Technology and Environment in Architecture-

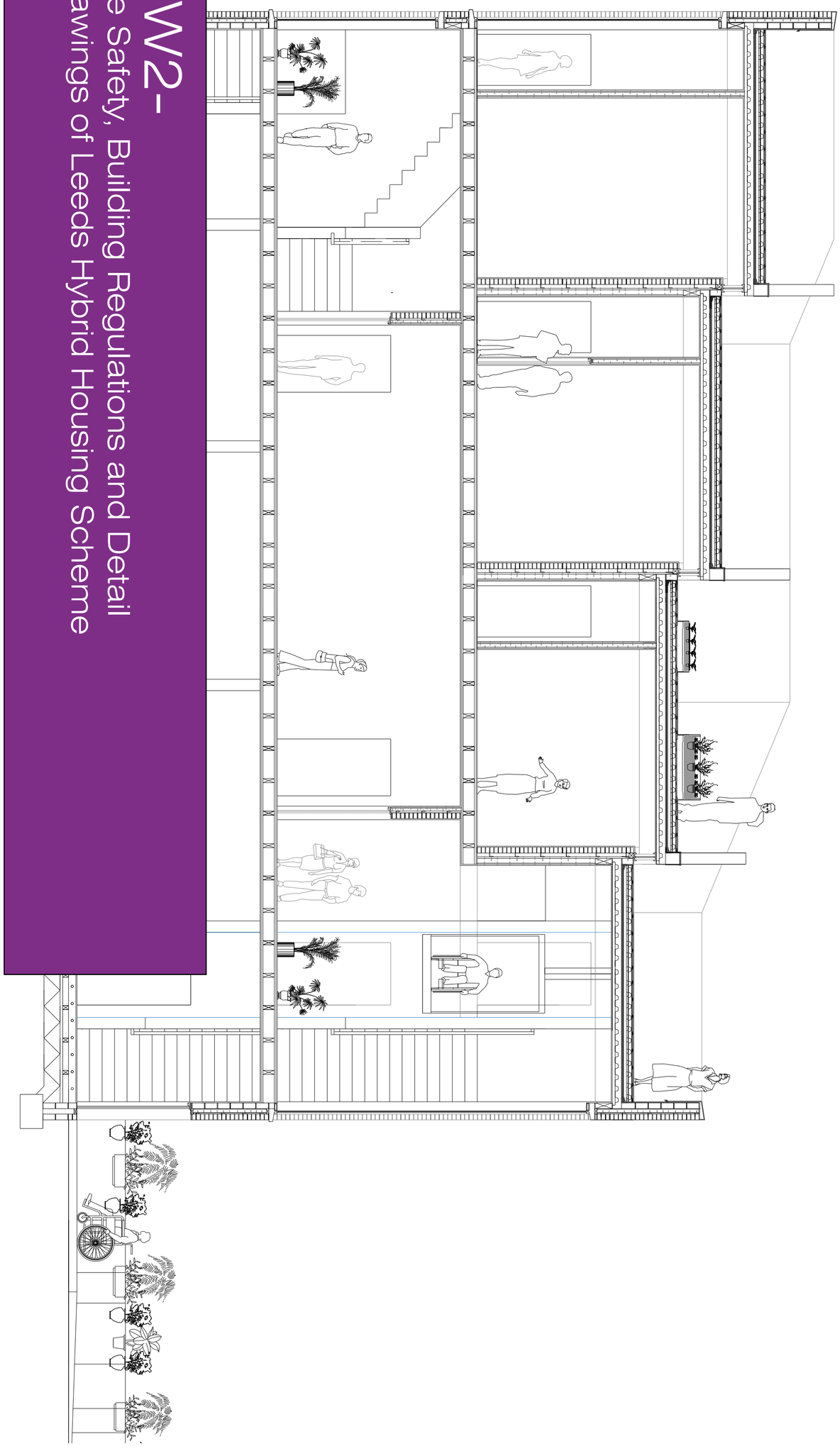
Fire Safety and Building Regulations

Joseph Beeley- N0810079

CW2-

Fire Safety, Building Regulations and Detail

Drawings of Leeds Hybrid Housing Scheme



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Section 1-
Environmental Strategy

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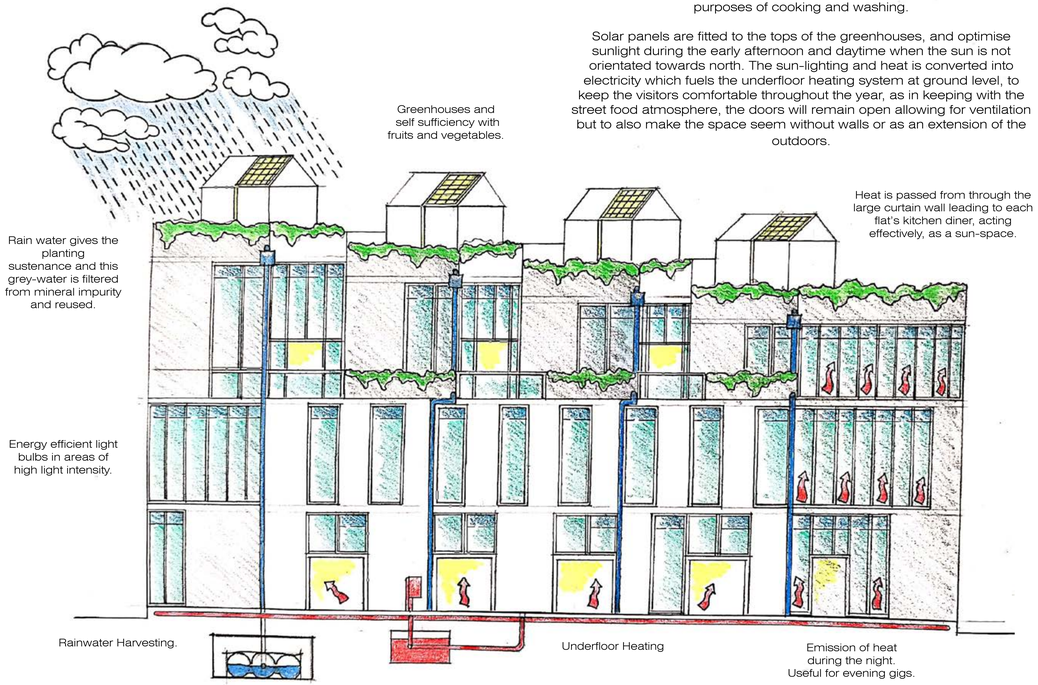
Water Recycling and Heating
Page 4

A couple of energy efficient and green aspects of my hybrid housing design include rainwater collection and storage underground that has been drained through the planters and the loose pebbles on the roof. These downpipes are located in the corner of each roof terrace to allow the walls to be decorated with growing plants and hanging baskets without obstruction. The piping then runs down to ground level and through additional drainage grids. This grey-water collected is used to sustainably flush the toilets and provide water to industrial sinks solely used for the purposes of cooking and washing.

Solar panels are fitted to the tops of the greenhouses, and optimise sunlight during the early afternoon and daytime when the sun is not orientated towards north. The sun-lighting and heat is converted into electricity which fuels the underfloor heating system at ground level, to keep the visitors comfortable throughout the year, as in keeping with the street food atmosphere, the doors will remain open allowing for ventilation but to also make the space seem without walls or as an extension of the outdoors.



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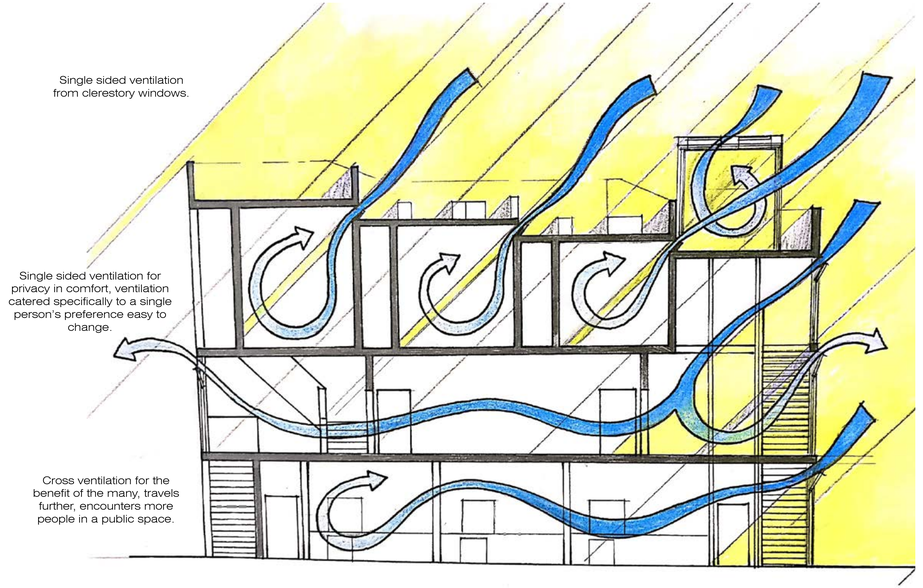
Air Flow in Section
Page 5

Air can circulate within each bedroom of each flat through the small clerestory window at the top that of which is big enough to allow for ventilation and a small amount of natural light but not to much as to disturb the sense that the bedroom is a 'back' in terms of positioning, an area of calm, and relaxation that is subtle instead of foreboding.
This is an example of single sided ventilation, those ventilating effects strengthened as the air circulates around the room. The fact that cold air sinks contributes well to the cooling effect of opening this window at night during a stagnant summer.



Ventilation on the first floor can be considered as stacked if the high window on the second floor allows for a cold breeze to enter and then sink into the recreational space. The laundry room would also have to be well ventilated with fans or air-con powered potentially by the panels on the roof.

Sunlight penetrates the first floor and second floor curtain glass wall and the void between them in such a way that it almost acts like a sun-space of which the heat transferred into the flooring can emit and pass through into the recreation and meeting space should it be needed.

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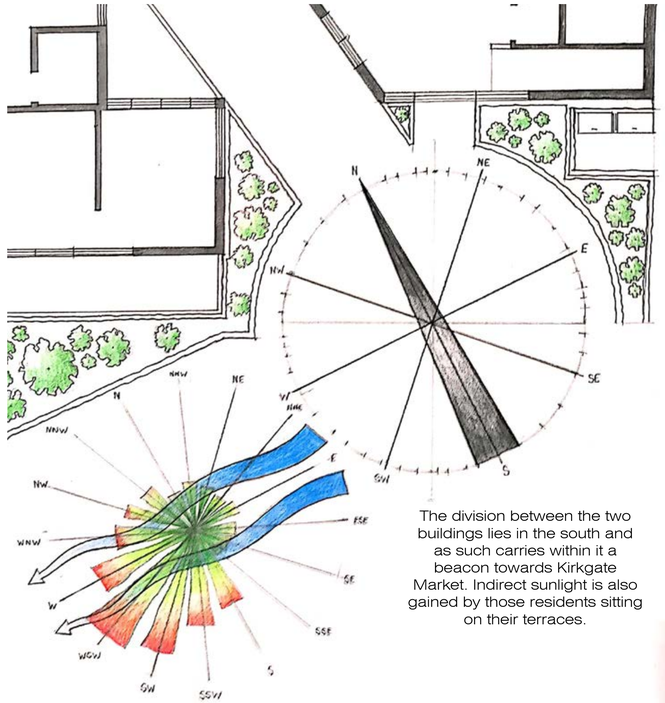
Prevailing Wind and Lighting
Page 6

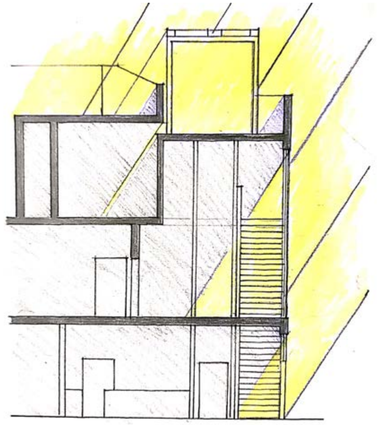


The prevailing wind direction in this area of Leeds is to the West, from the direction of Kirkgate, and this would seemingly implore that there cannot be adequate ventilation, but regular winds from the south and south-west show cross ventilation to be possible.

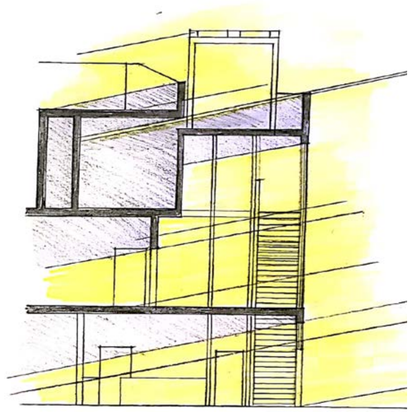
Planting that requires a high intensity of sunlight can be planted on this side.

June 21st
12:00
Azimuth: 155.43°
Altitude: 57.87°

The division between the two buildings lies in the south and as such carries within it a beacon towards Kirkgate Market. Indirect sunlight is also gained by those residents sitting on their terraces.



Transparency of greenhouses allows light onto each terrace.



December 21st
12:00
Azimuth: 164.93
Altitude: 11.52

The winter months allow these open plan public spaces to look even more inviting as an alternative from being outside by the light within them .

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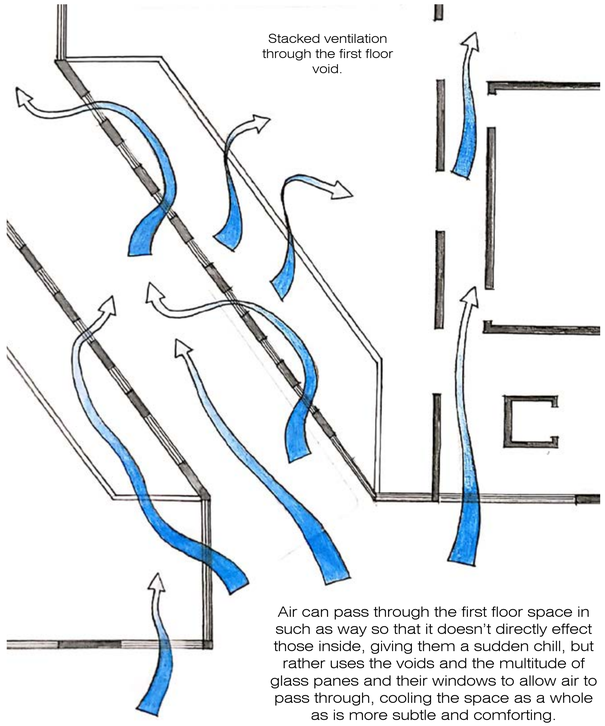
Additional Ventilation
Page 7

Wind funnelling through the space between the two building can be both a comfort and discomfort depending on the intensity.

Cross ventilation can occur in many places across the the first floor with the alternating windows that line the diagonal faces.



Stacked ventilation through the first floor void.

Air can pass through the first floor space in such as way so that it doesn't directly effect those inside, giving them a sudden chill, but rather uses the voids and the multitude of glass panes and their windows to allow air to pass through, cooling the space as a whole as is more subtle and comforting.

Vulnerable or fragile planting won't feel the brawn of strong winds.

The expanse of the space at ground level provides many fissure points for the air to seep into.

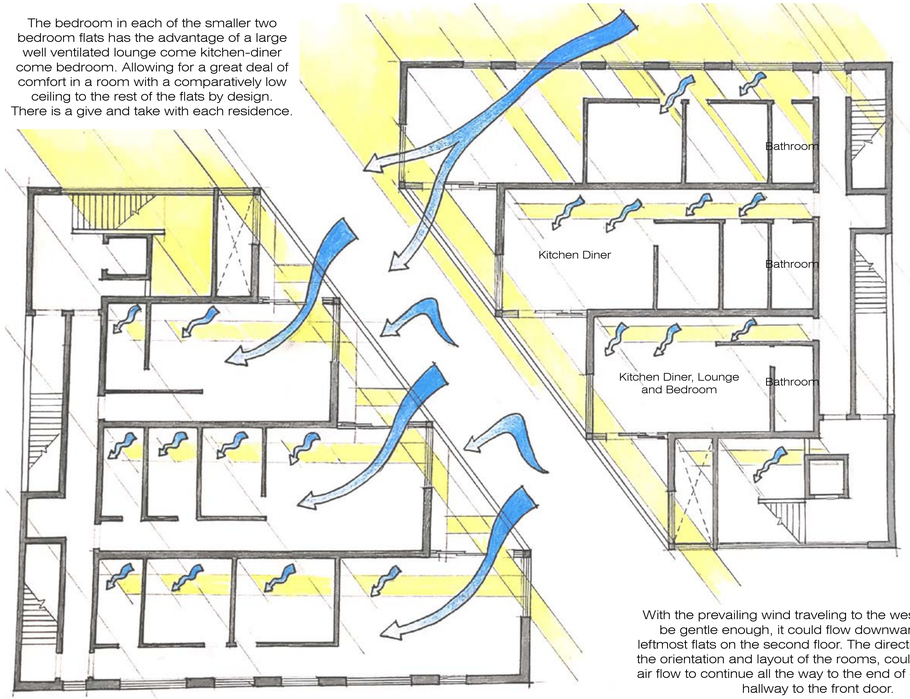
Stacked ventilation through the first floor void and out.

The angle allows the breeze to be indirect, activating the automatic doors doesn't release a sudden gust and pressure.

Residential Floor Strategy
Page 8

The bathroom in each of these flats are placed in such a way as be easy to rig up to piping, they are all spaced at regular intervals and are all the same size so interior elements can be bought in bulk for a lower price. The symmetrical nature of the bathrooms, kitchens balconies and their drainage makes the irrigation and heating systems all the more easy to design, and can site within the buildings, as the recess in the topology can be excavated and then levelled out.

The bedroom in each of the smaller two bedroom flats has the advantage of a large well ventilated lounge come kitchen-diner come bedroom. Allowing for a great deal of comfort in a room with a comparatively low ceiling to the rest of the flats by design. There is a give and take with each residence.



Sun-lighting from the south passing through the clerestory windows.

The repeating window placement allows for shifts of light to flood each kitchen.

With the prevailing wind traveling to the west, if it were to be gentle enough, it could flow downwards into the leftmost flats on the second floor. The direction; along with the orientation and layout of the rooms, could allow for this air flow to continue all the way to the end of each entrance hallway to the front door.

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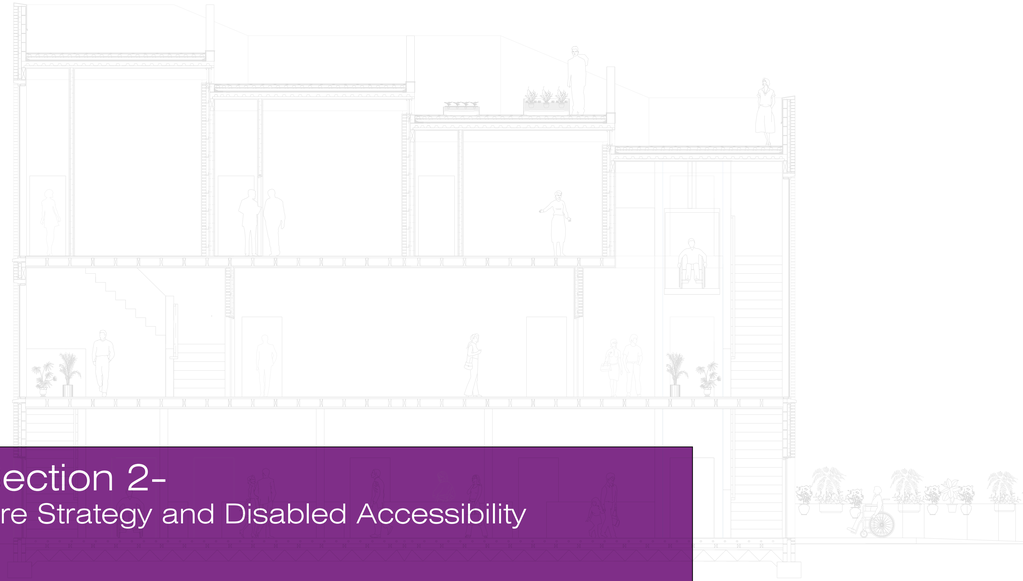

Section 2-
Fire Strategy and Disabled Accessibility

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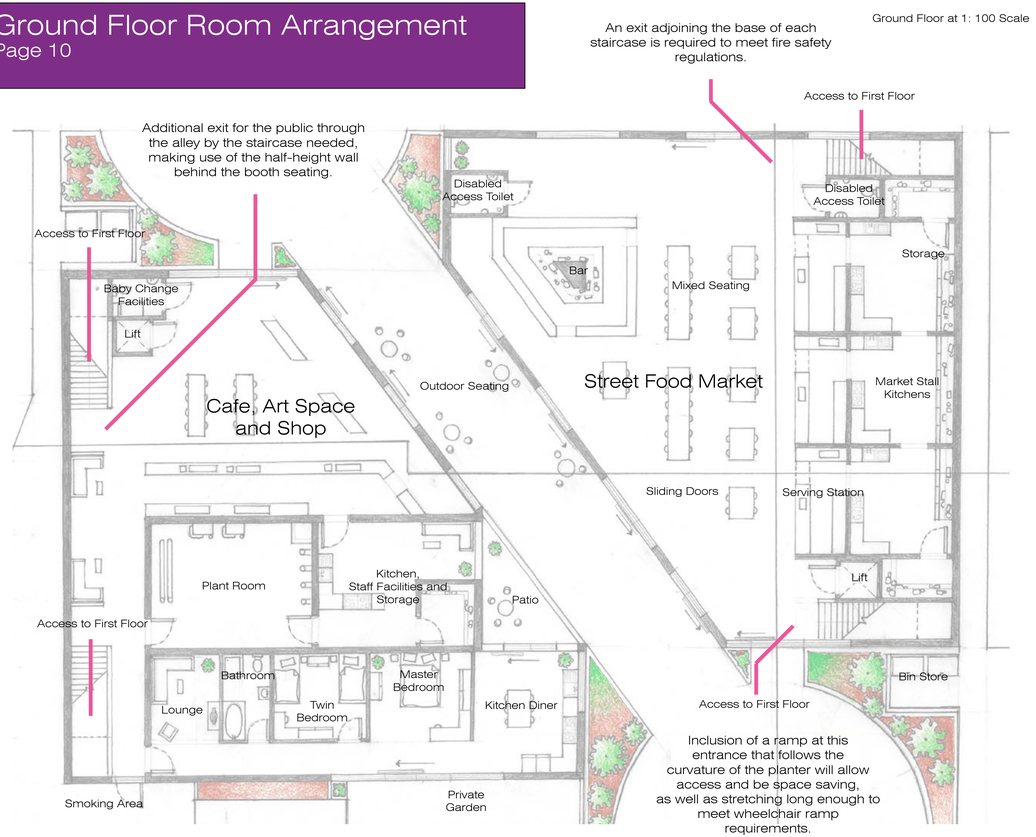
Ground Floor Room Arrangement
Page 10

Ground Floor at 1: 100 Scale



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First Floor Room Arrangement
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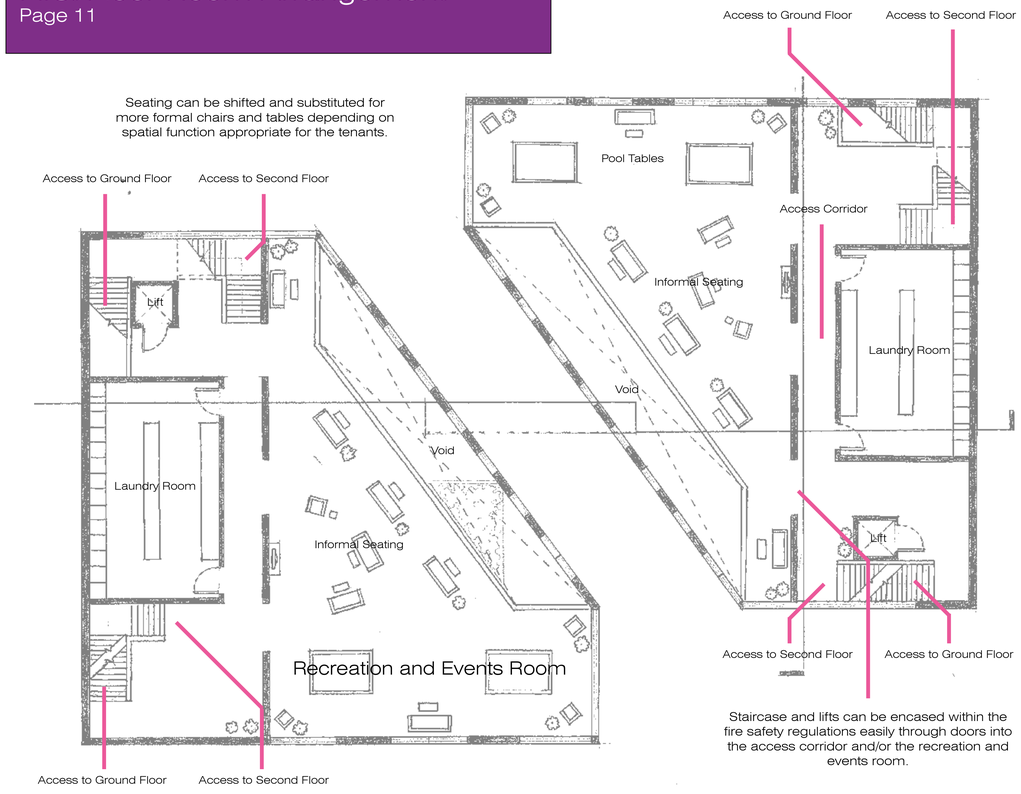
First Floor at 1: 100 Scale



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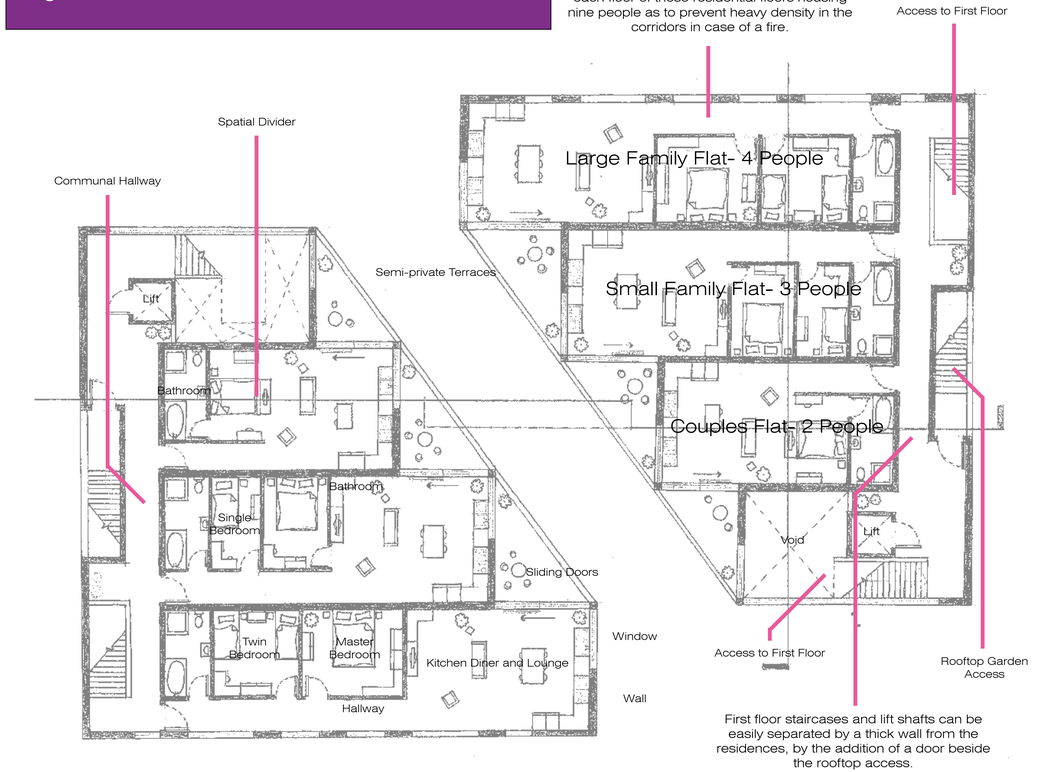
Second Floor Room Arrangements
Page 12

Second Floor at 1: 100 Scale

Flats are symmetrical between buildings, with each floor of these residential floors housing nine people as to prevent heavy density in the corridors in case of a fire.



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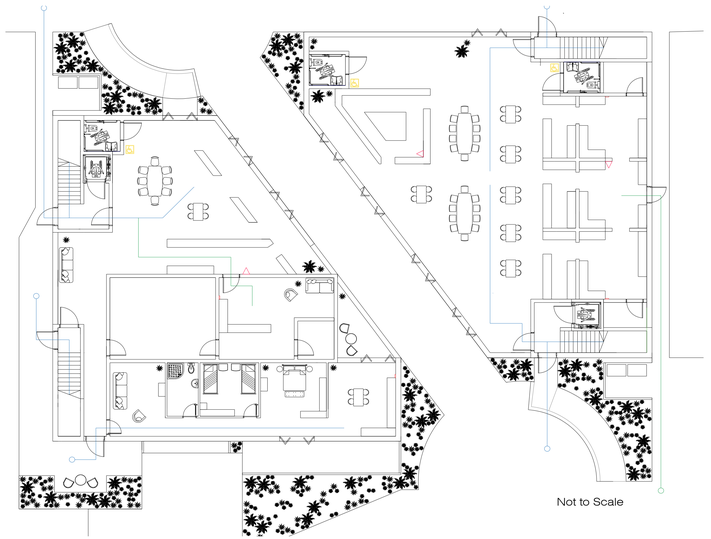
Escape Routes and Safety Equipment- GF
Page 13



Disabled Access Toilets
Emergency Fire Blankets
Emergency Fire Extinguishers
Public Escape Routes
Staff Escape Routes

The ground floor contains several fire safety precautions, should a fire start, and are appropriately placed. A fire extinguisher in the central kitchen space allows for quick access by all traders in the individual food stalls. with additional fire blankets at either end. There is also a quick escape rote through the central kitchen outside should the worst happen.

By law, a fire extinguisher must be easily attainable at a bar, due to the flammable nature of the the alcohol and the use of fire in the mixing and making of cocktails. I ensured there was also an extinguisher readily available in the cafe, if there were to be an electrical fault in the coffee machine, panini press etc: with a fire blanket inside the cafe kitchen to quickly and discretely combat a potential blaze.

Also by law, anything deemed to be a residency, in this case the ground floor flat owned by the general manager or tenant and their family, should contain a means of extinguishing fire, which in this case is a fire blanket located in the kitchen.

Wheelchair accessible toilets can be found on the north side of the housing scheme, although if I were to design the building again, I would swap the position of the toilet by the third street food stall to the south face to reduce travel to it from the south. This would mean the movement of my lift, which would have thrown my whole scheme into trouble.

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Escape Routes and Safety Equipment- 1F
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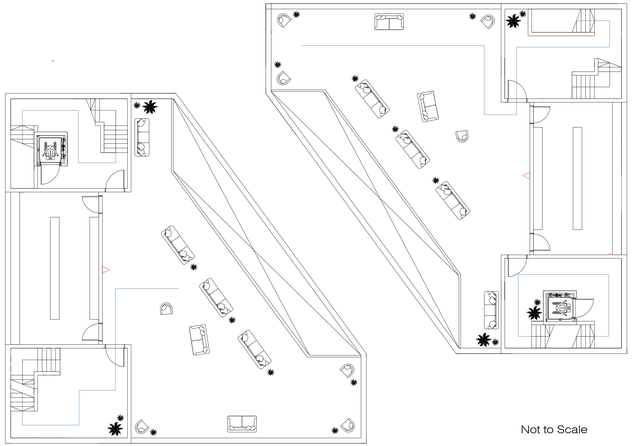

Not to Scale

A relatively simple floor with little risk of fire, precautions must still be put in place if outlets are fried by liquid damage, or if cigarettes are smoked causing fire. Precautions can be made with the couch fabrics and flooring selection as well as appropriate signage to deter smokers, to reduce these risks. A single centrally located fire extinguisher is in each lobby/ recreation room just in case.

The real risk comes from the laundry room, as as such,a fire blanket has been installed by the washers and dryers in case of faulty machinery, incorrect usage and material input that could be flammable, easily accessible even if a fire were to obscure the walkway closest to the exterior wall. Movement around the potential fire is safe.

- Disabled Access Toilets
- Emergency Fire Blankets
- Emergency Fire Extinguishers
- Public Escape Routes
- Staff Escape Routes

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Escape Routes and Safety Equipment- 2F
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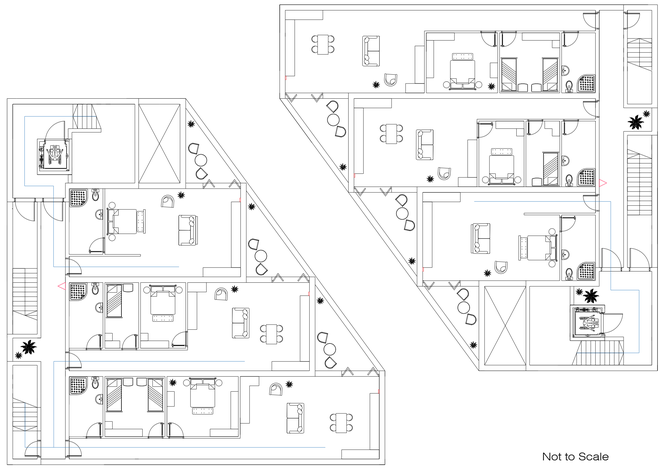

Not to Scale

The floor plan of the residences are symmetrical in format and thus the precautions for fire in each building are the same in this instance.

Much like the ground floor flat, a fire blanket is located by the sliding doors above the kitchen counter-top, at the side of a cupboard as to be discreet, and accessible at raised-arm level.
The kitchen being the most likely place for a fire.

The hallway contains a centrally located fire extinguisher, should the blaze block access to the corridor within each flat.

- Disabled Access Toilets
- Emergency Fire Blankets
- Emergency Fire Extinguishers
- Public Escape Routes
- Staff Escape Routes

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Escape Route Distances- GF
Page 16

Ground Floor at 1: 150 Scale

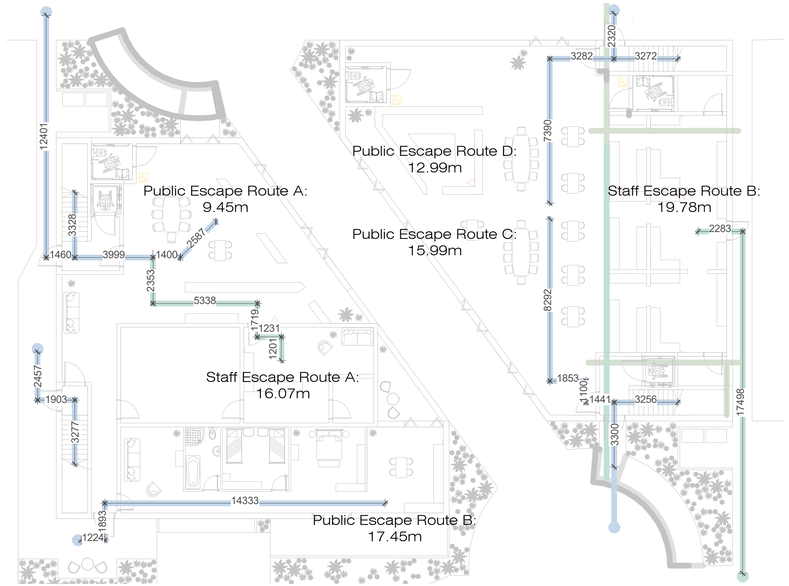

Table 2.1 Limitations on travel distance

Purpose group	Use of the premises or part of the premises		Maximum travel distance[1] where travel is possible in: One direction only (m)	More than one direction (m)
2(a)	Residential (institutional)		9	18
2(b)	Residential (other):			
	a. in bedrooms[2]		9	18
	b. in bedroom corridors		9	35
	c. elsewhere		18	35
3	Office		18	45
4	Shop and commercial		18	45
5	Assembly and recreation:			
	a. buildings primarily for disabled people		9	18
	b. areas with seating in rows		15	32
	c. elsewhere		18	45
6	Industrial[3]	Normal hazard	25	45

Fig 1.1: Limitations on Travel Distance
(GOV.uk, 2019)

According to 'Part B' of British Standards for fire safety, my ground floor bedrooms should be no more than 9m away from a given fire exit route, if you conclude the only exit is via the front door. However, exiting this flat can be done via the patio or garden, meaning any route out can be up to 18m, the longest of which, Public Escape Route B, meeting these criteria.

Shop and Commercial use spaces including the cafe and art space in the leftmost building, and the street food market in the rightmost building are never in excess of 18m from an exit, (routes A, C and D) following British Standards guidelines. The only exception to this rule is Staff Escape Route B, whereby, despite the annotation the staff are safely out of the building if in a maximum of roughly 10m travel, the assembly point to the south being 17m from the exit.

There are of course a multitude of exits via wide sliding doors that can more easily prevent foot traffic as the visitors flee, but in the case of an electrical fault, the exits via these fire escape doors is essential under extreme circumstances.

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Escape Route Distances- 1F
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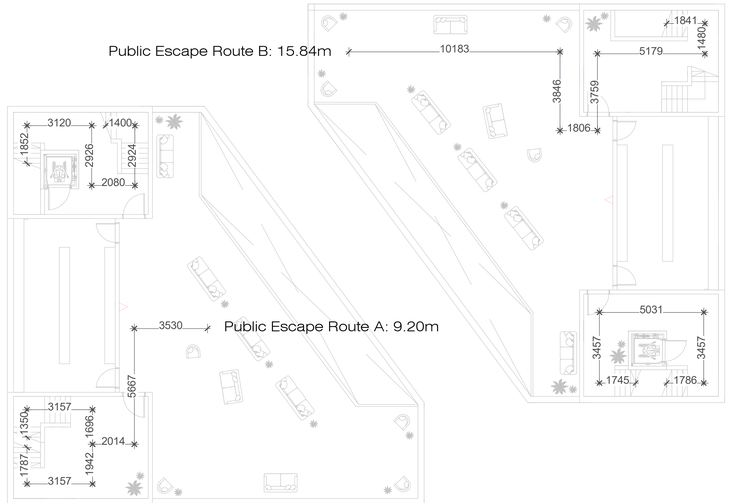
First Floor at 1: 150 Scale

4	Shop and commercial		18	45
5	Assembly and recreation:			
	a. buildings primarily for disabled people		9	18
	b. areas with seating in rows		15	32
	c. elsewhere		18	45
6	Industrial[3]	Normal hazard	25	45



'Assembly and Recreation' is probably the most applicable aspect of the British Standard Certificate for this floor, and I would denote my recreational rooms as fitting within the 'elsewhere' bracket. True for both buildings is the ability to leave via two exits to a set of isolated stairs, the closest of which; (from the furthest space away possible), is a journey of 15.84m via route B. With escape from the central seating area and potential meeting and discussion space being under 10m away from either exit.

The proximity of the laundry room door to the staircase access door is a blessing and a curse as it ensures anyone in the laundry room can escape quickly, but also in the event of a fire, the potentiality of the fire spreading and obstructing one staircase is possible should the blaze be left long enough.

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Escape Route Distances- 2F
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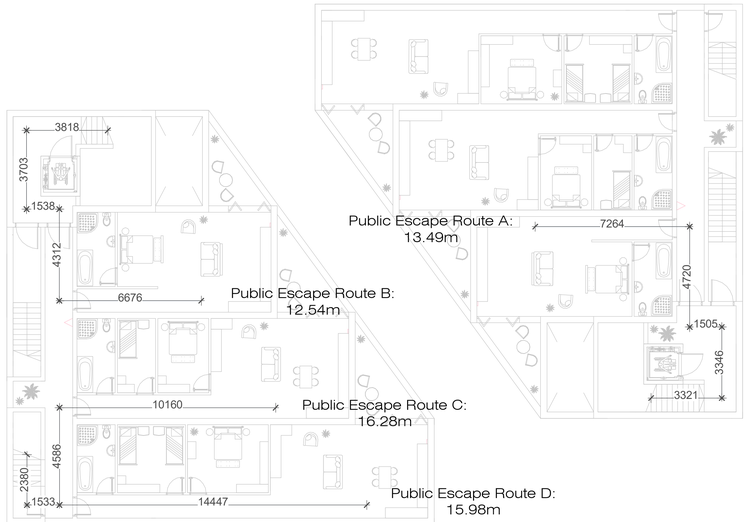
Table 2.1 Limitations on travel distance

Purpose group	Use of the premises or part of the premises	Maximum travel distance[3] where travel is possible in: One direction only (m)	More than one direction (m)
2(a)	Residential (institutional)	9	18
2(b)	Residential (other):		
	a. in bedrooms[2]	9	18
	b. in bedroom corridors	9	35
	c. elsewhere	18	35
3	Office	18	45

Second Floor at 1: 150 Scale



Used as a residential floor, there are two escape routes in each building, each being favourable by a different resident. The resident in the central flat being impartial as to their escape route.

Bedrooms or bedroom corridors never surpass 9m in distance from the front door as an exit, meaning quick escape in the event of a stove-top fire or similar kitchen blaze. And all bedrooms are never in excess of 18m from a fire escape staircase or disabled lift. Through multiple exit choices and the small amount of occupants on this floor, divided further into two buildings, escape is easy and as stress free as possible.

With each flat also having a balcony, emergency escape or rescue, or at the very least, access to clean air is available in emergencies.

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Fire Resistant Walls- Ground Floor
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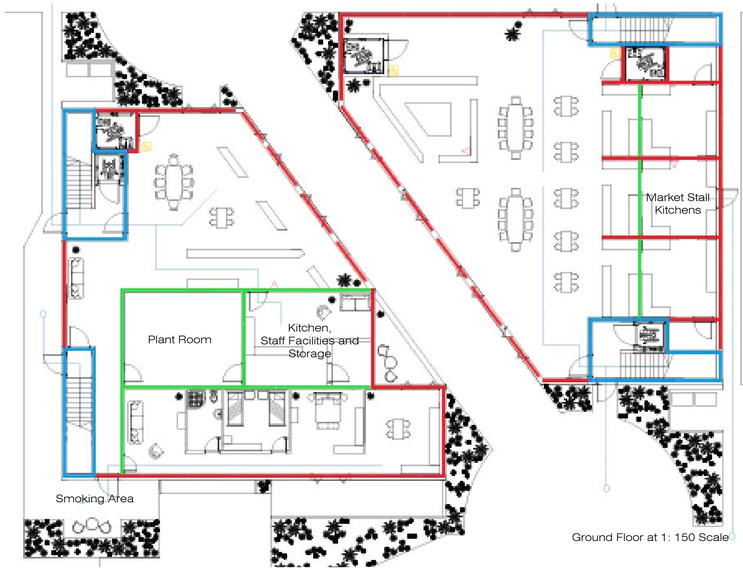
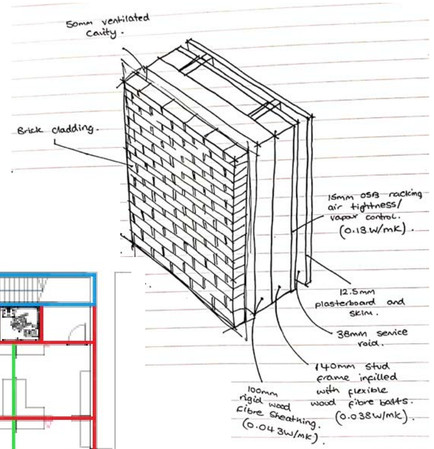
120 Minute Fire Protection
60 Minute Fire Protection
30 Minute Fire Protection



Ground Floor at 1: 150 Scale



The efficiency in which the public and staff can leave these spaces as they are in on the bottom floor, allows for slight leniencies in the fire protection, Providing those on higher levels remain within the isolated staircases as they exit.

There are a couple of elements I would reconsider, firstly, the plant room, which contains fuseboxes boilers gas valves etc: which could be extremely dangerous and thus pose a threat should that room become compromised. The escape via the smoking area combats this risk, but the door in the kitchen and staff room is perhaps too close to where the potential risk could be, to counteract this, the perimeter of the plant room should be made thicker and more thermally resistant. To truly make the market stalls an area resistant to fire for 60 minutes would require doors between each of them.

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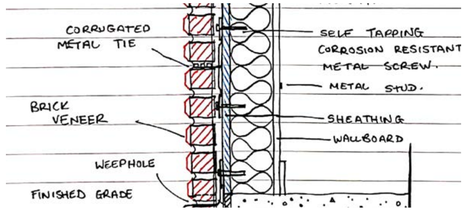
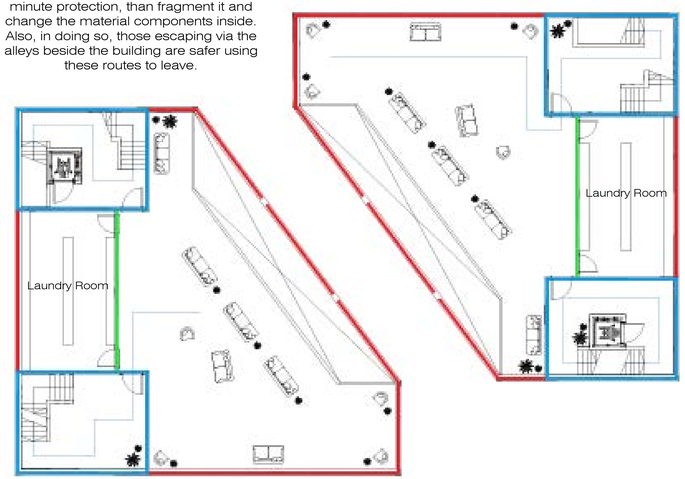
Fire Resistant Walls- First Floor
Page 20

120 Minute Fire Protection
60 Minute Fire Protection
30 Minute Fire Protection

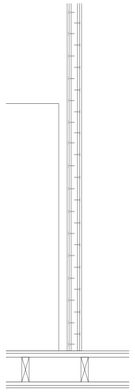


The only modification I would make to this fire strategy is the materiality of the exterior wall of each laundry room, as in terms of construction, it would be much easier to line this entire wall with 120 minute protection, than fragment it and change the material components inside. Also, in doing so, those escaping via the alleys beside the building are safer using these routes to leave.



First Floor at 1: 150 Scale

Alleyway at Ground Level



Above is a detail of the laundry room wall and the simple sandwiching of a wooden stud with gypsum board layers and plaster in order to surpass 30 minutes of fire protection. I felt this was important as, the main source of potential fire on this floor is the laundry room, which if contained effectively and for long enough won't spread to the rest of the floor or building.

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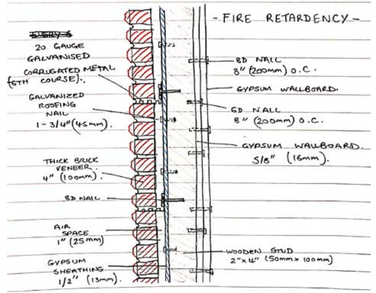
Fire Resistant Walls- Second Floor
Page 21

120 Minute Fire Protection
60 Minute Fire Protection
30 Minute Fire Protection



Second Floor at 1: 150 Scale

Fire protection through the materiality of my interior walls is possible through the use of wooden studs instead of Met-Sec and insulation, with layers of wall board nailed on. The more layers of wall board, the greater the fire protection. My hand-drawn diagram above depicts my process as I formulate the elements within my walls.

The application of this gypsum wall board system can easily be applied to exterior walls to increase fire protection times as you have already seen.

The perimeter of my buildings will be protected by at least 60 minute fire protection, the staircases at each level protected by 120 minutes, allowing for residents and visitors on all floors to move in an orderly and steady fashion down the stairs should their numbers be great enough. Wall between the flats have thirty minute fire protection which could be more but my logic was that once the alarm is raised, The residents will immediately be out of their rooms, the rest of their journey out of the building taking longer, with more measures needed to protect them on their way out of the complex.

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Manoeuvrability and Toilets
Page 22

Table 2 Minimum effective clear widths of doors

Direction and width of approach	New buildings (mm)	Existing buildings (mm)
Straight-on (without a turn or oblique approach)	800	750
At right angles to an access route at least 1500mm wide	800	750
At right angles to an access route at least 1200mm wide	825	775
External doors to buildings used by the general public	1000	775

Note:
The effective clear width is the width of the opening measured at right angles to the wall in which the door is situated from the outside of the door stop on the door closing side to any obstruction on the hinge side, whether this be projecting door opening furniture, a weather board, the door or the door stop (see Diagram 9). For specific guidance on the effective clear widths of doors in sports accommodation, refer to "accessible sports facilities".

Diagram 9 Effective clear width of doors

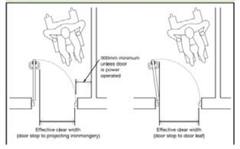


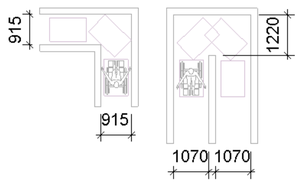
Fig 1.2: Effective Clear Width of Doors
(GOV.uk, 2016)

Minimum wheelchair manoeuvrability requirements have been denoted below, regarding 90-degree and 180-degree turnings, those of which are then followed by diagrams as to how wheelchair users would navigate my street food market ground floor, coming form each protected staircase.

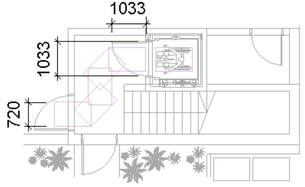
In each instance my doors have been positioned in such a way as to open against a wall, removing the need for 300mm clearance against said wall if the hinge were on the opposite side. Instead, a 100mm spacing of said door to wall is needed when open.

The minimum doorway width of 800mm has also been surpassed when entering the disabled toilet of width 1850mm.

However, the interior dimensions of the disabled toilet are slightly too small in terms of depth by 100mm. The requirements being 1500mmx2200mm. This can easily be catered for by reducing the width of the storage slightly. (Right)



Minimum Spatial Dimensions for Turnings



Lift Exit to Car Park Renovation

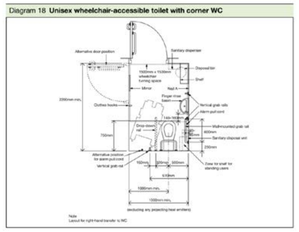
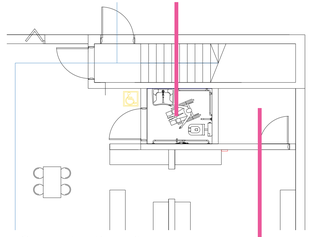


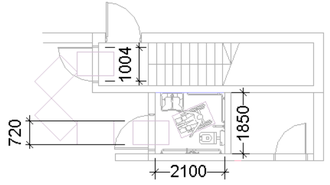
Fig 1.3: Wheelchair Accessible Toilet
(GOV.uk, 2016)

Disabled Toilet



Ground Floor Plan with market stall and customer seating.

Storage



Disable Toilet and Safe Access to Kirkgate

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Staircases and Ceilings
Page 23

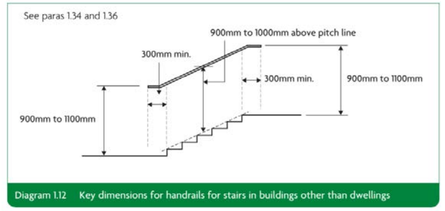


Fig 1.4: Handrail Dimensions
(GOV.uk, 2013)

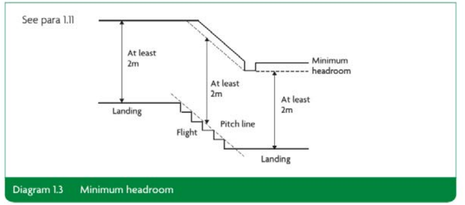
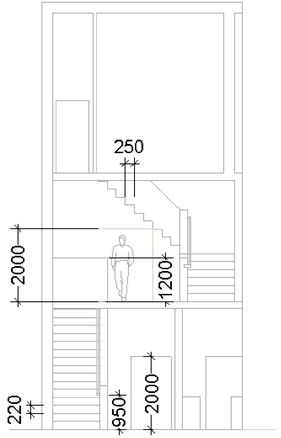


Fig 1.5: Minimum Headroom
(GOV.uk, 2013)



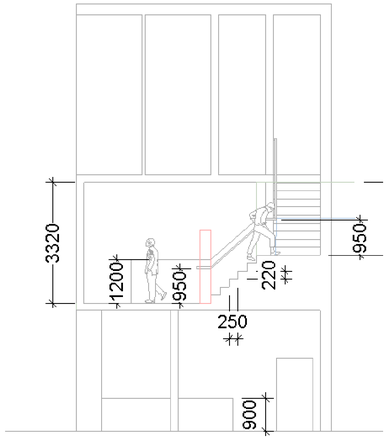
Headroom on the First Floor

There are several consistencies between the British Regulation requirements of staircases and my building.

In accordance to part 1.11, my staircase at the point it turns from the first into the second floor, has a minimum headroom of 2m.

Part 1.36 illustrates the parameters of the handrail height, which my handrail fits within. It's height for the ground and the landing remains constant as to keep the spacing from the pitch of the staircase constant. It also continuously bends around the corner the risk of clothing becoming attached is minimised. The red box denotes the 300mm handrail extension upon it reaching each landing, my rails of which surpass this.

The rises and treads of my stairs are slightly outside of the required bracket, the rise being slightly too high, and the treat being slightly too short, which could be rectified throughout the building by enlarging the isolated staircases in their dimensions.



Staircase Dimensions on the First Floor

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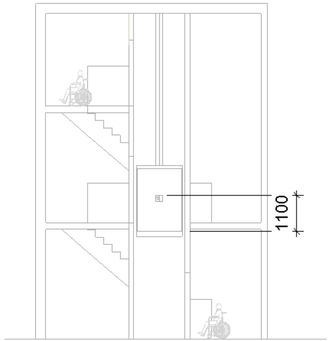
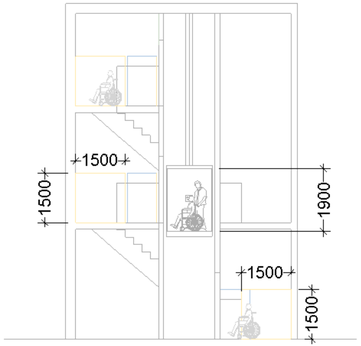
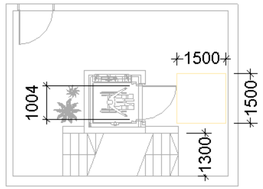
Lift Dimensions
Page 24



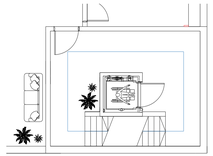
Lift Control and
Movement Direction



Shared Lift Occupancy



Manoeuvrable Space on
the First Floor Landing



The lift these sections goes
through on the first floor.

Diagram 11 **Key dimensions associated with passenger lifts**

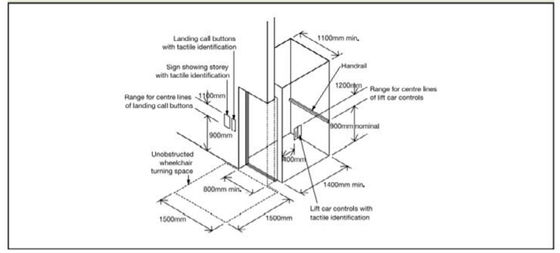


Fig 1.6: Key Dimensions of Passenger Lifts
(GOV.uk, 2016)

My lift button has been placed perhaps slightly too high for a disabled occupant of the lift to use it independently, an oversight I missed because I had considered the travel of a wheelchair user and support worker simultaneously, the able bodied person using the lift controls. Although the standard is a control panel of maximum height 1200mm this still feels a little high considering the exterior controls being positioned between 900mm and 1100mm.

The proximity to the entrance door is also different but I think it is better to have the button deeper into the lift, especially considering, the occupant will be leaving the lift from the opposite side.

What works effectively however is the door positioning of the lift on each floor as it minimises the manoeuvring needed to orientate the wheelchair user correctly on each floor, proving the minimum turning space of 1500mmx1500mm has been accomplished in yellow. The dimensions of the lift themselves are also seemingly appropriate, so long as entering and exiting the lift requires only forward or backward movement, which in this case it does.

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Ramps and Corridor Widths
Page 25

Table 3.1 Minimum widths of escape stairs

Situation of stair	Maximum number of people served[1]	Minimum stair width (mm)
1a. In a 'residential (institutional)' building (unless the stair will only be used by staff)	150	1000[2]
1b. In an 'assembly and recreation' building and serving an area used for assembly purposes (unless the area is less than 100m²)	220	1100
1c. In any other building and serving an area with an occupancy of more than 50	Over 220	See note 3
2. Any stair not described above	50	800[4]

NOTES:

Fig 1.7: Minimum Escape Stair Width
(GOV.uk, 2019)

Diagram 28 **Corridors, passages and internal doors**

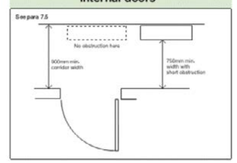


Fig 1.8: Corridors and Internal doors
(SpecifiedBy, 2016)

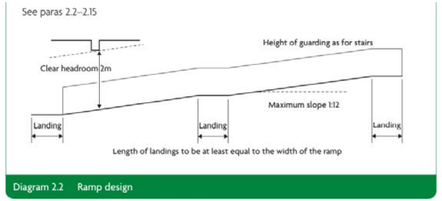
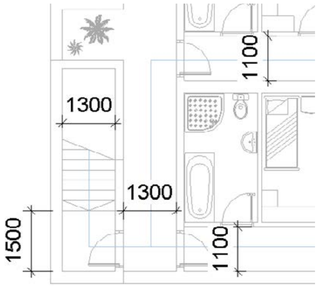
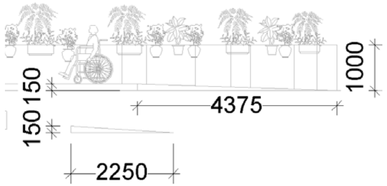


Fig 1.9: Ramp Design
(GOV.uk, 2013)



Second Floor Corridor
and Landing Dimensions

Dimensions of corridor widths meet requirements, and extend to at least 1100mm, whereas landings for staircases accommodate a turning space of depth and width equal to that of the width of the staircase itself as required.



Outdoor Ramp
Dimesnions

The ramp gradient is very shallow, even more so than the required 1:12 ratio of depth against length, even surpassing the 1:15 common ratio. My ramp closer to 1:30, considering the circumference of my plotted circle and the radius of the circle itself.

Section 3-
U-Value Tables

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Determining U-Values
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Element	U-value W/m²K
External Wall	0.18
Party Wall	0.0
Floor	0.13
Roof	0.13
Windows (whole window U-value)	1.4
Opaque doors	1.0
Semi glazed doors	1.2

Fig 1.10: U-Value Requirements
(First In Architecture, nd)

$$U = \frac{1}{R_{SI} + R_{SO} + R_A + R_1 + R_2 + R_3 + R_b}$$

R_{SI} - thermal resistance of **I**nternal surface
R_{SO} - thermal resistance of **o**utside surface
R_A - thermal resistance of unvented air cavities
$R_{1\,etc.}$ - thermal resistances of building components

Units - W/m^2K

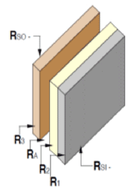

Fig 1.11: U-Value Equation
(Insulationcart, nd)

The 'thermal resistance' being calculated using the thickness of the material divided by the thermal conductivity of the material itself. Below are short explanations as to the U-Values I obtained on the next few pages to preserve room. In each case, my value is compared to the standard requirements of heat retention, which will thus indicate the energy grade value. With a desired U-Value of as small a number as possible indicating a small amount of heat loss, which in turn, means central heating doesn't have to be used as much reducing bill prices for residents. A small U- Value also indicates the effectiveness of passive heating and cooling within a building as buildings that are heat sinks, would waste the use of passive systems.

Wall U- Value: 0.143 to 3dp.

Maximising the dimensions of the air space pocket and the thickness of the PIR insulation around known constants such as the building paper, sheathing and gypsum board proved vital in ensuring this value was low enough to be energy efficient. The wall being the most exposed element, it needed to score well for the benefit of visitor and resident comfort.

Floor U- Value: 0.129 to 3dp.

The ground floor calculation doesn't include the known value of the hardcore and its mineral composite because that counts as exterior. Despite this the U-Value still sits within expected requirements in this age of greener energy systems and minimising waste for the benefit of the planet.

Roof U- Value 0.101 to 3dp.

This value takes into consideration the built-in planters on the terraces roof, draining directly into the reservoir that is then vented out of the roof itself and through the wall to be reused as grey-water. The varying heights of the flats allow for a thicker roof system that can allow for the drainage piping to sit within it. Considering the limestone flooring as roof exterior the U-Value becomes 1.333 to 3dp, slightly below requirements. Which could be fixed by applying a slightly thicker layer of reinforced concrete onto the metal decking atop the steel structure.

Materials	Thickness - (l) (mm)	Thermal Capacity - (C) (W/mK)	R Value - (l/C) (Km^2/W)
External Surface Resistance	–	–	0.400
Brickwork	105	0.710	0.148
Air Space	50	0.025	1.992
Building Paper	5	0.050	0.100
Gypsum Sheathing	12	0.254	0.047
PIR Insulation	80	0.023	3.478
Blockwork	105	0.180	0.583
Wall Board	12	0.190	0.084
Plaster	5	0.160	0.031
Internal Surface Resistance	–	–	0.130
		R Total	6.993
		U Value - (1/R total)	0.143

Wall U-Value Calculation
Page 28

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Materials	Thickness - (l) (mm)	Thermal Capacity - (C) (W/mK)	R Value - (l/C)
External Surface Resistance	–	–	0.400
Hardcore	350	0.290	1.207
Sand	30	0.250	0.120
Timber Battens	100	0.040	2.500
PIR Insulation	100	0.023	4.348
Concrete Slab	135	0.600	0.225
Flooring	5	0.115	0.044
Internal Surface Resistance	–	–	0.130
		R Total	7.767
		U Value - (1/R total)	0.129

Ground Floor U-Value Calculation
Page 29

Materials	Thickness - (l) (mm)	Thermal Capacity - (C) (W/mK)	R Value - (l/C)
External Surface Resistance	–	–	0.400
Soil (DH02)	400	0.180	2.222
Polythene Eco Roof-board	10	0.033	0.303
Filter Fabric	5	0.060	0.083
Reservoir	75	0.025	2.983
Moisture Retention	5	0.055	0.091
Aeration Layer	25	0.025	0.994
Thermal Insulation	75	0.035	2.143
Drainage Layer	10	0.080	0.125
Root Barrier	5	0.330	0.015
DPC	5	0.039	0.128
Thermoplastic	5	0.200	0.025
Concrete	100	0.390	0.256
Steel	5	13.389	0.00037
Plaster	5	0.350	0.014
Internal Surface Resistance	–	–	0.130
		R Total	9.912
		U Value - (1/R total)	0.101

Roof U-Value Calculation
Page 30

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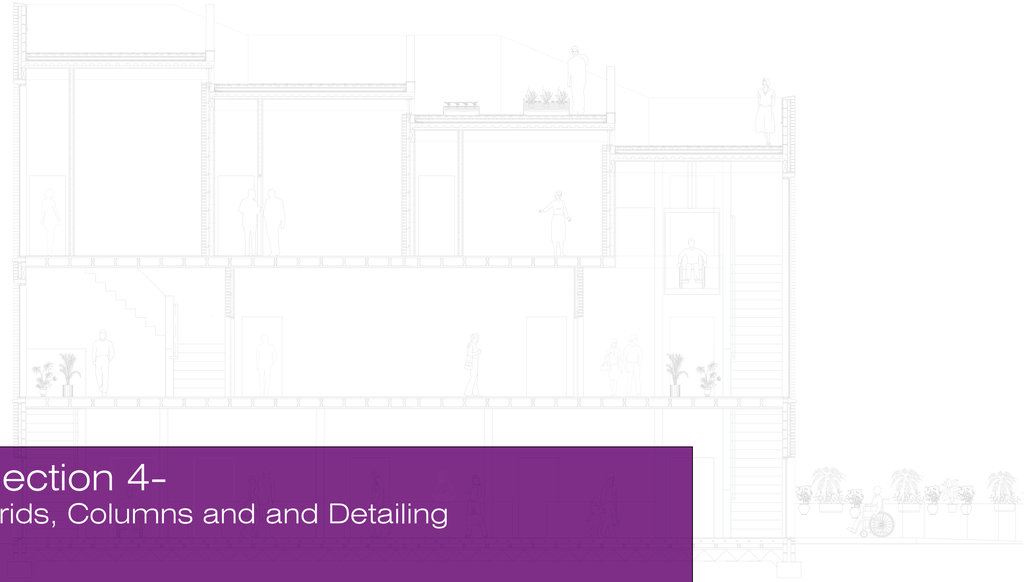

Section 4-
Grids, Columns and and Detailing

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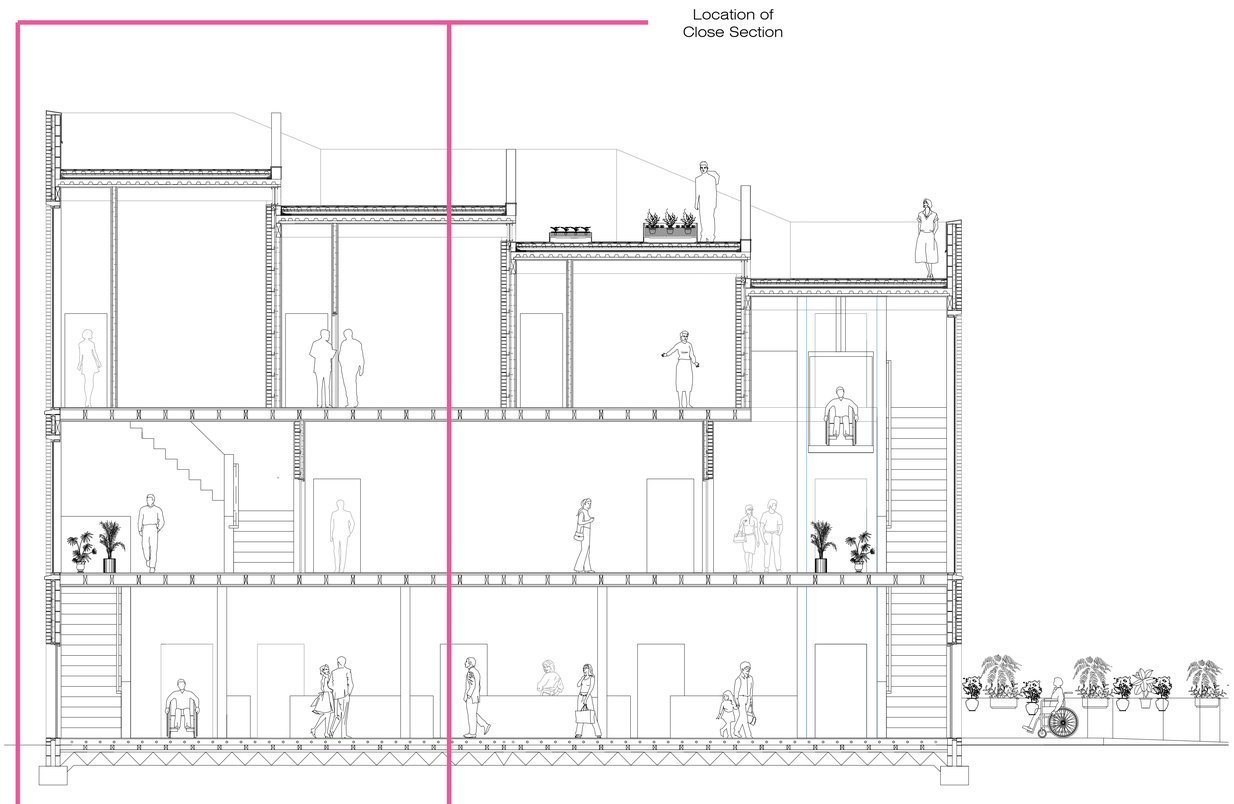
Hybrid Housing Digital Short Section
Page 32



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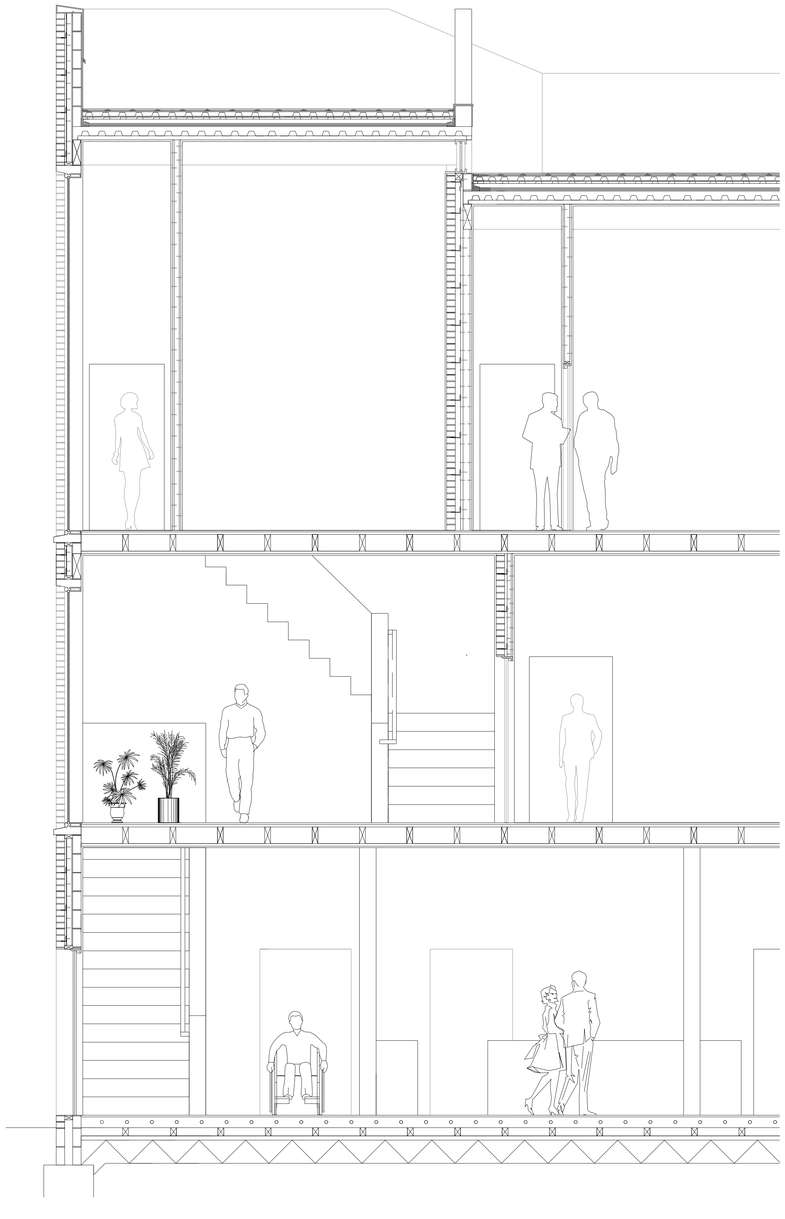
Hybrid Housing Digital Detail
Page 33

Short Section at 1: 20 Scale



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Hybrid Housing Hand-drawn Detail
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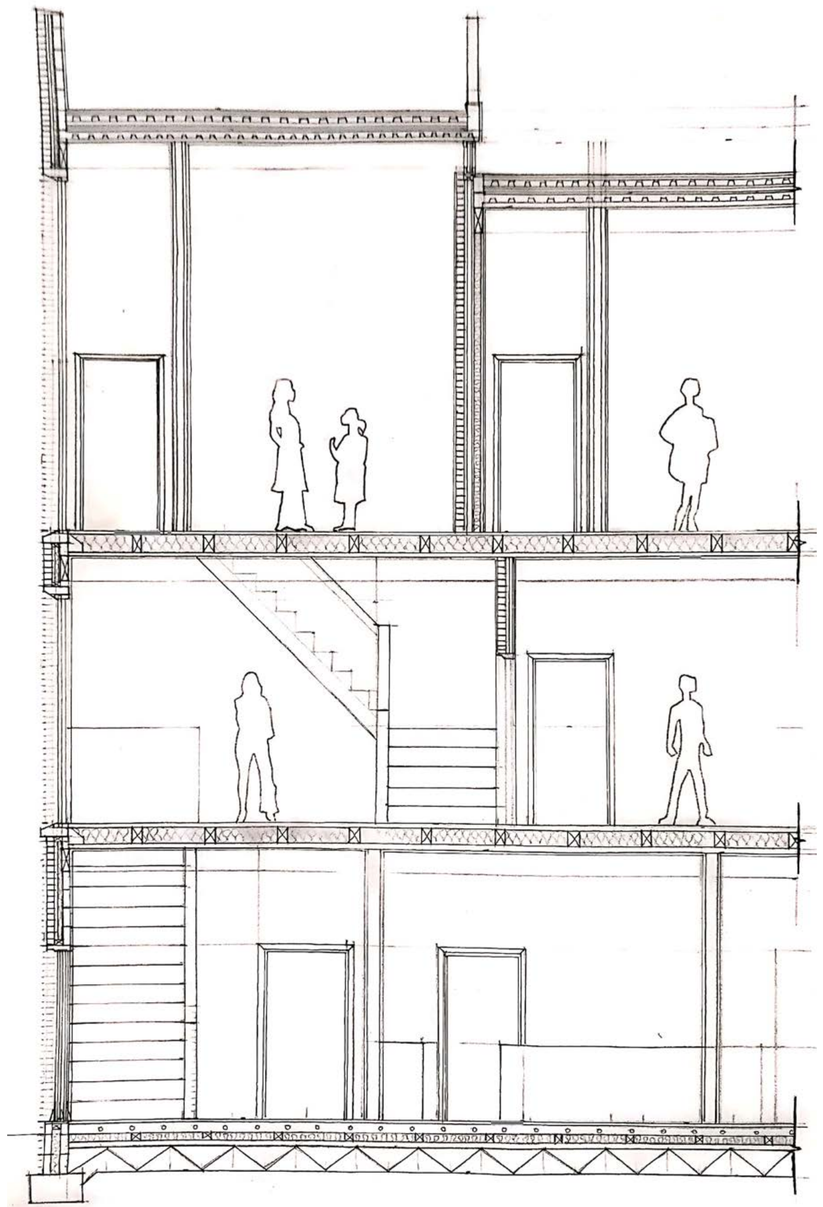
Short Section at 1: 20 Scale



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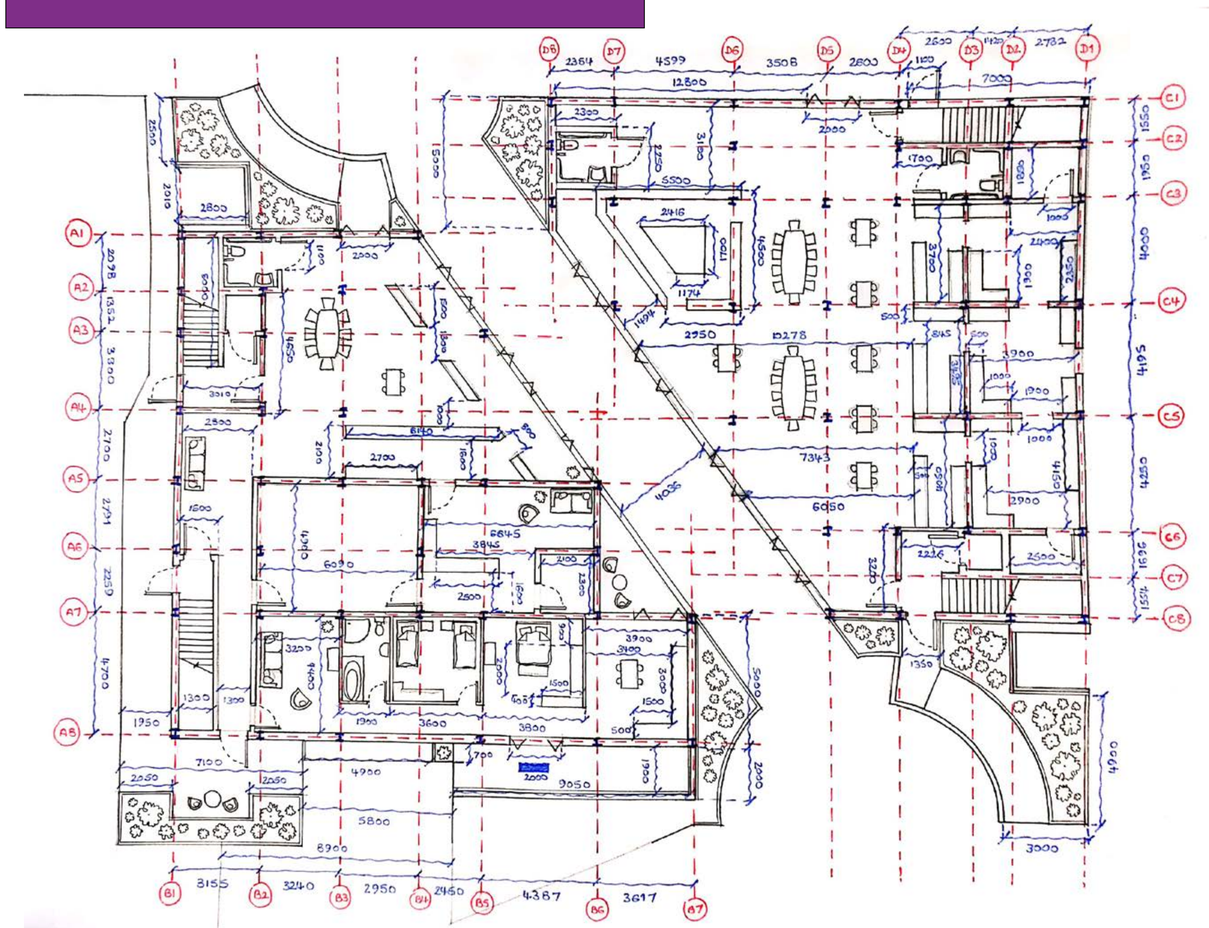
Grids, Dimensions and Columns- GF
Page 35

Ground Floor at 1:100 Scale



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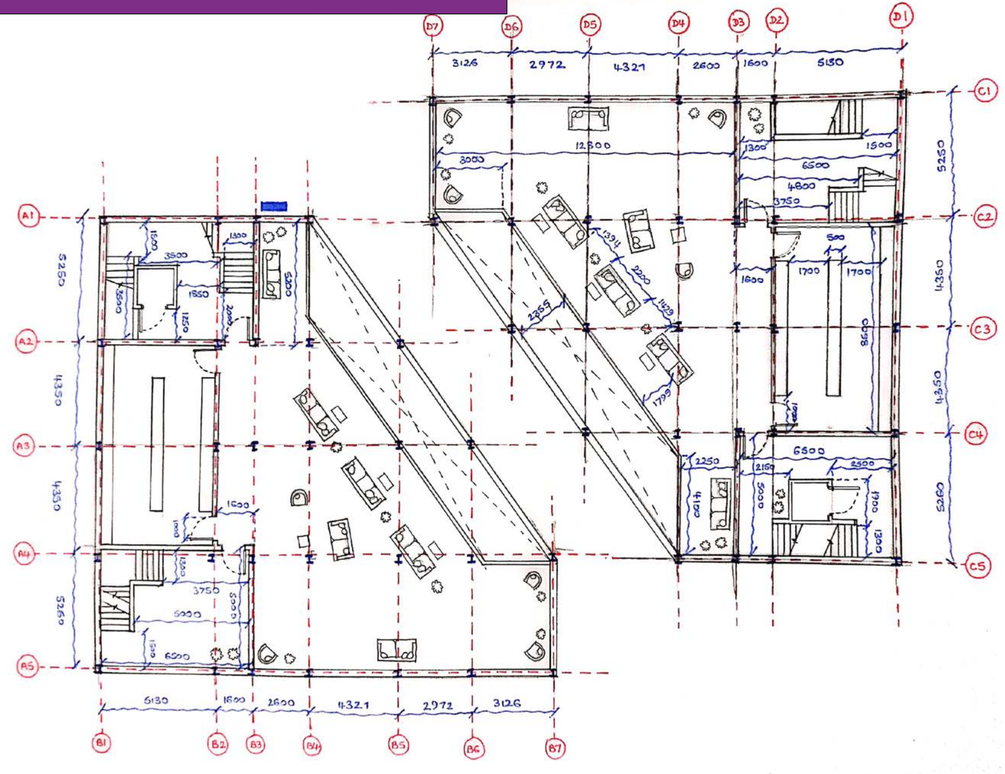
Grids, Dimensions and Columns- 1F
Page 36

First Floor at 1:100 Scale



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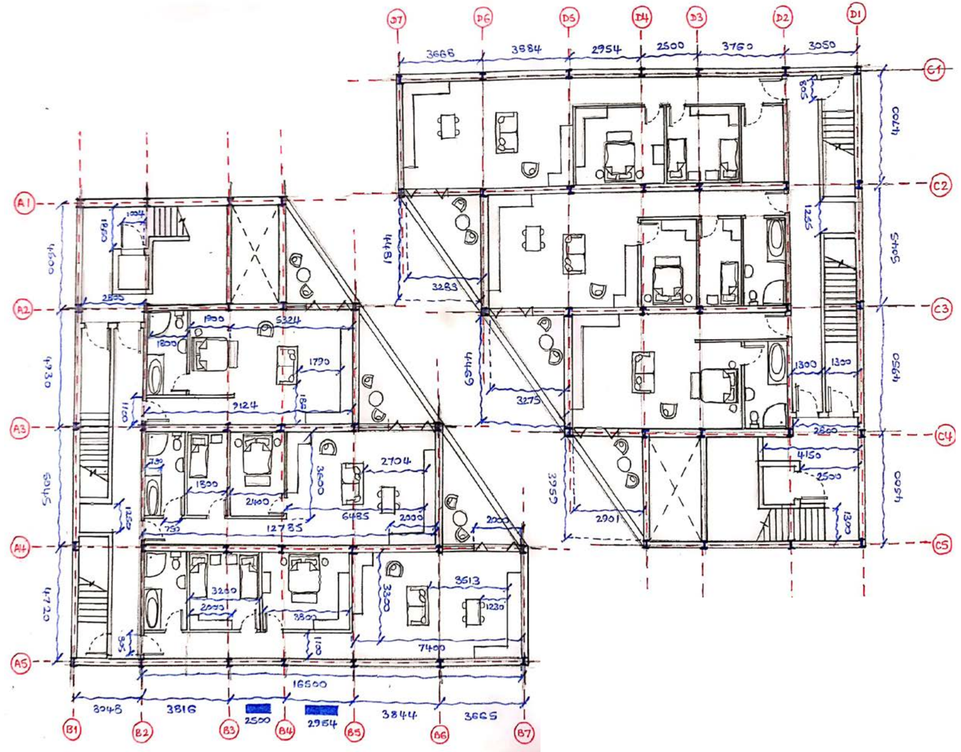
Grids, Dimensions and Columns- 2F
Page 37

Second Floor at 1:100 Scale



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Section 5-
Large Scale Details

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Foundation Detail
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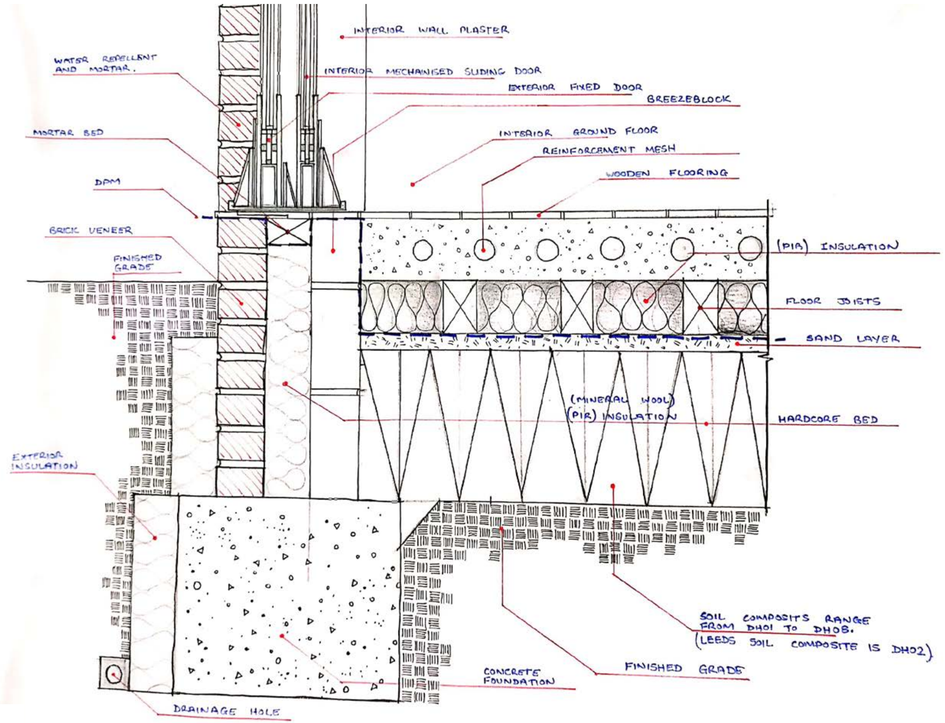
Foundation Detail at 1:5 Scale



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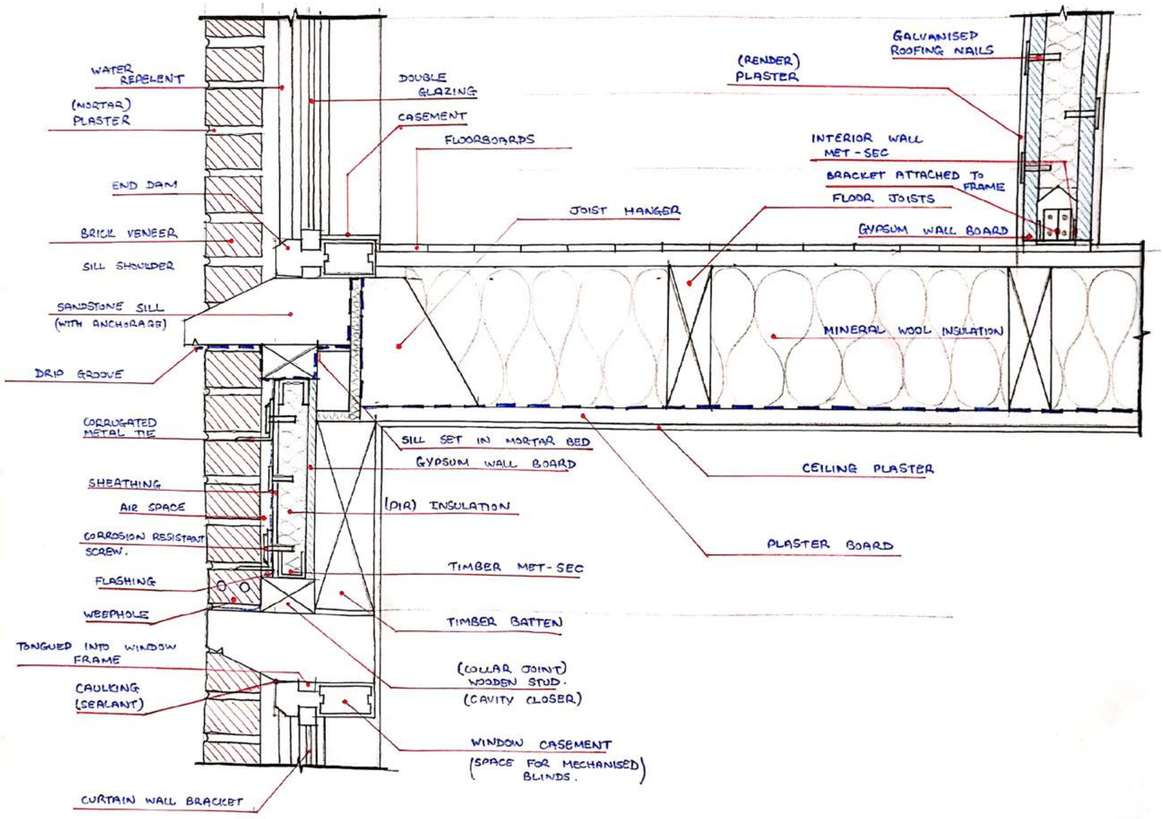
First Floor Detail
Page 40

First Floor Detail at 1:5 Scale



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Roof Parapet Detail
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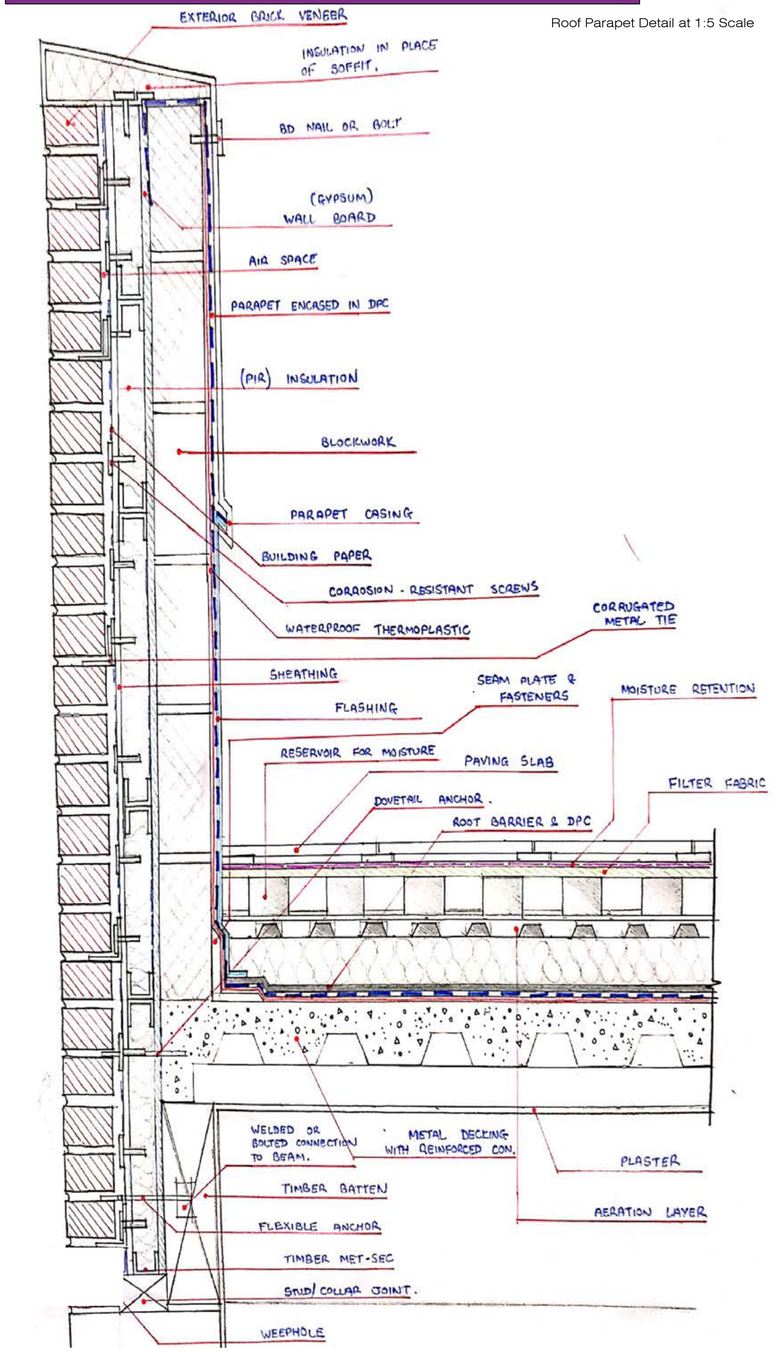
Roof Parapet Detail at 1:5 Scale



Clerestory Window and Green Roof Detail
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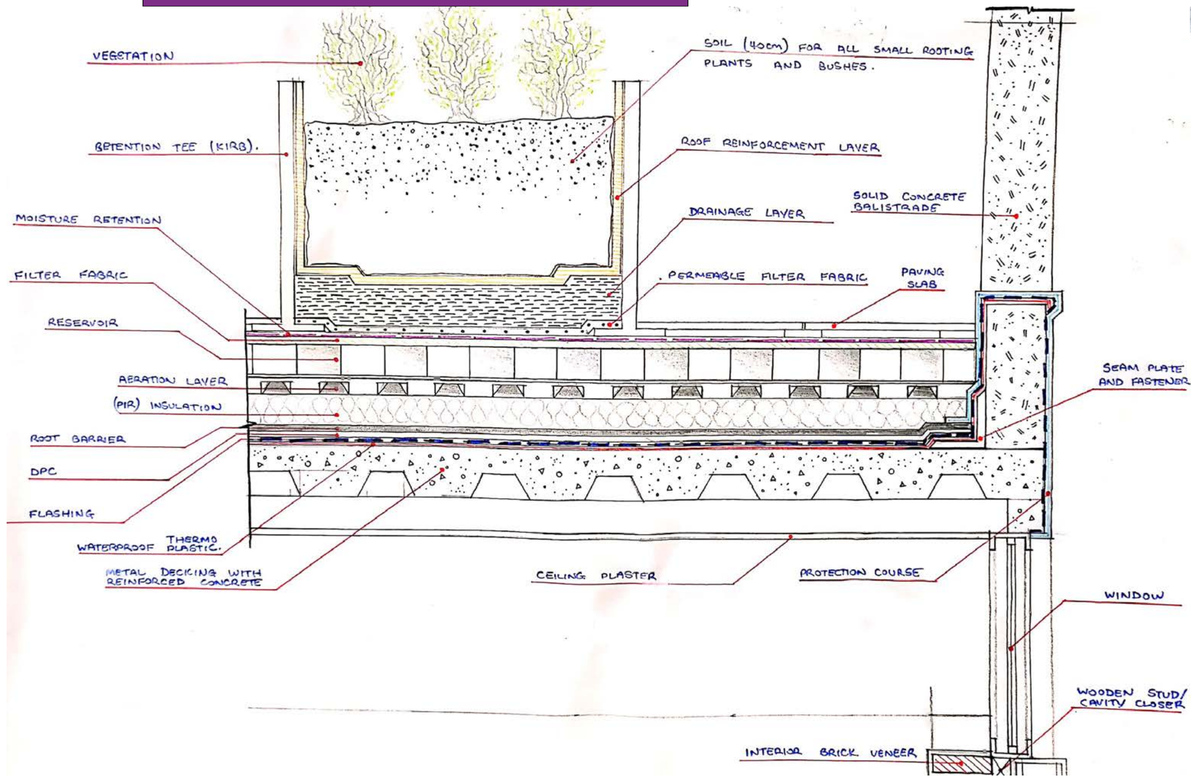
Clerestory Window and Green Roof Detail at 1:5 Scale



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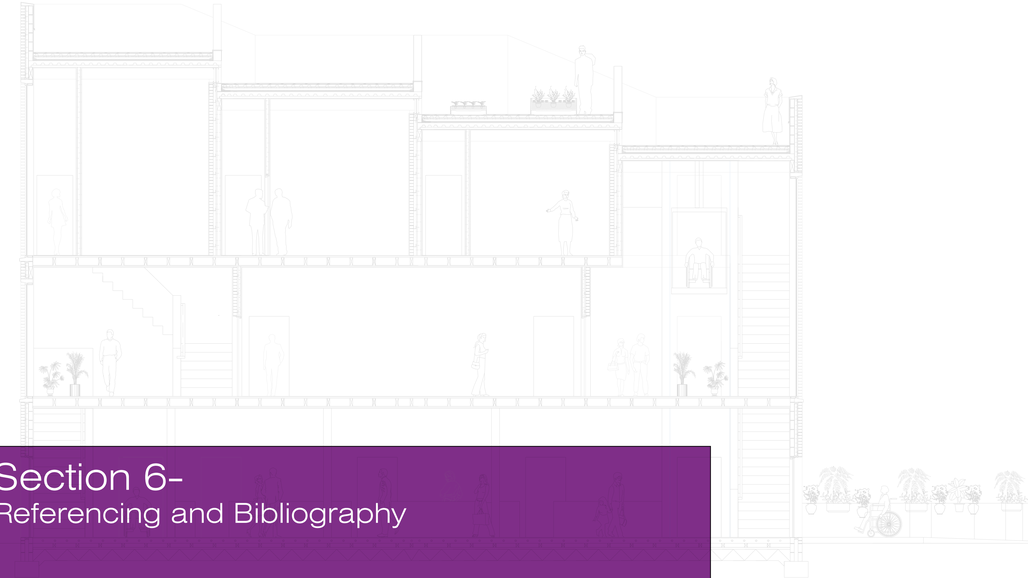

Section 6-
Referencing and Bibliography

Referencing and Bibliography

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