TECHNOLOGY REPORT

Proposed development for the Northern Ireland Boxing Academy (NIBA) at 4-6 Market Street, Armagh, BT61 7BU / April 2015
Advanced Technology & Environment III
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Fig. 1: Armagh City within Northern Ireland

Situated in the south of Northern Ireland and surrounded by counties Tyrone, Antrim, Down, Louth and Monaghan, Armagh is the county town of County Armagh. It is the ecclesiastical capital of Ireland with the seats of both the Church of Ireland and Roman Catholic Archbishops located in two cathedrals on prominent hills. With a population of approximately 15,000 people it is the least populated city in Northern Ireland.

Market Street is located east of the Church of Ireland Cathedral and has historical significance as the connection between the Cathedral and the main commercial district. Fig. 4 shows the drop in ground level from the Cathedral down to the Mall. The fall is at its steepest on Market Street.

The building itself consists of a boxing arena with space for up to one hundred and thirty spectators, gym space, changing area, offices, residential accommodation for eighteen people, function venue and associated administrative facilities.

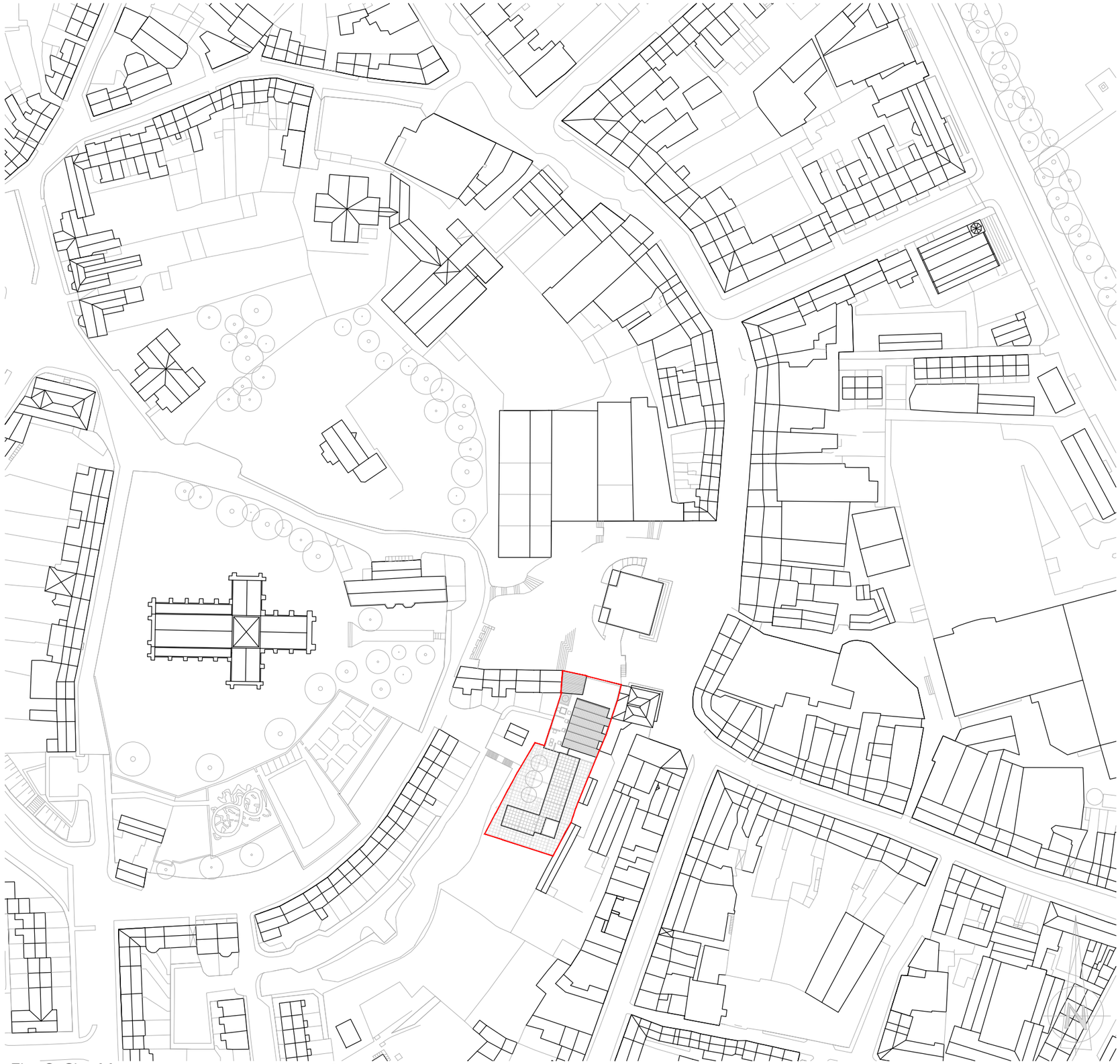


Fig. 2: Site Map

The building is constructed of materials which represent the essential qualities of the boxing profession: honesty, resilience, precision and expertise.

Insitu concrete will be used as the superstructure of the building with timber used as a means of cladding and partition. Zinc will also be used for roofing.

The grid for the building has been developed from the proportions of an olympic sized boxing ring (7m x 7m)

Fig. 3: NIBA North Elevation to Market Street / Scale 1:200

Portion of residential block using insulated concrete wall as infill

Residential block to be concrete frame construction with insulated timber panels and glazing used as infill

Administrative block to be load bearing wall construction

Existing load-bearing Georgian dwelling to be retained

Gym and Arena to be constructed of precast concrete frame with timber and concrete infill panels

The structure of the building needs to deal with different levels of load and stress. Therefore the areas of the academy which serve a collective purpose have a thicker structure than the individual accommodations and administrative areas.

Fig. 4: NIBA Ground Floor Plan / Scale 1:200

Live load and dead load acting vertically

Axial load being transferred vertically through the structure

Load being transferred through the structure through shear.

Load being transferred vertically to the foundations

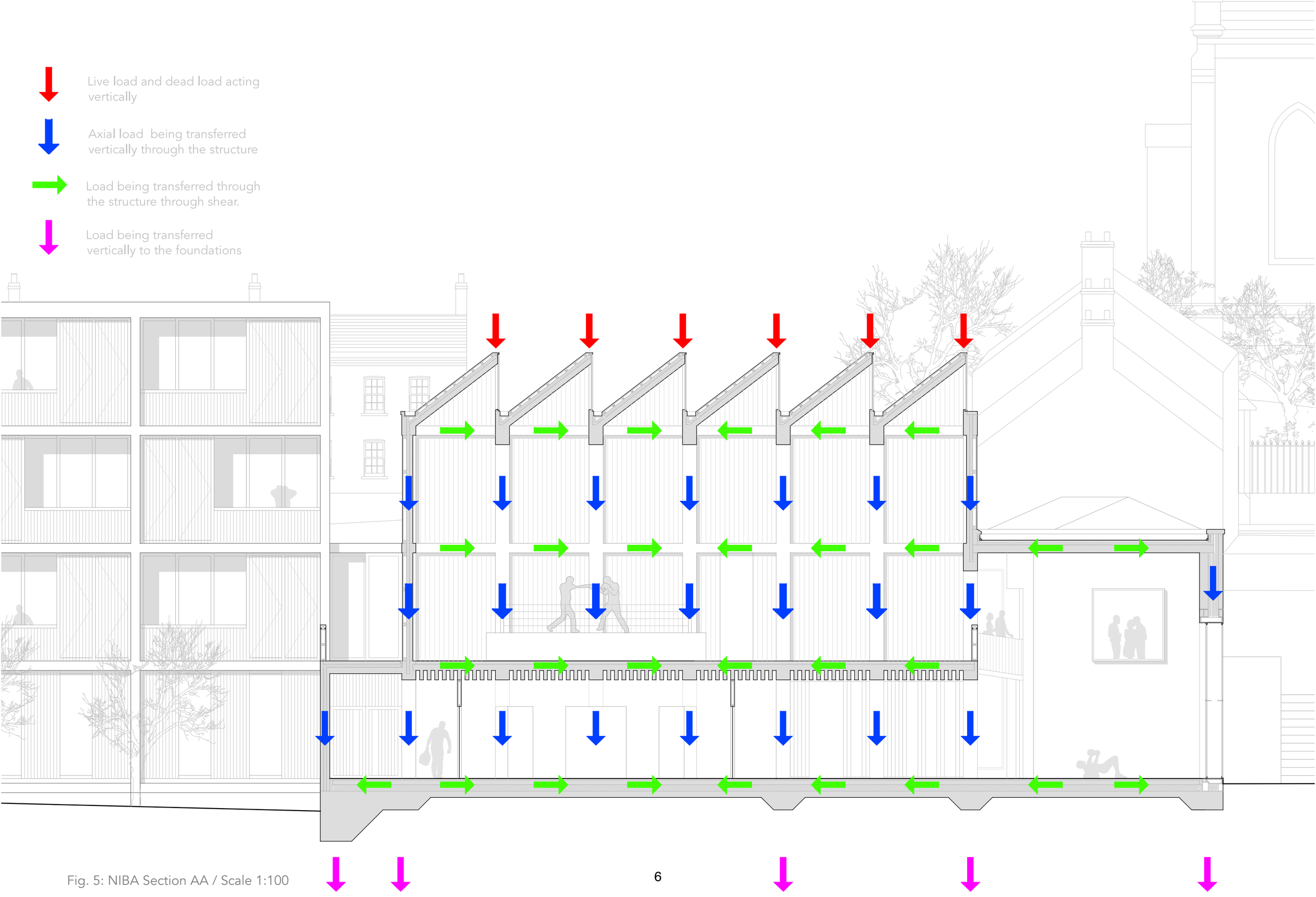


Fig. 5: NIBA Section AA / Scale 1:100

Description of roof structure (inside to outside):

- Angled concrete roof slab
- Insulation fixed to slab
- 50x50mm batons with breather membrane fixed to insulation.
- Zinc fixed to batons to provide waterproofing leading to gutter.

The window element extends up beyond the slab to allow people to see from the street what the roof is constructed of.

Fig. 6: Section Through Arena Roof / Scale: 1:20

2.0 Sustainability

Sun Study:

This was important to see where shadows fall on the building at different times of year. It allows us to see where the opportunities are for passive heat gains during the day. Currently the residential accommodation design tries to exploit the suns position. Also the internal courtyard adjoining the existing terrace is an opportunity get natural light into the core of the building.

Concrete as a Sustainable Structural Choice:

Concrete is a strong and durable material which can have many benefits over its life cycle. It isn't weakened by moisture, mould or insects. It is fire resistant by its nature. It has relatively low CO_2 emissions when compared to the other building materials, such as steel. Processes which occur in a building, such as typical heating and cooling systems, account for almost 80% of a buildings emissions and it is therefore more effective to target these sources when trying to reduce emissions. It slows the passage of heat through its thermal mass and so reduces temperature swings, increasing thermal comfort. It is important to consider night-time-cooling when choosing a concrete mass solution. It is produced locally and therefore does not clock up huge CO_2 miles during its transport. It is a low maintenance material and is a sensible choice for the atmospheric aspirations of the boxing academy. It's use almost solely as a structural element for the academy allows timber to be used to further reduce CO_2 emissions.

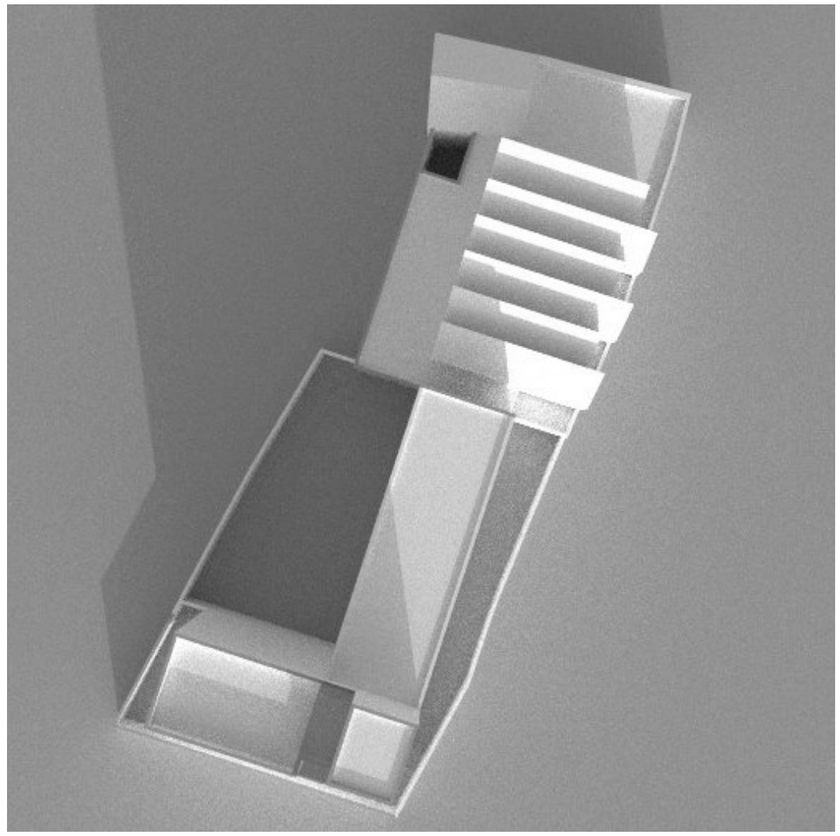


Fig. 7: Sun Position 12pm December 21st

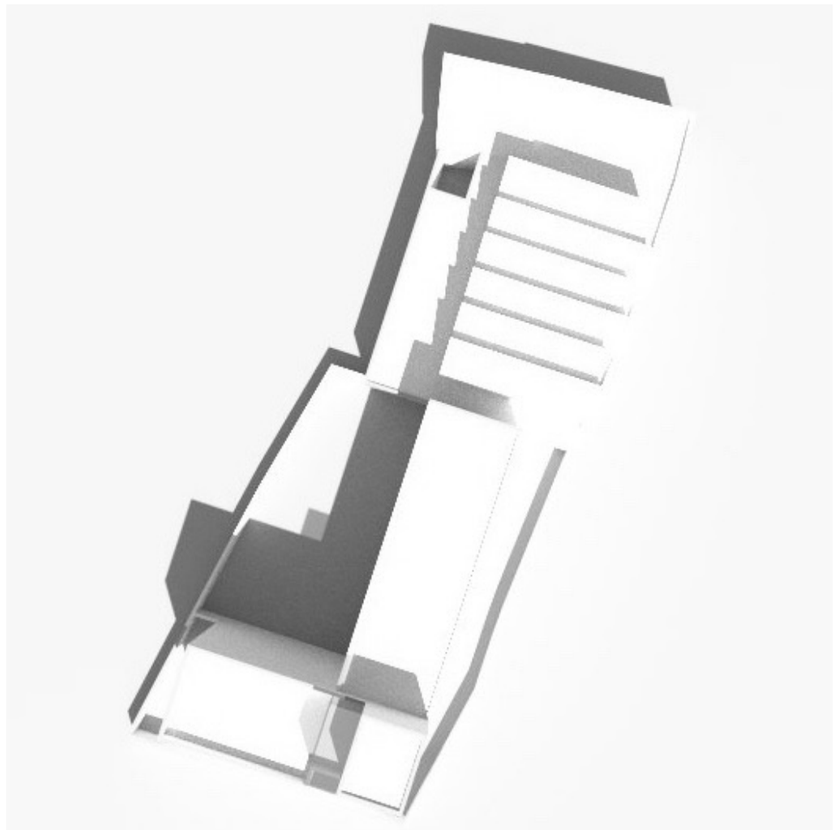


Fig. 8: Sun Position 12pm June 21st

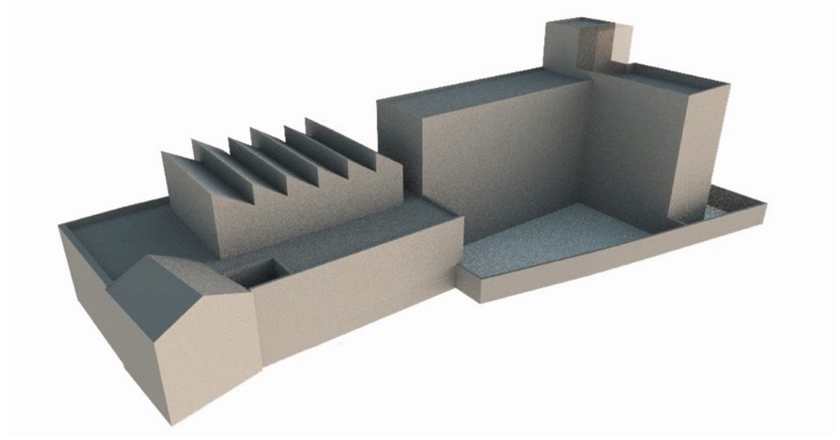


Fig. 9: Sun Position 3pm December 21st

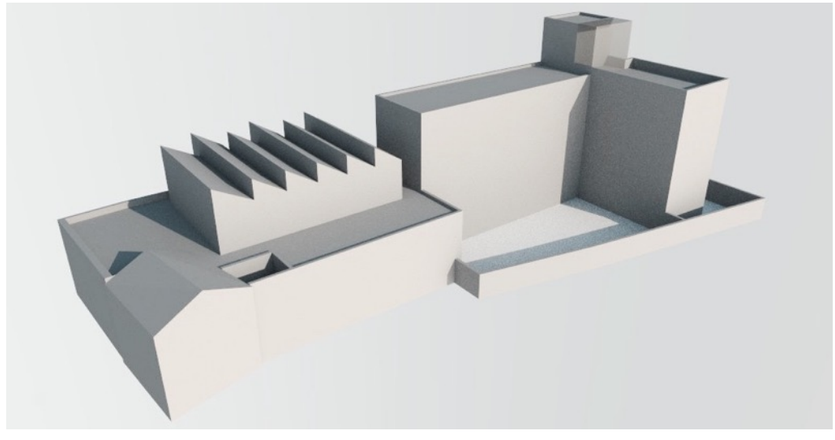


Fig. 10: Sun Position 4pm June21st

Residential Accommodation:

This part of the building has been designed to provide optimum comfort to inhabitants,using passive design solutions. Setting the glazing back allowed a balcony to be placed in front. While giving users views and connections to the outside world it also acts as a shade to the hot summer sun (max angle 58°), allowing the less harsh winter sun (max angle of 12°) to heat the room. The thermal mass of the concrete frame will help to keep a regular temperature with cross ventilation being used to cool the rooms if overheating occurs. Acoustically the noise levels within the rooms will increase while windows and doors are open however the ability to choose between the opening a window or not is acceptable in this scenario.

It is also envisaged that rainwater may be collected from the roof and stored in tanks above the bathroom facilities for local use.

It is suggested that a ground source heat pump be placed in the courtyard to provide heating in times where solar gain is not enough. These systems use heat already in the ground and transfers it into the building.

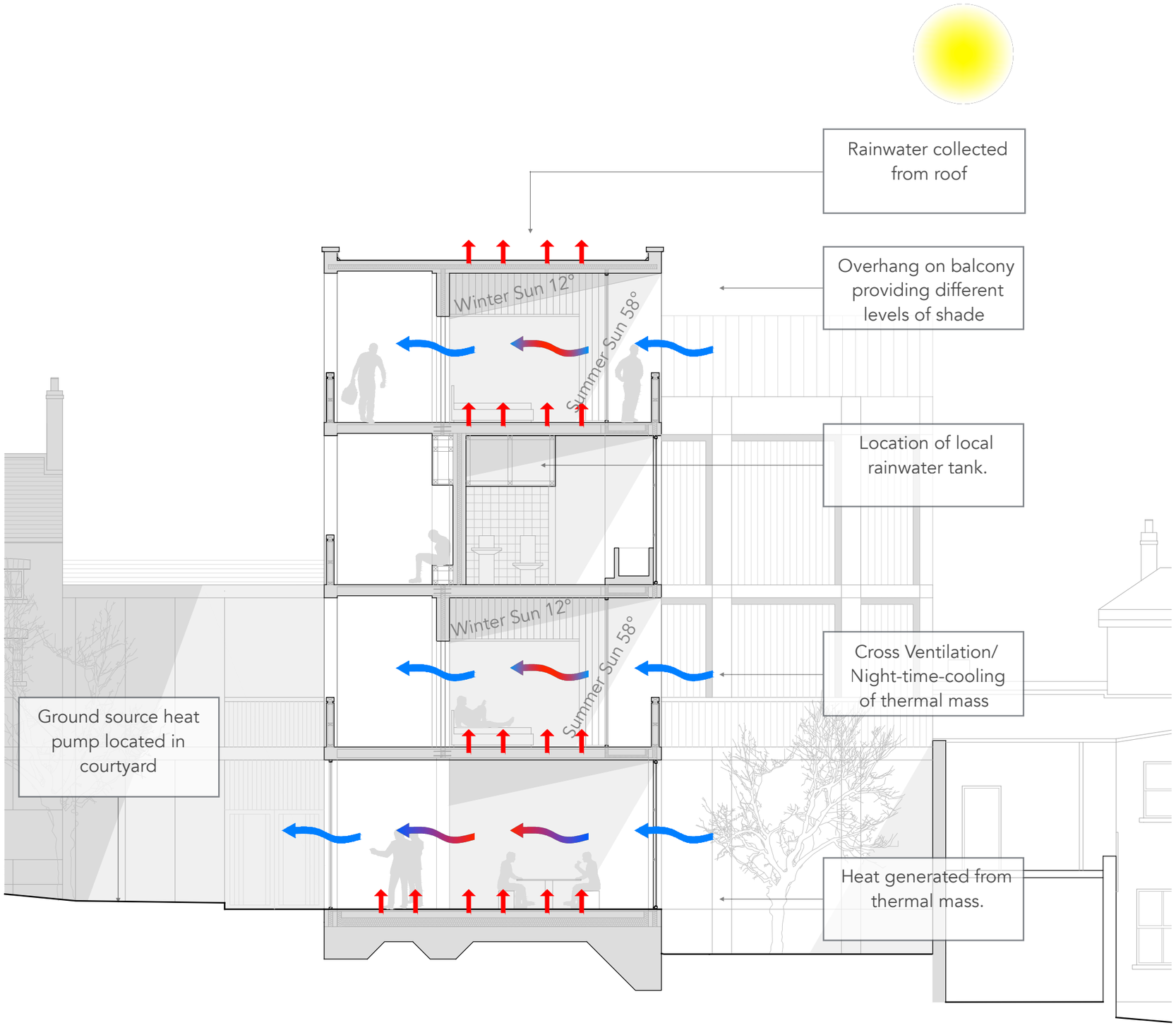


Fig. 11: Section Through Residential Accommodation Scale 1:100

Boxing Arena:

This part of the building is likely to need more air changes due to the level of activity and number of people attending matches. Therefore it has a dynamic natural ventilation system consisting of three ventilation chimneys. These chimneys can be opened or closed and create a draw which extracts hot air generated in the arena. It is not anticipated that they will affect acoustic levels.

The gym space incorporates a large area of glazing which is double skinned. This is to reduce the effects of heat loss on a north facing facade and also allows ventilation of the gym.

An internal courtyard helps to naturally light the long corridor.

Rainwater may also be collected from the roof and stored in tanks for local use.

It is suggested that the ground source heat pump placed in the courtyard would also provide heating in times where solar gain is not enough.

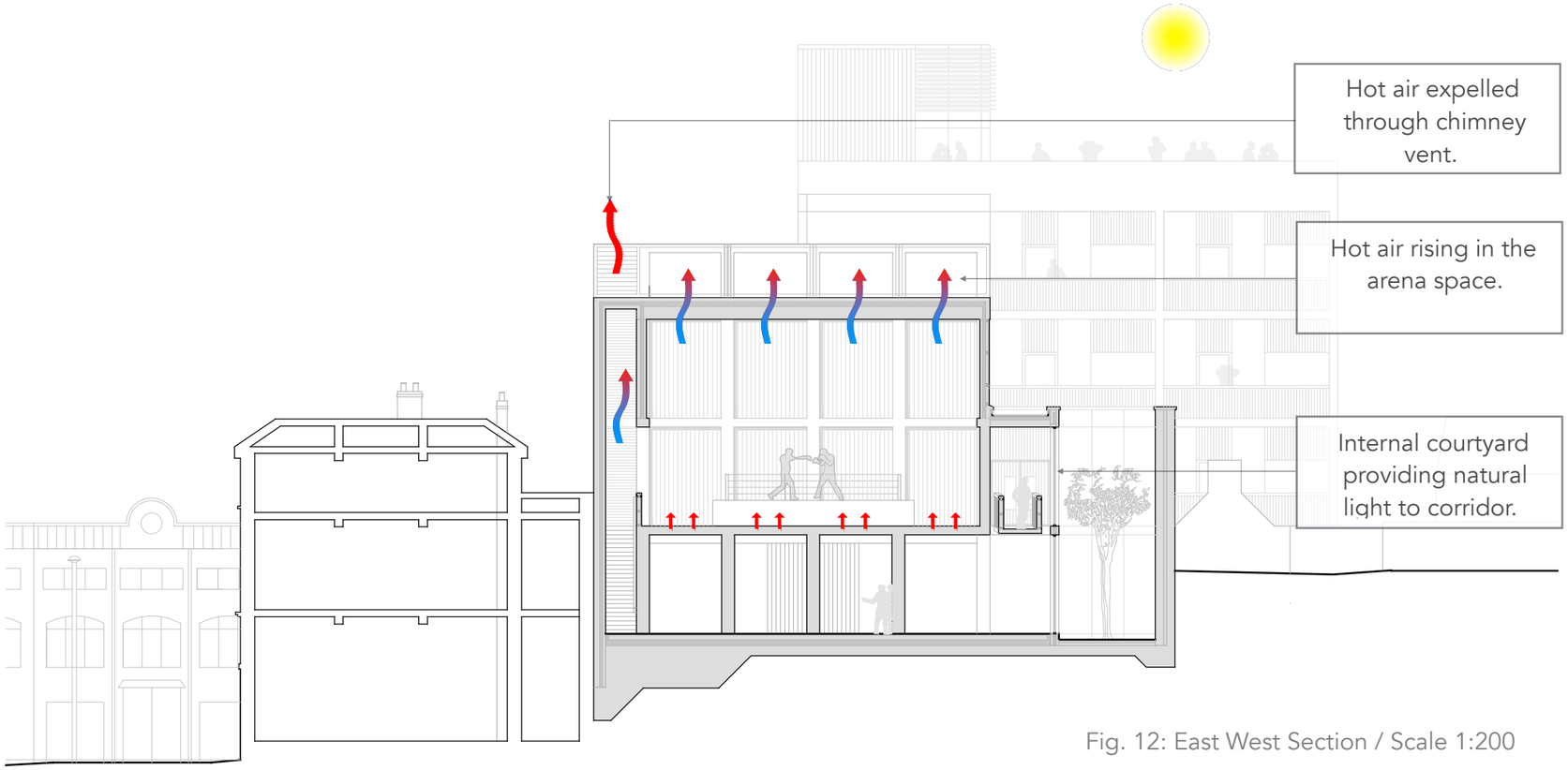


Fig. 12: East West Section / Scale 1:200

Fig. 13: North South Section / Scale 1:200

3.0 Fire Safety Strategy:

Fire safety in building begins at the design stage. Risks need to be identified and action taken to minimise these risks through design. In this section of the assignment I will show how I have identified and acted upon fire risks in this building.

The Risks:
The NIBA comprises of a arena space with function room and living accommodation.
The greatest risk of fire in this building is in the residential kitchen space in the restaurant. It is important that this risk is minimised with an adequate design response.

Design Response:
The following sections need to be considered in the design of the building:
-Purpose Grouping.
-Means of escape in case of fire.
-Internal fire spread (zoning).
-Internal fire spread (vertical circulation).

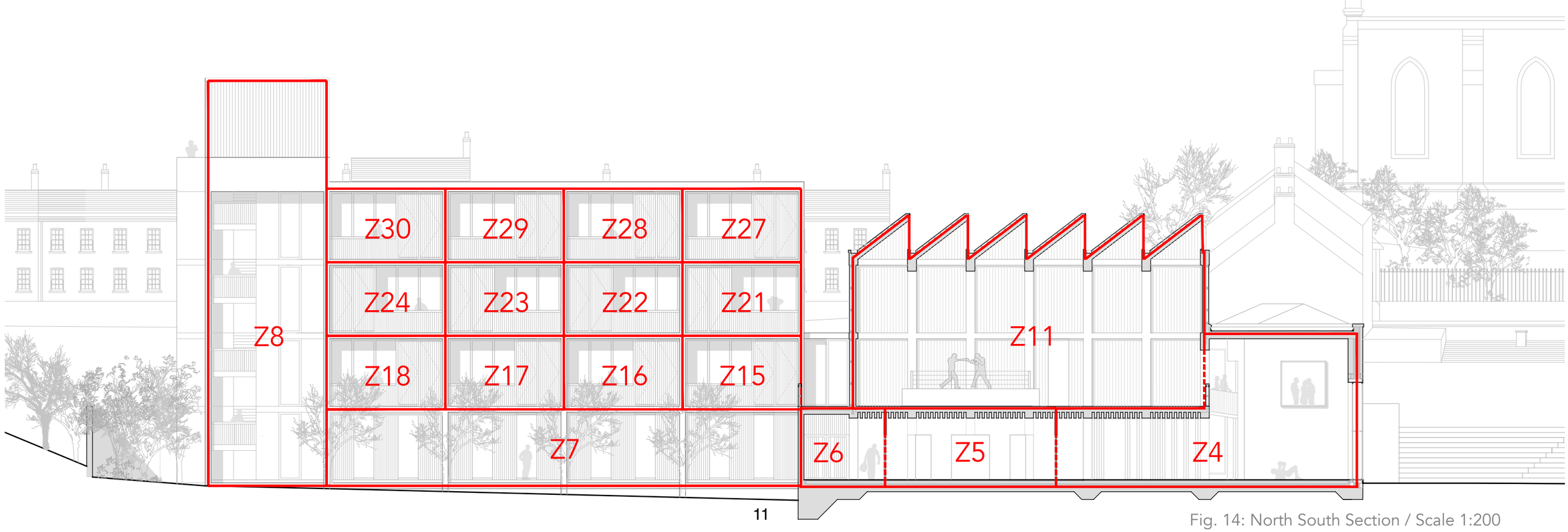


Fig. 14: North South Section / Scale 1:200

Zoning:

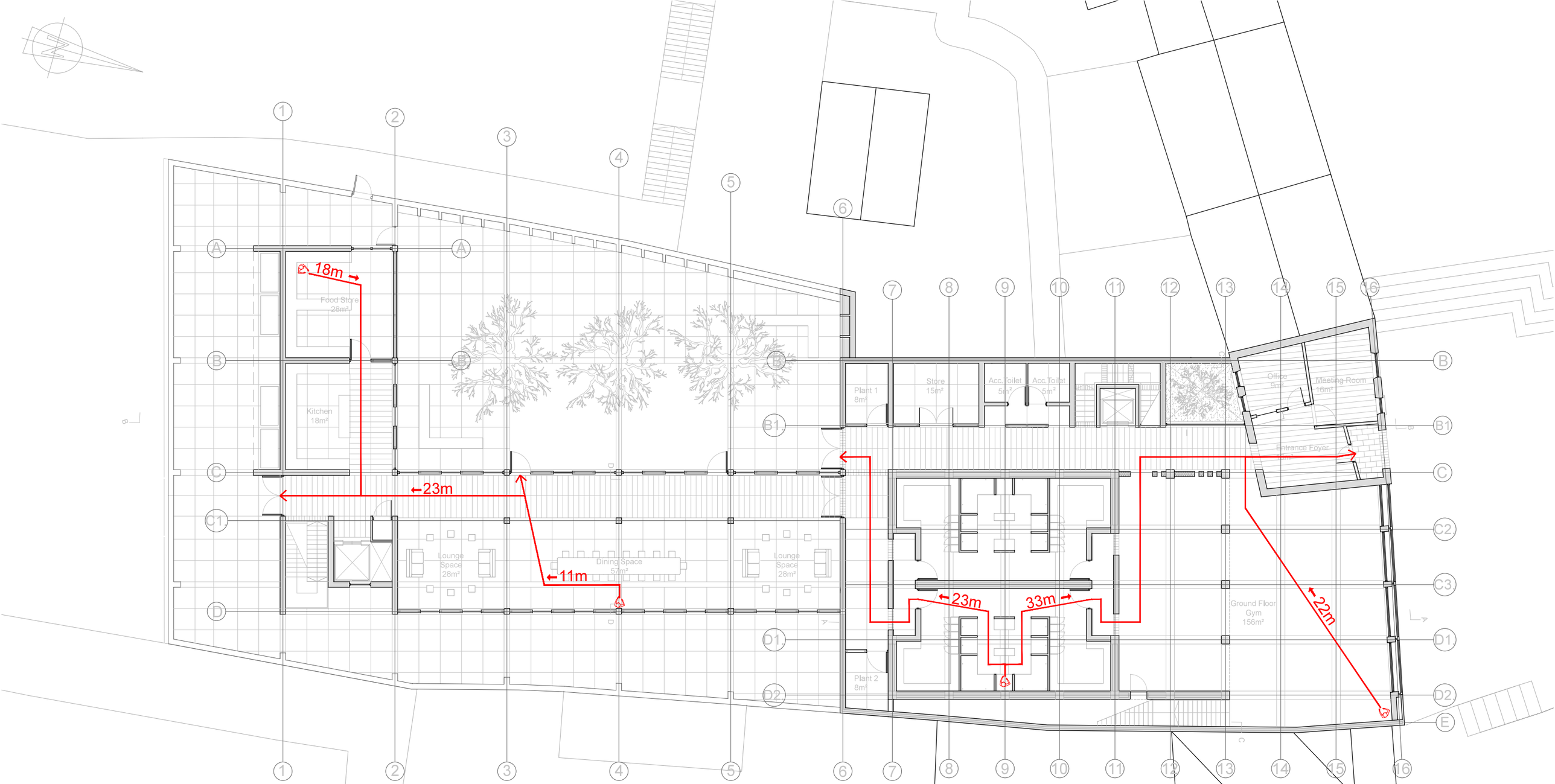
The building has been zoned accordingly to prevent the spread of fire. All users of the building are entitled to an exit which provides safe passage to an outdoor area in the event of a fire. Such means of escape should be relatively short and direct. The NIBA has one main entrance, an entrance for the residential accommodation and three entrances onto the courtyard which can be used in the event of fire.

Zone boundaries are indicated by a thick red line. Fire Doors and shutters are indicated by a dashed thick red line.

Purpose Groups:

In order to comply with fire regulations we must first consider what activities are occurring inside. We can say that the boxing arena comes under Purpose Group 5 Assembly and Recreation within Table A.1 Classification of Purpose Groups - Part E (Fire Safety 2012) We can also say that the residential portion of the building comes under Purpose Group 2(b) Residential (Other).

Fig. 15: Zoning Plan / Scale 1:200

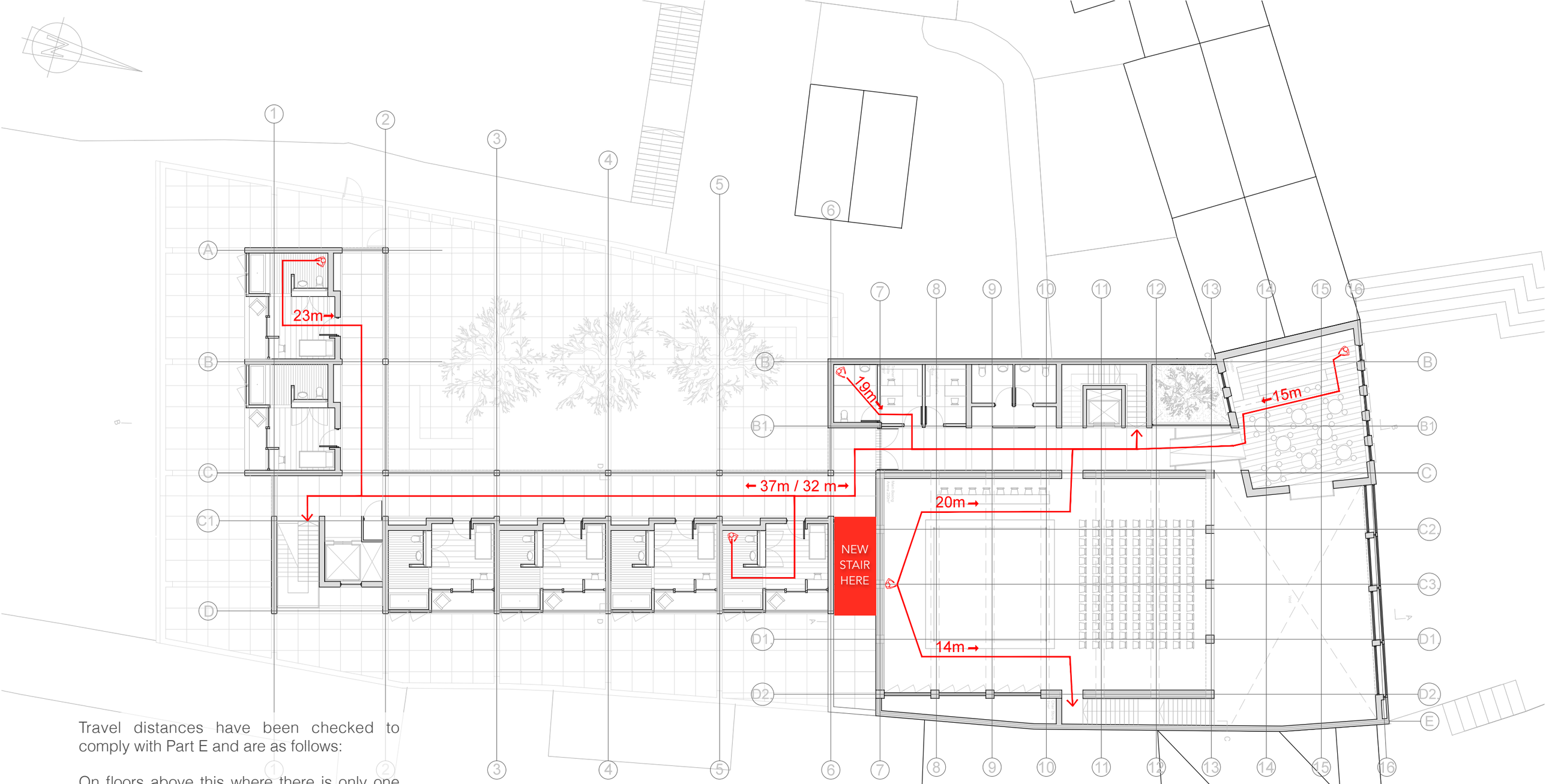


Travel distances have been checked to comply with Part E and are as follows:

Purpose Group 2(b)	Actual	Limit
-Food Store	18m	35m
-Dining Space	23m	35m

Purpose Group Five	Actual	Limit
-Changing Room	23m	45m
-Changing Room	33m	45m
-Gym	22m	45m

Fig. 16: Travel Distances Ground Floor / Scale 1:200



Travel distances have been checked to comply with Part E and are as follows:

On floors above this where there is only one means of escape a second staircase will need to be added to comply with the regulations.

Purpose Group 2(b)	Actual	Limit
-Bedroom 1	23m	35m
-Bedroom 2	32m	35m

Purpose Group Five	Actual	Limit
-Trainer's Office	20m	32m
-Arena Changing Room	33m	45m
-Function Room	15m	45m

Fig. 17: Travel Distances First Floor / Scale 1:200

Corridors in compliance with paragraphs 4.2-4.8 of Part R (Access and Use 2012) Current width 2,300mm

Two accessible toilets for users in compliance with paragraphs 6.1-6.10 of Part R (Access and Use 2012) Doors changed to open outward, emergency assistance alarm, layout in accordance with Diagram 6.1

Passenger lift to be provided in compliance with paragraphs 4.25-4.38 of Part R (Access and Use 2012) Including 1500x1500mm turning circle outside. Internal dimension currently 1300x1600mm.

Reception area for users in compliance with paragraphs 5.2-5.4 of Part R (Access and Use 2012) Including the provision of a reception desk.

Accessible level access for users in compliance with paragraphs 3.2-3.9 of Part R (Access and Use 2012) Covered distinguishable entrance, 1500mmx1500mm turning area in front)

Corridors in compliance with paragraphs 4.2-4.8 of Part R (Access and Use 2012) Current width 2,300mm

Two private wheelchair accessible changing facilities to be provided within existing facility in accordance with paragraph 5.28-5.37 Part R (Access and Use 2012) using Diagram 5.7 as a guide.

Fig. 18: Ground Floor Accessibility Strategy / Scale 1:200

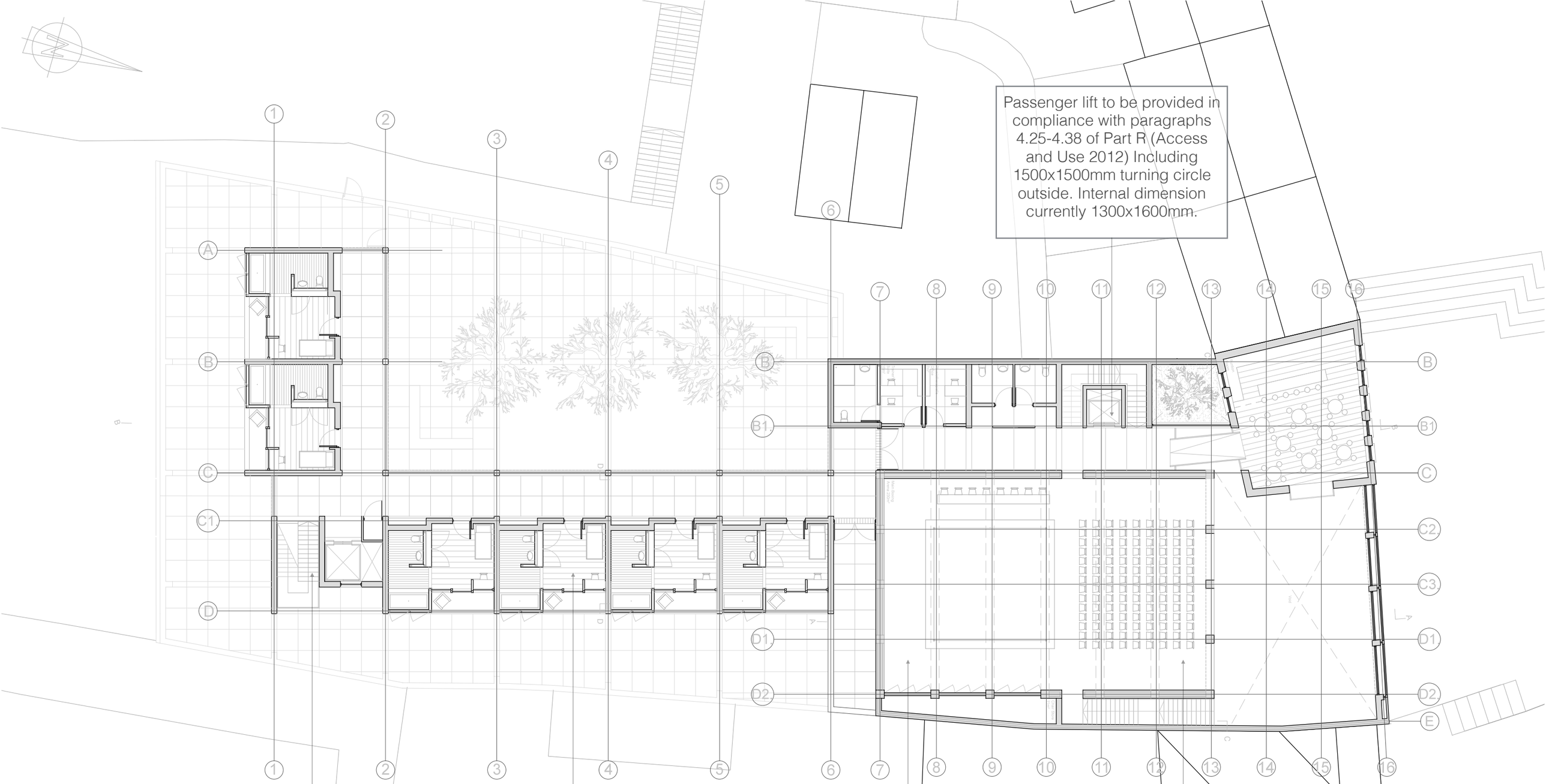


Fig. 19: First Floor Accessibility Strategy / Scale 1:200

Passenger lift to be provided in compliance with paragraphs 4.25-4.38 of Part R (Access and Use 2012) Including 1500x1500mm turning circle outside. Internal dimension currently 1300x1600mm.

Ramped access (bridge) to existing building in compliance with paragraph 4.15 of Part R (Access and Use 2012) Exceptional circumstances imposed by an existing building: Ramp currently 1:7 with a 1100mm width, The requirement for a 4m long ramp is 1:14 with a width of 1500mm without exceptional circumstances

Reception counter to comply with paragraph 5.1-5.4 and Diagram 5.1 of Part R (Access and Use 2012) Max height 760mm, actual 550. Clear space of 1200x1800mm in front of counter, 500mm deep counter top.

Accessible level access for users in compliance with paragraphs 3.2-3.9 of Part R (Access and Use 2012) Covered distinguishable entrance, 1500mmx1500mm turning area in front)

All stairs to be constructed in compliance with paragraphs 3.29-3.36 Part H and Diagram 3.9 (Stairs, Ramps, guarding and protection from impact), tactile warning surface, contrasting first and last step. 900mm high balustrade projecting no more than 110mm into stairway. Stair width not compliant - must be minimum 1200mm wide

3450

1150

50

600

3950

2850

900

3450

2850

1093

550

150

1100

1182

2164

Proposed Building	Price x Area	Cost
Foundations	£78 x 2580	£193,500
External Walls	£120 x 2580	£309,000
Roof	£100 x 2580	£258,000
Upper Floors	£10 x 2580	£25,800
Stairs	£5 x 2580	£12,900
Windows and External Doors	£60 x 2580	£154,800
Internal Partitions	£30 x 2580	£77,400
Internal Doors	£18 x 2580	£46,440
Floor Finishes	£27 x 2580	£69,660
Wall Finishes	£60 x 2580	£172,800
Ceiling Finishes	£10 x 2580	£25,800
Fixtures	£13 x 2580	£33,540
Sanitary	£50 x 2580	129,000
Drainage	£5 x 2580	£12,900
Water Infrastructure	£7 x 2580	£18,060
Heating	£20 x 2580	£51,600
Electrical Infrastructure	£29 x £937	£27,173
	Construction Cost	**£1,618,373**

Item	Area / Price	Cost
Site	1529.1m²	£161,674
Planning Fees	2580m²	£13,475
Engineer	8% of Construction	£129,470
Architect	7% of Construction	£113,286
Quantity Surveyor	2.02% of Construction	£32,691
Contingency Fund	5% of Construction	£81,000
Construction Cost		£1,618,373
	Estimated Cost	**£2,149,969**

Fig. 21: 6-8 Market Street