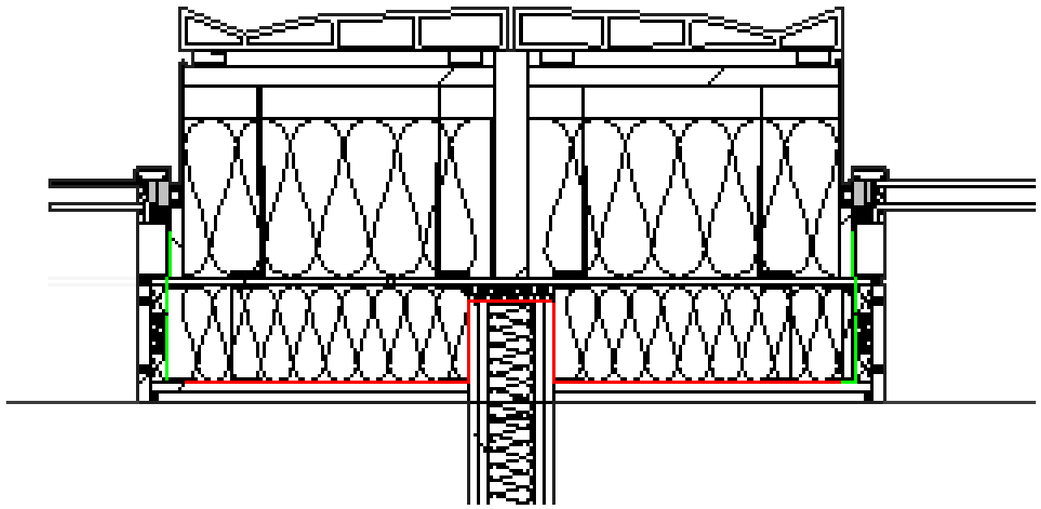


Fig134 - Rainscreen Ceramic Plan Detail (Author, 2021)

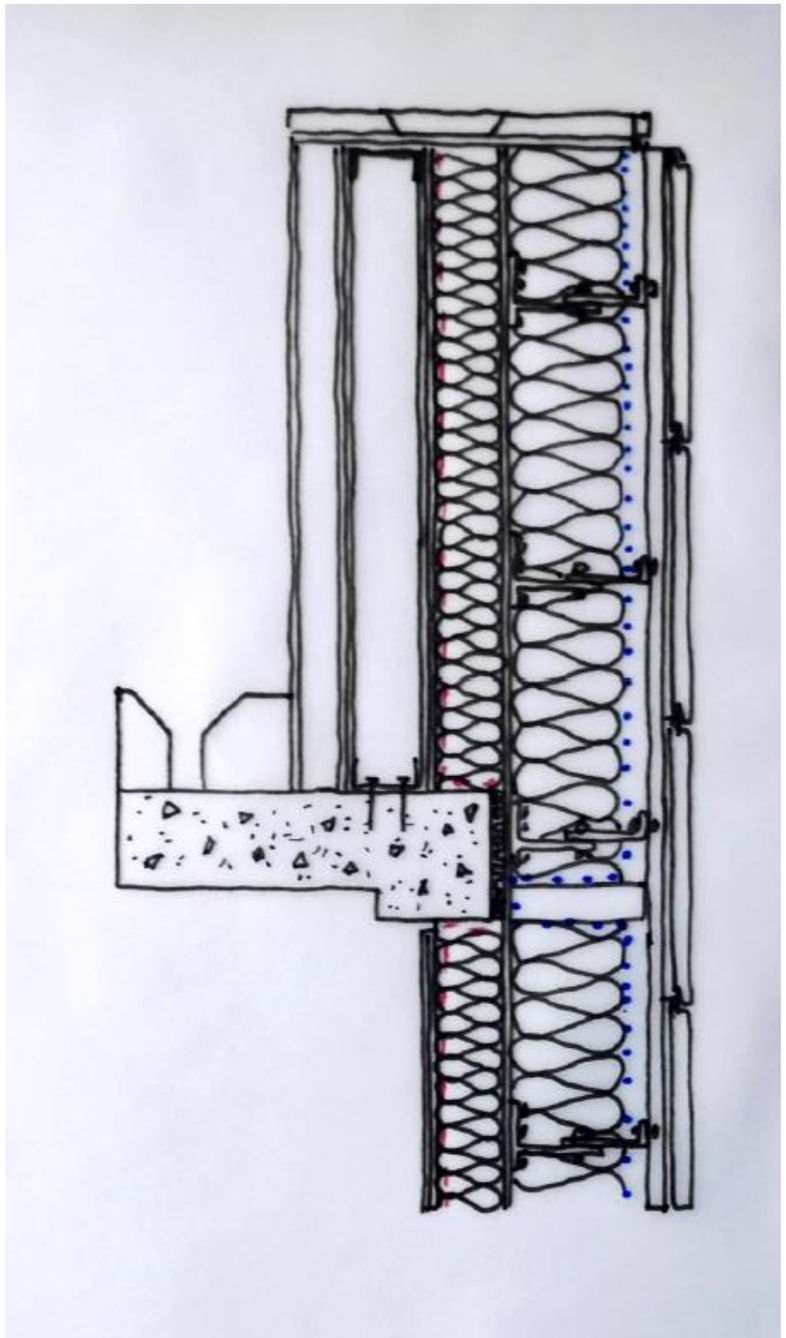


Fig135 - Parapet Sketch (Author, 2021)

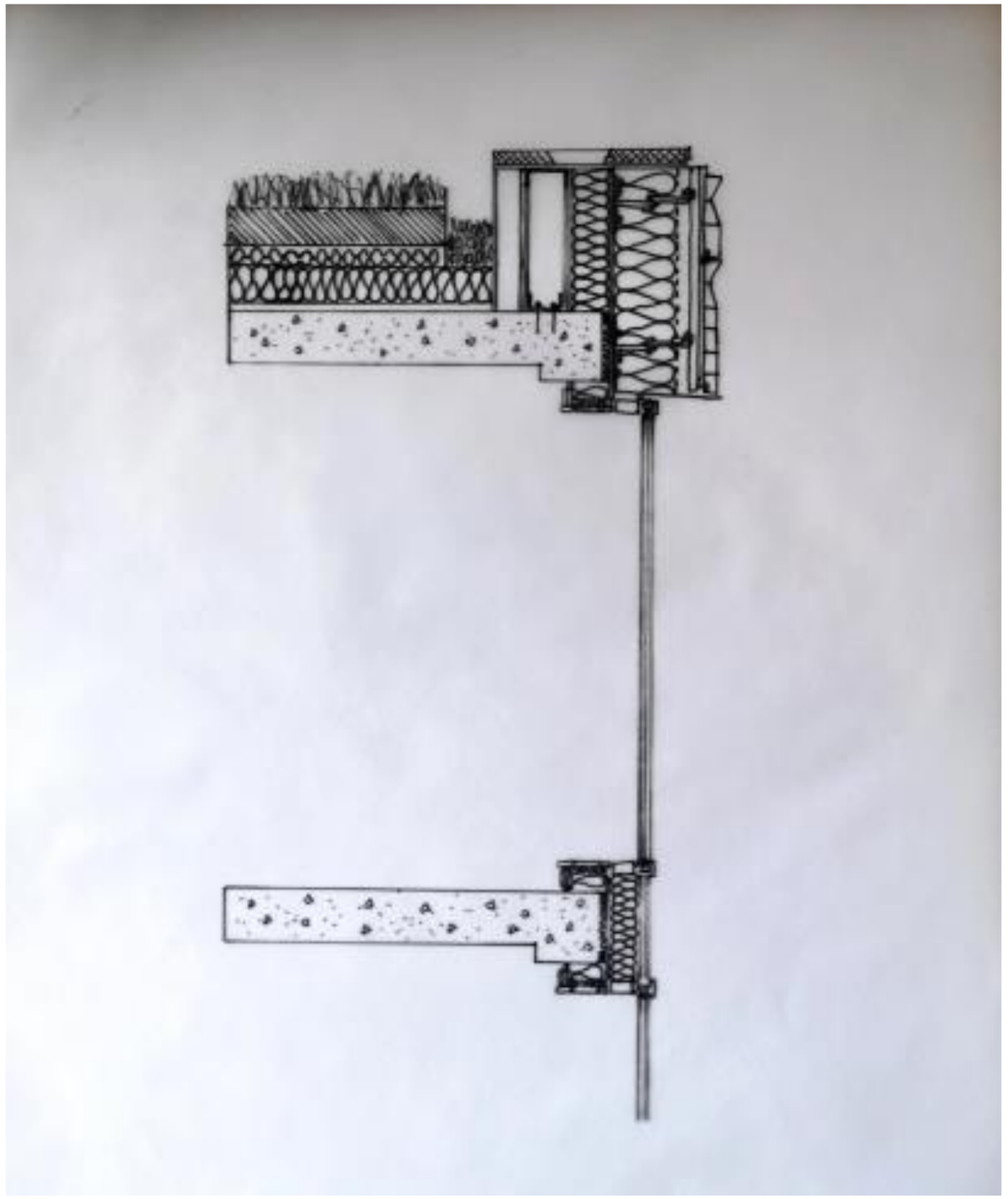


Fig136 - Green Roof Sketch (Author, 2021)

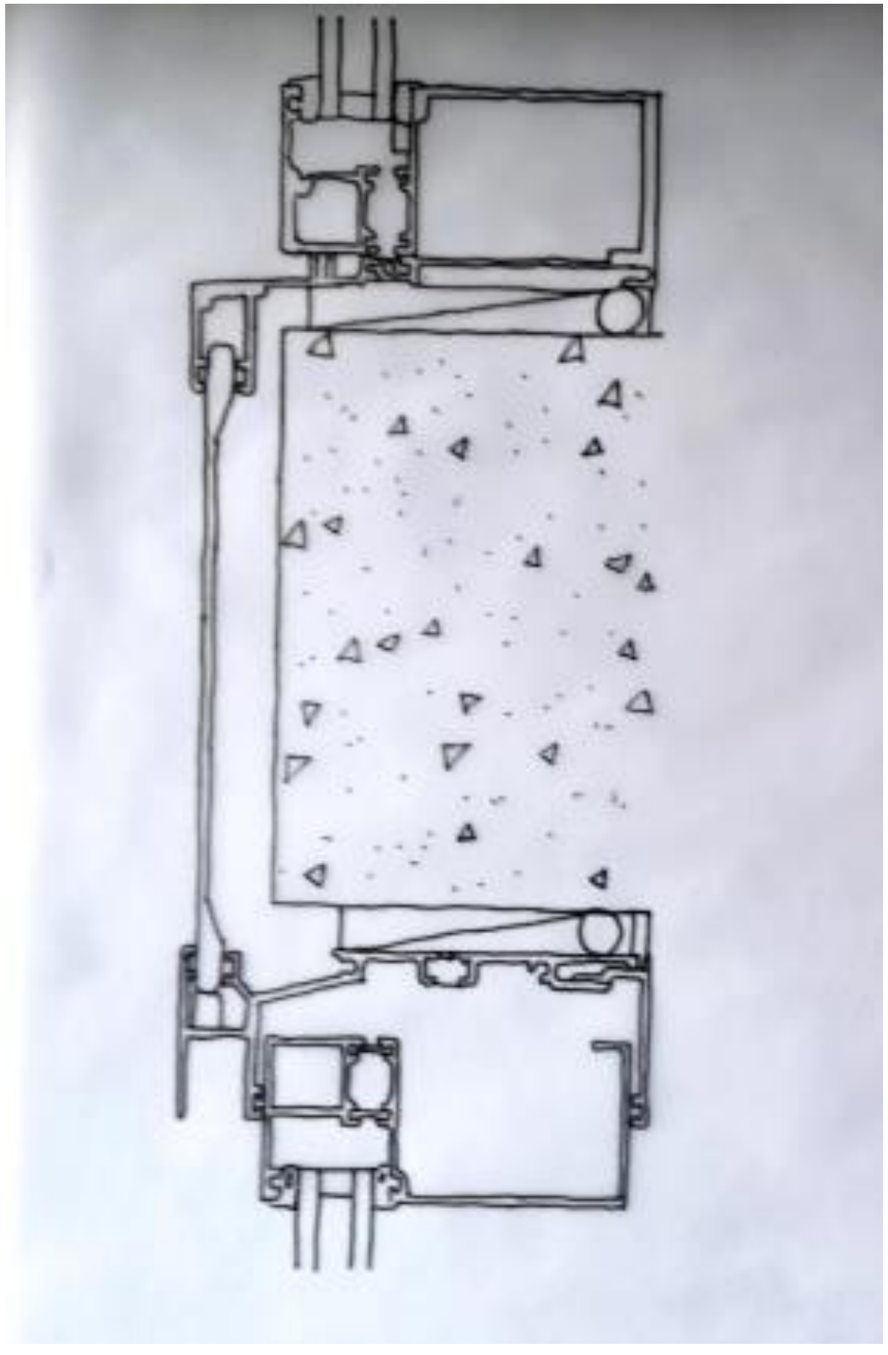


Fig137 - Thermally Broken Capping around Structure Sketch (Author, 2021)

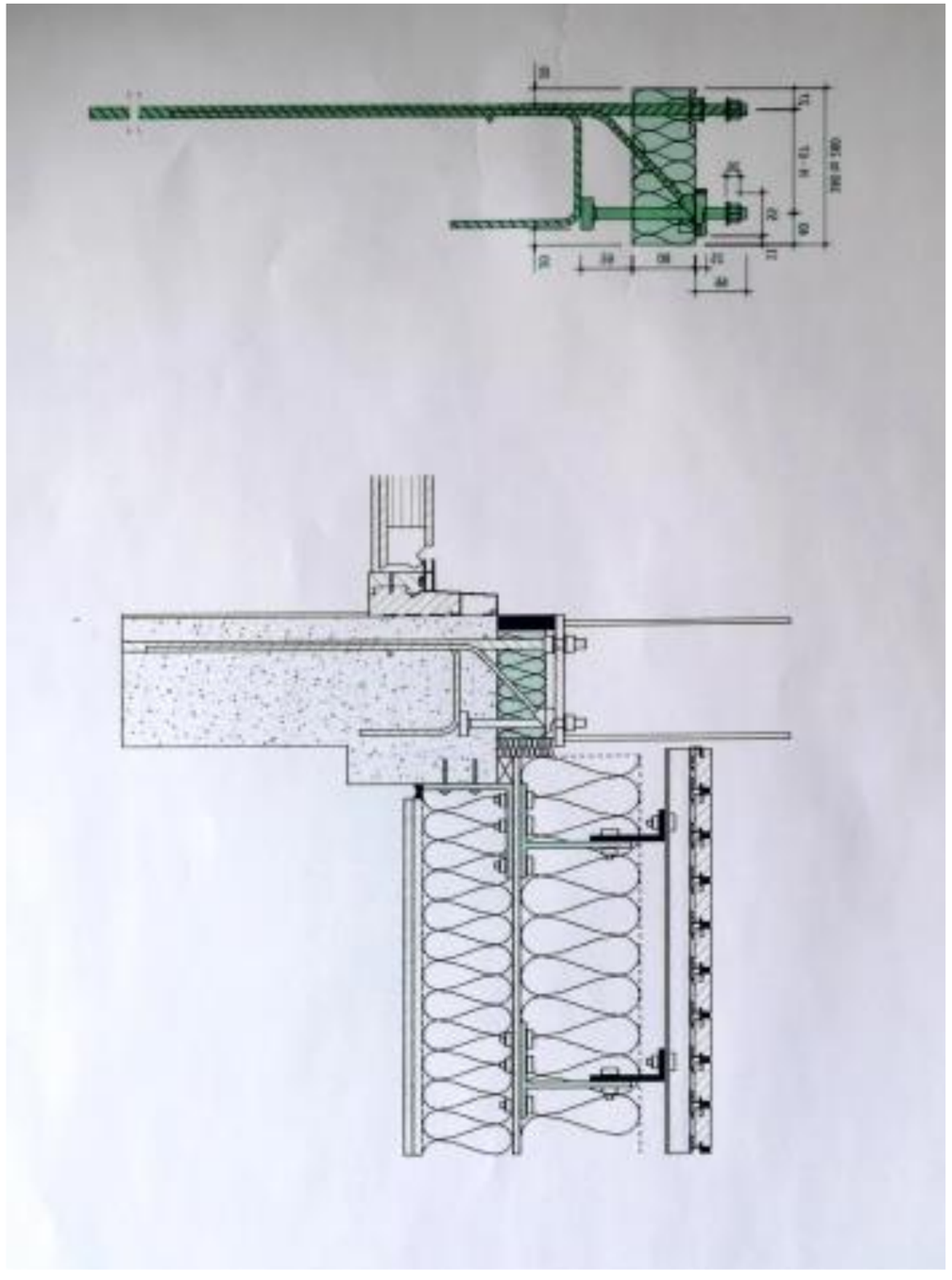


Fig138 - Balcony Design Development (Author, 2021)

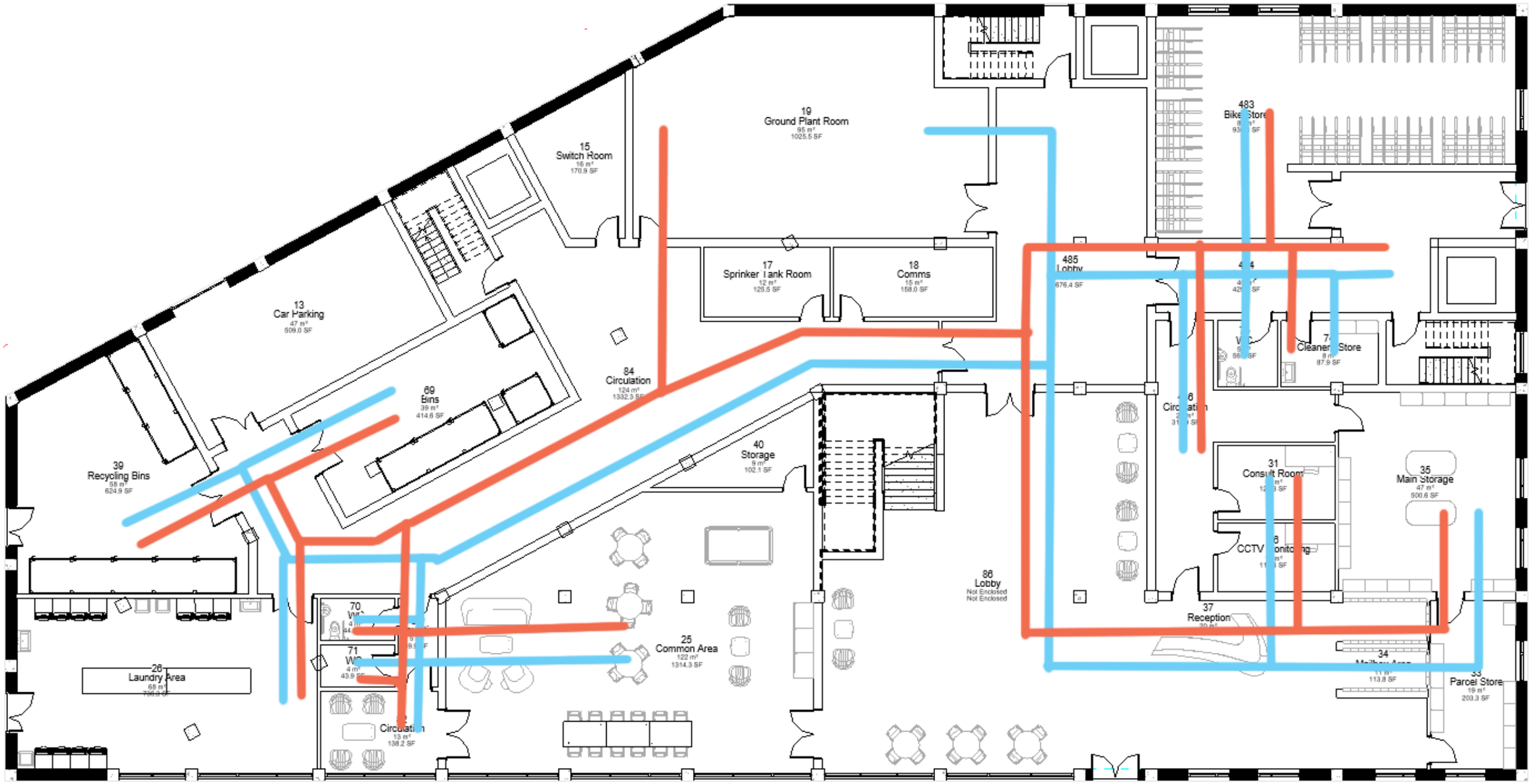


Fig139 - Level 00 Mechanical Flow (Author, 2021)

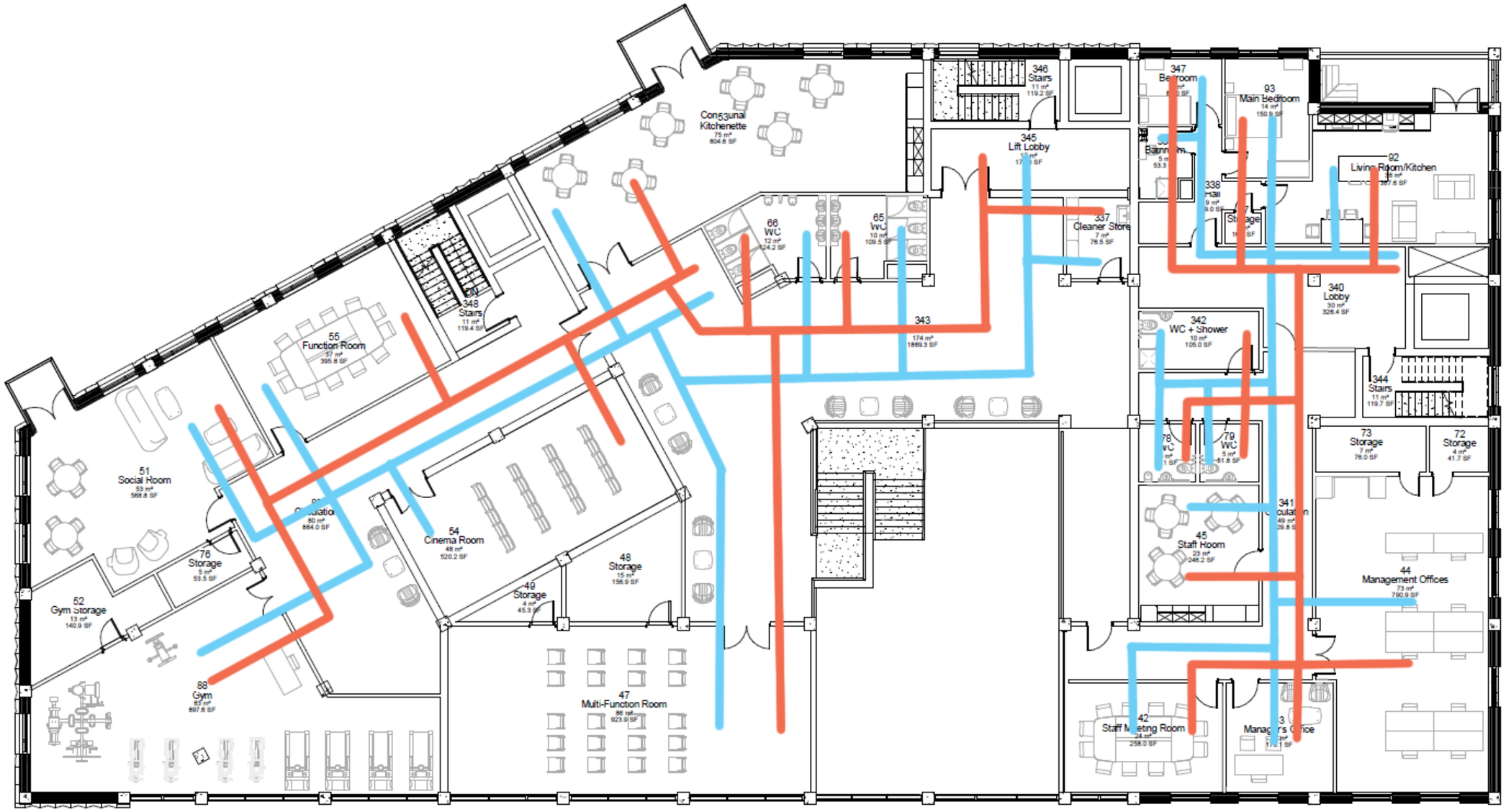


Fig140 - Level 01 Mechanical Flow (Author, 2021)

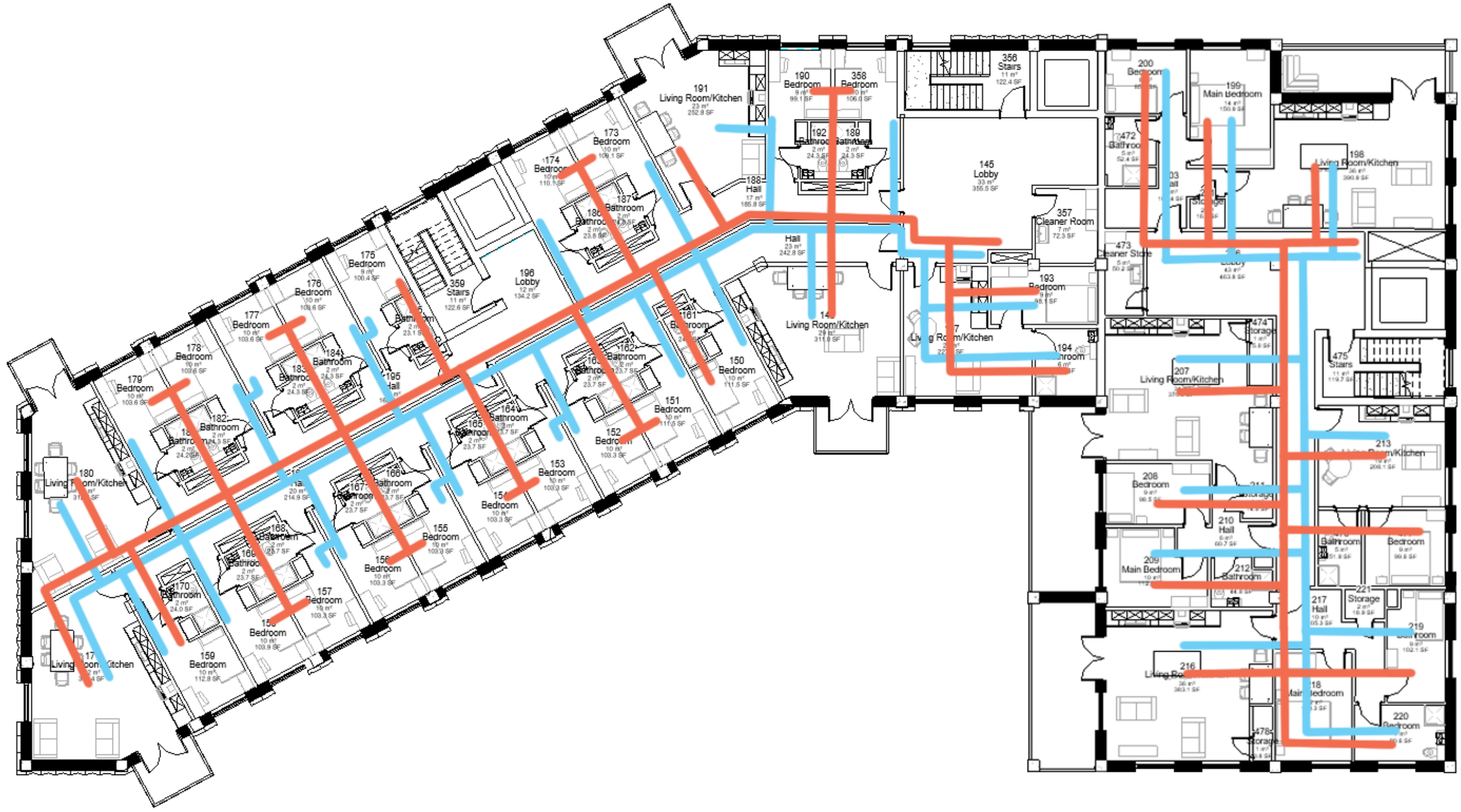


Fig141 - Level 03 Mechanical Flow (Author, 2021)

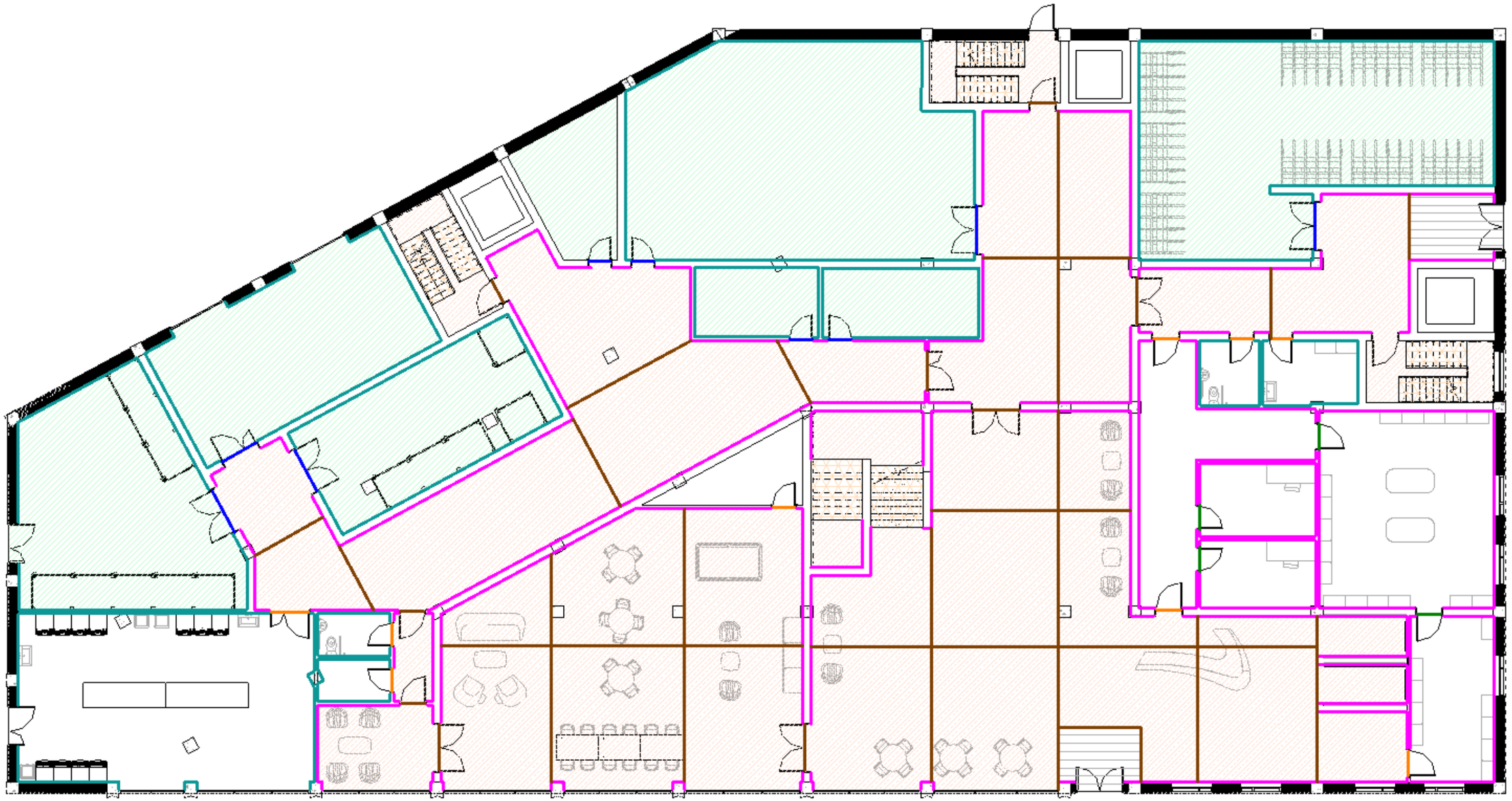


Fig142 - Level 00 Floor Finishes (Author, 2021)

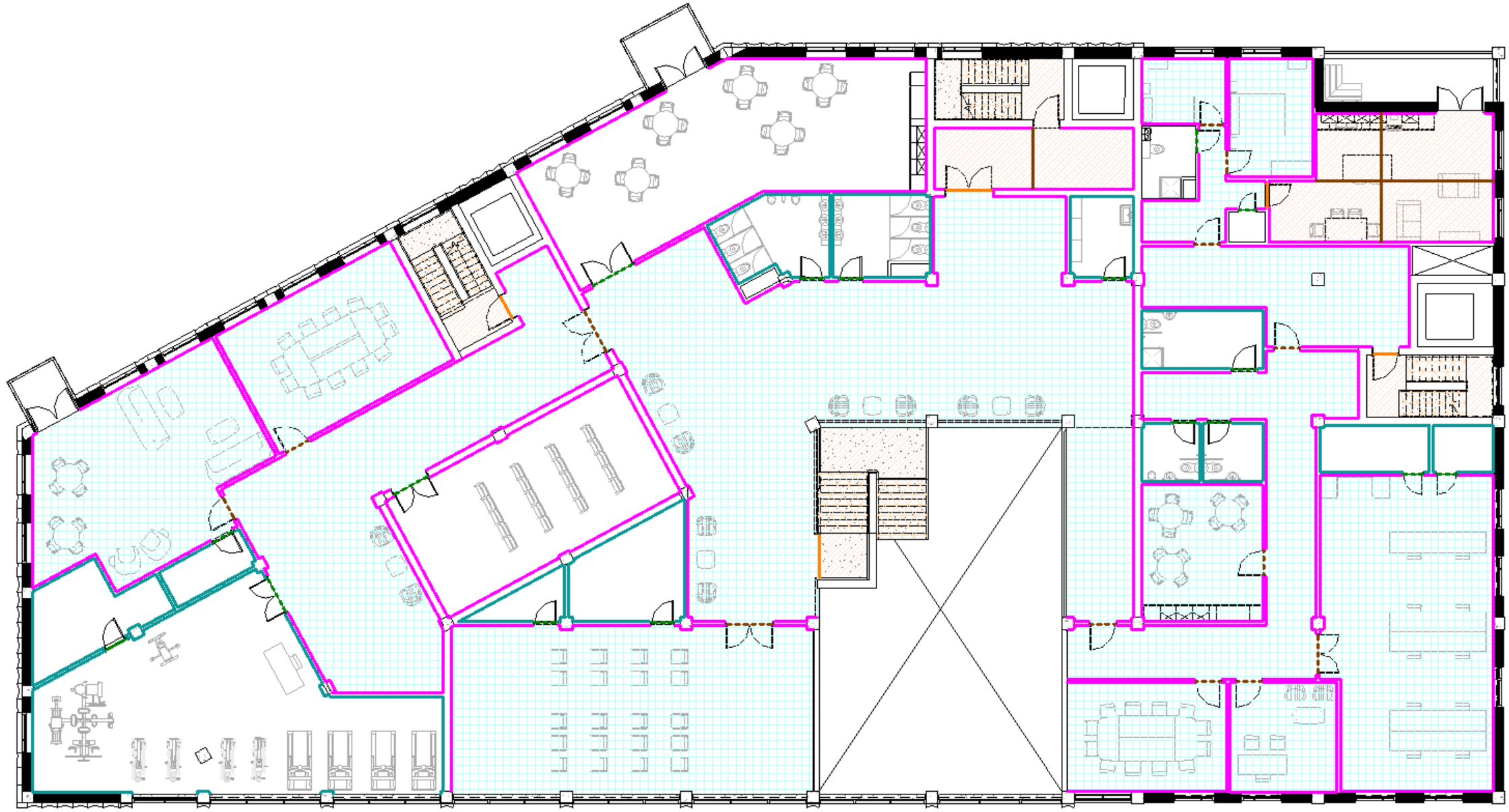


Fig143 - Level 01 Floor Finishes (Author, 2021)

Fig144 - Level 00 Floor Finishes (Author, 2021)

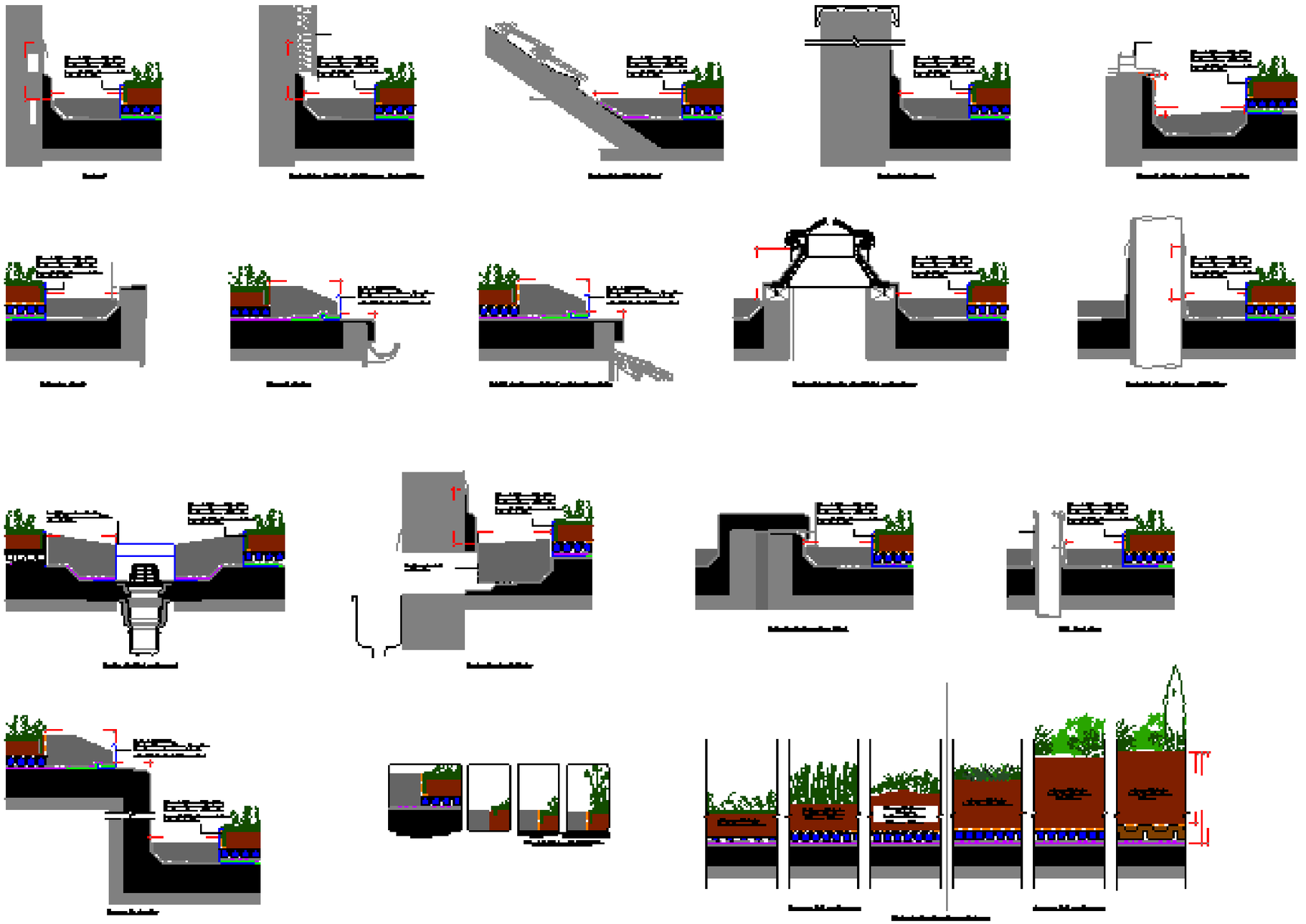


Fig144 – Bauder Green Roof Details (Bauder, 2021)

Room Schedule 2			
Level	Number	Name	Area
Level 00	AG.1	Lobby	169 m²
Level 00	AG.1B	Reception	20 m²
Level 00	AG.1C	Mailbox Area	11 m²
Level 00	AG.2	Lobby	9 m²
Level 00	AG.2B	Firefighting Stair	22 m²
Level 00	AG.3	Circulation	54 m²
Level 00	AG.4	Common Area	124 m²
Level 00	AG.4B	Storage	9 m²
Level 00	AG.5	Circulation	13 m²
Level 00	AG.6	Circulation	5 m²
Level 00	AG.7	WC	4 m²
Level 00	AG.8	WC	4 m²
Level 00	AG.9	Stairs	11 m²
Level 00	AG.10	Switch Room	16 m²
Level 00	AG.10	Circulation	124 m²
Level 00	AG.11	Ground Plant Room	85 m²
Level 00	AG.12	Sprinker Tank Room	12 m²
Level 00	AG.13	Comms	15 m²
Level 00	AG.14	Laundry Area	69 m²
Level 00	AG.15	Car Parking	58 m²
Level 00	AG.16	Bins	39 m²
Level 00	AG.16B	Recycling Bins	47 m²
Level 00	BG.1	Lobby	40 m²
Level 00	BG.2	Stairs	11 m²
Level 00	BG.3	Bike Store	87 m²
Level 00	BG.4	Cleaners Store	8 m²
Level 00	BG.5	WC	5 m²
Level 00	BG.6	Circulation	29 m²
Level 00	BG.7	Main Storage	47 m²
Level 00	BG.8	Consult Room	11 m²
Level 00	BG.9	CCTV Monitoring	11 m²
Level 00	BG.10	Parcel Store	18 m²
Level 01	A1.1	Circulation	172 m²
Level 01	A1.2	Lift Lobby	9 m²
Level 01	A1.2B	Firefighting Stair	22 m²
Level 01	A1.3	Communal Kitchenette	75 m²
Level 01	A1.4	WC	12 m²
Level 01	A1.5	WC	10 m²
Level 01	A1.6	Cleaner Store	7 m²
Level 01	A1.7	Multi-Functi on Room	82 m²
Level 01	A1.7B	Storage	15 m²
Level 01	A1.7C	Storage	4 m²
Level 01	A1.8	Circulation	80 m²
Level 01	A1.9	Stairs	11 m²
Level 01	A1.11	Function Room	36 m²
Level 01	A1.12	Cinema Room	48 m²
Level 01	A1.13	Social Room	52 m²
Level 01	A1.13B	Storage	5 m²
Level 01	A1.14	Gym	85 m²
Level 01	A1.14B	Gym Storage	13 m²
Level 01	B1.1	Lobby	31 m²
Level 01	B1.2	Stairs	11 m²

Room Schedule 2			
Level	Number	Name	Area
Level 01	B1.3	Circulation	49 m²
Level 01	B1.4	WC + Shower	10 m²
Level 01	B1.5	WC	5 m²
Level 01	B1.6	WC	5 m²
Level 01	B1.7	Staff Room	23 m²
Level 01	B1.8	Manageme nt Offices	74 m²
Level 01	B1.8B	Storage	7 m²
Level 01	B1.8C	Storage	4 m²
Level 01	B1.9	Manager's Office	17 m²
Level 01	B1.10	Staff Meeting Room	23 m²
Level 01	B1.A1	Hall	9 m²
Level 01	B1.A1B	Bathroom	5 m²
Level 01	B1.A1C	Bedroom	8 m²
Level 01	B1.A1D	Main Bedroom	14 m²
Level 01	B1.A1E	Living Room/Kitch en	36 m²
Level 01	B1.A1F	Storage	2 m²
Level 02	A2.1	Lobby	20 m²
Level 02	A2.2	Lobby	9 m²
Level 02	A2.2B	Firefighting Stair	22 m²
Level 02	A2.3	WC	6 m²
Level 02	A2.4	WC	6 m²
Level 02	A2.5	Circulation	11 m²
Level 02	A2.6	Cleaner Store	11 m²
Level 02	A2.7	Social Room	65 m²
Level 02	A2.7B	Storage	3 m²
Level 02	A2.7C	Storage	3 m²
Level 02	A2.8	Circulation	13 m²
Level 02	A2.9	Lobby	12 m²
Level 02	A2.10	Room	12 m²
Level 02	A2.11	Group Study Room	24 m²
Level 02	A2.12	Group Study Room	24 m²
Level 02	A2.13	Library	65 m²
Level 02	A2.14	Quiet Study	31 m²
Level 02	A2.S1	Hall	17 m²
Level 02	A2.S1A	Bedroom	10 m²
Level 02	A2.S1AB	Bathroom	2 m²
Level 02	A2.S1B	Bedroom	9 m²
Level 02	A2.S1BB	Bathroom	2 m²
Level 02	A2.S1C	Living Room/Kitch en	22 m²
Level 02	A2.S1D	Bedroom	10 m²
Level 02	A2.S1DB	Bathroom	2 m²
Level 02	A2.S1E	Bedroom	10 m²
Level 02	A2.S1EB	Bathroom	2 m²
Level 02	A2.S2	Hall	15 m²
Level 02	A2.S2A	Bedroom	10 m²
Level 02	A2.S2AB	Bathroom	2 m²
Level 02	A2.S2B	Bedroom	10 m²
Level 02	A2.S2BB	Bathroom	2 m²
Level 02	A2.S2C	Bedroom	10 m²
Level 02	A2.S2CB	Bathroom	2 m²
Level 02	A2.S2D	Bedroom	10 m²
Level 02	A2.S2DB	Bathroom	2 m²
Level 02	A2.S2E	Bedroom	10 m²
Level 02	A2.S2EB	Bathroom	2 m²

Room Schedule 2			
Level	Number	Name	Area
Level 02	A2.S2F	Living Room/Kitch en	30 m²
Level 02	B2.A2BB	Room	1 m²
Level 02	B2.RAB	Bathroom	3 m²
Level 02	B2.RAC	Storage	1 m²
Level 02 B	B2.1	Lobby	49 m²
Level 02 B	B2.2	Stairs	11 m²
Level 02 B	B2.3	Storage	2 m²
Level 02 B	B2.A1A	Hall	7 m²
Level 02 B	B2.A1B	Bathroom	5 m²
Level 02 B	B2.A1C	Bedroom	8 m²
Level 02 B	B2.A1D	Main Bedroom	14 m²
Level 02 B	B2.A1E	Living Room/Kitch en	35 m²
Level 02 B	B2.A1F	Storage	2 m²
Level 02 B	B2.A2A	Hall	10 m²
Level 02 B	B2.A2B	Living Room/Kitch en	36 m²
Level 02 B	B2.A2C	Main Bedroom	12 m²
Level 02 B	B2.A2D	Bathroom	8 m²
Level 02 B	B2.A2E	Bedroom	10 m²
Level 02 B	B2.A2F	Storage	2 m²
Level 02 B	B2.A3A	Hall	6 m²
Level 02 B	B2.A3B	Bathroom	4 m²
Level 02 B	B2.A3C	Main Bedroom	11 m²
Level 02 B	B2.A3D	Bedroom	9 m²
Level 02 B	B2.A3E	Living Room/Kitch en	34 m²
Level 02 B	B2.A3EB	Storage	1 m²
Level 02 B	B2.A3F	Storage	1 m²
Level 02 B	B2.RAA	Living Room/Kitch en	29 m²
Level 03	A3.1	Lobby	14 m²
Level 03	A3.2	Room	9 m²
Level 03	A3.2B	Firefighting Stair	24 m²
Level 03	A3.3	Cleaner Room	7 m²
Level 03	A3.4	Lobby	12 m²
Level 03	A3.5	Stairs	12 m²
Level 03	A3.RAA	Living Room/Kitch en	22 m²
Level 03	A3.RAB	Bedroom	9 m²
Level 03	A3.RAC	Bathroom	6 m²
Level 03	A3.S1	Hall	23 m²
Level 03	A3.S1A	Living Room/Kitch en	29 m²
Level 03	A3.S1B	Bedroom	11 m²
Level 03	A3.S1BB	Bathroom	2 m²
Level 03	A3.S1C	Bedroom	11 m²
Level 03	A3.S1CB	Bathroom	2 m²
Level 03	A3.S1D	Bedroom	10 m²
Level 03	A3.S1DB	Bathroom	2 m²
Level 03	A3.S1E	Bedroom	10 m²
Level 03	A3.S1EB	Bathroom	2 m²
Level 03	A3.S2	Hall	17 m²
Level 03	A3.S2A	Bedroom	10 m²
Level 03	A3.S2AB	Bathroom	2 m²
Level 03	A3.S2B	Bedroom	9 m²
Level 03	A3.S2BB	Bathroom	2 m²
Level 03	A3.S2C	Living Room/Kitch en	23 m²

Room Schedule 2			
Level	Number	Name	Area
Level 03	A3.S2D	Bedroom	10 m²
Level 03	A3.S2DB	Bathroom	2 m²
Level 03	A3.S2E	Bedroom	10 m²
Level 03	A3.S2EB	Bathroom	2 m²
Level 03	A3.S3	Hall	15 m²
Level 03	A3.S3A	Bedroom	10 m²
Level 03	A3.S3AB	Bathroom	2 m²
Level 03	A3.S3B	Bedroom	10 m²
Level 03	A3.S3BB	Bathroom	2 m²
Level 03	A3.S3CB	Bathroom	2 m²
Level 03	A3.S3D	Bedroom	10 m²
Level 03	A3.S3DB	Bathroom	2 m²
Level 03	A3.S3E	Bedroom	10 m²
Level 03	A3.S3EB	Bathroom	2 m²
Level 03	A3.S3F	Living Room/Kitch en	30 m²
Level 03	A3.S4	Hall	20 m²
Level 03	A3.S4A	Bedroom	10 m²
Level 03	A3.S4AB	Bathroom	2 m²
Level 03	A3.S4B	Bedroom	10 m²
Level 03	A3.S4BB	Bathroom	2 m²
Level 03	A3.S4C	Bedroom	10 m²
Level 03	A3.S4CB	Bathroom	2 m²
Level 03	A3.S4D	Bedroom	10 m²
Level 03	A3.S4DB	Bathroom	2 m²
Level 03	A3.S4E	Bedroom	10 m²
Level 03	A3.S4EB	Bathroom	2 m²
Level 03	A3.S4F	Bedroom	11 m²
Level 03	A3.S4FB	Bathroom	2 m²
Level 03	A3.S4G	Living Room/Kitch en	32 m²
Level 03	A3.S5C	Bedroom	10 m²
Level 03 B	B3.1	Lobby	43 m²
Level 03 B	B3.2	Stairs	11 m²
Level 03 B	B3.3	Cleaner Store	5 m²
Level 03 B	B3.A1A	Hall	9 m²
Level 03 B	B3.A1B	Bathroom	5 m²
Level 03 B	B3.A1C	Bedroom	8 m²
Level 03 B	B3.A1D	Main Bedroom	15 m²
Level 03 B	B3.A1E	Living Room/Kitch en	36 m²
Level 03 B	B3.A1F	Storage	2 m²
Level 03 B	B3.A2A	Hall	10 m²
Level 03 B	B3.A2B	Living Room/Kitch en	36 m²
Level 03 B	B3.A2BB	Storage	1 m²
Level 03 B	B3.A2C	Main Bedroom	12 m²
Level 03 B	B3.A2D	Bathroom	8 m²
Level 03 B	B3.A2E	Bedroom	10 m²
Level 03 B	B3.A2F	Storage	2 m²
Level 03 B	B3.A3A	Hall	6 m²
Level 03 B	B3.A3B	Bathroom	4 m²
Level 03 B	B3.A3C	Main Bedroom	10 m²
Level 03 B	B3.A3D	Bedroom	9 m²
Level 03 B	B3.A3E	Living Room/Kitch en	34 m²
Level 03 B	B3.A3F	Storage	1 m²
Level 03 B	B3.RAA	Living Room/Kitch en	29 m²
Level 03 B	B3.RAB	Room	3 m²
Level 03 B	B3.RAC	Storage	1 m²

Fig145 – Room Schedule Level 00 to 03 (Author, 2021)

3.0 Design in Context Images (Draft)

Fig146 - Level 02 Roof Garden (Author, 2021)

Fig147 - Level 08 Hardscape Terrace (Author, 2021)

Fig148 - Young-Old Apartment (Author, 2021)

Fig149 - Young-Old Apartment (Author, 2021)

Fig150 - Entrance Lobby (Author, 2021)

Fig151 - Small Gym (Author, 2021)

Fig152 - Social Space (Author, 2021)

Fig153 - Student Living Room/Kitchen (Author, 2021)

Fig154 - Student Room (Author, 2021)

Fig155 - Management Office (Author, 2021)

Fig156 - Terrace (Author, 2021)