

Stage 2 - Fire Safety Strategy Report

For

Fusion Lordship Lane

Reference: FSE2304

Issue No: 02a

19th February 2024

Revision History

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Initial issue for comment by Design Team.			
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Issue for comment by Design Team. Changes include: - Inclusion of evacuation lift requirements for London Plan - Amendments to wording including clarification in some areas. - Clarification of sprinkler requirements to commercial accommodation in Building A and confirmation of compartment sizes being limited to less than 100m² in Buildings B and C. - Amendment to space separation for commercial unit in Building A.			
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Issue Number:	02a– Draft Stage 2	Issue Date:	19 th February 2024
Issue for comment by Design Team. Changes include minor amendments to wording and drawing numbers.			

Client Details

Client	Fusion Students
Client Address	Fusion House The Green Letchmore Heath Hertfordshire WD25 8ER
Project	Fusion Lordship Lane

Validity

This report is produced on the basis of the information and experience available at the time of preparation. It is applicable to the above-mentioned project only in accordance with the client’s instructions. It is only valid provided no other modifications are made other than those for which a formal opinion has been sought from and given by Helios Fire & Construction Consultancy UK.

The report outlines the principal opinion of Helios Fire & Construction Consultancy and is prepared based on information issued by other parties, this report should not be viewed as an approval of that information and no liability is accepted for its accuracy.

All legislation quoted is primarily concerned with life safety and property protection is not specifically considered although the fire protection provisions to be provided for the building will offer some degree of property protection.

Furthermore, other issues such as insurers’ requirements, cultural heritage, environmental, or continuity issues have not been specifically addressed or included within the development of the fire safety strategy.

Transmission and receipt of Information used in the preparation of the Fire Safety Strategy is agreed on the basis outlined in the fee proposal as issued by Helios Fire & Construction Consultancy. Should a web-based document management system be used, information that is specifically to be assessed and reviewed by Helios Fire & Construction Consultancy should be issued directly to the representative of Helios Fire & Construction Consultancy. The acceptance of access onto any web-based system by Helios Fire & Construction Consultancy does not constitute an acknowledgement that all information on the specific portal will have been assessed and reviewed.

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1 Overview of Development

1.1 Description

The site has been split into four separate buildings.

Building A is the largest block at ten storeys (ground plus 9 above ground floors including a mezzanine between ground and first floor) and contains retail, Purpose Built Student Accommodation (PBSA) amenity/storage, duplex units, studios and cluster flats. Due to the building height it has multiple stairs.

Building B is a six storeys high residential block and has a mix of one bed two person flats and three bed five person flats accessed via a single stair and external balconies as well as duplexes accessed from ground floor.

Building C is also a six storeys high residential block and has waste/stores and a mix of two bed four person units and three bed five person units accessed via two stairs and external balconies as well as duplexes accessed from ground floor.

Block D is split into three storey five bed eight person dwellinghouses.

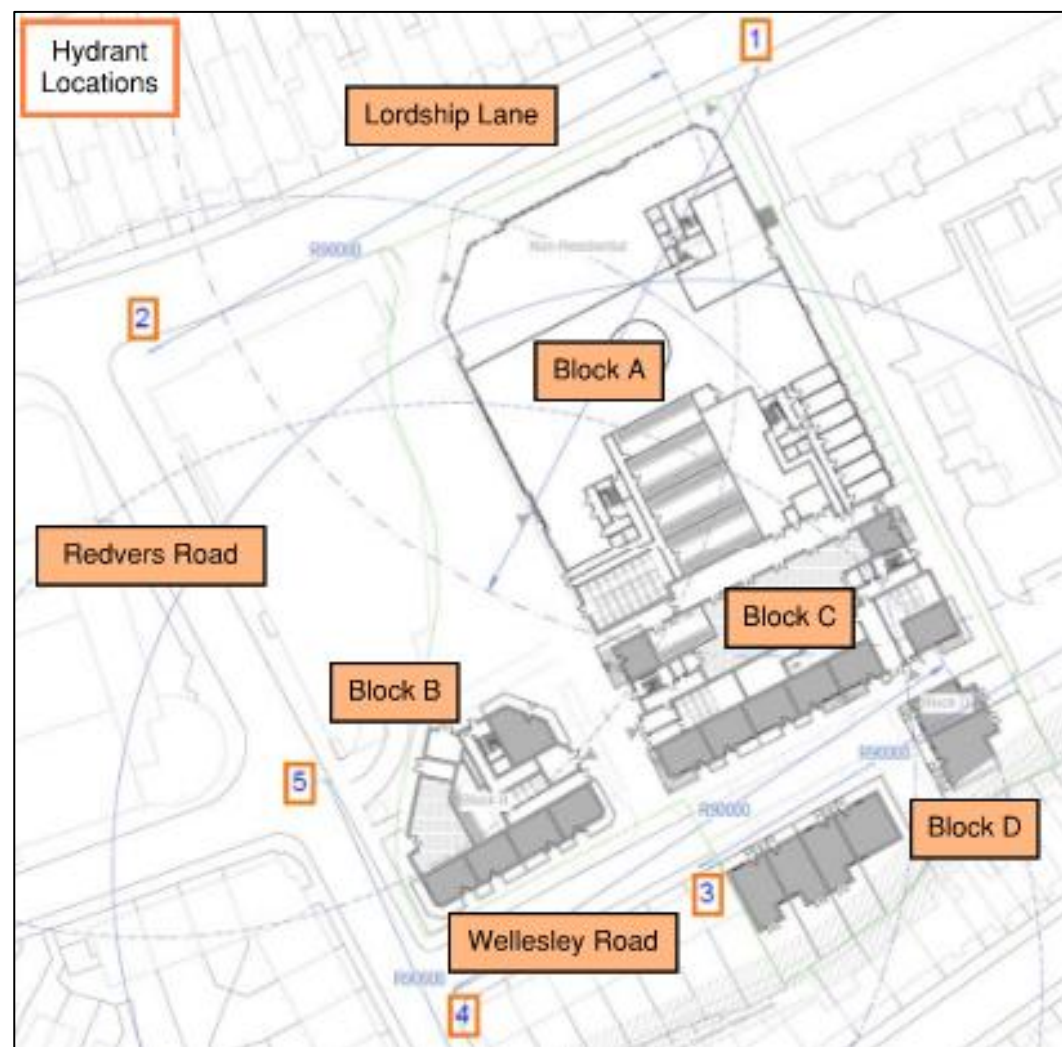


Figure 1: Buildings A, B C & D – Site Plan

1.2 Building Height

For the purposes of this fire safety strategy the height of the building has taken from the lowest surrounding ground level to the top occupied storey.

Block A is approximately 27.4m to the top habitable storey from ground floor level.

Blocks B & C are approximately 16.9m to the top habitable storey from the ground floor level.

Block D is approximately 6.1m to the top habitable storey from ground floor level.

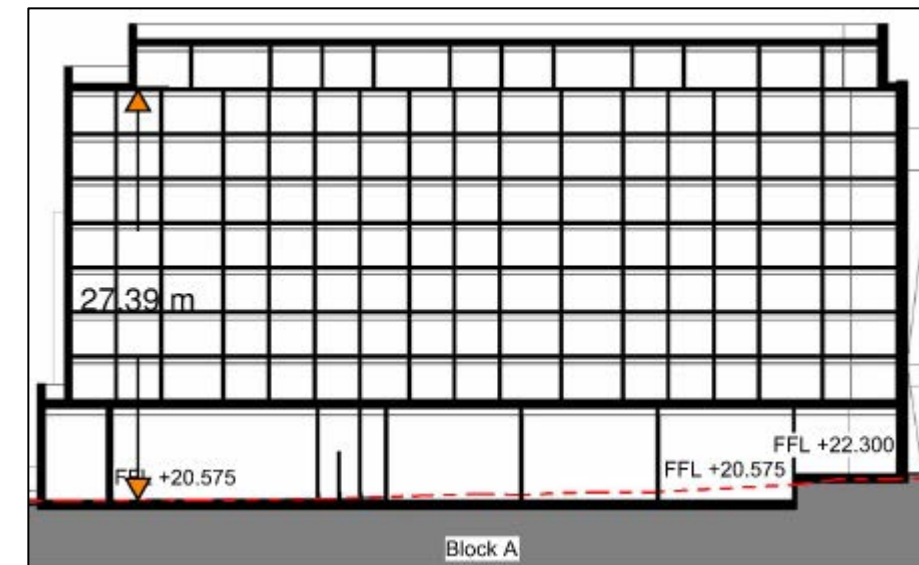


Figure 2: Building Height Block A

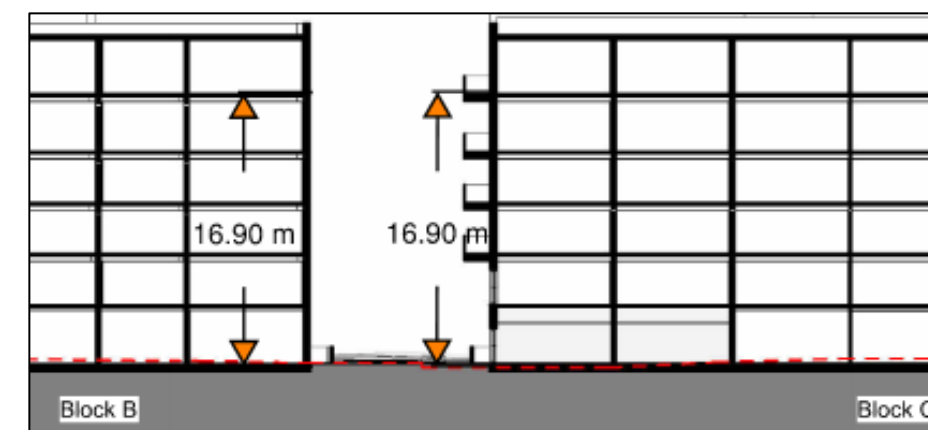


Figure 3: Building Height Blocks B & C

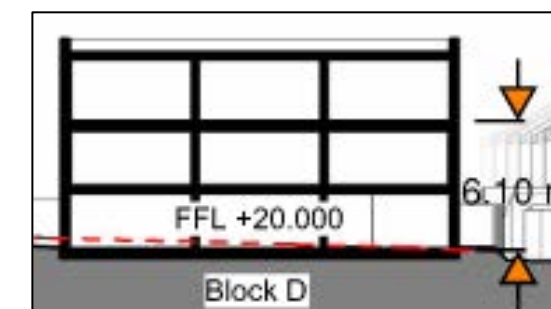


Figure 4: Building Height Block D

1.3 General Building Arrangements

1.3.1 Block A

Block A ground floor comprises a common amenity area which is a double height space leading to a mezzanine, retail, ancillary accommodation and a small portion of the ground floor containing duplex units separated by a compartment wall. The total approximate ground floor area is 3,072m². The block is served with two firefighting shafts and an escape stair. Every floor is served by at least two stairs and therefore there is no single stair scenario served by ancillary accommodation occurring.

The mezzanine is provided with a single open staircase that is accessed from the common amenity space on ground floor. Firefighting stair 01 and escape stair 03 also serve the mezzanine level. There are also a number of duplex apartments which are also not accessed from the firefighting stairs. The total approximate floor area of the mezzanine level (combined) is 715m².

Floors 01-06 are each served by three stairs and contain a mixture of Cluster flats, studios and social studios with an area of approx. 2,330m². Floor seven is stepped back on the east elevation and approx. 1,900m². On the eighth floor the floorplate is reduced further with an area of approx. 1,085m² and contains two stairs with access to the right hand side flats from the south west firefighting shaft. Escape can be made to firefighting stair 02 through the adjacent cluster flat.

Note: Ancillary accommodation includes plant, refuse, cycle stores and retail.

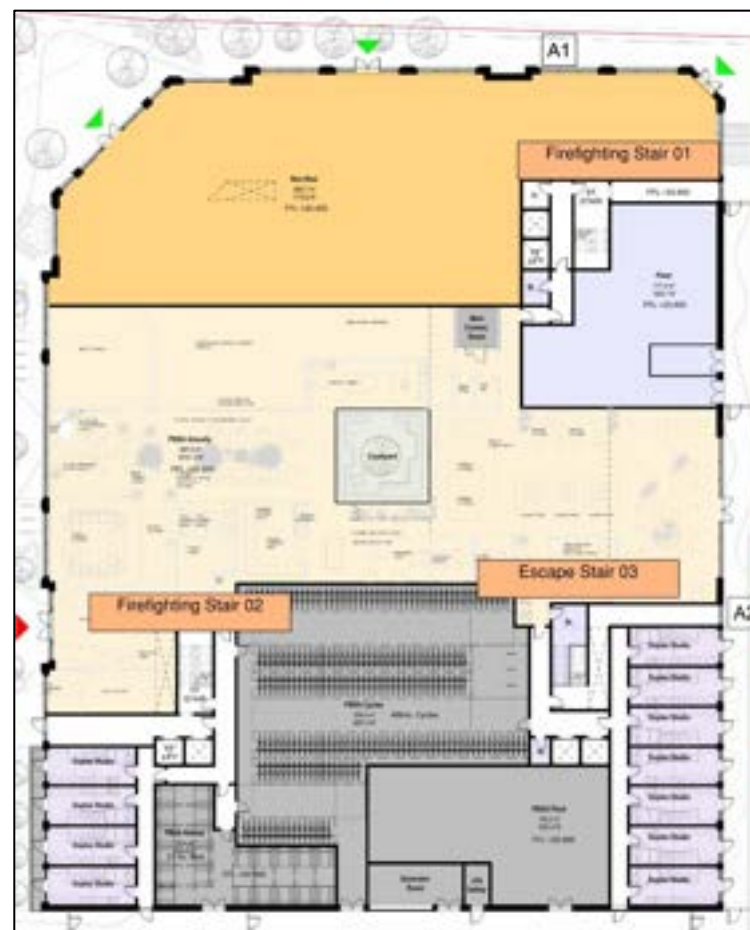


Figure 5: Ground Floor

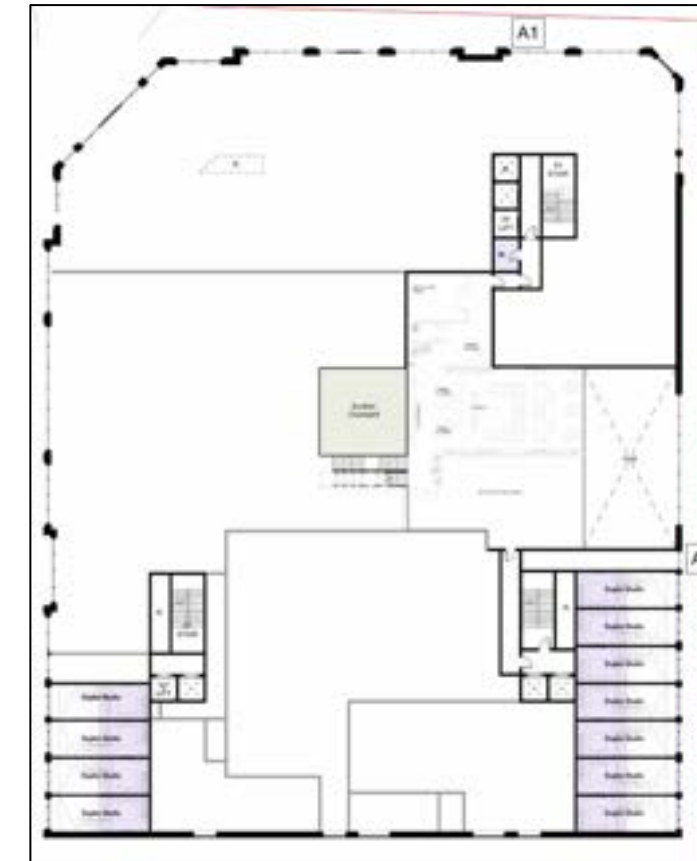


Figure 6: Mezzanine Floor

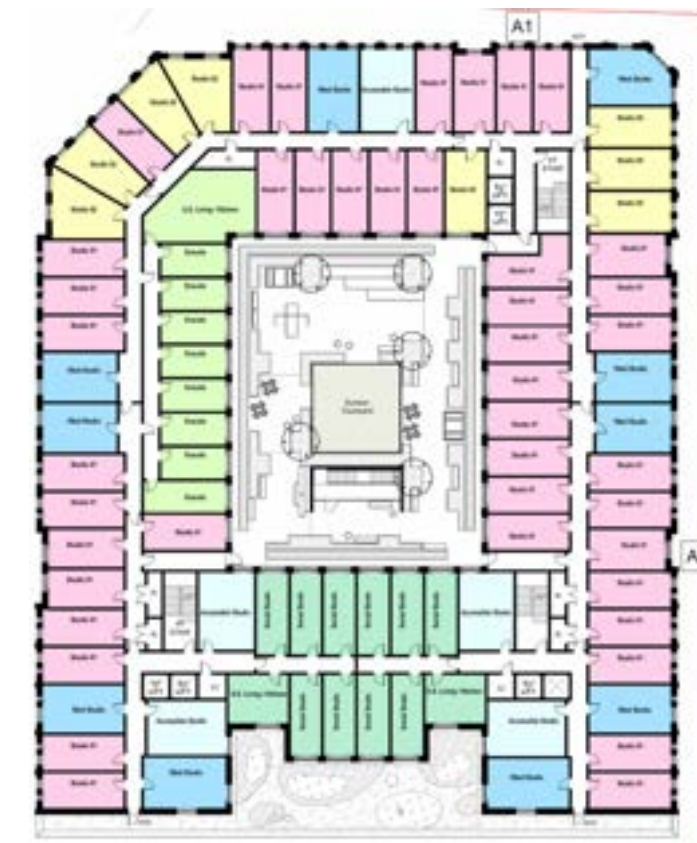


Figure 7: Floors 01-06

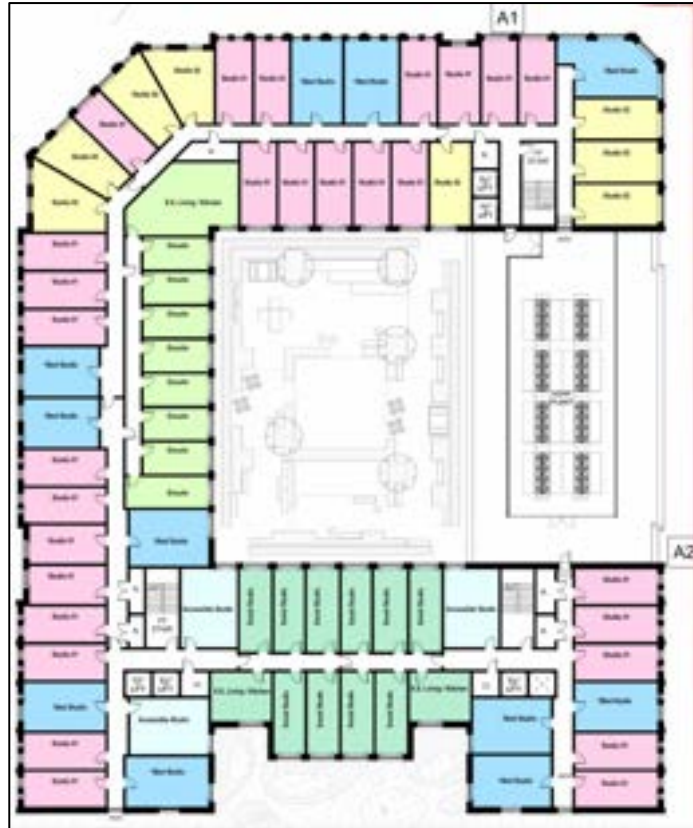


Figure 8: Floor 07



Figure 9: Floor 08

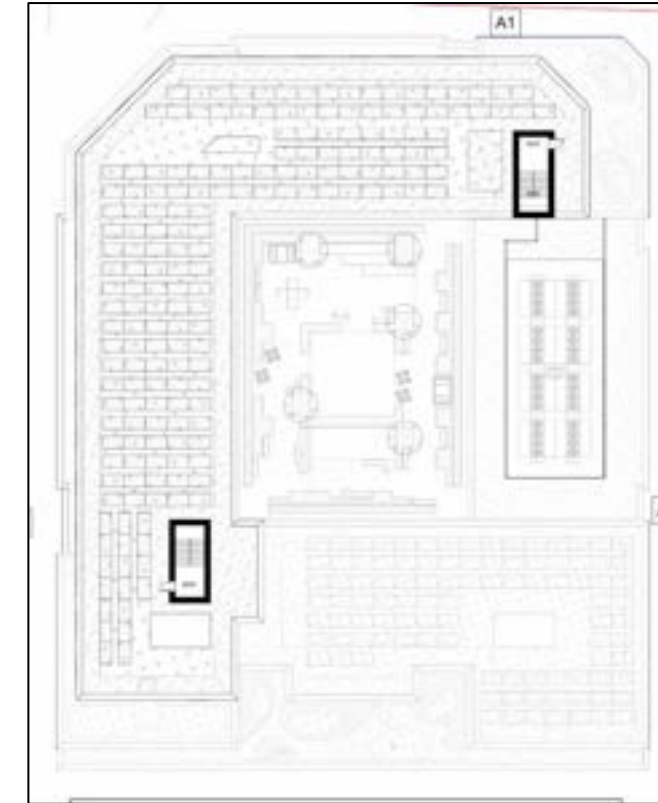


Figure 10: Roof

1.3.2 Block B

Block B ground floor comprises ancillary accommodation, duplex units and a one bed flat. The total approximate ground floor area is 552m². The block is served via a single stair with a dry riser. No ancillary accommodation is directly accessed from the stair or corridor serving the stair.

The first floor provides upper floor access to four duplex units and a flat accessed via a common balcony/ egress.

Floors 02 – 04 consists of five flats per floor with common balcony access/egress with a floor area of approx. 445m².

Floor 05 steps back and provides four flats with common balcony access/egress with a floor area approx. 382m².

Note: Ancillary accommodation includes plant, refuse, cycle stores and retail.



Figure 11: Ground Floor



Figure 12: Floor 01



Figure 13: Floors 02-04



Figure 14: Floor 05

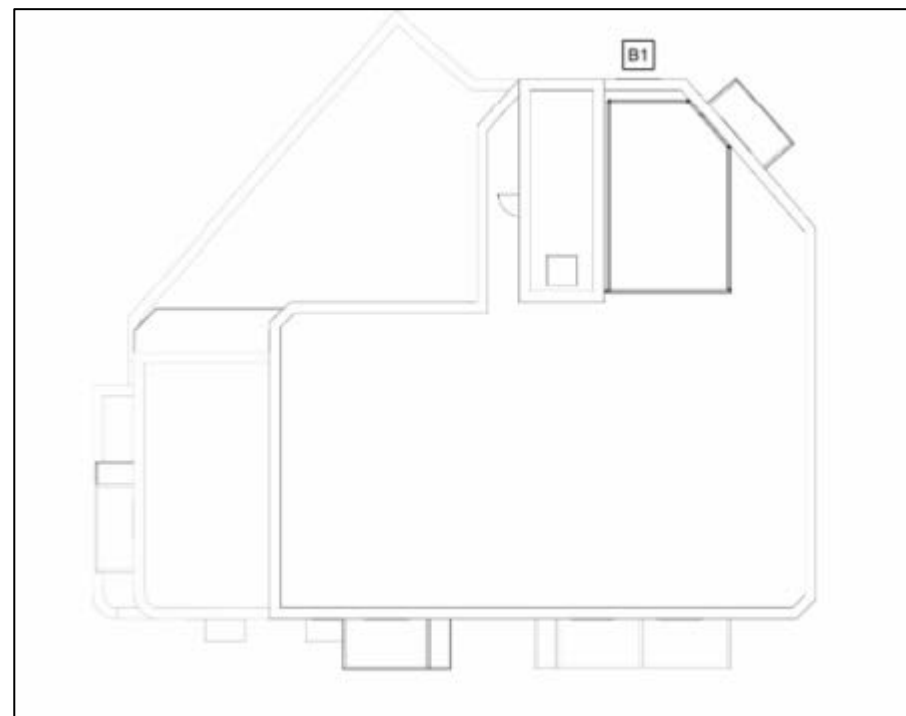


Figure 15: Roof

1.3.3 Block C

Block C ground floor comprises ancillary accommodation and duplex units. The total approximate ground floor area is 1,025m². The block is served via two stairs with a dry riser to the west stair core. No ancillary accommodation is directly accessed from the stair or corridor serving the stair.

The first floor contains the upper floor access to the duplex units and a single flat.

The upper floors consist of nine flats per floor with common balcony access/egress.

Note: Ancillary accommodation includes plant, refuse, cycle stores and retail.



Figure 16: Ground Floor

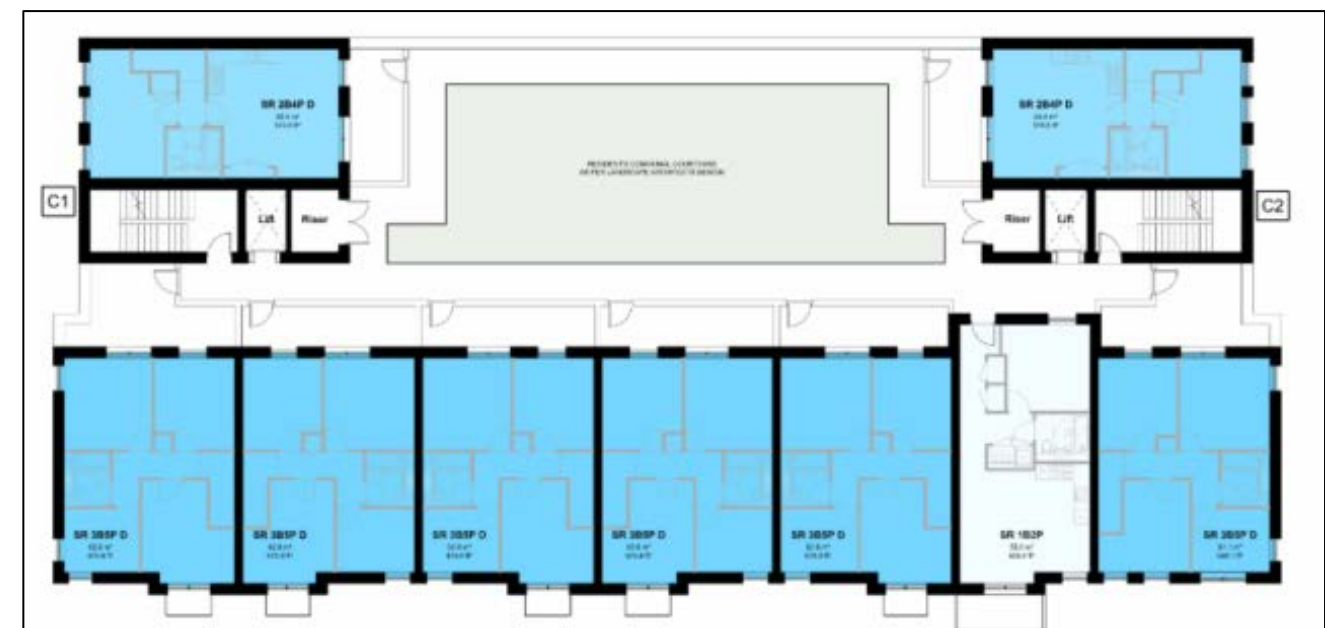


Figure 17: Floor 01

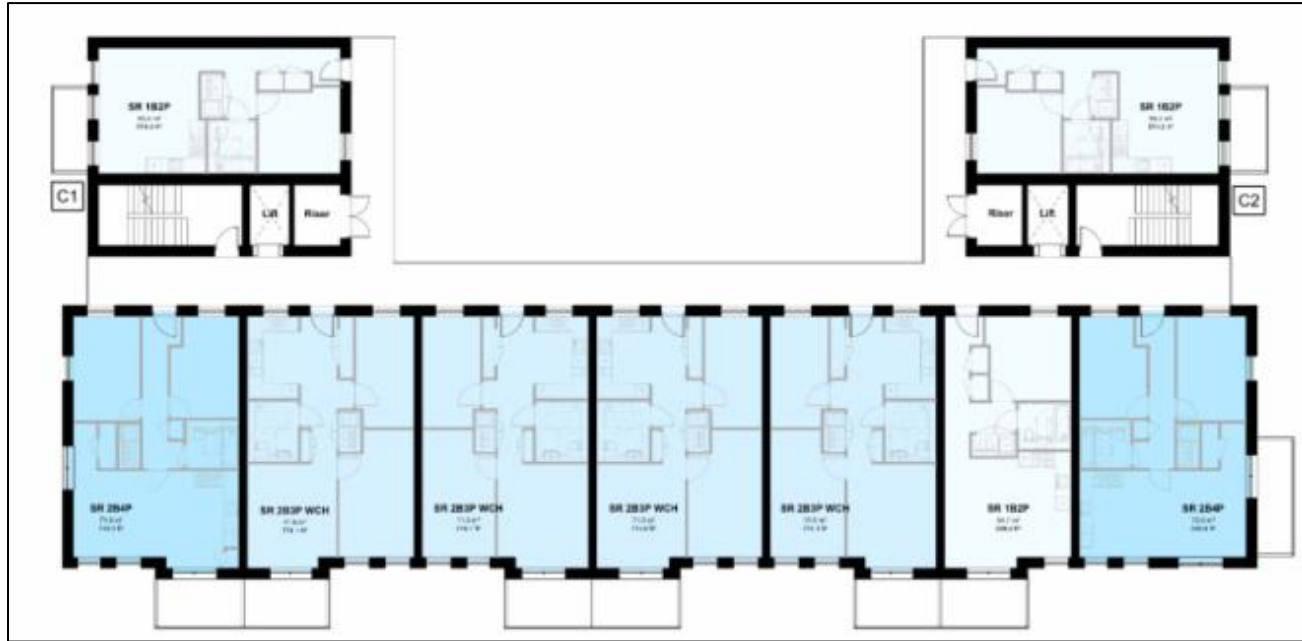


Figure 18: Floors 02-04

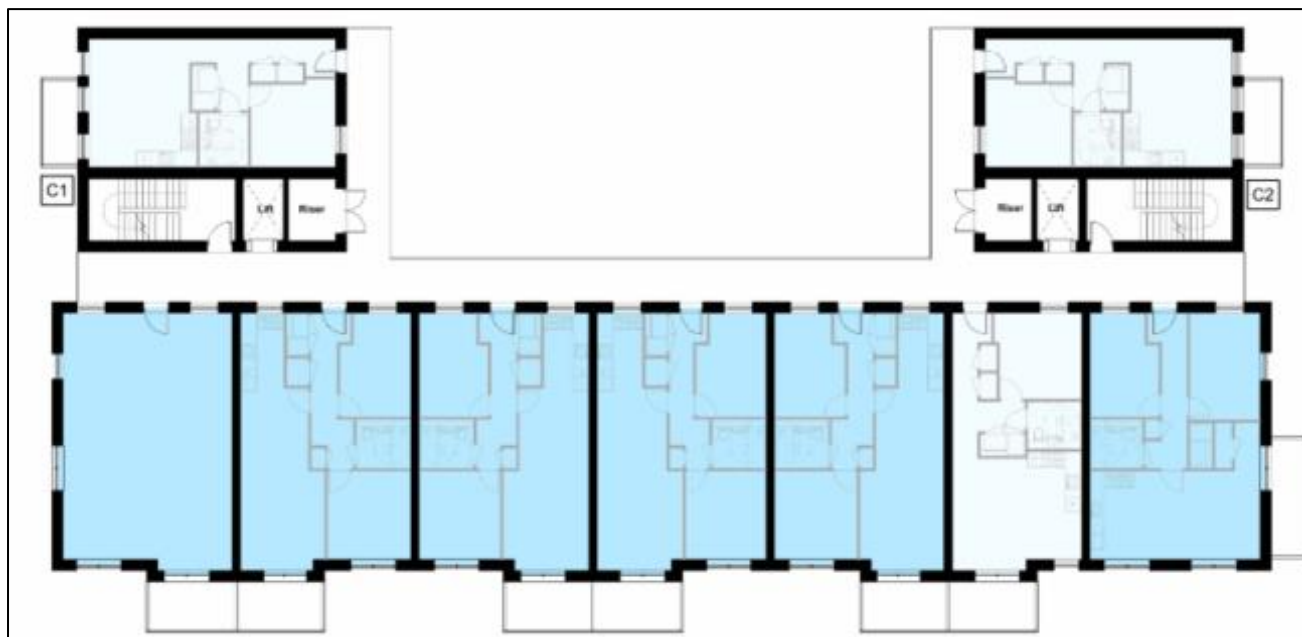


Figure 19: Floor 05

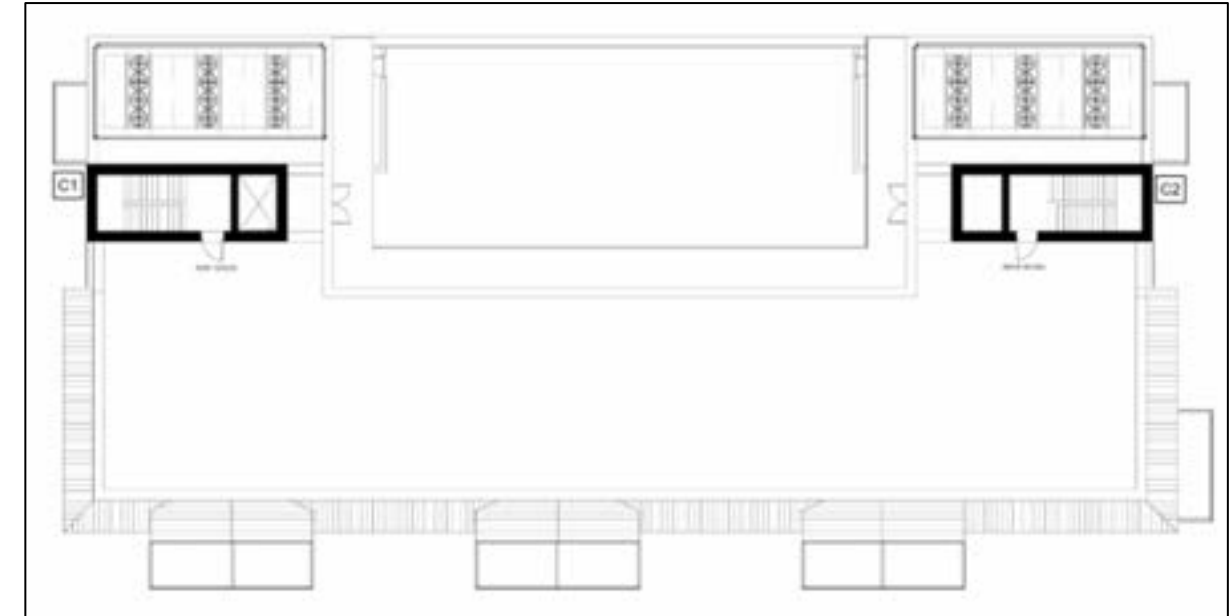


Figure 20: Roof

1.3.4 Block D

Block D ground floors provide the main living areas to the dwellinghouses and are approximately 50m². The upper floors contain bedrooms and bathrooms served via protected stairs.



Figure 21: House Type 1



Figure 22: House Type 2



Figure 23: House Type 3

1.3.5 Occupancy

The building is proposed to operate a stay put evacuation strategy, therefore for the residential areas it is not necessary to determine occupancy numbers. However, for Block A as it is proposed to provide an emergency simultaneous evacuation system, the occupancy of the building has been reviewed to ensure the buildings stairs contain sufficient capacity in the event of a simultaneous evacuation. Although it is noted that the system will operate floor by floor, worst case scenario has been calculated.

Generally, most rooms will be single occupancy, the report has assessed a worst-case scenario of a single occupant per room plus a 50% allowance for guests and visitors in the residential levels.

For the amenity and social spaces, whilst only occupied by the residents, when calculating door widths etc., floor space factors from BS9999 have been used and noted below:

- 2m² per person of the gross floor area for the communal amenity areas.
- 4m² per person of the gross floor area for the non-residential areas/commercial units.

This does not consider all of the furniture / fixtures and fittings in the space which will additionally reduce the usable floors space.

The tables below presents the maximum occupancy numbers within the residential accommodation including the associated social and ancillary amenity spaces and adjacent no-residential space.

Table 1: Occupancy Numbers – Building A

Floor		Beds/ Floor Area	Visitors	Occupancy
8		41 beds	22	63
7		68 Beds	34	102
6		84 beds	42	126
5		84 beds	42	126
4		84 beds	42	126
3		84 beds	42	126
2		84 beds	42	126
1		84 beds	42	126
Mezzanine		245m ² @ 2m ² per person	NA	122
Ground	Amenity	954m ² @ 2m ² per person	NA	477
	Non-Resi	666m ² @ 4m ² per person	NA	167
	Duplex Studios	11 beds	6	17
Total				1704

2 Purpose of Report

The objective of this report is to develop a fire safety strategy, which satisfies the performance requirements of the Building Regulations 2010 whilst maintaining an acceptable level of life safety, protection of adjacent property and adequate provisions for fire service intervention.

BS9991: 2015 and BS9999: 2017 will be used as the primary guidance documents for the development in order to achieve statutory approval under Part B of the Building Regulations 2010.

Where no specific provision is mentioned in this fire safety strategy regarding any particular aspect reference should be made to BS9991 & BS9999.

This report details the fire safety strategy and is intended to highlight the key design issues and the proposed solutions to meet the challenges of compliance with the Building Regulations 2010.

This document will therefore act as the basis of discussions between the design team and Approval Authorities, in order to obtain approval in principle for the design in respect to fire safety compliance.

Summary of Departures from Design Guidance

Provision	Helios Comment	Section	AHJ / Client Acceptance
B1 – Means of Warning and Escape			
Evacuation Strategy	Open plan flats without the kitchen enclosed.	6.1.2	

2.1 Design Team/ Client Confirmation Requirements

Further information / confirmation is required by the Design Team / Client and approvals from Building Control, these have been provided in the following colours throughout the report:

‘Blue’ – Information / confirmation is required from the Design Team / End User,

‘Purple’ – Approvals are required from the Authorities Having Jurisdiction

The fire strategy report should be read in full by all relevant parties.

2.2 Sources of Information

The information within this report is based on information and drawings provided to Helios Fire & Construction Consultancy up to the date of this report.

Table 2: Drawings

Drawings/ Document Title	Drawing/ Document Reference	Revision
Landscape Proposal – Ground Floor Plan	7692-PHL-SW-XX-DR-L-2001	00
Block A Proposed Level 00	21820-0150	09
Block A Proposed Level Mezz	21820-0151	09
Block A Proposed Level 01	21820-0152	09
Block A Proposed Level 07	21820-0158	09
Block A Proposed Level 08	21820-0159	09
Block A Proposed Level 09	21820-0160	09
Block A North Elevation	21820-0165	03
Block A South Elevation	21820-0166	03

Block A East Elevation	21820-0167	03
Block A West Elevation	21820-0168	03
Block B Proposed Level 00	21820-0170	03
Block B Proposed Level 01	21820-0171	03
Block B Proposed Level 02	21820-0172	03
Block B Proposed Level 05	21820-0175	03
Block B North Elevation	21820-0212	03
Block B South Elevation	21820-0213	03
Block B East Elevation	21820-0214	03
Block B West Elevation	21820-0215	03
Block C Proposed Level 00	21820-0180	03
Block C Proposed Level 01	21820-0181	03
Block C Proposed Level 02	21820-0182	03
Block C Proposed Level 03	21820-0183	03
Block C Proposed Level 04	21820-0184	03
Block C Proposed Level 05	21820-0185	03
Block C Proposed Level 06	21820-0186	03
Block C North Elevation	21820-0216	01
Block C South Elevation	21820-0217	01
Block C East Elevation	21820-0218	01
Block C West Elevation	21820-0219	01
Block B & C 1 Bed Apartment Types	21820-0310-00	00
Block B & C 2 Bed WCH Apartment Types	21820-0315-00	00
Block B & C Apartment Types 1	21820-0320-00	00
Block B & C Apartment Types 2	21820-0321-00	00
Block B & C Maisonettes Type 1	21820-0325-00	00
Block B & C Maisonettes Type 2	21820-0326-00	00
Block D Proposed Level 00	21820-0190	05
Block D Proposed Level 01	21820-0191	05
Block D Proposed Level 02	21820-0192	05
Block D Proposed Level 03	21820-0193	05
Block D House Type 1	21820-0330	00
Block D House Type 2	21820-0331	00
Block D House Type 3	21820-0332	00
Block D North & South Elevations	21820-0254	01
Block D East and West Elevations 1	21820-0255	01
Block D East and West Elevations 2	21820-0256	01

Note: The figures within this report are intended to illustrate the fire safety principles. For confirmation of layout or other design details, reference should be made to the current plans.

3 Statutory Compliance

3.1 The Building Regulations

The building will be subject to the statutory requirements of the Building Regulations 2010. It is, therefore, necessary for the building to meet the functional requirements of Part B of Schedule 1 of these Regulations. These requirements relate to:

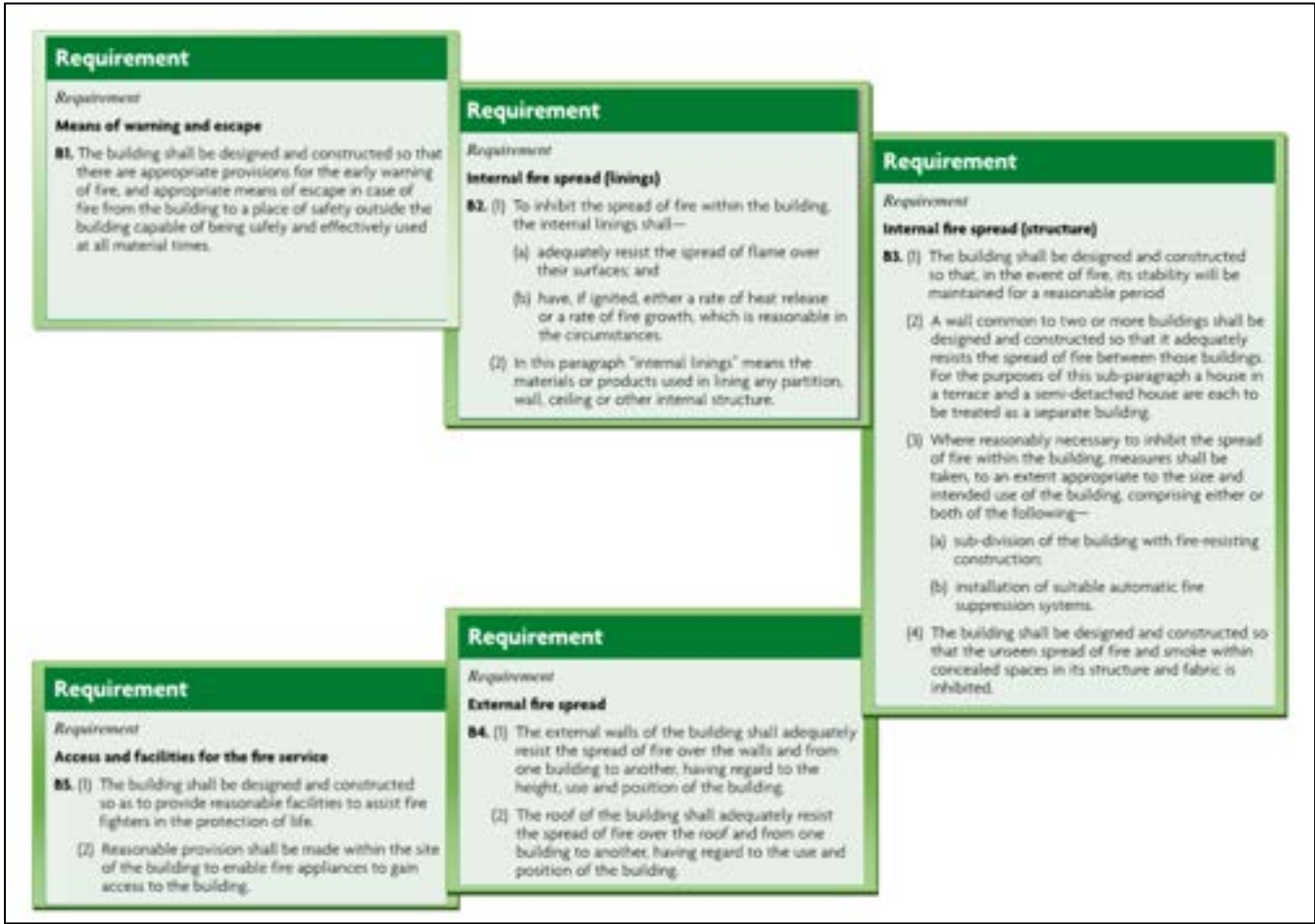


Figure 24: Schedule 1 Part B of the Building Regulations 2010

3.2 Regulation 7 – Building Regulations

In assessing the Building Regulations and schedule 1, this report will also specifically highlight and assess Regulation 7 of the Building Regulations relating to 'Materials and Workmanship' which outlines the general principals of materials being used in the construction being appropriate for the circumstances in which they are used and installed, and also commenting on the workmanship standards and certification expected for material installation.

3.3 Guidance

For the building, compliance with the above requirements will be achieved by the guidance of BS9991 where appropriate and supplementing this with fire engineering solutions when necessary to ensure that the key fire safety objectives for the design are achieved.

In relation to External Fire Spread, Suppression Systems and Internal Wayfinding Signage BS9991 and BS9999 are not based on the current guidance in relation to fire spread and combustibility of external walls; on this basis it

is proposed to utilise the guidance in the amended Approved Document B 2020 with 2022 amendments as this is the most onerous guidance and is in line with current legislation.

Note: BS9991 is currently being reviewed and the latest guidance document may be released but it is not clear what changes will be incorporated within the British Standard or when the document will be released. On this basis this report has utilised the current guidance from BS9991 and Approved Document B that has been updated and amended in 2022.

This legislation is primarily concerned with life safety and property protection is not specifically considered although the fire protection provisions to be provided for the building will offer some degree of property protection.

Furthermore, other issues such as insurer's requirements, cultural heritage, environmental, or continuity issues have not been specifically addressed or included within the development of the fire safety strategy.

3.3.1 Accessible Design

There is no detailed requirement within the guidance of BS9991 to provide any facilities specifically for use by mobility impaired occupants as the primary evacuation strategy is a stay put evacuation 'Defend in Place' where the high level of compartmentation is deemed to provide adequate protection to the occupants.

Where a fire is considered in an individual apartment the occupant is deemed to leave this space and proceed to the protected corridor / staircase which then is the 'Defend in Place' protected location.

Remaining occupants, based on the levels of compartmentation, should remain in place unless directly affected by heat / smoke; or unless directed to leave by the Fire and Rescue Service. This is the primary driver for the additional ventilation requirements to common staircases in blocks of apartments to maintain tenable conditions in the escape staircases whilst a fire is contained within an individual apartment.

As noted in BS9991:

'it is the responsibility of the premises management to assess the needs of all people to make a safe evacuation when formulating evacuation plans.'

'This evacuation plan should not rely on the assistance of the fire and rescue service. This is an important factor that should be considered in the building design.'

Special management procedures might be required where it is reasonably foreseeable that the proportion of disabled people in a building will be relatively high; should this be the case this should be communicated to the design team during the initial design stages and briefing sections of the design.

Where known operational intent or specific management procedures for 'Relevant Persons' have been communicated to the designers this will be reflected in the Fire Safety Strategy and Regulation 38 Information issued. If no additional or specific requirements have been communicated, the design will be based on the relevant design standards as noted in the Building Regulations.

However, it should also be noted that the London Plan does include a requirement that in all developments where lifts are installed, as a minimum at least one lift per core (or more subject to capacity assessment) should be a suitably sized fire evacuation lift suitable to be used to evacuate people who require level access from the building. This will therefore apply to Buildings A, B and C.

3.4 Regulation 38 of the Building Regulations

To enable a comprehensive Fire Risk Assessment to be carried out as noted in Regulation 38 of the Building Regulations 2010 'The person carrying out the work shall give all relevant fire safety information to the responsible person not later than the date of completion of the work, or the date of occupation of the building or extension, whichever is the earlier' in this regulation:

Fire safety information - means information relating to the design and construction of the building or extension, and the services, fittings and equipment provided in or in connection with the building or extension which will assist the responsible person to operate and maintain the building or extension with reasonable safety.

Relevant building - is a building to which the Regulatory Reform (Fire Safety) Order 2005 applies or will apply after the completion of building work.

Relevant change of use - is a material change of use where, after the change of use takes place, the Regulatory Reform (Fire Safety) Order 2005 will apply, or continue to apply, to the building; and

Responsible person - has the meaning given by Article 3 of the Regulatory Reform (Fire Safety) Order 2005.

Helios would recommend that where appropriate manufacturers and installers that are subject to independent certification schemes are considered / specified for this development.

3.5 The Regulatory Reform (Fire Safety) Order 2005

3.5.1 Fire Safety Order 2005

Once the building is completed and occupied, the Regulatory Reform Fire Safety Order 2005 (RR (FS) O) becomes the controlling fire safety legislation.

It is necessary, among other things, under this order for the owner/occupier of the building to carry out and maintain a fire safety risk assessment. The building's management team will also be responsible under this order to ensure that the building's fire safety provisions are appropriately managed, maintained and tested over the whole life of the building.

3.5.2 Fire Safety Act 2021

The Fire Safety Act clarifies the scope of the Fire Safety Order to make clear it applies to the structure, external walls (including cladding and balconies) and individual flat entrance doors between domestic premises and the common parts of a multi-occupied residential building.

3.5.3 Fire Safety England Regulations

The Fire Safety (England) Regulations 2022 were laid under Article 24 of the Fire Safety Order 2005. Regulations made under Article 24 can impose requirements on responsible persons in relation to mitigating the risk to residents for specific premises for buildings over 11m.

3.6 Building Safety Act

The Building Safety Act 2022, provides a new framework for the design, construction and occupation of "higher risk" buildings. These are defined as those having at least 18 metres or 7 storeys in height and comprise of at least 2 domestic premises. It introduces a new duty holder: the "Accountable Person".

3.7 Construction, Design and Management Regulations

Projects undertaken within the UK are subject to the requirements of the Construction, Design and Management Regulations (CDM).

This report defines the strategy for meeting the functional and performance requirements for fire safety in the finished building. Where any conclusions or recommendations have been arrived at which specify particular materials, products, or forms of construction these will have been assessed, in accordance with CDM Regulation 9 (Duties for Designers).

In the event that these involve significant residual risks or health and safety critical assumptions, this information will be made available to the Principal Designer.

Where the architect or other consultants use the standards put forward in this report to specify works, they are understood to be competent in alerting the Client, Principal Designer, and Contractor and Building Occupier.

3.8 Third Party Accreditation Schemes

Independent Third-Party Certification Schemes provide confidence the required level of performance is achieved in the design, product selection, product manufacture, installation and commissioning of a building system, structure or component.

Third party certification schemes for fire protection products, design, installation and commissioning are an effective means of providing assurances of quality, reliability and safety. These schemes can assist in demonstrating compliance with the Material and Workmanship requirements of Regulation 7 to the Building Regulations is satisfied.

4 Access & Facilities for the Fire Service

4.1 General Access

Access to the site is via Lordship Lane, Redvers Road and Wellesley Road. There is an existing route through the site which will be kept and amended to suit the new building layouts.

Access to the amenity spaces for Buildings A, B and C will be based on the fire service being able to get to within 45m to all parts of the space. This can be achieved based on the entry points provided to the amenity spaces and current vehicle access between the buildings as noted above.

Access to the residential areas in Buildings A, B and C will be based on internal firefighting as per the guidance from BS9991. The proposal is to provide dry rising mains to all common stairs.

Building A is over 18m but less than 50m and therefore will be provided with firefighting shafts which will include firefighting lifts and dry rising mains.

The firefighting shaft at ground and mezzanine level will be designed as a commercial shaft in regards to fire protection e.g. 120 minutes enclosure around the lobby, lift and stair. On the residential floors, the shaft will be designed as a residential firefighting shaft.

Blocks B and C are under 18m and therefore only protected escape stairs are required with dry rising mains.

The pump appliance is able to get within 18m to all dry riser inlet connection points as can be seen in figure below. See Section 4.3.4 below for more information.

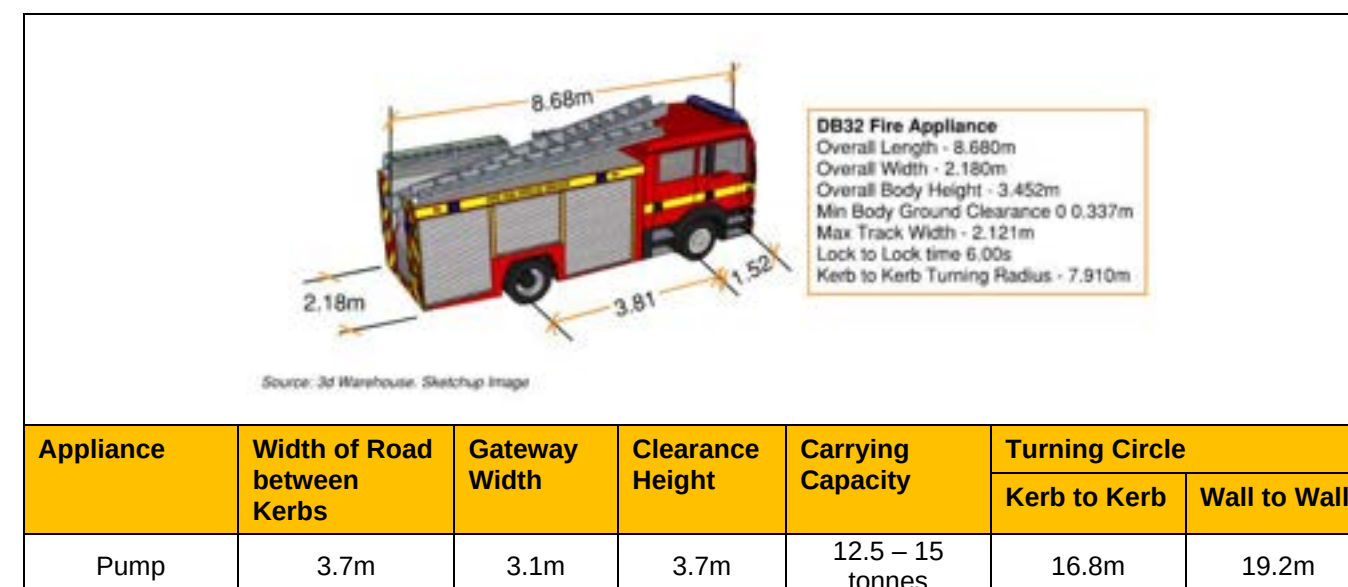
There are eleven flats with galleries located on the ground floor to Block A. The fire service are able to lay a hose from the fire appliance within 75m of all parts of the flats with galleries.

There are seven dwellinghouses and the fire service are able to lay a hose from the fire appliance within 45m of all parts of the dwellings.

4.2 Vehicle Access

The access provision will be designed in accordance with the table below. The table below contains standardised figures as well as ranges based on past discussions with fire services around the UK; the local fire service should be consulted with to confirm their requirements.

Table 3: Fire Service Vehicle Access Routes



The fire service should not need to reverse more than 20 metres; to support this; turning facilities (such as hammer heads) are to be provided, as necessary. As it can be seen by the figure below, access is provided through the site and a tender is able to reverse into this route from the Block D dwellinghouses. Tracking will need to be undertaken otherwise a hammerhead will be required.

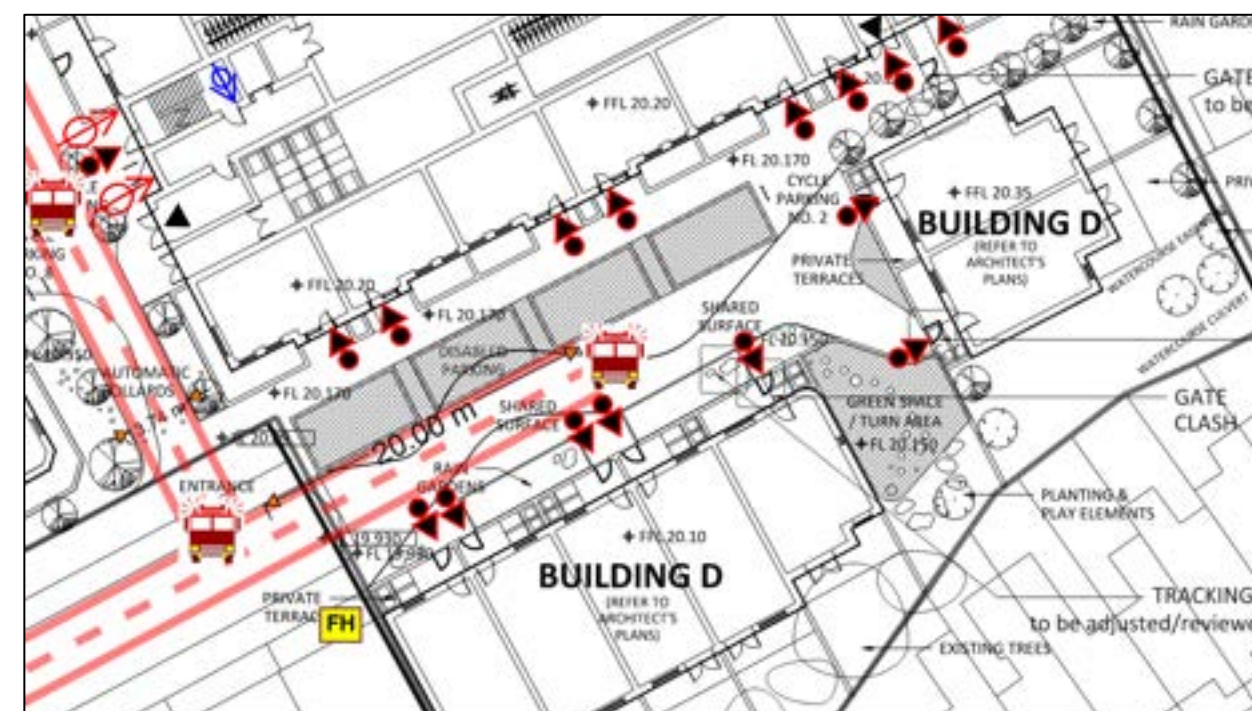


Figure 25: Block D 20m Reversing Distance

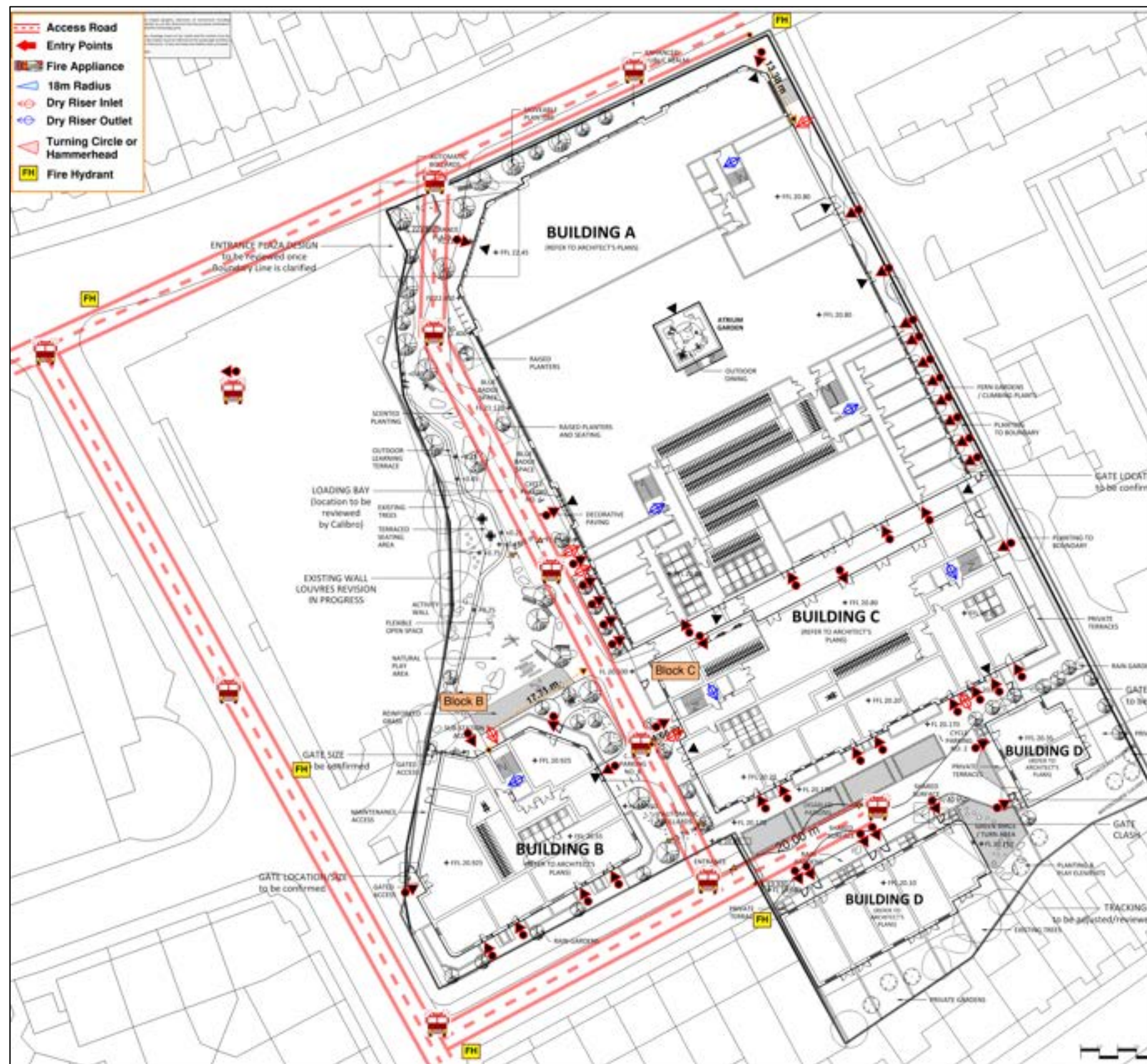


Figure 26: General Fire Service Access

4.3 Firefighting Provisions

Blocks B and C do not exceed 18m to the top habitable storey, on this basis only protected stairs and dry rising mains are required. See Section 4.3.4 below for dry rising mains requirements.

Block D comprises dwelling houses and hose distances can be met, therefore no additional firefighting provisions are necessary.

The guidance in BS9991 recommends that in buildings with a floor higher than 18m above fire and rescue service access level should be provided with firefighting shafts(s) containing firefighting lifts. Block A meets this requirement.

It also recommends that a sufficient number of firefighting shafts should be provided to meet hose laying requirements (e.g., a maximum of 60m in buildings provided with AWFSS in accordance with BSEN 12845 or BS9251) and that at least two firefighting shafts should be provided in buildings with a storey of 900m² or more in area. Building A is provided with two firefighting shafts and one protected escape stair.

The proposals have been based on the actual hose distances where all parts of all floors can be accessed with a 60m hose distance as stipulated in BS9991 for suitable hose distances.

The figures below illustrate the recommended layout of a typical firefighting shaft for the ground floor and for the residential floor.

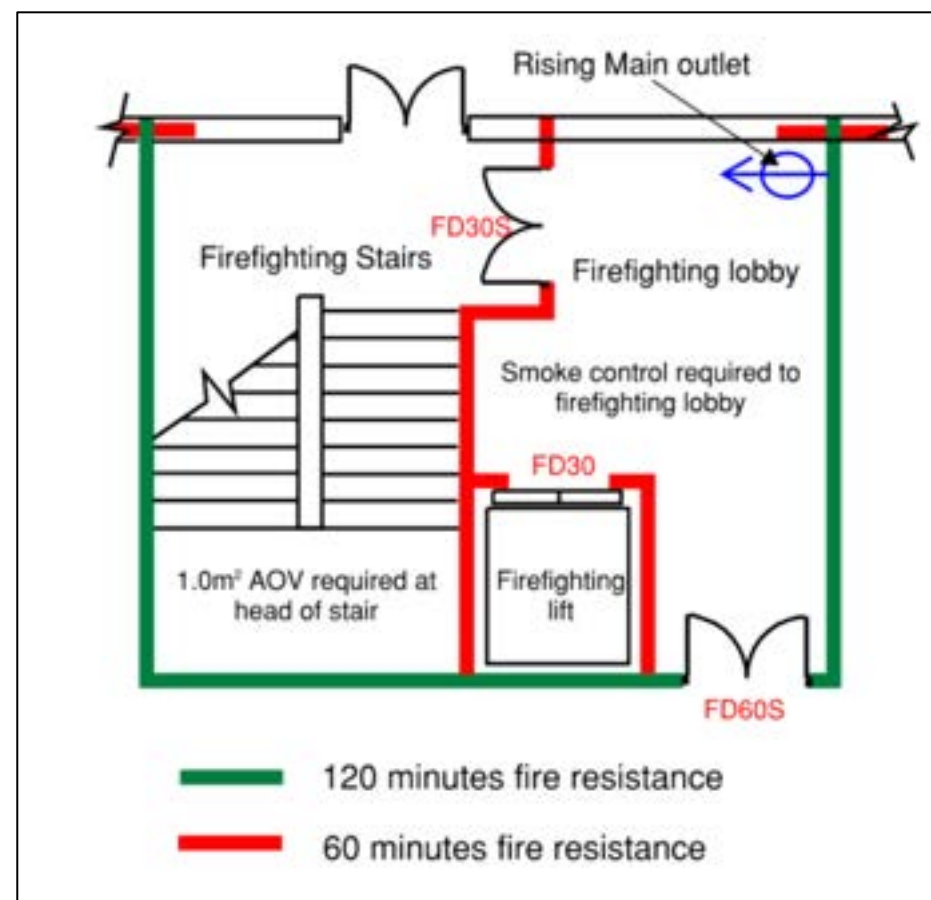


Figure 27: Commercial Firefighting Shaft Layout

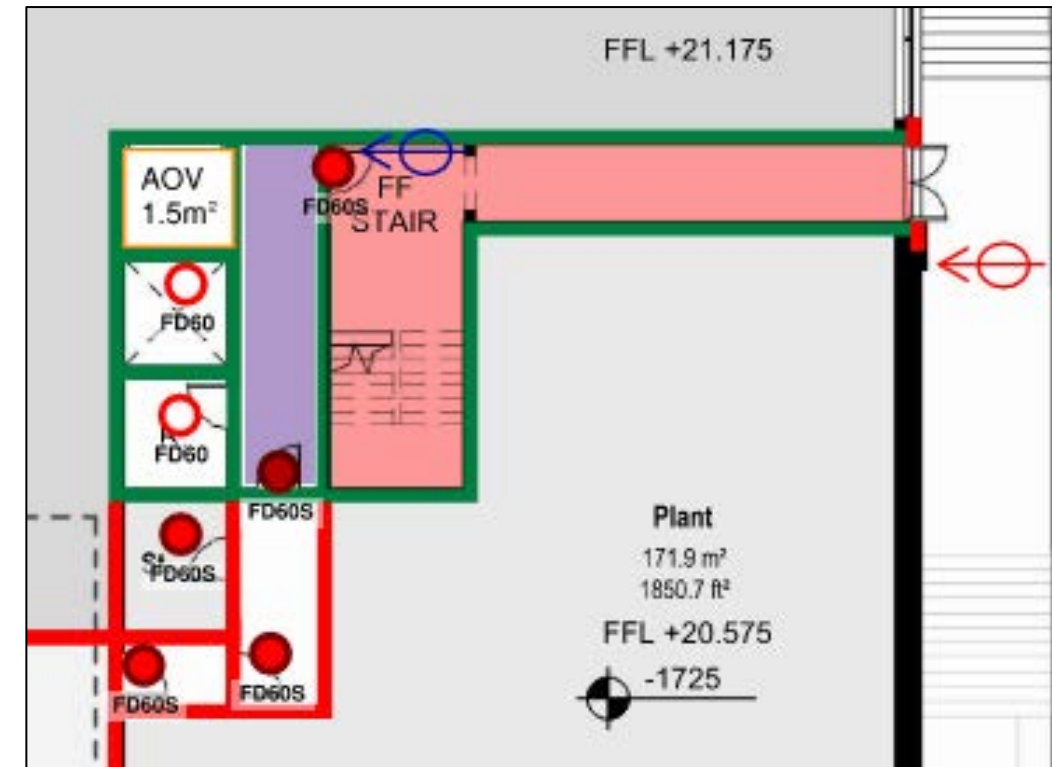


Figure 28: Example of Ground Firefighting Shaft Layout

Firefighting Stair 02 lifts are accessed within the stair core. The layout will need re-arranging in accordance with Figure 27.

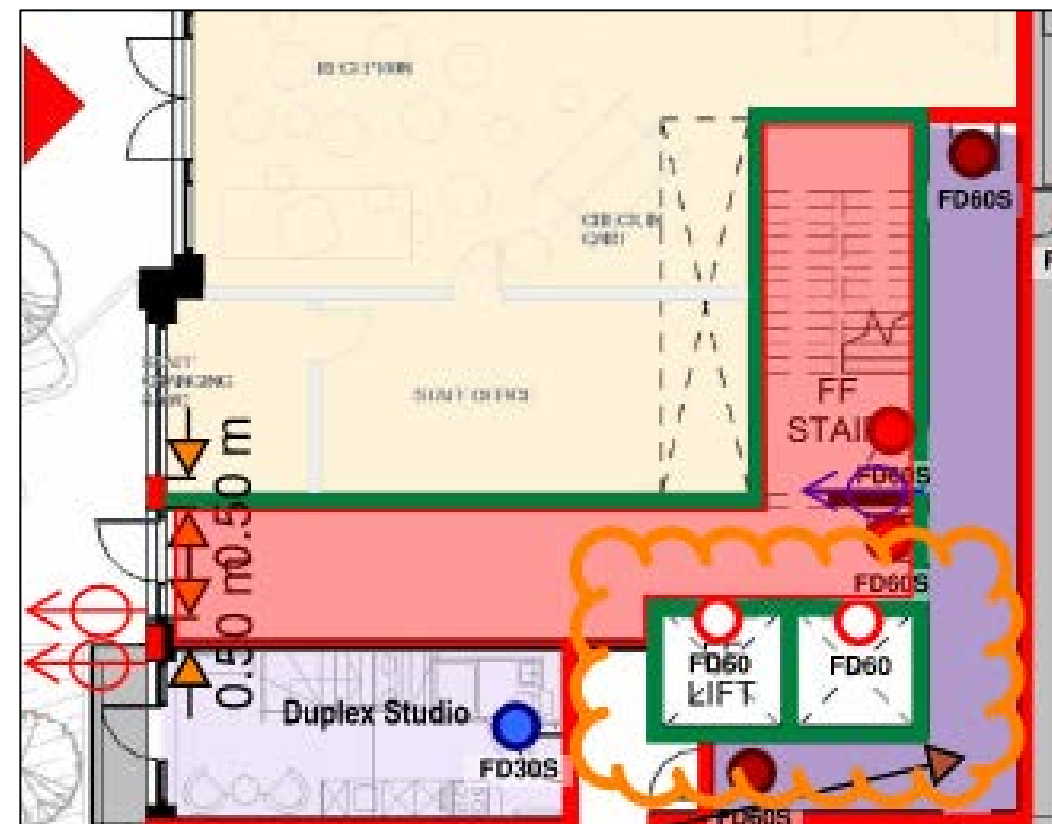


Figure 29: Residential Firefighting Shaft Layout 02

On the upper floors the firefighting shaft is designed in accordance with Figure 35 from BS9991, as illustrated below.

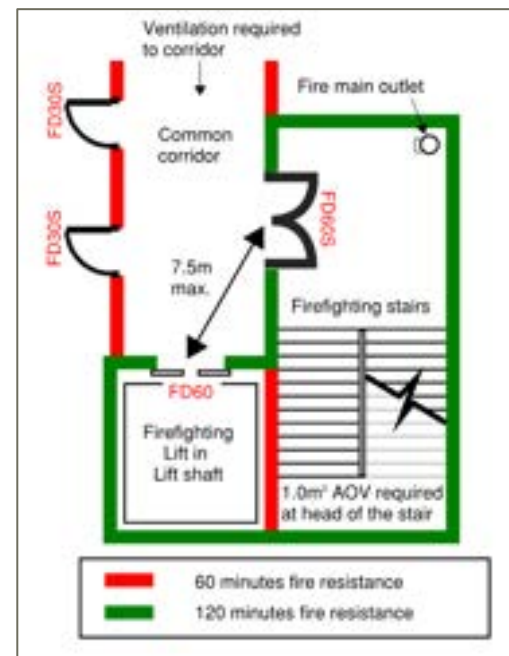


Figure 30: Residential Firefighting Shaft Layout (Fig.35 BS9991)

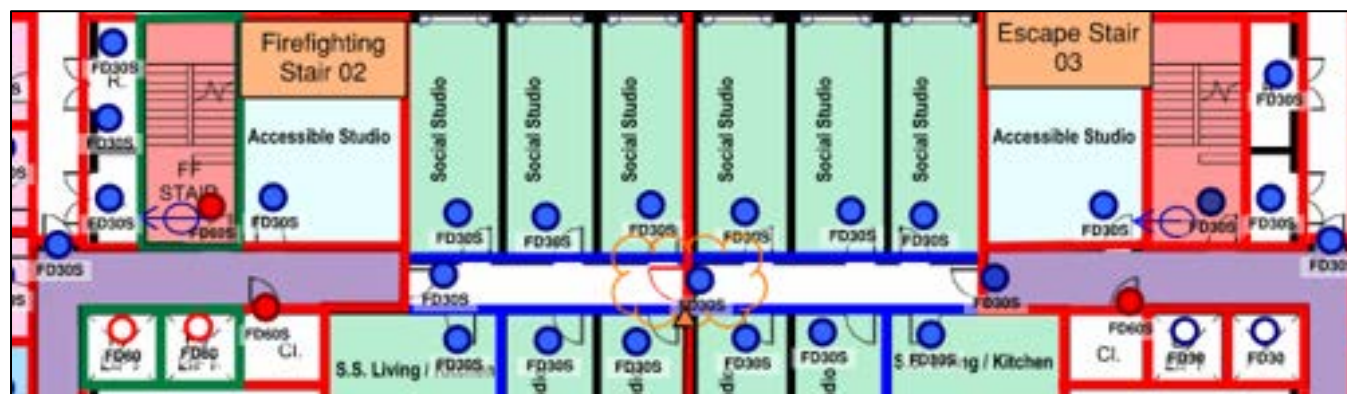


Figure 31: Typical Residential Firefighting Shaft and Escape Stair

4.3.1 Firefighting Stairs

The minimum clear width for a firefighting stair is 1100mm. The stairs should be designed in accordance with Clause 50.3.2.1 of BS9991:2015.

Other requirements for the firefighting stair are:

- A firefighting stair should not contain any cupboards or provide access to service shafts serving the remainder of the building. Only services associated with the fire-fighting shaft, such as ventilation systems and lighting for the shaft, should pass through or be contained within the fire-fighting stair (or associated access corridor at access level).
- The stair should have a clear width of not less than 1100mm, this width should be kept clear for a vertical distance of 2000mm.
- Emergency escape lighting in firefighting stair enclosures should be provided in accordance with BS5266-1.
- Both firefighting lift and stair are used together during fire-fighting operations.
- Signage numerically indicating the floor level should be provided within the firefighting stair.

Within Building A all the staircases are provided at a minimum of 1200mm as this will encompass the accessibility requirements and means of escape requirements.

4.3.2 Firefighting Lobbies

Firefighting stairs should be provided with common corridor/lobby protection to act as a bridge head for firefighting operations and to protect the staircase from the ingress of smoke.

The level of protection provided to the stairs by the common protected corridors/lobbies and communal ventilation system is deemed adequate and additional stair lobbies are not required on residential levels.

Only services associated with the fire-fighting shaft, such as ventilation systems and lighting for the shaft, should pass through or be contained within the access corridor.

4.3.3 Firefighting Lift

The firefighting lift installation includes the lift car itself, the lift installation within the well and the lift machinery spaces, together with the lift control system and the fire service communications system. The firefighting installations should conform to BSEN81 – 72.

The power supply to the lift and lighting should consist of primary and secondary supplies. There will also be a means to minimize the effect of water penetration into the fire-fighting lift well.

Access points to the lift are to be designed in accordance with BSEN81-72.

4.3.4 Rising Mains

The two firefighting stairs and the escape stair to Block A are required to have dry rising mains. Block B is a single stair building with a dry rising main. Block C has two stairs and it is proposed that stair 1 will be provided with dry rising mains. The rising main should be designed in accordance with BS9990 and BS9991.

Dry riser inlets should be located within 18m from a fire appliance parking position and be clearly visible.

Landing valves (dry riser outlets) should be provided at every storey including ground and roof level (for test purposes if practicable) and be located within the stair. These outlets shall be located to facilitate easy access for firefighters, e.g., should not inhibit opening of doors.

Clause 4.1.5, Note 1 from BS9990 notes *'it is expected that the landing valves are located within the staircase on the full landings.'*

The dry fire main should also be fitted with a 25mm drain valve to facilitate draining of the rising main after use in accordance with BS5041-3.

The hose distance from the dry rising main outlet to all parts of all floors within Block A can be accessed with a 60m hose distance as stipulated in BS9991 for suitable hose distances for the firefighting shafts and 45m for the protected stair in Block A and the protected stairs to Block B and C.

The dry riser inlet connection points for all blocks are available from the fire appliance within 18m.

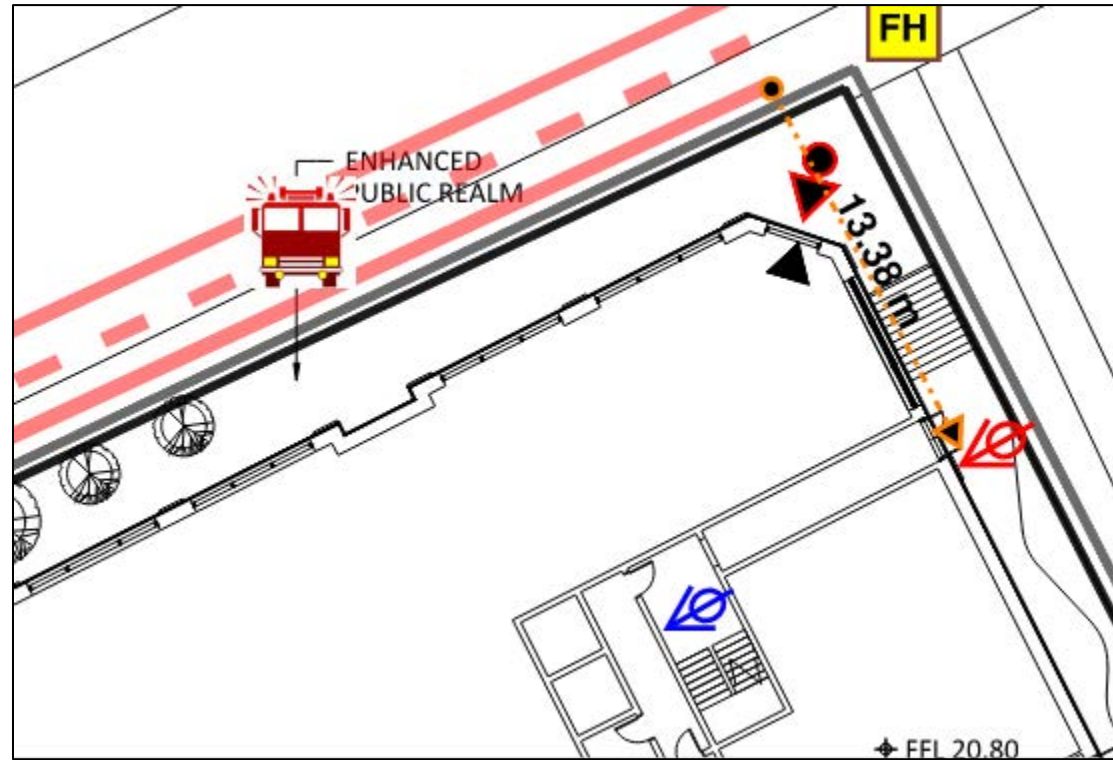


Figure 32: Block A Dry Riser Inlet Connection Point Firefighting Stair 01

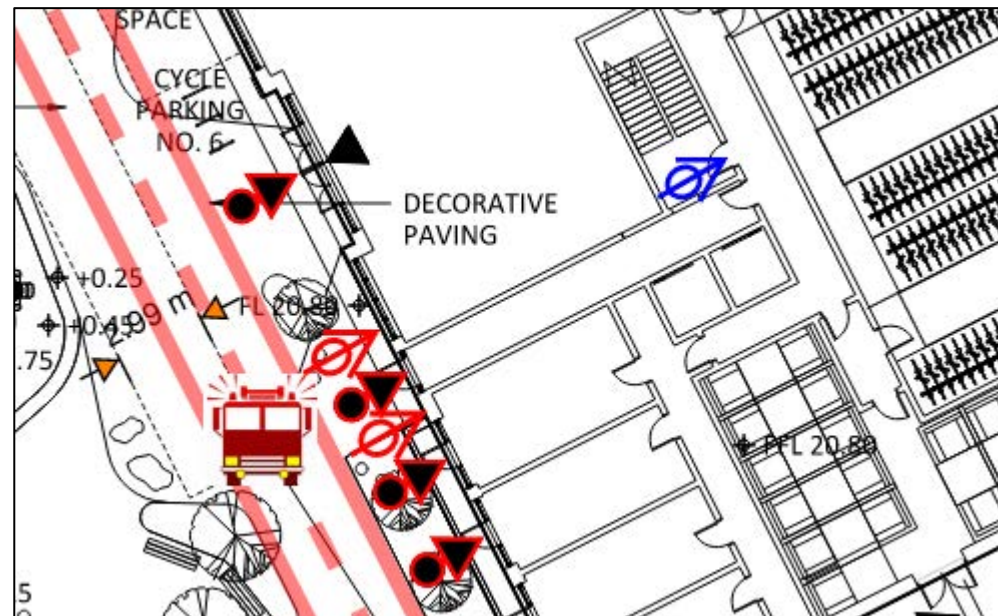


Figure 33: Block A Dry Riser Inlet Connection Point to Firefighting Stair 02 and Escape Stair 03

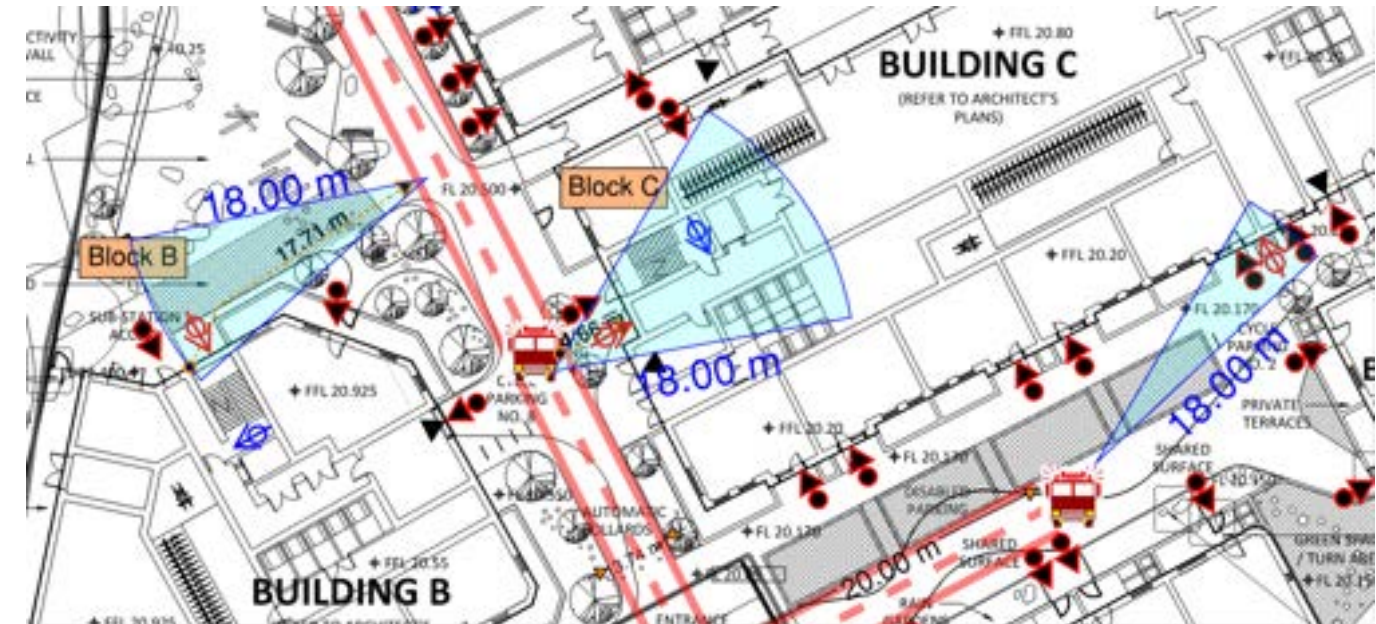


Figure 34: Block B & C Stair 01 Dry Riser Inlet Connection Points within 18m.

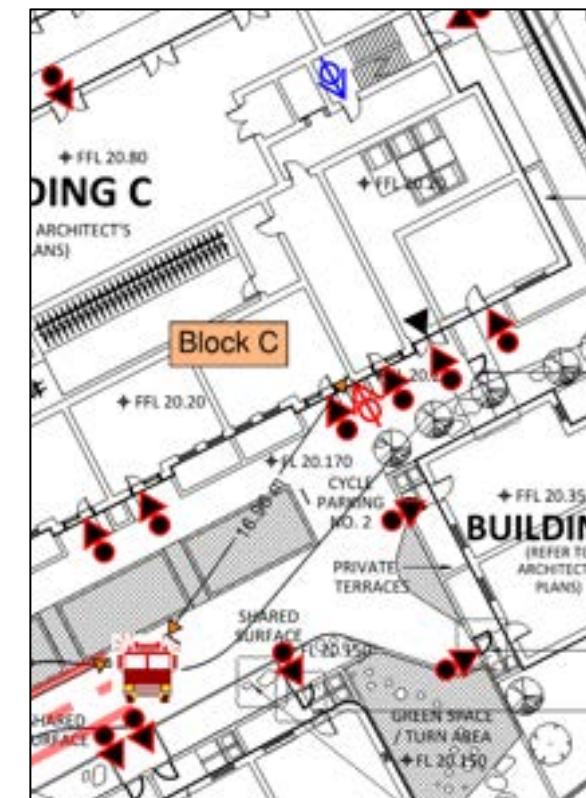


Figure 35: Block C Stair 02 Dry Riser Inlet Connection Point within 18m.

Below is the longest hose distance for Block A which is within 60m as noted within BS9991.

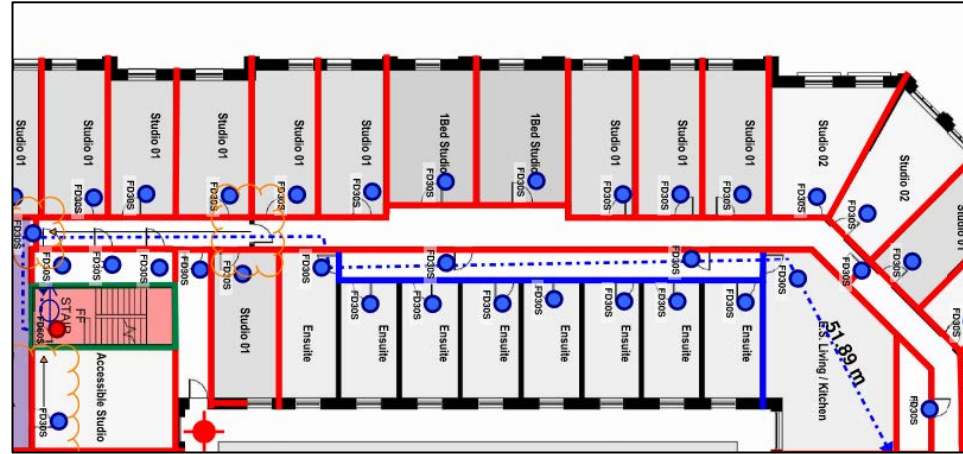


Figure 36: Building A Hose Distance

The longest hose distance for Block B is under 45m.

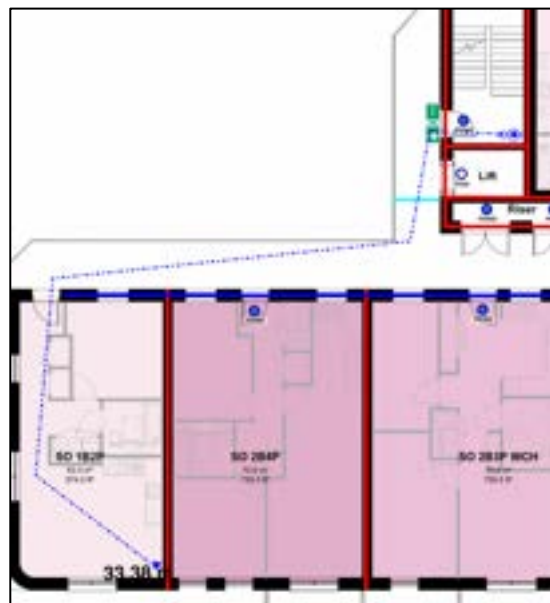


Figure 37: Building B Hose Distance

Below is the hose distance for Building C. A secondary dry riser has been applied to the stair 02 with an inlet adjacent Building C stair 01 as a dry riser inlet adjacent the entrance to stair 02 would not be within 18m of the fire tender or easily visible from the road. Access is provided from an open air balcony and the flat is covered with a sprinkler system.

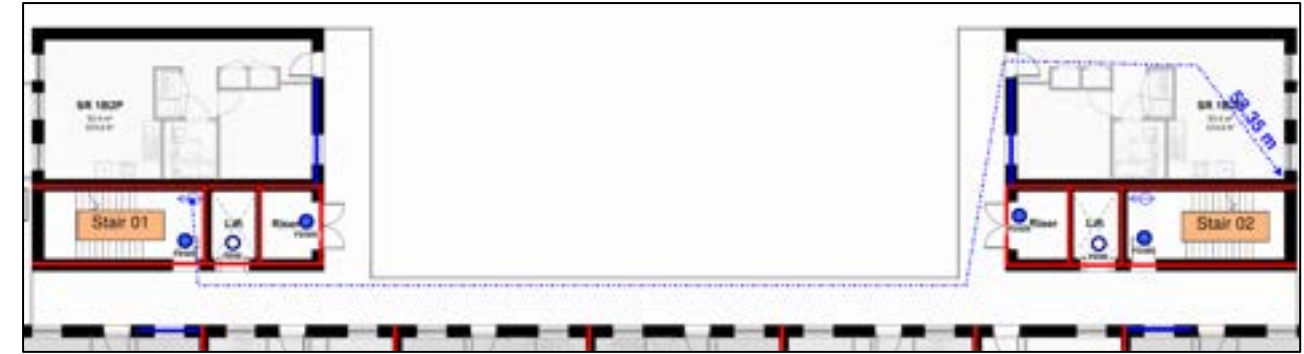


Figure 38: Building C Hose Distance

4.4 Smoke Ventilation

4.4.1 Smoke Ventilation to Protected Shafts and Firefighting Shafts

Smoke ventilation is required to the firefighting shafts, below is a summary of the smoke ventilation requirements and is explained in more detail within Section 5.7 in this report.

- Ground– Smoke control is required to the firefighting lobby.
- Residential floors – The common corridor serving the stairs require smoke control.

4.4.2 Smoke Ventilation to Ancillary Areas

See Section 5.7 of this report for more information on the requirements.

4.5 Wayfinding Signage

Due to the height of the building people who are escaping and / or the fire service attending a potential fire can find themselves easily disorientated especially if there is smoke present.

Whilst not required under BS9991 the most current guidance on this type of accommodation [Approved Document B 2020 with 2022 amendments] notes that the benefits of the Wayfinding signage for the fire service and for means of escape is invaluable and on this basis the wayfinding signage will be provided in the full premises i.e. floor identification signs will be provided on every landing of a protected stairway and every protected corridor/lobby into which a firefighting lift opens.

Approved Document B has been references in this section opposed to BS9991, as BS9991 has no specific requirements for the additional wayfinding signage.

Wayfinding signage for the fire service will be provided in the full premises; floor identification signs will be provided on every landing of a protected stairway and every protected corridor/lobby into which a firefighting lift opens.

Apartment indicator signs to identify apartment numbers should also be used and supplemented by arrows where necessary.

- The floor identification signs should meet all of the following conditions:
- The signs should be located on every landing of a protected stairway and every protected corridor/lobby.
- The text should be in sans serif typeface with a letter height of at least 50mm. The height of the numeral that designates the floor number should be at least 75mm.
- The signs should be visible from the top step of a stair.
- The signs should be mounted between 1.7m and 2m above floor level and, as far as practicable, all the signs should be mounted at the same height.
- The text should be on a contrasting background, easily legible and readable in low level lighting conditions or when illuminated with a torch.

For more information see Approved Document B.

4.6 Fire Hydrants

For buildings provided with dry riser mains, hydrants should be provided within 90 metres of dry fire main inlets and not more than 90 metres apart.

Based on a visual check and information provided by Thames Water, there are five existing public fire hydrants located around the site. Coverage is achieved as per the drawing in the figure below showing direct 90m coverage.

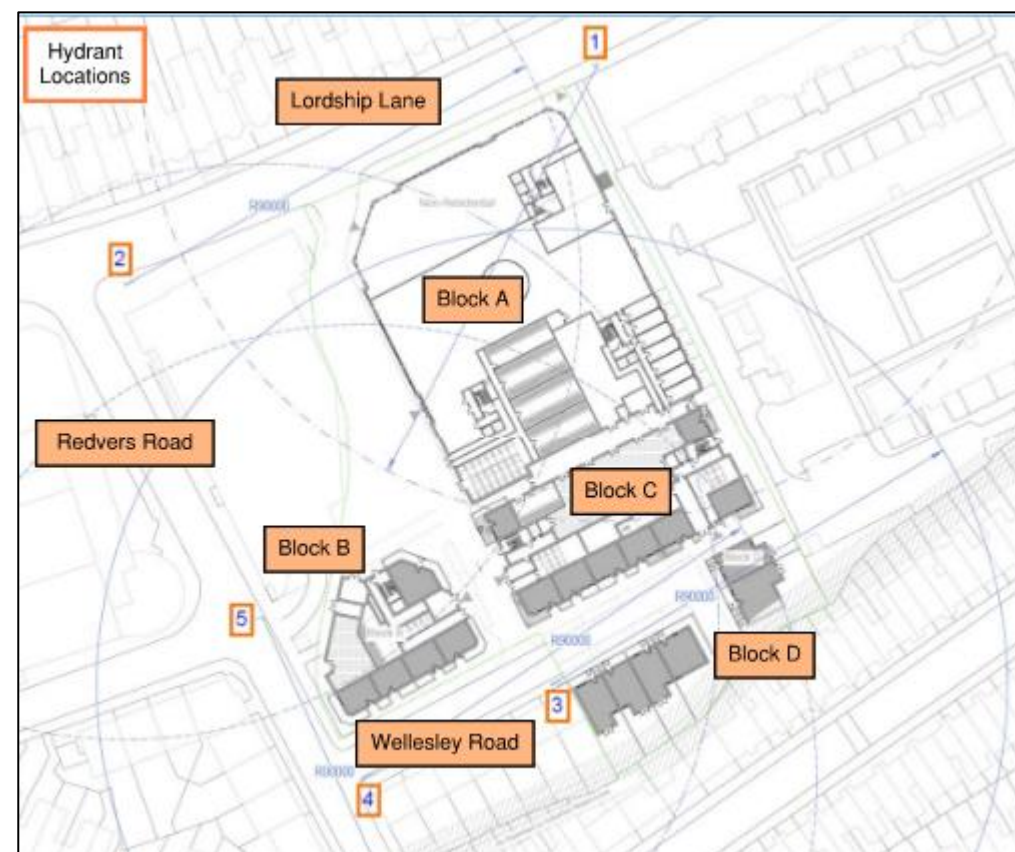


Figure 39: Existing Hydrant Approximate Locations (Thames Water)

4.7 Automatic Water Fire Suppression System

Buildings A, B and C will be provided with an automatic water fire suppression system. See Section 5.6 for more information.

4.8 Emergency Simultaneous Evacuation System Building A

Whilst an Emergency Simultaneous Evacuation System is not a specific regulatory requirement, when assessing the building height and the complications in firefighting activities due to occupancy type and scale of the Building A, we are proposing to incorporate an evacuation alert system.

A BS5839-6 system is the minimum standard fire detection and fire alarm system with a BS5839-1, Category L5 system in the common spaces (only provided to activate the smoke control system), however, it is proposed to provide a BS5839-1, Category L1 system to cover the building.

This is an enhancement over the minimum recommendations and should provide flexibility to support any variations of the escape arrangements that may arise.

This will allow an escalating evacuation strategy based on a confirmed incident; this provides the added benefit of a management or fire service controlled simultaneous evacuation but reduces the risk of malicious activation or false alarms i.e., should a confirmed fire be detected, or the flow switch of the suppression system activate an evacuation alert can be sounded for all apartments.

The system will also provide early warning for the apartments and the ancillary areas included on the same level.

The system will provide the facility for mass evacuation of the building should the attending Fire and Rescue Service deem this necessary and provide additional capability to the management team should they wish to evacuate the building for other reasons.

This also has the benefit of allowing communication between detector heads in apartments and the fire alarm panel and vice versa.

A BS5839-1 system also has some other functionalities such as allowing for remote testing and monitoring of detection heads (so does not need to be done by tenants) and the flexibility of introducing investigation times for the management to investigate what is happening before alerting the fire brigade, potentially reducing false alarm calls to the fire brigade.

In addition, a separate Evacuation Alert System in accordance with BS8629 will be provided for use by the fire service.

4.9 Firefighting Power Supplies

Any life safety system will require secondary power supplies, see Section 5.10 for more information.

4.10 Secure Premises Information Boxes

As recommended in Approved Document B there should be a facility to store a building Emergency Response Pack [ERP] in an accessible location to aid the Fire & Rescue Service in understanding building layouts, outlining access provisions, and notifying them of the active systems within the building. These should be provided for Buildings A, B and C.

The Premises Information Box [PIB] should be sited at the primary Fire & Rescue Service entry point to the building in proximity to the other fire safety systems e.g. evacuation alert panel / fire alarm panel / smoke control systems / PV inverter shut offs and rising main connectors; if the building is managed 24 / 7 this can be located in a concierge / security office on the basis this is readily accessible at all times and is easily locatable for the Fire & Rescue Service.

The PIB should be securely fixed to the building to avoid damage or vandalism and be mounted circa 1400mm from finished floor level to allow easy access; the box should be of a robust and secure design as the information within could be determined as sensitive under GDPR requirements.

A PIB should be unlocked using one of the following two methods:

- Key system, or
- Mechanically operated keypad.

The PIB should be suitably signed at the Fire & Rescue Service entry point into the building unless the building is managed 24 / 7 and management assistance is available to the Fire & Rescue Service.



Figure 40: Premises Information Box Signage

The Premises Information Box is specifically for the use of the Fire & Rescue Service in any potential fire incident, the information contained within the box should specifically relate to the relevant information for this premises e.g.

- Two sets of building layouts / floor plans [A3] laminated or in plastic wallets; the plans should be specific to fire service requirements and show all services provided for the fire service, e.g., firefighting lifts.
- An Emergency Response Pack containing information that is required for the purpose of operational firefighting and rescue e.g.
 - A logbook for recording events, amendments, updates, and reviews of the PIB system and equipment.
 - 'Off The Run' notice containing details of any firefighting fixed installations not available for use by the Fire & Rescue Service.
 - A Summary of information available to the Fire & Rescue Service.
 - Orientation Site Plan, showing the location of the building in relation to surrounding buildings and local infrastructure including Fire Fighting water supplies.
 - Information on residents with mobility, cognitive or sensory impairments.
 - Details of any significant fire safety issues e.g., compartmentation, higher risk external wall systems; storage of specific risk items within the building or other fire safety issues which may affect the behaviour and growth of fire within the building.
 - A detailed description of the evacuation strategy, e.g., stay put, simultaneous evacuation, progressive horizontal or phased evacuation.

For further information reference should be made to "Code of Practice for the Provision of Premises Information Boxes in Residential Buildings" published by the Fire Industry Association (FIA).

5 Active Fire Protection Systems

5.1 Evacuation Approach

5.1.1 Building A

The base code compliant evacuation process is a stay put evacuation strategy 'Defend in Place' for the residential areas. This means that the only occupants who evacuate are the occupants who are directly affected by the effects of fire. The remaining occupants remain within their apartments unless asked to evacuate by the fire service.

To support a 'Defend in Place' fire strategy the fire detection and alarm system to the flats should be in accordance with BS5839-6 System with a BS5839-1, Category L5 system in the common spaces. [Only provided to activate the smoke ventilation systems].

However, as an enhancement over the minimum standards, it is proposed to employ an option for an escalating evacuation strategy based on a confirmed incident; this provides the added benefit of a fire service controlled simultaneous evacuation if deemed absolutely necessary but reduces the risk of malicious activation or false alarms e.g. should a confirmed fire be detected, or the flow switch of the suppression system activate an evacuation alert can be sounded for all flats.

To enhance the effectiveness of the detection and alarm system and to provide the capacity for the escalating evacuation strategy and evacuation alert system, a Category L1 system will be installed in accordance with BS5839-1:2017.

This is an enhancement over the minimum recommendations and will provide flexibility to support any variations of the escape arrangements that may arise.

The detailed cause and effect will be developed by the system specialist, but a suggested cause and effect is outlined below.

In the communal and common areas including back of house a simultaneous evacuation procedure will be adopted.

Table 4: Typical Cause and Effect Building A

Cause	Effect	Comments / Recommendations
Student Accommodation Areas		
Detection within apartment (Includes internal entrance hall of cluster apartment)	Any detector activation within the apartment, all sounders within the apartment will operate only, all other areas stay put. The detector signal will also alert the building's 24/7 management or a Remote Monitoring Centre (RMC) to a fire for quick response	To provide more flexibility for management where a site is remote a more robust warning system can be adopted where the system can be enhanced to allow for a double knock activation to evacuate a full floor.
Detection within common corridor	Any detector activation within the common corridor will operate the closest AOV into the smoke shaft or external wall and the detector signal will also alert the building's 24/7 management or an RMC to a fire for quick response. Lift return to Ground floor and go out of service (or to first floor if ground floor is fire origin) Open smoke vent at head of stair	Any firefighting or evacuation lifts will then revert to key control where the fire service can control the lifts in the firefighting phase. These lifts, if supported by a robust management procedure can be reenergized by the building management to affect evacuation of mobility impaired users on the basis this procedure is documented in the managements Fire Risk Assessment and understood by onsite employees.
Detection within ancillary space (e.g., storerooms)	Any activation within an ancillary area, all sounders within the ancillary area will operate only, all other areas stay put. The detector signal will also alert the building's 24/7 management or an RMC to a fire for quick response	Investigation by staff. No general warning required but the system can be enhanced to allow for a double knock activation to evacuate a full floor.

Cause	Effect	Comments / Recommendations
Amenity/ Social Spaces		
Detection in Amenity/ Social Spaces	Any activation within the social spaces all sounders within the ancillary area will operate only, all other areas stay put. The detector signal will also alert the building's 24/7 management or an RMC to a fire for quick response. Release hold-open device on fire doors (where fitted) Close down air handling plant where necessary / applicable	Investigation delay may be programmed for single smoke detector operation primarily to allow management investigation of the activation to limit false alarms. No general warning required but the system should be enhanced to allow for a double knock activation to evacuate the full floor.
Manual call point operated in Amenity/ Social Spaces	Any activation within the social spaces all sounders within the ancillary area will operate only, all other areas stay put. The detector signal will also alert the building's management or an RMC to a fire for quick response. Release hold-open device on fire doors (where fitted) Close down air handling plant where necessary / applicable Close safety devices as necessary (e.g., gas valves).	
Ancillary Areas		
Detection or Manual call point operation in Ancillary Areas	Any activation within the ancillary areas all sounders within the ancillary area will operate only, all other areas stay put. The detector signal will also alert the building's 24/7 management or an RMC to a fire for quick response. Release hold-open device on fire doors (where fitted) Close down air handling plant where necessary / applicable.	Investigation delay may be programmed for single smoke detector operation primarily to allow management investigation of the activation to limit false alarms.
Detection or Manual call point operation in Ancillary Areas	Any activation within the ancillary areas all sounders within the ancillary area will operate only, all other areas stay put. The detector signal will also alert the building's 24/7 management or an RMC to a fire for quick response. Release hold-open device on fire doors (where fitted) Close down air handling plant where necessary / applicable.	
Full building evacuation required by Fire Service or sprinkler flow switch activation	Following a dynamic risk assessment of any fire incident, the building management may decide to evacuate the entire building.	

5.1.2 Building B and C

The base code compliant evacuation process is a stay put evacuation strategy 'Defend in Place' for the residential areas. This means that the only occupants who evacuate are the occupants who are directly affected by the effects of fire. The remaining occupants remain within their apartments unless asked to evacuate by the fire service.

To support a 'Defend in Place' fire strategy the fire detection and alarm system to the flats should be in accordance with BS5839-6 System with a BS5839-1, Category L5 system in the common spaces. [Only provided to activate the smoke ventilation systems].

5.1.3 Building D

Each townhouse is treated as a separate dwelling for means of escape.

5.2 Fire Detection and Alarm

The minimum required fire detection and fire alarm system in accordance with BS9991:2015 for the cluster and studio apartments is a Grade D1 Category LD 1 installed in accordance with BS5839-6:2019. For the dwellinghouses a Grade D1 LD 2 will need to be installed in accordance with BS5839-6:2019.

The social and common spaces minimum fire detection and fire alarm system would be a manual system.

The minimum required fire detection and fire alarm system for the common corridors is a Category L5 system installed in accordance with BS5839-1:2017.

Note: The fire detection and fire alarm system within the common corridor is only to operate the smoke control and does not need to generate an evacuation alarm.

In Building A to further enhance the effectiveness of the fire detection and fire alarm system and to provide the capacity for a full escalating evacuation under management control (see Section 5.3), a Category L1 fire detection and fire alarm system will be installed in accordance with BS5839-1:2017.

This will be installed throughout the whole building including the separate ancillary areas detached from the main buildings.

This will provide a suitable level of protection provided that it is configured to support the evacuation strategy which may require variations from a standard Category L1 system, such as e.g.

- Omission of some manual call points in student residential accommodation areas (common corridors)
- Omission of sounders in common protected corridors serving flats etc. to support defend-in-place strategy.

Note: The system will need to be ratified and designed by a fire detection and alarm specialist and ensure it follows the principles noted within this report.

Note: The MEP design should allow for vibrating pillows / pads within bedrooms to provide suitable alert facilities for individual occupants who have hearing impairments (i.e. where required by individual PEEPS).

5.3 Emergency Simultaneous Evacuation System Building A

Whilst an Emergency Simultaneous Evacuation System is not a specific regulatory requirement when assessing the building height and the complications in firefighting activities due to occupancy type and scale of the building, it is proposed to incorporate an Emergency Simultaneous Evacuation System in the building. For more details on the system see Section 4.8 and BS8629.

5.4 Emergency Evacuation Alert System Building A

In addition to the emergency simultaneous evacuation system, a separate Evacuation Alert System in accordance with BS8629 will be provided for use by the fire service.

5.5 Emergency Lighting and Signage

Emergency lighting should be installed in accordance with BS9991 Clause 44, so that on the failure of the normal lighting the emergency lighting will allow occupants to escape safely by:

- Providing means of locating and identifying escape routes and signage.
- Providing suitable means of escape.
- Allowing safety measures to be carried out effectively.
- Providing adequate cover to high-risk task areas.
- Allowing people to safely evacuate away from the building.

For a full detailed listing of locations BS5266 should be consulted but as an indication:

Table 5: Indicative Emergency Lighting Locations

Areas Requiring Emergency Lighting
All common escape routes from residential accommodation which includes common corridors and the escape stairs ^{Note1}
Amenity and Social spaces
Windowless accommodation
Electricity and generator rooms
Switch room/ battery room for emergency lighting
Electric vehicle charging area

Note 1: Escape stair lighting should be on a separate circuit from the electricity supply to any other part of the escape route.

Illumination should also be provided to key areas where specific tasks as to be carried out and at focal points; an indicative list is provided below as a guide; for the full listing and planes of reference for specialist areas please consult BS 5266-1: 2016.

Table 6: Indicative Specific Lux Levels

Location	Response Time [S]	Minimum Illuminance [Lx]	Minimum Duration	Reference Plane
Plant Rooms & Switch Rooms	5	15	Full rated – building duration	In plane of visual task
Fire alarm control and indicating Equipment	5	15	Full rated – building duration	In plane of visual task
Panic Bars or security devices	5	5	Full rated – building duration	Horizontal on plane of panic bar / vertical at wall mounted signage and security devices.

Escape and other fire safety signage should also be provided in accordance with BSISO 3864-1: 2011 and BS5499-4: 2013.

Fire doors should have signage as detailed in Section 9.5 below.

5.5.1 Wayfinding Signage

It is proposed to provide wayfinding signage, see Section 4.5 for the requirements.

5.6 Automatic Water Fire Suppression System (AWFSS)

Buildings A, B and C exceed 11m in height therefore AWFSS will be provided to all parts of each building.

This will need to be addressed by the project team in conjunction with a specialist adviser to confirm specific design parameters to provide effective protection.

The following information is informative; compliant systems and design assumptions will need to be ratified with the Specialist AWFSS Designer as they would be deemed the 'Competent Person' as stated in BS9251: 2021 and BSEN 12845.

Where no specific provision is mentioned in this section regarding any particular aspect of the system reference should be made to BS9251:2021 & BSEN 12845.

Once a system specification is proposed consultation with other interested parties (client, insurer) is advisable.

Note: According to BS9991: 2015, AWFSS should be provided within the ancillary areas in accordance with either BS9251 or BSEN 12845: 2015.

5.6.1 Residential Areas

It is proposed that the residential areas that contain flats and common corridors are provided with AWFSS in accordance with BS9251, as summary of recommendations are noted below to support the design team until such time a AWFSS specialist is engaged.

Table 7: BS9251 Sprinkler Principles

Design Standard BS9251:2021	Notes
Category 2 System – Residential between 11m and 18m	Apartments in Buildings between 11m and 18m to be covered. Where communal parts of the building are non-fire sterile they should be category 3.
Category 4 System – Residential over 18m	Apartments more than 18m and communal areas to be covered by the suppression system.
Ancillary and Amenity/ Social spaces exceeding 100m ²	BSEN 12845 System, see Section 5.6.2
Minimum Design Parameters	Category 2: 4mm / min for a single head operation or 2.80 mm/min through each sprinkler operating simultaneously up to a maximum of 1 - 2 sprinklers in a single area of operation with a minimum duration of 30 minutes. Category 4: 4mm / min for a single head operation or 2.80 mm/min through each sprinkler operating simultaneously up to a maximum of 1 - 2 sprinklers in a single area of operation with a minimum duration of 60 minutes. In areas designated as high risk increase to 5mm / min. Where communal areas / corridors are managed areas and considered to be sterile within a fire strategy report and with agreement by the AHJ, the number of design sprinklers can be limited to two in these areas only. In areas covered with BSEN 12259 – 14 Residential sprinkler heads design density should be increased to 5mm / min.
System flow rate to be calculated discharge density multiplied by the area of operation.	Maximum area covered by a single sprinkler head is 25m². No more than 5.5m apart, and no more than half the design spacing distance from a wall. Sprinklers no closer than 2.4m. Shielding and obstructions need to be taken into consideration.
Duration minutes	Cat 2 and 3 minimum, 30 minutes. Cat 4 requires minimum 60 minutes.

Design Standard BS9251:2021	Notes
Sprinkler heads should be quick response.	Table 3 BS9251 denotes example areas to be covered with BSEN12259 – 14 residential Sprinkler Heads. In these areas design density should be increased to 5mm / min & coverage reduced to 12m²
Hydraulic calculations required.	Full hydraulic calculations should be carried out for each system to determine the required pressure and flow, which determines the required water supply. For very tall buildings consideration should be demonstrated in relation to the subdivision of the system into hydraulic stages.
Stored Water Tank	Tank sizing based on the maximum flow demand multiplied by the required duration. Low water alarm system. Dedicated Sprinkler pump
Flow Switches connected to the AFD system and RMC	Minimum floor by floor.
Additional Resilience Measures	Clause 4.2.4 from BS 9251 regarding resilience measures should be considered. Latest guidance within Approved Document B (England) notes where a sprinkler system is installed to satisfy Part B of the Building Regulations, should be provided with additional measures to improve system reliability and availability.
Note: This overview is for discussion only and should not be taken / used as a technical specification or a technical design note for tendering, installation or as a detailed design requirement. The overview information above is for information only, the detailed system design, hydraulic calculations and design assumptions will need to be ratified and designed by the Specialist AWFSS designer as they would be deemed the ‘Competent Person’ as stated in BS9251: 2021 & BSEN12845.	

Building D is not proposed to contain any sprinklers as these are dwellinghouses.

5.6.2 Amenity/ Social Spaces/ Ancillary Areas and Commercial Areas

As noted in the revised BS9251 2021, to enable a BS9251 system to be used throughout the building the social and ancillary spaces and commercial areas should be limited to compartments (60 minutes) with a maximum floor area of 100m².

On the basis the current ancillary areas, communal areas and commercial areas in Building A exceed the 100m² a BSEN 12845 system will be incorporated to these areas.

Note: In Building B all communal/ancillary areas will be restricted to less than 100m². In Building C it has also been confirmed that all communal/ancillary areas will be restricted to less than 100m² including the plant room which is currently shown as exceeding this area.

The category and all hydraulic calculations should be confirmed by the AWFSS designer.

5.7 Smoke Ventilation

Ventilation is required to the common corridors and the stair for both means of escape and firefighting to maintain the staircase free of smoke. Below is an extract from Figure 7 within BS9991 for the recommended solution to achieve the principles. Balcony escape is covered under Section 5.7.6.

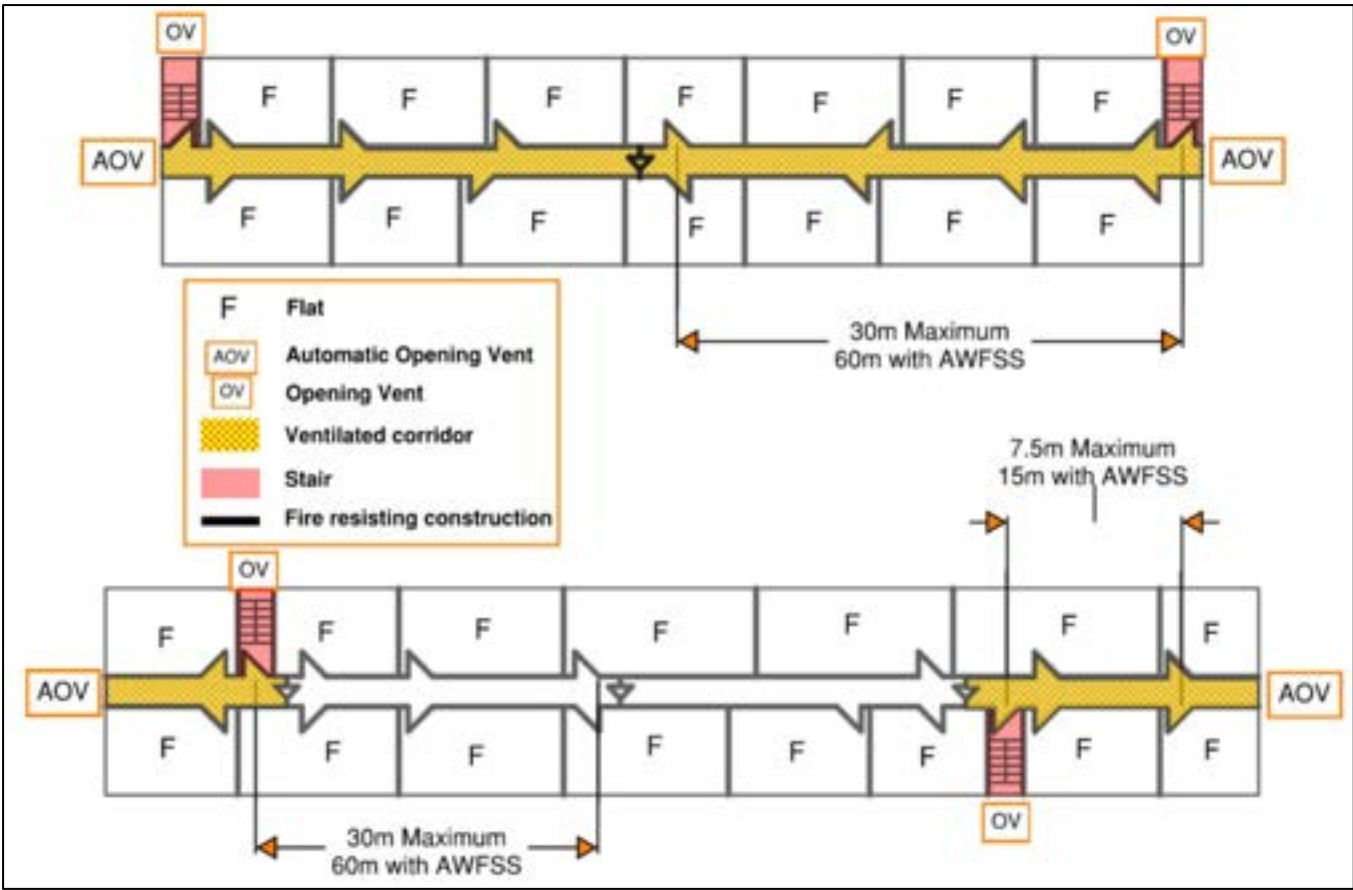


Figure 41: Common Escape Route for a Multiple Stair Building

The communal corridors/lobbies are required to be ventilated; this can be provided by one of the following.

- Automatic opening ventilators (AOV) to the exterior of the building with a minimum geometric free area of 1.5m², that are fitted in the common corridor or lobby directly adjacent to the stair at as high a level as practicable and an automatic openable vent sited as high a level as is practicable on the top storey of the stair having a minimum geometric free area of 1m². However where buildings exceed 30m, external AOVs should not be provided.
- A natural smoke shaft (conforming to the following section) that is fitted in a common corridor (located away from the stair), and an automatic openable vent that is sited as high as is practicable on the top storey of the stairway, having a minimum geometric free area of 1.0m².
- A mechanical smoke ventilation system (conforming to the following section) that is fitted in the protected lobby or protected corridor (located away from the stair) and an automatic openable vent that is sited at a high as level practicable on the top storey of the stairway and having a minimum geometric free area of 1m².
- A pressure differential system.

As can be seen in the figure above the allowable travel distance with AWFSS and smoke control is 15m. All corridors serving flats on the upper levels within Building A have distances that are in within this distance.

5.7.1 Automatic Opening Vents (AOVs)

AOVs opening to outside air should conform to BSEN 12101-2.

Vents designed to open automatically from the top storey of the stairs in buildings should be configured to operate upon smoke detection within any of the protected corridors or protected lobbies directly adjacent to the staircase enclosure.

Only the AOV leading from the protected corridor or protected lobby where the smoke has been detected should be configured to open. This should open either to external air or into a smoke shaft; all other protected lobby vents should be configured to remain closed. Fire and rescue service override controls should not permit multiple lobby vents to be open simultaneously.

Note: This applies whether the vent opens to outside air or into a natural or mechanical shaft.

Note: The purpose of smoke detectors is to operate the smoke control system, not to raise an alarm.

All connections between the smoke detection, vent control panels and actuator mechanisms should be within an environment that provides protection from expected fire conditions.

Where any part of the control mechanism is powered by electricity, a secondary supply should be provided, see Section 5.10.

The distance between mechanical or natural smoke exhaust ventilators and the stair AOV is recommended to be a minimum of 5m apart to reduce the likelihood of smoke recirculating back into the building.

5.7.2 Natural Smoke Shafts

Where natural ventilation is to be provided it is to be designed in accordance with BS9991:2015 Clause 14.2.3.2 of BS 9991:2015. Which states.

- The smoke shaft should be fully open to the external air at the top and closed at the base.
- The opening at the top of the smoke shaft should be located at least 0.5m above any surrounding structures that fall within a 2m radius on a horizontal plane so that it is not subject to adverse wind effects.
- The shaft should extend a minimum length of 2.5m above the ceiling of the highest storey which is served by the shaft.
- The cross-sectional area (geometric free area) of the smoke shaft should be at least 1.5m², with a minimum dimension of 0.85m in any direction.
- The lobby or corridor vent, the opening at the head of the shaft and all internal locations (such as safety grilles) within the shaft should have a free area of at least 1.0m².
- The top of the lobby or corridor vent should be located as close to the ceiling of the lobby or corridor as is practicable and should be at least as high as the top of the door connecting the lobby or corridor to the stairwell.
- The lobby or corridor vents, in the closed position should have a minimum fire and smoke resistance performance of 30 minutes and integrity (leakage) no greater than 360m³/h/m² when tested in accordance with BSEN 1366-2.
- The smoke shaft should be constructed either of non-combustible materials conforming to BS476-4 or of any material which, when tested in accordance with BS476-11, does not flame or cause any rise in the temperature on either the centre of the specimen or the furnace thermocouples. The smoke shaft should run vertically from top to bottom with no more than 4m of the shaft at an inclined angle (max 30°).
- No services other than those relating to the smoke shaft should be contained within the smoke shaft.
- The smoke shaft should be located at the remote end of the corridor away from the staircase.

Where any part of the control mechanism is powered by electricity, a secondary supply should be provided, see Section 5.10.

5.7.3 Mechanical Smoke Shafts

Where mechanical ventilation is provided, the mechanical smoke shafts will depressurise the lobbies and remove any smoke in the area. Where the mechanical smoke ventilation system uses a shaft, it should meet the following principles;

- The smoke shaft should be fully open to the external air at the top and closed at the base.
- The top of the lobby or corridor vent should be located as close to the ceiling of the lobby or corridor as is practicable and should be at least as high as the top of the door connecting the lobby or corridor to the stairwell.
- The lobby or corridor vents, in the closed position should have a minimum fire and smoke resistance performance of 30 minutes and integrity (leakage) no greater than 360m³/h/m² when tested in accordance with BSEN 1366-2.
- No services other than those relating to the smoke shaft should be contained within the smoke shaft.
- The smoke shaft should be located at the remote end of the corridor away from the staircase.

The system is to be designed and installed by a specialist designer. Computational Fluid Dynamics (CFD) modelling will be required to demonstrate appropriate performance of the system for both means of escape (taking into account the extended travel where appropriate) and firefighting activities. The CFD modelling should demonstrate tenability as noted in the Smoke Control Association Guide and BSEN12101 or provide a comparative assessment with a standard code compliant design.

Fans, all actuators and controls powered by electricity will need to be provided with a secondary supply, see Section 5.10.

[If a mechanical smoke control system is provided it will need to be designed to ensure the corridors will remain tenable during means of escape and firefighting. Specialist smoke control designer will need to provide acceptance criteria before CFD is undertaken to review and agree with the authorities having jurisdiction.](#)

5.7.4 General Requirements

Design, installation, commissioning and maintenance of smoke control systems should be carried out in accordance with BS7346-8. An AOV is also required at the head of each stair to Building A with a geometric free area of 1.0m².

Buildings B and C require an OV at the head of each stair with a geometric free area of 1.0m². Helios would recommend that AOVs are provided.

5.7.5 Ancillary Smoke Ventilation

In relation to ancillary areas that are contained within the buildings, only A and B have areas that could be deemed higher fire risk in accordance with BS9991 that requires additional lobbies and smoke ventilation to be provided to the lobby.

Where corridor access to the cycle store area is separated at ground floor level in Building A it will be provided with a ventilated common lobby providing 0.4m² permanent ventilation as noted in BS9991. In Building B the corridor serving the refuse area will require 0.4m² permanent ventilation.

There are refuse stores located on the ground floors which are accessed from outside and do not communicate with the common corridors.

5.7.6 Common Balcony Escape

In Buildings B and C the apartments are accessed via open balconies; on the basis the balconies are more than 50% open, there is no requirements to provide a smoke control system other than at the head of the staircases.

However there are some instances where the corridor exceeds a width of 2m, it is recommended down stands are provided as per BS9991, to prevent lateral smoke spread. See figures below that note approximate locations where the down stands are required.

The down-stands should be placed at 90° to the face of the building (on the line of separation between individual apartments or maisonettes). Down-stands should project 0.3 m to 0.6 m below any other beam or down-stand parallel to the face of the building.

For more information on balcony escape, see Section 6.1.6.

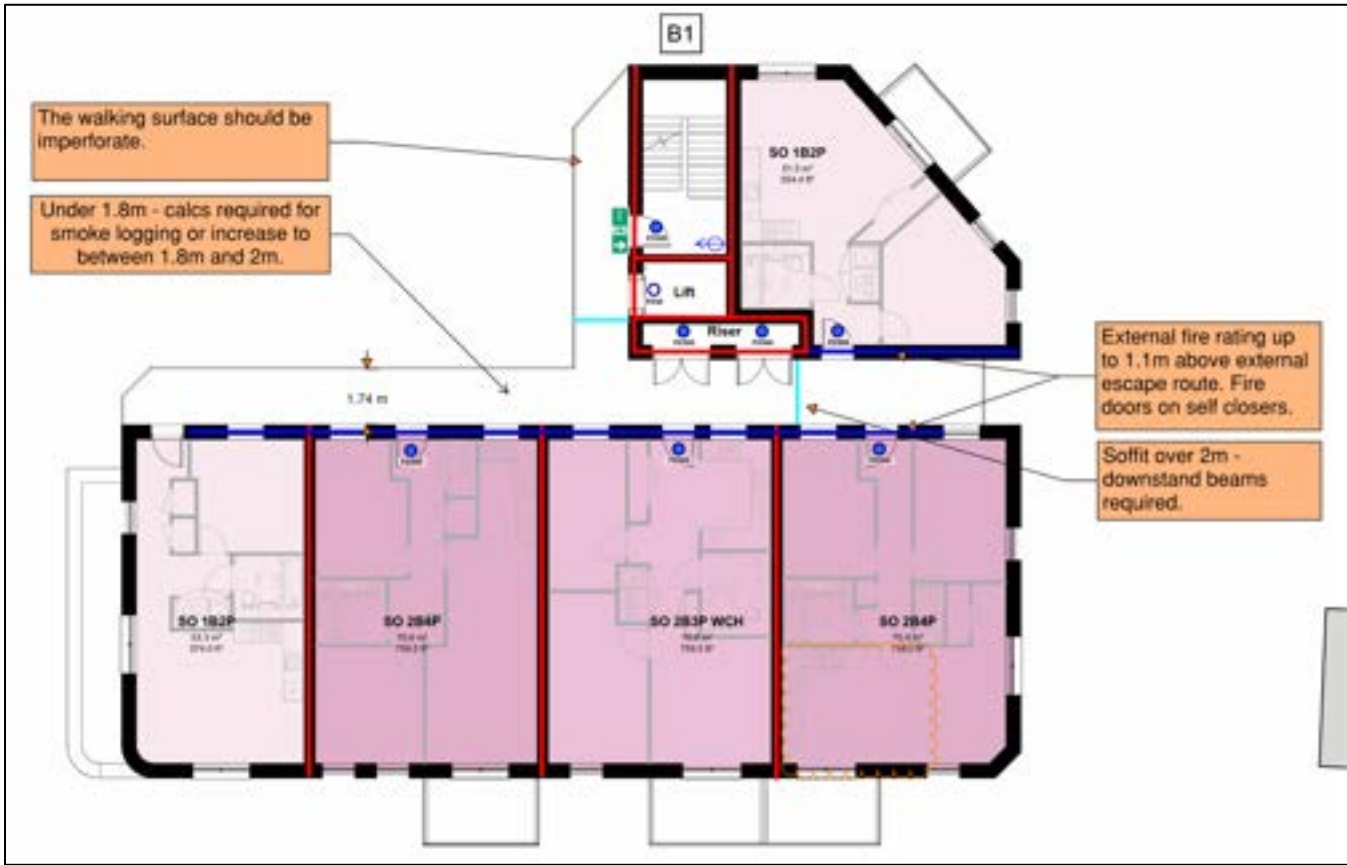


Figure 42: Balcony Escape Building B



Figure 43: Balcony Escape Building C

5.7.7 Smoke Ventilation Summary

Below is a summary table of the smoke control arrangements for each building.

Table 8: Smoke Control Summary

Floor	Building A	Building B	Building C
Roof	Stairs are provided with a 1m ² AOV at the head of the stair	Stairs are provided with a 1m ² AOV at the head of the stair	Stairs are provided with a 1m ² AOV at the head of the stair
Level 07	Common corridor serving stair provided with natural smoke shaft at remote end of corridors achieving a geometric free area of 1.5m ²	NA	NA
Level 06	Common corridor serving stair provided with natural smoke shaft at remote end of corridors achieving a geometric free area of 1.5m ²	NA	NA
Level 05	Common corridor serving stair provided with natural smoke shaft at remote end of corridors achieving a geometric free area of 1.5m ²	Balcony Escape	Balcony Escape
Level 04	Common corridor serving stair provided with natural smoke shaft at remote end of corridors achieving a geometric free area of 1.5m ²	Balcony Escape	Balcony Escape
Level 03	Common corridor serving stair provided with natural smoke shaft at remote end of corridors achieving a geometric free area of 1.5m ²	Balcony Escape	Balcony Escape
Level 02	Common corridor serving stair provided with natural smoke shaft at remote end of corridors achieving a geometric free area of 1.5m ²	Balcony Escape	Balcony Escape
Level 01	Common corridor serving stair provided with natural smoke shaft at remote end of corridors achieving a geometric free area of 1.5m ²	Balcony Escape	Balcony Escape
Mezzanine	Common corridor serving stair provided with natural smoke shaft at remote end of corridors achieving a geometric free area of 1.5m ²	NA	NA
Ground	Common Corridor natural/mechanical ventilation. Ancillary accommodation lobbies 0.4m ² permanent ventilation	Common Corridor natural/mechanical ventilation. Ancillary accommodation lobbies 0.4m ² permanent ventilation	Common Corridor natural/mechanical ventilation. Ancillary accommodation lobbies 0.4m ² permanent ventilation

Note: Specialist smoke control designer should confirm the ventilation principles, AOV requirements, locations and size to include in the fire strategy at the next stage of design.

5.7.7.1 Building A Smoke Control Summary

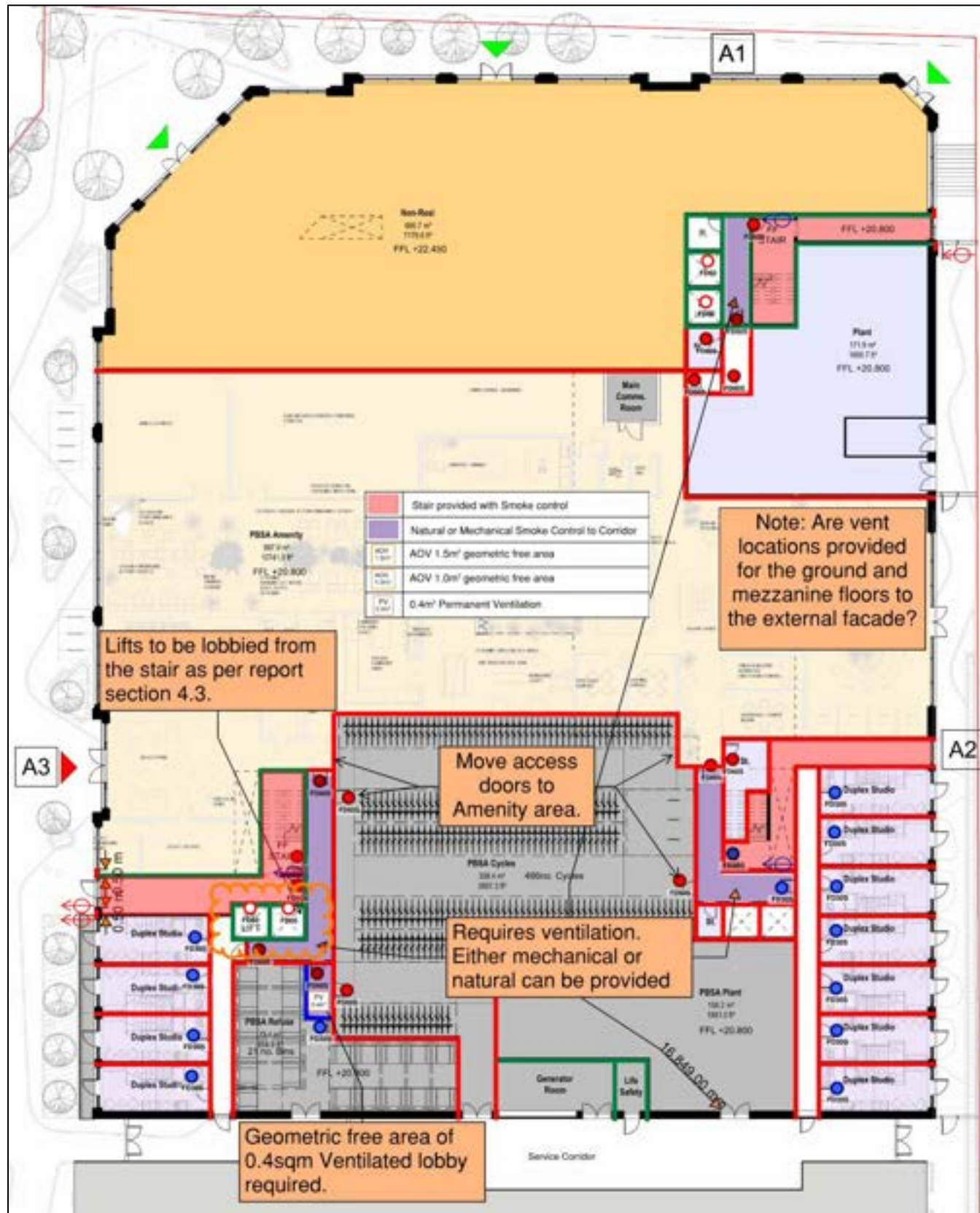


Figure 44: Ground Floor Smoke Control Summary

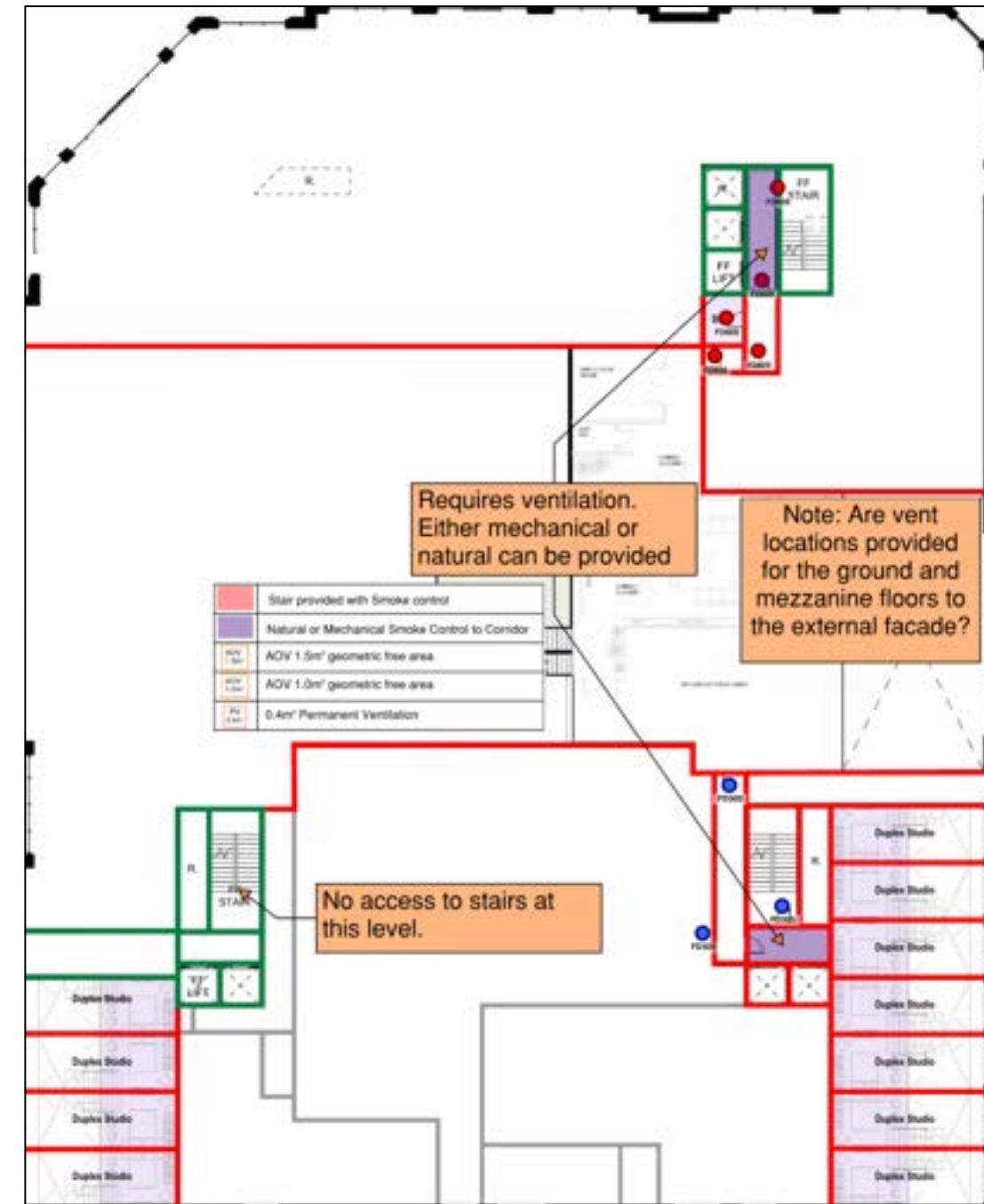


Figure 45: Mezzanine Floor Smoke Control Summary

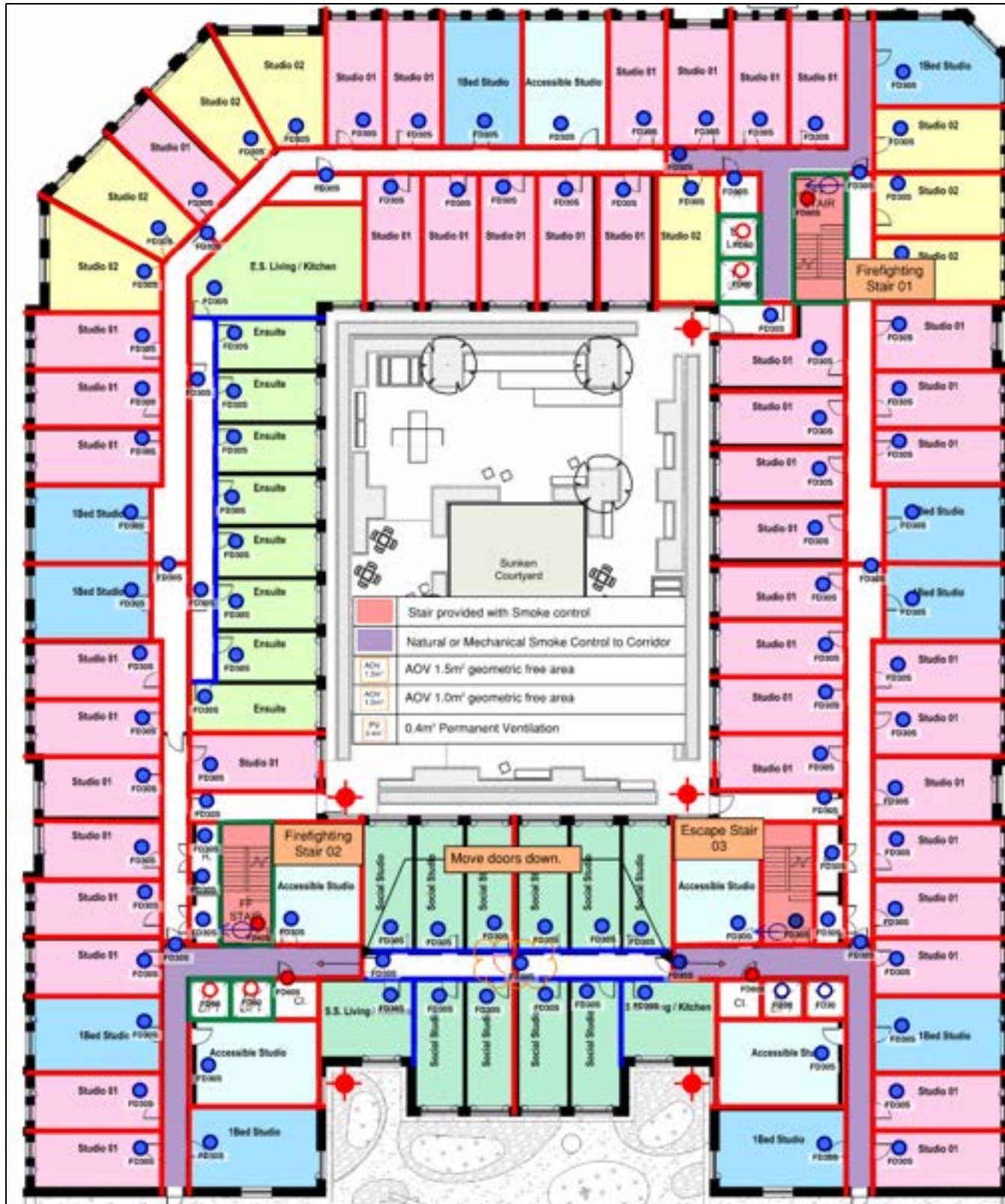


Figure 46: Floors 1-6 Smoke Control Summary

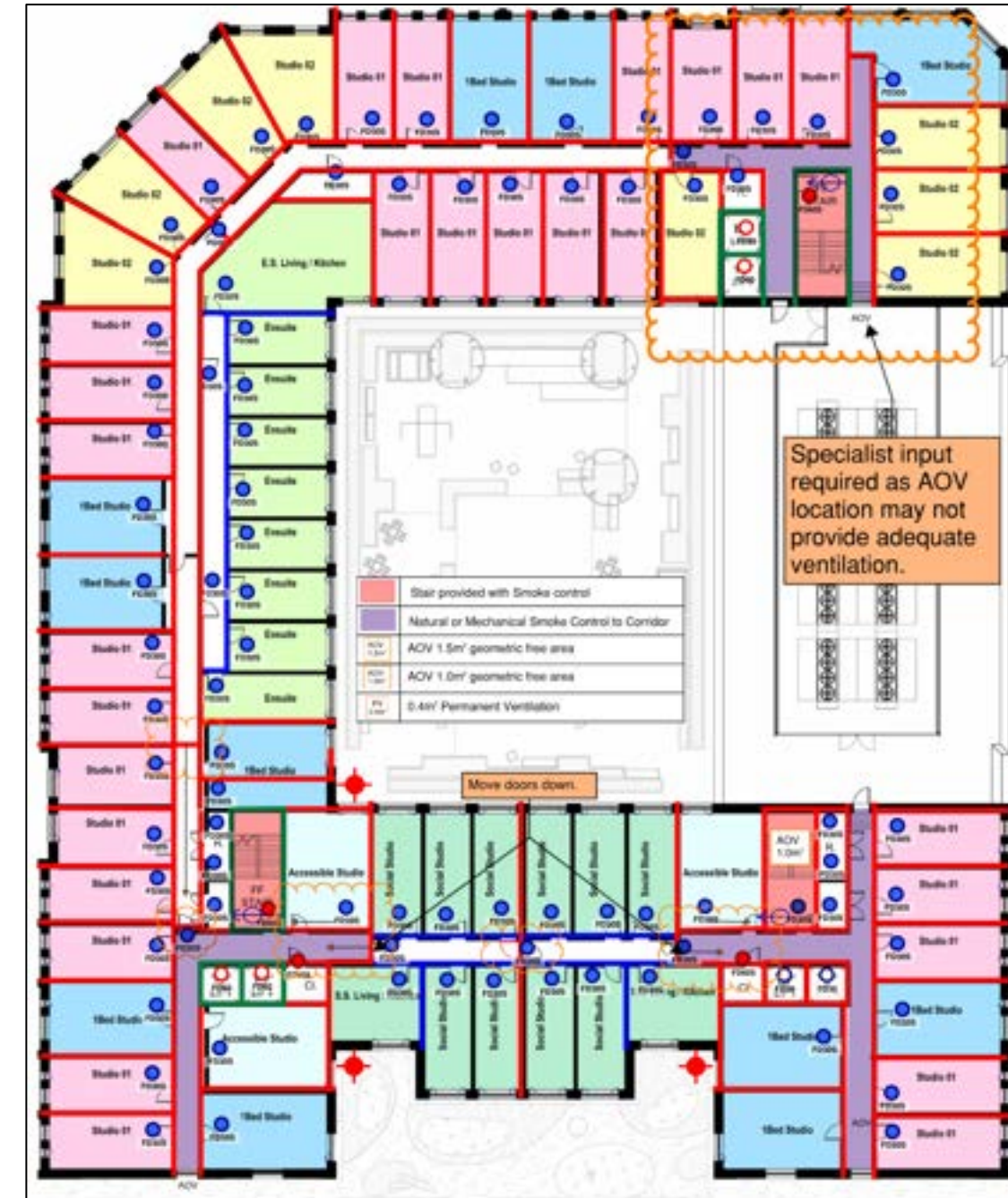


Figure 47: Floor 7 Smoke Control Summary



Figure 48: Floor 8 Smoke Control Summary

5.8 Fire and Smoke Dampers

If fire and smoke dampers are required in the building to maintain compartmentation. The provision of dampers is discussed within Section 10.2.2.

5.9 Category B Protective Devices

In accordance with Fusion Student's requirements, all cooking hobs in Building A are to be provided with Category B Preventative devices. This is due to the building being purpose built student accommodation.

On this basis each cooking facility regardless of location will be provided with a Category B Preventative Cut Off Device to BSEN 50615 in addition to the building wide suppression system and a Category L1 fire detection and alarm system in accordance with BS5839-1.

BSEN 50615 describes three categories of protective device:

- Category A – Device for extinguishing and simultaneous power cut-off of the appliance.
- Category B - Device for preventive power cut-off of the appliance.
- Category AB - Device for preventive power cut-off of the appliance, followed by extinguishing if flame occurs.

The protective device is effective only for fires on the hob and is not intended to protect against fires in the oven or in places adjacent to the cooker. It is noted the building wide suppression system would cover the adjacent areas.

This European standard deals with the safety of electric devices used for detection, prevention and suppression of fire originated:

- from a cooking process, or
- from flammable material left on the hob.

A Category B device may give some protection against fires originating in other (non-cooking) materials left on the hob, however this will depend on the nature and quantity of materials.

A Category B device shall switch-off the appliance before a fire originates and an audible warning of at least 65 dB measured 1m distance in accordance with EN54-3 shall be generated until the user resets the alarm. Thus, the system is more proactive than a suppression system.

The temperatures are set by BSEN 50615:2015 for preventive cut off devices i.e., the standard BSEN Test data notes smoking of any oil would occur pre auto ignition of the test oil sample i.e., setting off the audible alarm. At this point the BSEN for Preventative cut off device's notes:

Category B Protective Devices

Category B devices shall switch-off the appliance before the flames start and an audible warning of at least 65 dB measured 1 m distance in accordance with EN 54-3 shall be generated until the user stops the alarm, for example by pressing a button, or the temperature of the oil starts to decline.

The device should cut off power to the cooktop before the oil temperature reaches 320°C (before fire starts). The sunflower oil shall not ignite within 10 minutes after the power to the cooktop has been cut.

At this point there is no fire on the premise auto ignition has not occurred, on this basis the tenability limits are not relevant as essentially the temperatures over 60°C are within the cooking pan.

The key benefit with these devices is they are designed to prevent a fire starting so they are a proactive device; these devices are widely accepted by statutory authorities where it is proposed to remove the fire rated enclosure to the cooking facilities subject to fitting of Category B device complying with BSEN 50615.

Also, this is accepted as a means of justifying the locations of the cooking facilities not being remote from the main entrance egress areas in studios and cluster accommodation.

This is on the basis it is intended to have the effect of eliminating the risk for a cooking fire as a 'Preventative Cut off Device' is tested so that it will shut off the device prior to flames occurring.

Room layouts in Building A are currently unknown, however, if required the Category B system can potentially mitigate the risk posed by the cooking appliance within the studio bedrooms through the following:

- The Category B system will comply with the new European standard BSEN 50615 Household and similar electrical appliances – Safety – Particular requirements for devices for fire prevention and suppression for electric hobs.
- The system should be tested in a third-party, accredited test laboratory (VTT Expert Services)
- The Category B system monitors the cooking appliance and will react to any sharp rise in temperature by isolating power supply to the hob, therefore turning it off.
- The Category B system will give an audible and visual alarm when temperature reach 200°C and cut off power supply to the hob before temperature reach 330°C.
- The Category B system will sound an alarm, before a fire is ignited, the audible alarm will not be less than 65dB, as well as audible alarm, the system will also provide a visual alarm.
- The system will isolate power supply to the hob if it is tampered with.
- If the battery is low, the system will give audible and visual alarm, and if the battery has expired then it will not be possible to turn on the cooking appliance without a replacement.
- It will not be possible for the occupants to adjust the device as it will require a qualified specialist to access the settings.
- The system has ten-year minimum lifespan.

As stated earlier the provision of Category B system will ensure that a fire is prevented as a result of misuse of cooking appliance or from flammable material left on the hob. Hence, the system is considered to be sufficient as a compensatory feature where cooking appliance are located close to the exit proximity and are not enclosed in Building A.

5.10 Power Supplies

All power supplies, electrical wiring and control equipment should be protected against the effects of fire for an appropriate period. Power and control cables should be installed in accordance with BS 8519. A secondary power supply is required for essential fire safety measures and should be in accordance with Clause 15 from BS9991, e.g.

- Fire detection and alarm system.
- Smoke ventilation systems.
- Emergency lighting and illuminated signage.
- AWFSS
- Firefighting lift provisions
- Fire and smoke dampers

Note: The systems shall comply with their respective British Standards regarding secondary power supplies. The list above is not exhaustive.

The primary power source is taken from the public electricity supply, with secondary power being supplied from an alternative supply. The output from the secondary power supply should be enough to satisfy the maximum demands of the system.

6 Horizontal Means of Escape

6.1 Flat Types

The building comprises a mix of flats designs. The different apartment designs are discussed below:

Building A has various different studio types, however, the configurations are yet to be confirmed and as such their designs will be specified and reviewed during the next design stage.

6.1.1 Flats with Restricted Distances (Buildings B and C)

In accordance with Clause 9.4.2 a) from BS9991 flats can be planned so that the travel distance from the flat entrance to any point in any habitable room is a maximum of 9m. With the provision of AWFSS and a Category L1 fire detection and alarm system, the distance can be increased to 20m. The cooking facilities should be sited away from the flat entrance door and the internal escape route.

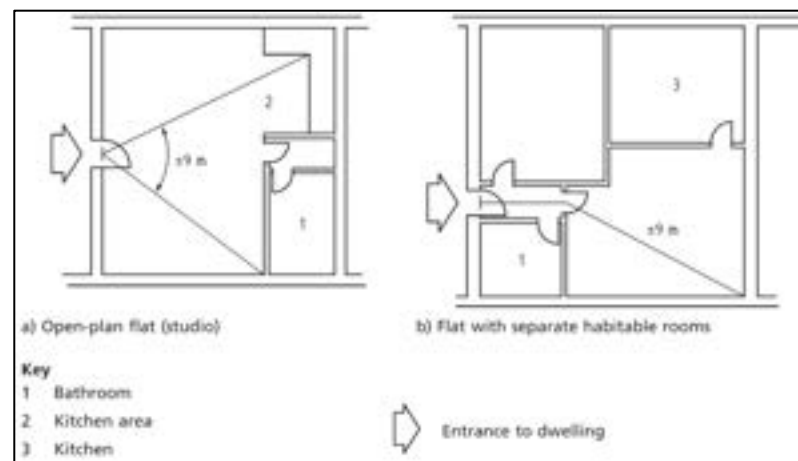


Figure 49: Flats with Restricted Distances

The flats below have separate habitable rooms off an entrance hall. Where cooking facilities are adjacent the balcony escape they should be made to be remote. Travel distances are well within the limitations.



Figure 50: Building B Flat Examples

In Building C travel distances are within the limitations.

6.1.2 Open Plan Flats (Buildings B and C)

There are flat layouts such as SR 1B2P in and SO 1B2P below that are open plan flats with inner room bedrooms. In accordance with Clause 9.7 of BS9991:2015 the flats do not exceed an area of 16mx12m on a single level with ceilings a minimum of 2.25m high. They will have a Grade D LD1 fire alarm and detection system and AWFSS. The kitchens are not enclosed however the cooking facilities are remote from the entrance and bedroom doors are close to the main entrance door for means of escape. *On that basis the arrangement is considered no worse than a smaller open plan arrangement or a studio apartment. This will need to be agreed with the AHJ.*



Figure 51: Building B Open Plan Flat Example



Figure 52: Building C Open Plan Flat Example

In Building B and C there are a number of flats where the cooking facilities are adjacent the escape route and need to be reconfigured and enclosed as shown for the flat type below.



Figure 53: Building C Flat Examples

6.1.3 Cluster Accommodation – Building A

Building A include some cluster flats. As per the recommendations from Clause 9.8 from BS9991 the clusters should meet the following recommendations:

- Each cluster should be separated from one another by 60 minutes fire resistance and a FD30S fire door.
- The entrance hall to the cluster accommodation should be protected to a minimum of 30 minutes fire resistance which separates the rooms from the protected entrance hallway. The doors to the bedrooms, living spaces and cupboards etc should be a minimum of FD30S fire doors with self-closing devices.
- There is no limit to the number of bedrooms as long as the travel distances can be met, see figure below.
- Cross-corridor doors should be provided around the midpoint of the protected hallway where two escape routes are proposed, and the internal corridor length exceeds 15m.
- The cluster is provided with a Category L1 fire detection and alarm system in accordance with BS5839-1: 2017. The fire detection and alarm system should be addressable so that a link is provided to 24/7 management or to a remote monitoring system (RMC).
- Kitchens in clusters should be separated from any bedrooms by 30 minutes fire resistance.
- Kitchen doors can be on electromagnetic hold opens linked to the detection system to prevent doors being wedged open.
- Kitchens should be located at the remote end of the corridor.

It should be confirmed if the clusters that include social studios are to include cooking facilities within bedrooms which would not be in line with standard guidance. If to be included, the provision of Category B preventative devices are considered to mitigate the risk presented by the provision of cooking facilities within these bedrooms, **however, this approach would need to be agreed with the Authorities Having Jurisdiction.**

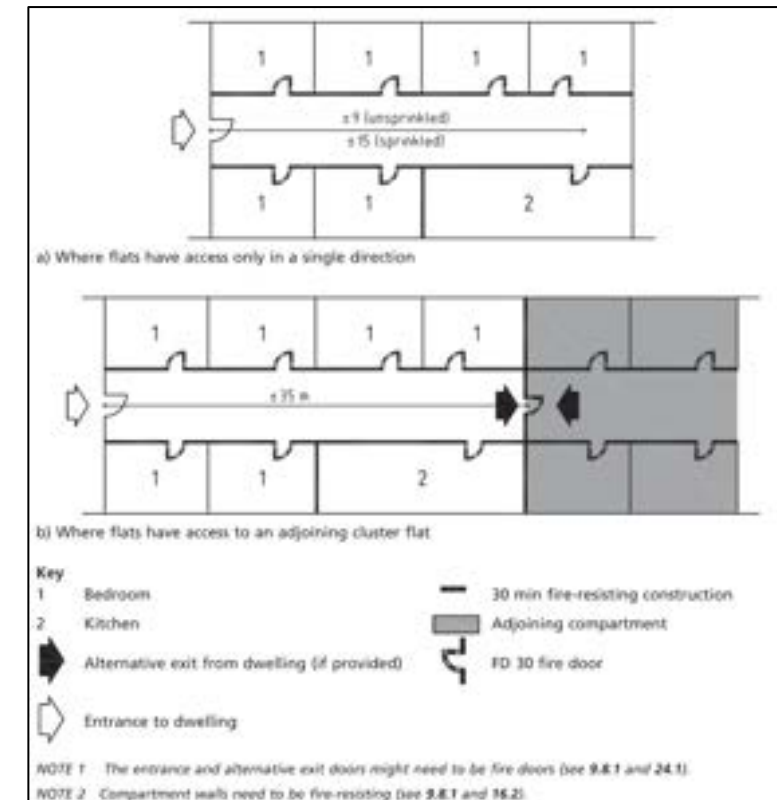


Figure 54: Figure 16 from BS9991

An example of cluster accommodation is noted below in blue.



Figure 55: Cluster Accommodation Example

All the provisions noted above can be applied to the cluster accommodation other than the location of the social/ kitchen space however the corridor is provided with two exits either side of a cross corridor door.

Whilst the position of the kitchen does not fully follow the recommended guidance within BS9991 as the cookers are considered a higher fire risk, with the measures described below, any additional risk posed by the cookers are considered reduced and the social space is no worse than a flat or bedroom.

- The cookers will be provided with Category B devices which are a fire preventative measure. The devices will prevent a fire from occurring. See Section 5.9 for more information on the devices.
- The cluster accommodation and kitchen/ social space will be provided with AWFSS
- The cluster is provided with a Category L1 fire detection and alarm system that will on activation evacuate the entire cluster flat.
- The social space/ kitchen door will be provided with a electromagnetic hold open device or provided with a door screecher to prevent the door from being wedged open.

On this basis the location of the kitchen/ social space is not considered any worse than the bedrooms. This will need to be agreed with the AHJ.

6.1.4 Two Storey Houses (Buildings B and C)

Buildings B and C have two storey dwellings. The floor levels do not exceed 4.5m in height therefore they should meet one of the following recommendations for means of escape.

- Escape windows should be provided with an unobstructed openable area that is a minimum of 0.33m² with a minimum dimension of 450mm in height and width.
- The internal stairway should be constructed as a protected stairway, connecting the ground and all upper storeys; and deliver directly to a final exit.

Within the Lordship Lane development all houses are provided with protected entrance halls that have a direct connection to a final exit. Illustrative examples shown below.

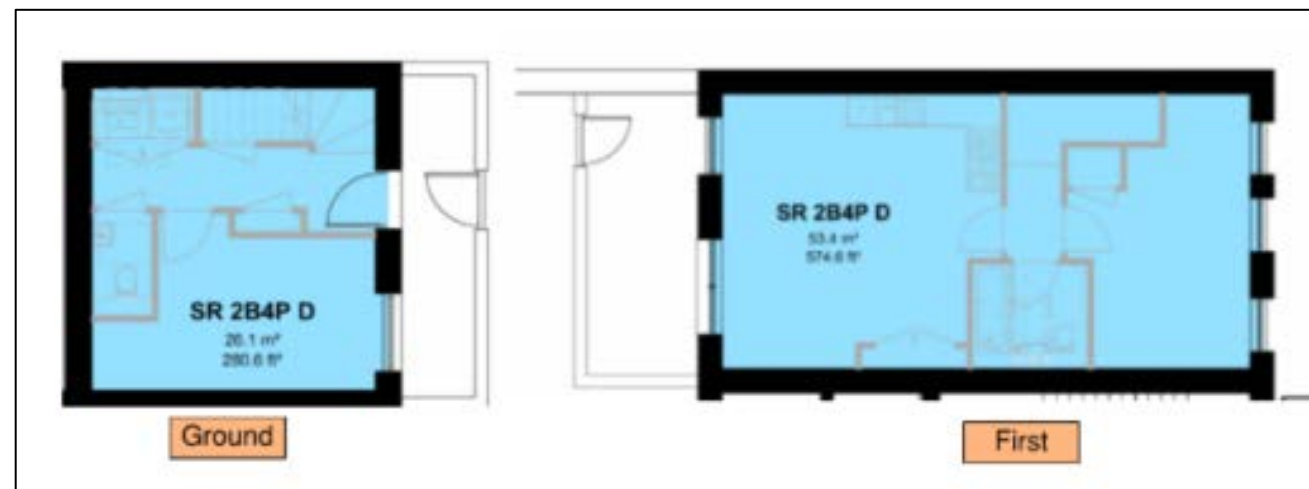


Figure 56: Building C Townhouses Example

6.1.5 Townhouses (Building D)

Building D consists of a number of Townhouses, located to the south of the site. As noted in BS9991 where these houses have a floor level exceeding 4.5m above access level the house should meet one of the following recommendations.

- The top storey or level of the house should be separated from the lower storeys by fire-resisting construction and should be provided with an alternative escape route leading to its own final exit.
- The internal stairway should be constructed as a protected stairway, connecting the ground and all upper storeys; and deliver directly to a final exit.
- Where an open-plan arrangement exists at ground level, in order to separate the ground floor from the upper storeys, either:
 - A protected stairway should be provided; or
 - The house should be fitted throughout with an AWFSS together with a fire-resisting partition and door to separate the ground floor from the upper storeys. The fire-resisting door should be arranged such that occupants on the upper floors can access an escape window at first floor level as noted above in the event of a fire in the open-plan area.

Within the Lordship Lane development all houses are provided with protected stairways that have a direct connection to a final exit. Illustrative examples shown below.



Figure 57: Building D Townhouses Example

6.1.6 Flats with Common Balcony Escape

All common escape corridors are considered 'open' to the elements and the guidance from Clause 7.3 from BS9991 will be adopted. In general, there is little risk of a balcony becoming smoke logged and therefore travel distance limitations are not necessary, although account should be taken of the needs of the fire and rescue service. Therefore, travel distance is inherently limited by the maximum length of a hose pipe from the dry riser outlet and the furthest flat. See section 4.3.4.

The principles that should be followed for all levels are as follows.

- The structure, including the floor, should be protected by 60 min fire-resisting construction (integrity and insulation).
- The walking surface should be imperforate (i.e., there should be no holes or perforations in the structure so that users are protected from the effects of heat or smoke from below).
- The sectional profile should be such that any fire plume breaking out of an apartment is directed outwards and upwards and should be arranged such that smoke does not leak laterally along the soffit. Balconies should be as open as possible to allow for the dispersal of smoke originating in a flat. At least 50% of the vertical section should be open and the area of opening should be uniformly spread around the surface. The opening for ventilation should be at least between the top of the balustrade at 1.1 m and the soffit to the balcony above.
- The soffit above a balcony or deck having a width of more than 2 m should be designed with down-stands placed at 90° to the face of the building (on the line of separation between individual apartments or maisonettes). Down-stands should project 0.3 m to 0.6 m below any other beam or down-stand parallel to the face of the building.
- Balconies providing a single direction of escape should be further safeguarded by the following provisions.
 - The face of the building (excluding window openings) should provide at least 30 min fire resistance.
 - Doors opening onto the balcony should be FD 30 self-closing doors.
 - Window openings should not extend below a height of 1.1 m above the deck level.
 - The external balustrade should be imperforate.
 - Surface materials of the facing wall, balcony soffit and balustrade should be of a Class B-S3,d2 rating.
 - The length of balconies should be such that no point in any apartment or maisonette is more than 45 m from a rising main landing valve or the approach position of a fire appliance (measured along the fire-fighting route of access)

Downstand beams are to be provided in accordance with Section 5.7.6 of the report.

6.1.7 Flats with Galleries

There are eleven flats with galleries located within Building A on the ground floor. Access to the galleries is via a common corridor or a direct entry from outside as each flat is provided with two escape routes on ground floor. The flats should follow the guidance from Clause 9.6 within BS9991 and noted below.

- To be classed as a gallery, the gallery should overlook at least 50% of the area of the room below.
- Any cooking facilities within a room containing a gallery should, where practicable, be enclosed with fire-resisting construction. Where cooking facilities are not enclosed with fire-resisting construction, they should be sited away from the escape route from the gallery or from the flat.
- The distance from the foot of the access stair to the gallery and the entrance door of the flat or a door leading to a protected entrance hall should not exceed 3m.
- Where the travel distance from the head of the access stair to the gallery to any point in the gallery exceeds 7.5 m, an alternative exit should be provided from the gallery.
- Where the gallery exceeds 50% of the area of the floor below, the gallery should be treated as an inner room.

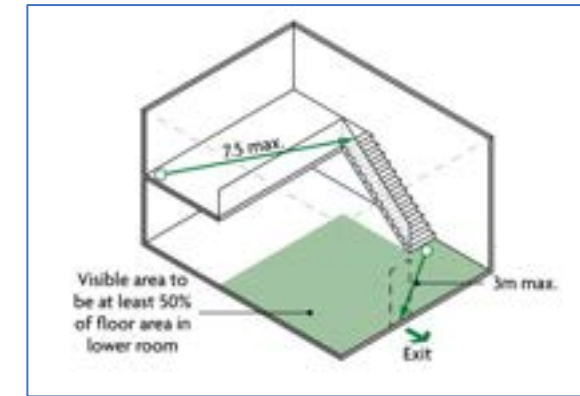


Figure 58: Flats with Galleries

The figure below is a typical flat with a gallery for the development and all the provisions noted above can be achieved.

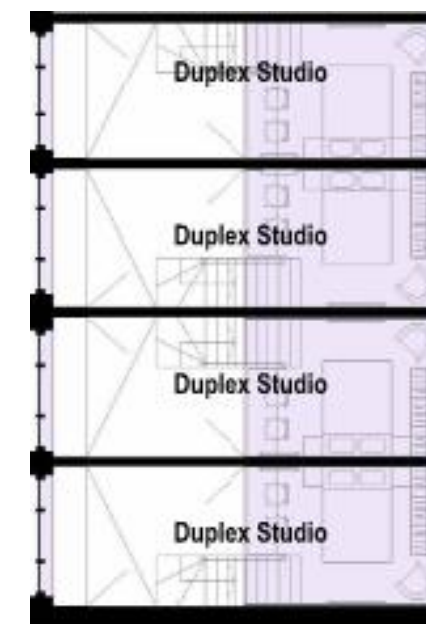


Figure 59: Flats with Galleries Example

6.1.8 Balconies

A number of apartments are provided with their own private balconies; where these are located on floor in excess of 4.5m above access level the balcony should be provided with the following additional measures.

- The escape route from the balcony should not pass through more than one access room.
- The interior of the access room should be clearly visible from all parts of the balcony unless provided by a fire detection and alarm system in accordance with BS 5839-6:2013.
- Any cooking risk in the access room should be enclosed with fire-resisting construction unless:
 - The open cooking risk is remote from the balcony and positioned in such a way that it does not prejudice the escape route through the access room; and
 - A fire detection and fire alarm system in accordance with BS 5839-6:2013 is provided to the access room with an alarm system on the balcony.
- Where the travel distance from the balcony access door to the furthest point on the balcony exceeds 7.5 m, it should be provided with an alternative escape route without going via the same access room, or the access room should be provided with automatic smoke detection.

All of the private balconies on the development will be provided with audible warning on the balcony areas and will be in accordance with the above criteria.

6.2 Travel Distances

6.2.1 Travel Distances – Residential Accommodation

The table provides a summary of the maximum allowable travel distances in accordance with BS9991 and ancillary accommodation in accordance with BS9999.

Table 9: Maximum Travel Distances

Area	Single Direction of Travel	Multiple Directions of Travel
Flats with restricted distance	9m (With AWFSS and Category L1 system this can be extended to 20m)	NA
Flats with galleries	3m from foot of stair to exit. 7.5m on the gallery to head of stair	NA
Cluster Accommodation	9m Can be increased to 15m with AWFSS	35m
Dwelling houses	NA – As accommodation opens into stair	NA
Common Corridor	7.5m Can be increased to 15m with Smoke control and AWFSS	30m Can be increased to 60m with Smoke control and AWFSS
Roof	60m	200m

6.2.2 Residential Summary

All the travel distances within the flats, clusters and common corridors meet the recommendations noted in the table above.

On Level Seven the secondary means of escape from the cluster flat and flats adjacent Escape Stair 03 is via either the adjacent cluster flat into Firefighting Stair 02. It is recommended that conditional signage is provided to the cluster flat and Escape Stair 03. In the event of smoke entering Stair 03, the conditional signage will activate above the cluster flat and Stair 03 will show that the stair should not be used.



Figure 60: Conditional Signage

6.2.3 Travel Distances - Ancillary Accommodation

The plant areas, staff areas and the communal social/amenity spaces for use by students will be treated independently for means of escape, acting on simultaneous evacuation.

These areas are designed as totally separate compartments and they will be designed in accordance with BS9999.

The social areas accessed by the students will have a A1 Risk Profile and staff areas will have a A1 Risk Profile taking into account the provision of sprinklers throughout the building.

The ancillary areas such as plant rooms, refuse store would typically have an A3 risk profile, however, with the provision of sprinklers an A2 risk profile is assumed.

The travel distances in accordance with BS 9999 and are set out in the table below.

Table 9: Travel Distances (Actual) – BS9999

Risk Profile	Single Direction of Travel	Multiple Directions of Travel
A1	26m	65m
A2	22m	50m
A3	18m	40m
Roof	60m	200m

In general , the ancillary accommodation travel distances as noted in the table above can be met. However, it is noted that layouts in some areas such as plant rooms are not currently shown. When planning the internal layouts of these areas the above travel distance limitations should be taken into account.

6.2.4 Summary

The ancillary accommodation travel distances as noted in the table above can be met including the mezzanine which has egress to Firefighting Stair 01 and Escape Stair 03.

6.2.5 Roof Areas

The travel distances on the roof are within the limitations noted in the table above.

6.3 Exit Width Requirements

6.3.1 Clear Exit Widths

For the purposes of this report, the width of a doorway is the clear width of the opening between the door leaf and frame (or projecting building hardware or the width between two opening door leaves in the case of double doors) assuming that the door leaf is free to open 90° or more.

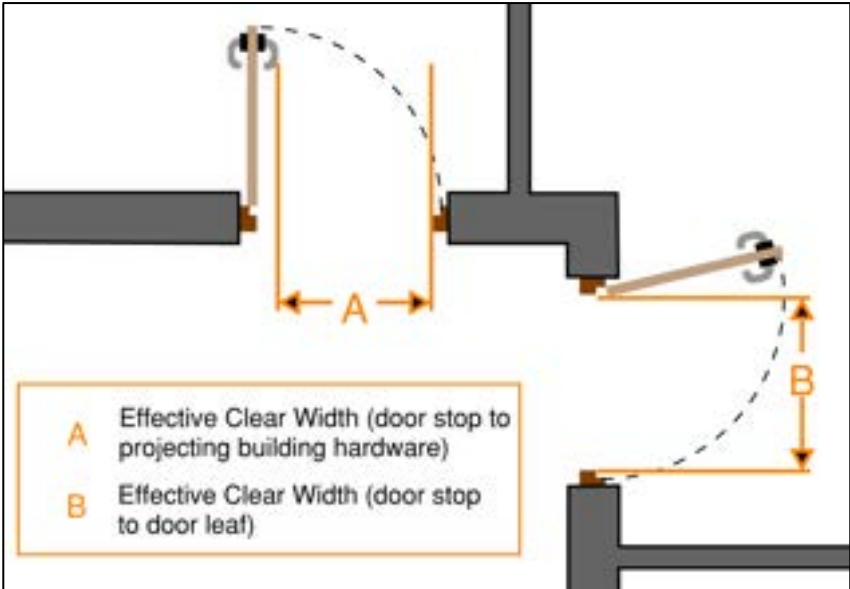


Figure 61: Example of Clear Width

6.3.2 Residential Required Exit Widths

Although the student accommodation (Building A) has primarily been designed based on a “Defend in Place” strategy, the facility for Emergency Simultaneous Evacuation of the residential areas has been provided should this be deemed necessary by management or the fire and rescue service.

On this basis the exit widths on residential floors have been assessed for simultaneous evacuation. BS9991 does not cover this type of evacuation and on this basis parts of BS9999 have been assessed to determine the minimum required clear widths based on a C1 Risk Profile.

For a defend in place strategy, the minimum required exit width in accordance with BS9991 is 750mm; based on simultaneous evacuation as discussed above, exit widths should be a minimum of 850mm other than final exits serving stairs where the final exit width should be equivalent to the width of the stair.

For Buildings B, C and D based on the evacuation strategy the minimum required exit width in accordance with BS9991 is 750mm.

6.3.3 Ancillary Required Exit Widths

For the smaller ancillary areas e.g., stores, plant rooms etc. the occupancy of each space will be less than 60 and therefore a minimum clear width of 800mm is acceptable.

The social amenity space on the ground floor based on the floor space factors within Section 1.3.5 can cater for an occupancy of 630 (477 on the ground floor and 153 on the mezzanine level).

The ground floor is provided with three final exits, all outward opening other than two exits. It is not proposed to sign the firefighting lobbies as escape routes from the amenity space or the common corridor serving the flats with galleries. These are indicated below.

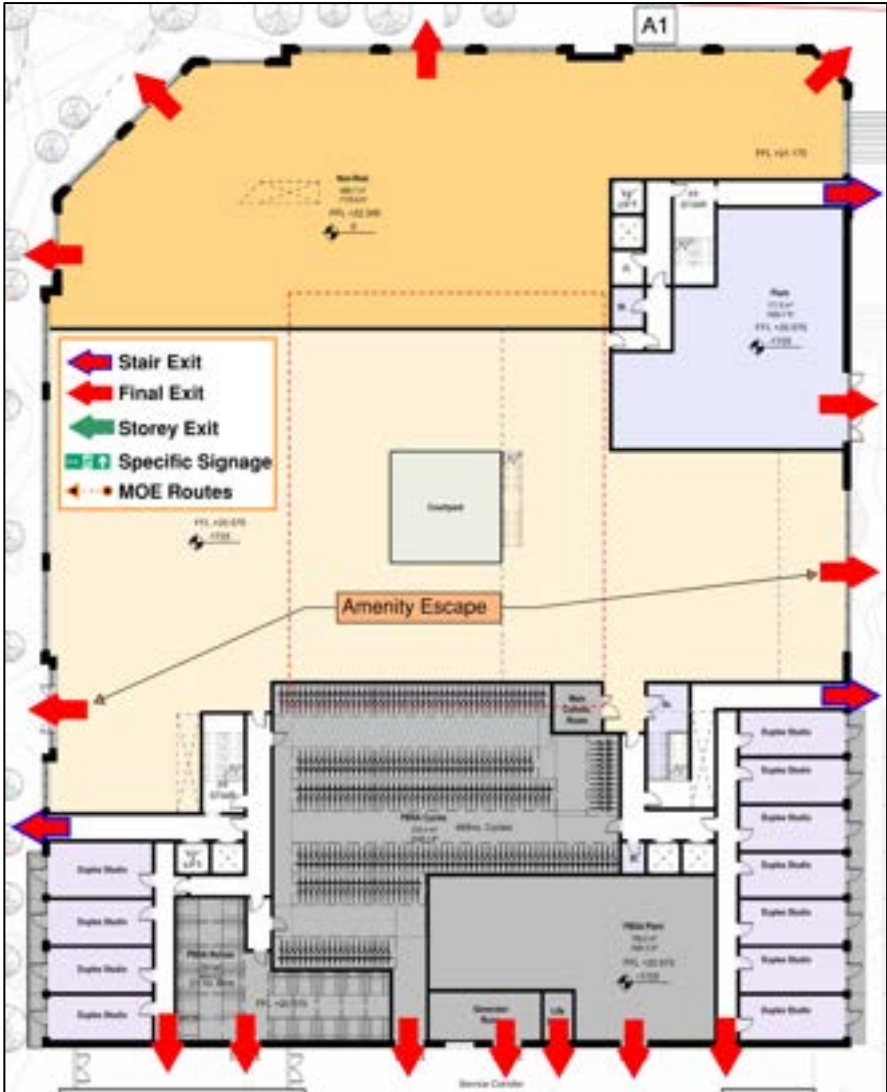


Figure 62: Social Amenity Available Exit

Table 10: Escape Widths (Actual) – BS9999

Risk Profile	Minimum exit width per person
A1	3.3mm
A2	3.6mm
A3	4.6mm

Due to the proximity of some exits, as part of the discounting process, two exits will be discounted. On this basis all 630 occupants will need to escape via a single exit. As the occupancy is over 600 an additional exit will be required. Based on the proposed availability of two final exits within the amenity space each exit can be a minimum of 1040mm based on the recommendations from BS9999.

The mezzanine level is provided with an open access stair which is acceptable under BS9999 access is also available to the escape stair and fire-fighting stair. An additional stair is required for means of escape purposes that is protected and leads to a final exit. Based on the potential occupancy of the mezzanine the storey exit widths should be a minimum of 800mm wide.

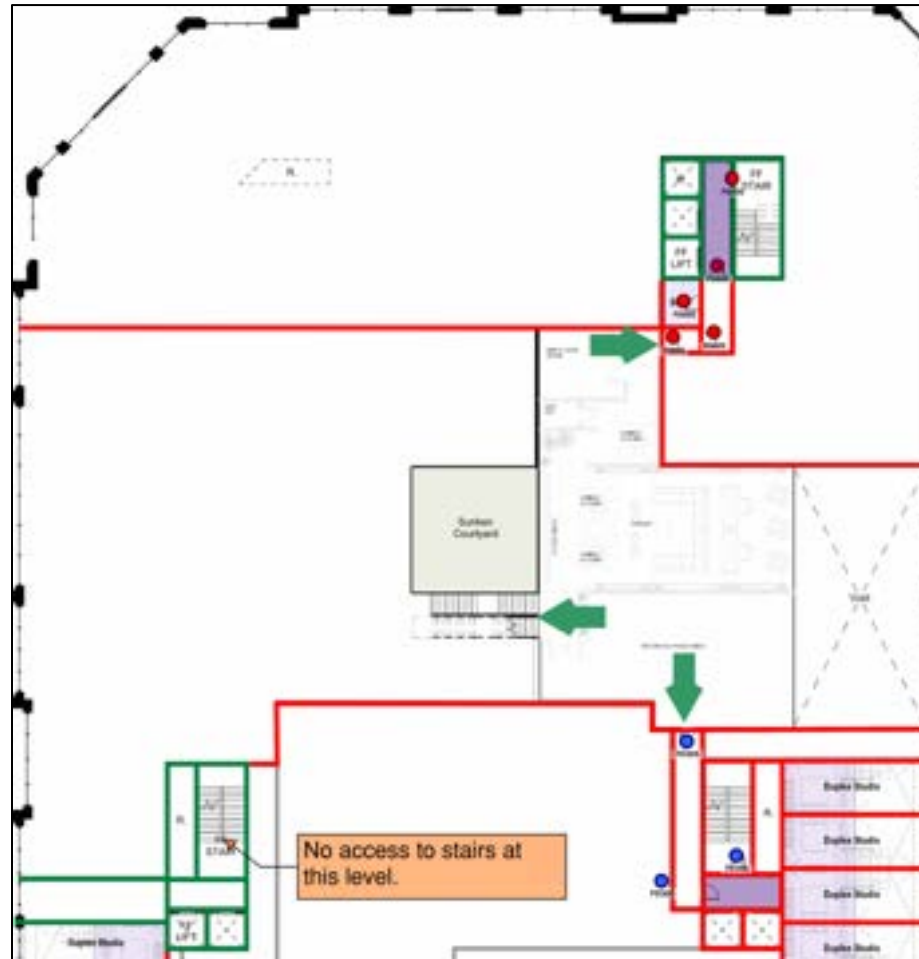


Figure 63: Mezzanine Level Escape Routes

6.4 Escape Routes – General

6.4.1 Protected Common Corridors

Protected common corridors are used for escape and due to the means of escape arrangement the corridors are enclosed within a minimum of 60 minutes fire resistance (REI60). The fire walls and doors should also reduce the likelihood of cold smoke penetrations.

6.4.2 Protected Entrance Halls

Protected entrance halls within dwellings and flats are used for escape and due to the means of escape arrangement the corridor is enclosed within a minimum of 30 minutes fire resistance (REI30). The fire walls and doors should also reduce the likelihood of cold smoke penetrations. For the cluster accommodation the doors are required to have self closers.

6.4.3 Non-Protected Corridors

Non-protected corridors are used for means of escape but are not protected corridors. The corridors provide some defence against the spread of smoke in the early stages of a fire, even though not designated to have fire resistance. The non-fire rated partitions should be taken up to the soffit of the structural floor above, or to a suspended ceiling and openings into rooms from the corridor should be fitted with doors, which need not be fire doors.

6.4.4 Cross Corridor Protection

Where provided cross corridor doors should be (FD30S).

6.4.5 Exits

Doors on escape routes (whether or not the doors are fire doors) should either not be fitted with lock, latch or bolt fastenings, or be fitted only with simple fastenings that can be readily operated from the side approached by all people (including disabled and elderly) making an escape. The operation of these fastenings should be readily apparent and openable without the use of a key and without having to manipulate more than one mechanism.

Similarly, where a secure door is operated by a code, combination, swipe or proximity card, biometric data or similar means, it should also be capable of being overridden from the side approached by people making their escape.

Any means of escape door which is provided with electrically powered locks should return to the unlocked position under any of the following conditions:

- On operation of the fire alarm.
- On loss of power or system error.
- On activation of a manual door release unit (type A) conforming to BS EN 54-11 positioned at the door on the side approached by people making their escape. Where the door provides escape in either direction a unit should be installed on both sides of the door.

6.4.6 External Escape Routes

Where an external escape route is beside an external wall of the building, BS9991 recommends that the external wall should be of fire resisting construction in both of the following zones.

- Within 1800mm of the escape route.
- Up to 1100mm above the surface of the escape route.

Building A's Eastern boundary is restricted with landscaping however escape from the firefighting stair, amenity space and duplex studios can be made in two directions. A minimum clear width of 1100mm must be maintained in either direction to include gated egress.

External balcony escape is covered in Section 6.1.6.

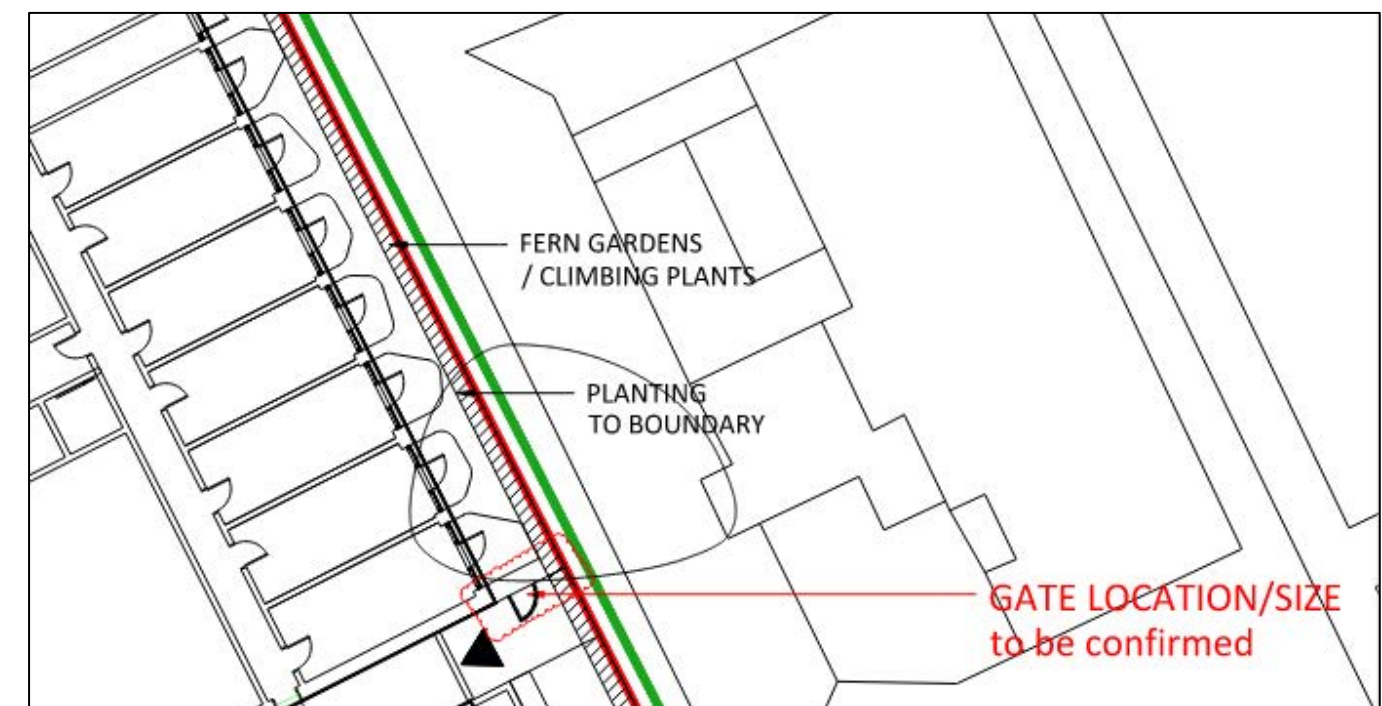


Figure 64: Building A External Escape Route

7 Vertical Escape

7.1 Vertical Escape

Building A is provided with two firefighting shafts up to the 8th floor (one continues to the top floor 9th) and an escape stair serving up to floor 7.

Buildings B and C are under 18m with Building B having a single escape stair and Building C served by two escape stairs.

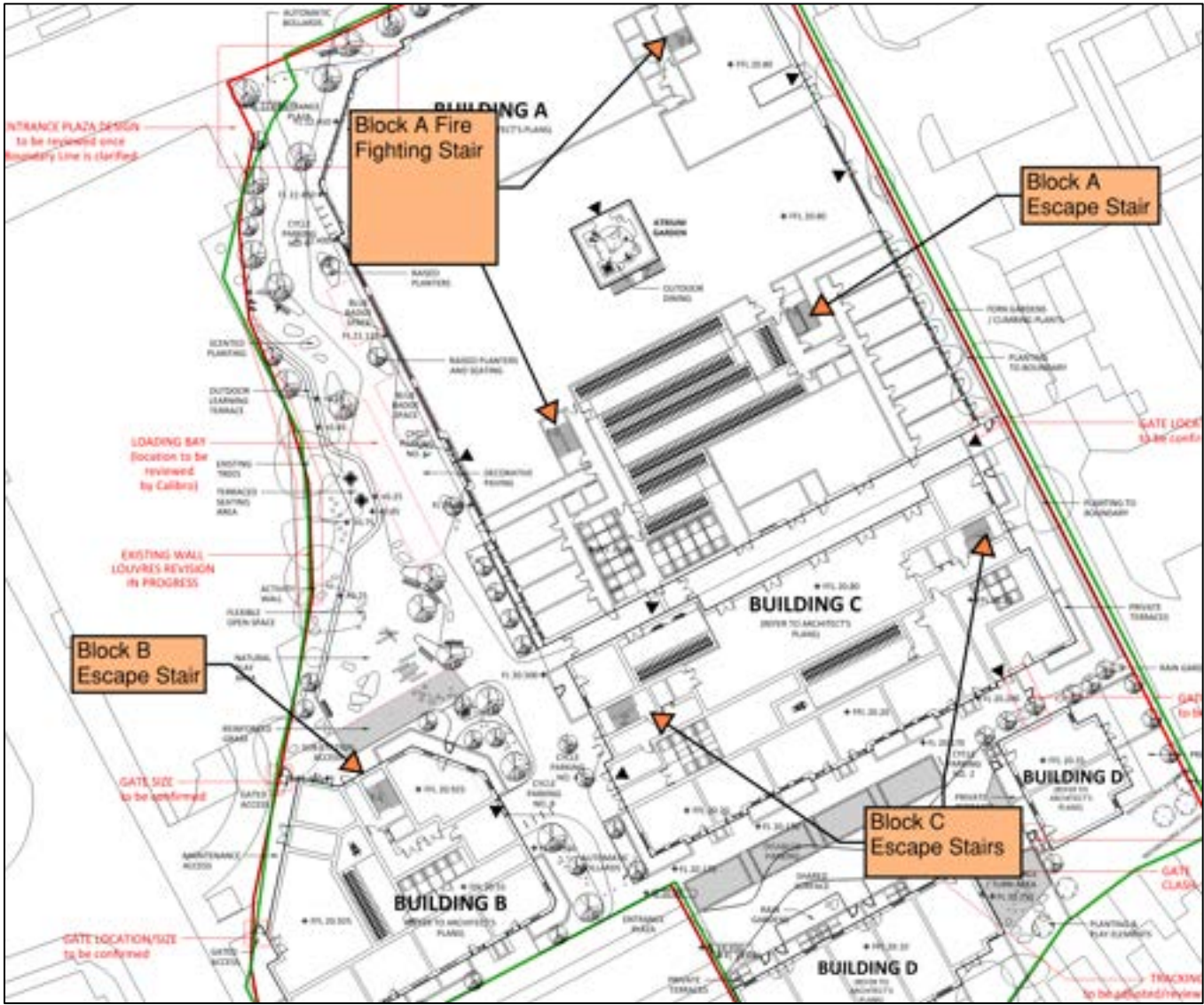


Figure 65: Escape Stairs

7.2 Vertical Clear Widths

The escape stairs in Buildings B and C require a minimum clear width of 750mm in accordance with BS9991. The proposed clear width of the stair is 1200mm.

The firefighting stairs within Building A require a minimum clear width of 1100mm in accordance with BS9991. The proposed clear width of the stair is 1200mm.

For Building A based on the escalating evacuation strategy, and the fire service override on the fire alarm system [Provided to allow for full emergency evacuation] we should assess the staircase widths for full evacuation as opposed to the base BS9991 single apartment evacuation provision.

As BS9991 does not consider full building evacuation we have assessed the staircase widths against the relevant BS9999 figures for long term managed tenancies C1. The table below indicates the expected occupancy on the upper floors of each building and the minimum required stair width from BS9999. The stairs do not need to be discounted as they are all provided with protected lobbies/ corridors and smoke control.

Table 10: Minimum Requires Stair Widths

Building	Upper Floor Occupancy	C1 Minimum Width Per Person	Minimum Clear Stair Width	Proposed Stair Width
Building A	1,043	9 floors served – 1.6mm PP ^{Note 1}	1100mm (for firefighting)	1200mm

Note 1: The total occupancy has been split evenly between the three stairs.

The Stairs are more than adequate to accommodate the occupancy of the building in addition to 50% visitors in case the building requires a simultaneous evacuation.

7.2.1 Final Exit Routes from Stairs

For Building A, all stairs should be provided with final exits direct to outside. Guidance recommends that final exit routes from stairs should be at least as wide as the stair they serve. There are no merging flows to the stairs as no signage should be provided from the amenity areas.

Where residential flats serve the ground floor, in these instances it is not considered necessary to increase the final exit width to consider merging flow as the number of people who would need to use the ground floor exits via the stair final exit routes are minimal for the residential areas.

For Buildings B and C, al final exits from stairs should be a minimum of 750mm.

7.3 Vertical Escape Routes – General

7.3.1 Firefighting Stair

The firefighting stairs (Building A) should be enclosed within 120 minutes fire resistance.

7.3.2 Protected Shaft/Stair

Protected shafts/stairs within Buildings A, B and C should be enclosed within 60 minutes fire resistance (the same fire resistance as the elements of structure).

7.3.3 Protected Stair within Duplexes and Townhouses

Protected stairs to dwellinghouses and townhouses in Buildings B, C and D should be enclosed with 30 minutes fire resistance.

7.3.4 Fire Protection to Internal Angles on External Walls

To ensure adequate levels of compartmentation are maintained where an adjacent compartment is recessed or protrudes from the rest of the building elevation and creates an internal opposing recessed angle, suitable fire protection should be provided to the opposing compartment faces to maintain adequate compartmentation.

Where a protected stairway projects beyond, is recessed from or in any way forms an internal angle of not more than 135° to the adjoining external wall of the building, then the distance between any unprotected area in the external enclosures to the building and any unprotected area in the enclosure to the stairway should be at least 1800 mm.

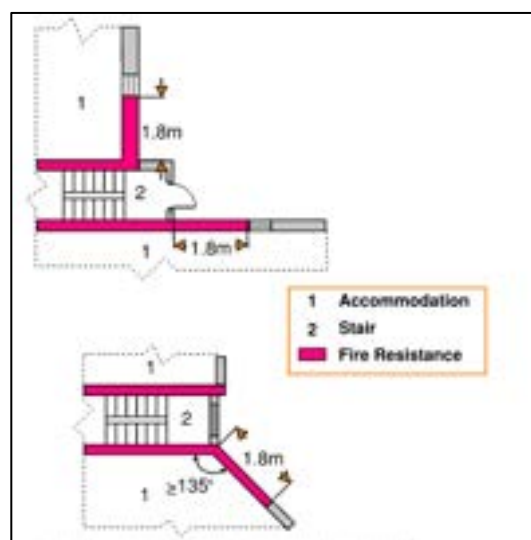


Figure 66: Re-Entrant Corner – Protected Escape Stair

It should be noted that the firefighting stairs require additional fire protection than a protected stair. Where a fire-fighting shaft is sited against an exterior wall, if any glazed area or opening in the exterior wall of the fire-fighting shaft is less than 500mm from the junction of the fire-fighting shaft with the exterior wall, then the fire resistance of the external wall immediately adjacent to the glazed area or opening should be not less than 1 h from both sides for a horizontal distance of 500mm.

Where there is an internal angle $<135^\circ$, the wall should be fire rated to 120 minutes for a distance of 5m. See the figure below for an example.

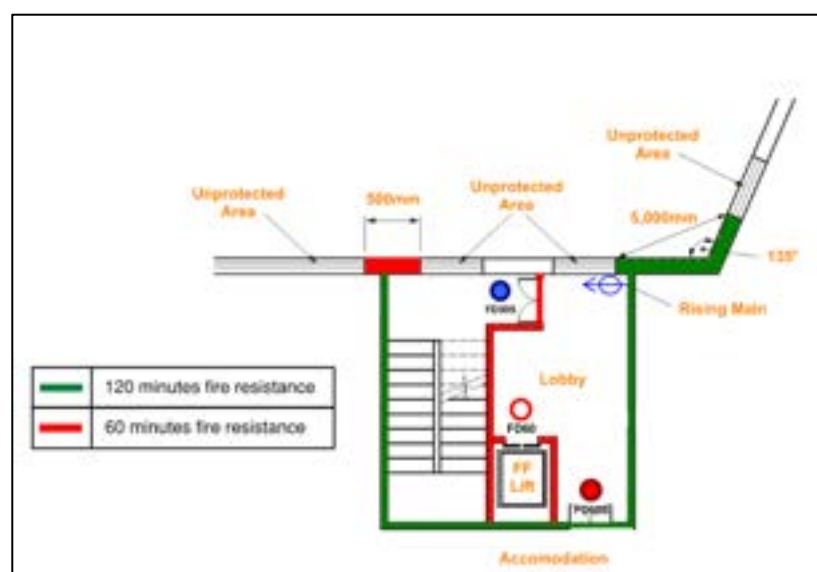


Figure 67: Firefighting Shaft External Wall Fire Resistance Requirements

There are no areas on the development that meets the criteria for 5m fire resistance as noted above. The 500mm protection should be provided.

7.4 Smoke Ventilation to Stairs

The stairs require a geometric free area automatic opening vent of 1m^2 . See Section 5.7 for more information.

7.5 Accessible Means of Escape

There is no detailed requirement within BS9991 guidance to provide any facilities specifically for the use by mobility impaired occupants as the primary evacuation strategy is 'Defend in Place' where the high level of compartmentation is deemed to provide adequate protection to the occupants. Where a fire is considered in an individual apartment the occupant is deemed to leave this space and proceed to the protected corridor / staircase which then is the 'Defend in Place' protected location.

Remaining occupants based on the levels of compartmentation should remain in place unless directly affected by heat / smoke; or unless directed to leave by the Fire and Rescue Service. This is the primary driver for the additional ventilation requirements to common staircases in blocks of apartments to maintain tenable conditions in the escape staircases whilst a fire is contained within an individual apartment.

As noted in BS9991 'it is the responsibility of the premises management to assess the needs of all people to make a safe evacuation when formulating evacuation plans.'

'This evacuation plan should not rely on the assistance of the fire and rescue service. This is an important factor that should be considered in the building design.'

Special management procedures might be required where it is reasonably foreseeable that the proportion of disabled people in a building will be relatively high; should this be the case this should be communicated to the design team during the initial design stages and briefing sections of the design.

Where known operational intent or specific management procedures for 'Relevant Persons' have been communicated to the designers this will be reflected in the Fire Safety Strategy and Regulation 38 Information issued. If no additional or specific requirements have been communicated, the design will be based on the relevant design standards as noted in the Building Regulations.

However, it should also be noted that the London Plan does include a requirement that in all developments where lifts are installed as a minimum at least one lift per core (or more subject to capacity assessment) should be a suitably sized fire evacuation lift suitable to be used to evacuate people who require level access from the building.

Building A is over 18m and will be provided with two firefighting shafts (firefighting stair, firefighting lift and dry riser) and one escape stair. Each core has two lifts one of which will be an evacuation lift as per the requirements of the London Plan (Note: firefighting cores will be provided with one firefighting lift and one evacuation lift).

A firefighting lift (which is provided principally for the use of the fire and rescue service in fighting fires) may be used for the evacuation of disabled people prior to the arrival of the fire and rescue service; the cause and effect and management of this evacuation should be clarified with the end user / management, and suitably trained operatives available 24 / 7 to facilitate this evacuation.

As per the London plan the lifts serving both cores in Building C and the single core in Building B will be provided as evacuation lifts. It is noted that the evacuation lifts will open directly on to the open balcony rather than into a protected lobby in line with standard guidance. This is considered acceptable in these instances on the basis all flats are provided with suppression, the balcony escape is in line with the guidance in BS9991 and the balcony is open with large amounts of ventilation helping to clear smoke and maintain access to the lifts.

8 Internal Fire Spread – Linings

8.1 Internal Linings

The interior wall and ceiling surfaces in a building may have a significant influence on how fast a fire may develop. Building Regulations requires that internal linings shall adequately resist the spread of flame over their surfaces and, if ignited, have either, a heat release rate or a rate of fire growth, which is reasonable in the circumstances.

It is particularly important that in circulation spaces, where the rapid spread of fire is most likely to prevent occupants from escaping, the surface linings are restricted, by making provision for them to have low rates of heat release and surface spread of flame.

For the purposes of classification, the following are deemed to be walls and ceilings.

- Walls:
 - The surface of glazing (except glazing in doors);
 - Any part of a ceiling that slopes at an angle of more than 70° to the horizontal
 - Exclusions to walls can be found within Clause 20.1 of BS9991.
- Ceilings:
- The surface of glazing.
- Any part of a ceiling that slopes at an angle of more than 70° or less to the horizontal
- Exclusions to walls can be found within Clause 20.1 of BS9991.

The surface finishes should satisfy the following classifications shown in the table below when tested under the European Classifications (in accordance with BS EN 13501-1:2002).

Table 11: Wall and Ceiling Lining Requirements

Location	European Class
Circulation spaces within dwellings	C-s3, d2
Other circulation spaces, including common areas of blocks of apartments	B-s3, d2
Small rooms of areas not more than 4m ²	D-s3, d2
Small rooms of area not more than 30m ² in non-residential accommodation	D-s3, d2

Note: When a classification includes 's3, d2' this means that there is no limit on the production of smoke or flaming droplets/particles.

8.2 Rooflights

Thermoplastic materials that cannot meet the classifications given in the table below and should be classified TP(a) rigid, TP(a) flexible, or TP(b) according to the following methods:

- a. **TP(a) rigid:**
 - i. Rigid solid PVC sheet.
 - ii. Solid (as distinct from double- or multiple-skin) polycarbonate sheet at least 3 mm thick.
 - iii. Multi-skinned rigid sheet made from unplasticized PVC or polycarbonate which has a Class C-s3, d2 rating.
- b. **TP(a) flexible:**
 - i. Flexible products not more than 1 mm thick that conform to the Type C requirements of BS5867 Part2: 2008.
- c. **TP(b):**
 - i. Rigid solid polycarbonate sheet products less than 3 mm thick, or multiple-skin polycarbonate sheet products that do not qualify as TP(a) by test.

If thermoplastic materials are to be used in windows, roof lights and lighting diffusers in suspended ceilings, they should meet the recommendations shown below.

Table 12: Limitations on Thermoplastic Rooflights & Diffusers in Suspended Ceilings

Minimum Classification Of Lower Surface	Use Of Space Below	Maximum Area ^{Note 1} - m ²	Maximum Area As Percentage Of Floor Area – [%]	Minimum Distance Between Diffusers / Rooflights – [m]
TP(a)	Any except protected stairway	No limit ^{Note 2}	No limit	No limit
D-s3, d2 or TP(b)	Rooms	1	50 ^{Note 3}	Distance equal to the largest dimension of the largest diffuser or roof light
		5	50 ^{Note 3}	3 ^{Note 3}
	Circulation spaces except protected	5	15	3

Note 1: Smaller panels can be grouped together provided that the overall dimension of the group satisfies the dimensions below.

Note 2: Lighting diffusers of TP(a) flexible rating should be restricted to panels of not more than 5m².

Note 3: Class 3 or D-s3, d2 rooflights in industrial and other non-residential purpose groups may be spaced 1800 mm apart, on the basis the rooflights are evenly distributed and do not exceed 20% of the area of the room.

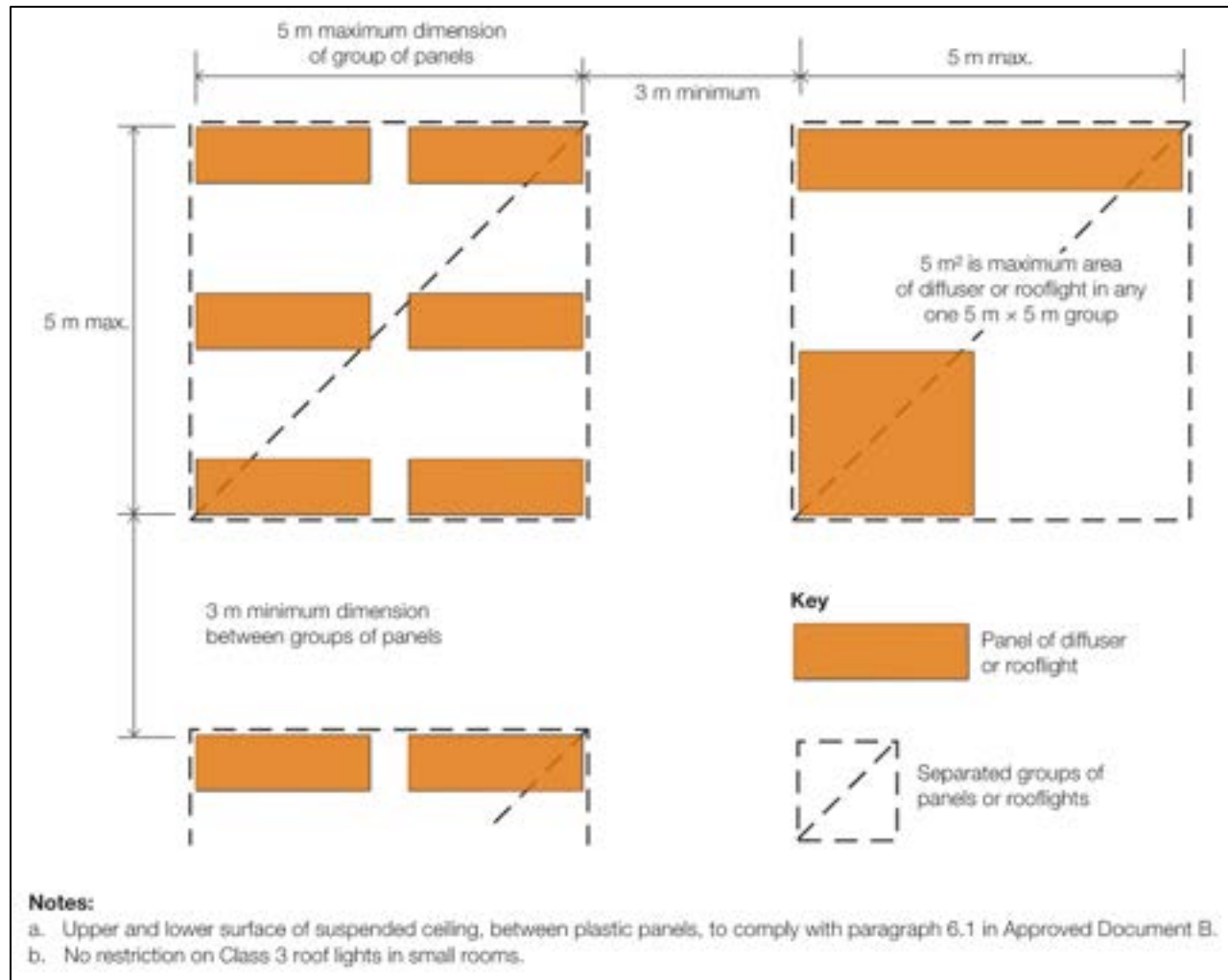


Figure 68: Limitations on Grouping of Rooflights and Diffusers

8.3 Lighting Diffusers

Lighting diffusers should meet the relevant classification in the table above or be classified as TP(a) or TP(b) i.e.

- Thermoplastic lighting diffusers meeting classification TP(a) may be used without restriction.

Thermoplastic lighting diffusers meeting classification TP(b) may be used in ceilings to rooms and circulation spaces (but not protected stairways) only if they meet the recommendations provided above.

9 Internal Fire Spread

9.1 Elements of Structure

The top habitable storey height for Building A is more than 18m in height but less than 30m. BS9991 recommends the elements of structure with AWFSS can be reduced from 90 minutes to 60 minutes fire resistance.

The top habitable storey height for Buildings B and C are more than 11m but less than 18m from ground floor level. On this basis the elements of structure require 60 minutes fire resistance.

Building D consists of three storey townhouses which require 60 minutes structural fire resistance.

The following are excluded from the definition of elements of structure.

- Lowest floor of the building
- External walls, such as curtain walls or other forms of cladding, which transmit only self-weight and wind loads and do not transmit floor load.
- Roof, unless
 - Forms a function of an escape route or floor (terrace)
 - The structure is essential for the stability of an external wall that needs to be fire resisting due space separation.

9.2 Minimum Fire Resistance Requirements

9.2.1 Building A

The minimum required fire resistance for the structural elements of the building based on the use and height of the building.

Table 13: Minimum Fire Resistance Requirements – Building A

Part of the Building	Minimum Provisions When Tested To The Relevant Parts Of BS 476 Or Relevant European Standard (Minutes)			Method of Exposure
	Load-Bearing Capacity [R]	Integrity [E]	Insulation [I]	
Structural Frame, Beam or Column	60	N/A	N/A	Exposed Faces
Load-Bearing Wall	60	N/A	N/A	Each Side Separately
Compartment Floors	60	60	60	From Underside
Compartment Wall	60	60	60	Each Side Separately
Compartment Walls Enclosing Flats	60	60	60	Each Side Separately
Enclosure to Ancillary Accommodation	See Section 9.4			Each Side Separately / From Underside
Roofs				
Any floor forming part of an escape route;	30	30	30	
Any roof that forms the function of a floor or is essential for the stability of external fire rated walls	60	60	60	From Underside
External Fire Spread				
Any part less than 1000mm from a point in the relevant boundary	60	60	60	Each Side Separately
Any part more than 1000mm from the relevant boundary ^{Note 1}	60	60	15	From Inside the Building
Any part adjacent to an external escape route or stair	30	30	N/A	From Inside the Building
Re-entrant corners/ Maintaining Compartmentation	Same as the compartment wall it serves			From Inside the Building ^{Note 2}
Firefighting shafts – Construction separating firefighting shaft from rest of building	120	120	120	From Side Remote from Shaft
	60	60	60	From shaft side
Protected Shafts	60	60	60	Each Side Separately
Protected Entrance Halls in Flats and separation of kitchens within cluster flats	30	30	30	Each Side Separately
Cross Corridor Doors	30	30	30	Each Side Separately
Cavity Barriers	N/A	30	15	Each Side Separately
Fire stopping/ Fire Barriers	See Section 10 for more information			Each Side Separately/ From Underside

Note 1: This does not apply to permitted unprotected areas as indicated within Section 13 of this Fire Safety Strategy report.

Note 2: Unless the protection is provided on the external wall to the stair, if this is the case protection to be provided on the outside of the building.

9.2.2 Buildings B and C

The minimum required fire resistance for the structural elements of the building based on the use and height of the building.

Table 14: Minimum Fire Resistance Requirements – Buildings B and C

Part of the Building	Minimum Provisions When Tested To The Relevant Parts Of BS 476 Or Relevant European Standard (Minutes)			Method of Exposure
	Load-Bearing Capacity [R]	Integrity [E]	Insulation [I]	
Structural Frame, Beam or Column	60	N/A	N/A	Exposed Faces
Load-Bearing Wall	60	N/A	N/A	Each Side Separately
Compartment Floors	60	60	60	From Underside
Compartment Wall	60	60	60	Each Side Separately
Compartment Walls Enclosing Flats	60	60	60	Each Side Separately
Enclosure to Ancillary Accommodation	See Section 9.4			Each Side Separately / From Underside
Roofs				
<i>Any floor forming part of an escape route;</i>	30	30	30	
<i>Any roof that forms the function of a floor or is essential for the stability of external fire rated walls</i>	60	60	60	From Underside
External Fire Spread				
<i>Any part less than 1000mm from a point in the relevant boundary</i>	60	60	60	Each Side Separately
<i>Any part more than 1000mm from the relevant boundary</i> ^{Note 1}	60	60	15	From Inside the Building
<i>Any part adjacent to an external escape route or stair</i>	30	30	N/A	From Inside the Building
<i>Re-entrant corners/ Maintaining Compartmentation</i>	Same as the compartment wall it serves			From Inside the Building ^{Note 2}
Protected Shafts	60	60	60	Each Side Separately
Protected Entrance Halls in Flats and separation of kitchens within cluster flats	30	30	30	Each Side Separately
Cross Corridor Doors	30	30	30	Each Side Separately
Cavity Barriers	N/A	30	15	Each Side Separately
Fire stopping/ Fire Barriers	See Section 10 for more information			Each Side Separately/ From Underside

Note 1: This does not apply to permitted unprotected areas as indicated within Section 13 of this Fire Safety Strategy report.

Note 2: Unless the protection is provided on the external wall to the stair, if this is the case protection to be provided on the outside of the building.

9.3 Compartmentation

All floors are required to be compartment floors, with the exception of the small mezzanine level in the amenity area in Building A.

All individual student accommodation units will be independent compartments with 60-minute walls and 60-minute floors; with the exception where they abut protected shafts, firefighting shafts etc where the higher fire resistance will prevail.

In Buildings B and C all flats will be independent compartments with 60-minute walls and 60-minute floors.

In Buildings B, C and D all dwellinghouses and townhouses will have 60 minute separating walls.

Ancillary accommodation should be compartmentalised from the remaining building with appropriate fire resistance.

All shafts should be considered as protected shafts and will require the same fire resistance as the elements of structure unless considered a firefighting shaft or requires higher fire resistance as described within Section 9.4.

9.3.1 Junctions with Compartment Walls and Roof

A compartment wall should be taken up to meet the underside of the roof covering or deck, with appropriate fire stopping where necessary at the wall / roof junction to maintain continuity. To reduce the risk of a fire affecting both compartments a zone of roof 1.5m wide on either side of the wall should have a covering of B_{ROOF}(t4) (European class) on a substrate or deck of A2-s3, d2 or better. If roof supports pass through the wall, fire protection to these may be required for a distance of 1500mm to delay distortion at the junction.

9.3.2 Fire Protection to Internal Angles on External Walls

To ensure adequate levels of compartmentation are maintained where an adjacent compartment is recessed or protrudes from the rest of the building elevation and creates an internal opposing recessed angle, suitable fire protection should be provided to the opposing compartment faces to maintain adequate compartmentation.

There is a requirement for external walls to protected stairways which has been identified within Section 7.3.4. In addition to this there is a risk of fire and radiated heat spread between adjacent compartments externally where there is an internal angle present.

The distance between any unprotected area in the external enclosures to the building and any unprotected area in the enclosure to the adjacent compartment should be at least 1800mm.

Fire resistance for the internal angle protection should meet the same fire performance as the compartmentation or stair it is protecting. Where the fire resistance to the stair is extended rather than the adjacent wall, the fire resistance will need to be from the outside in, rather than from the inside of the building.

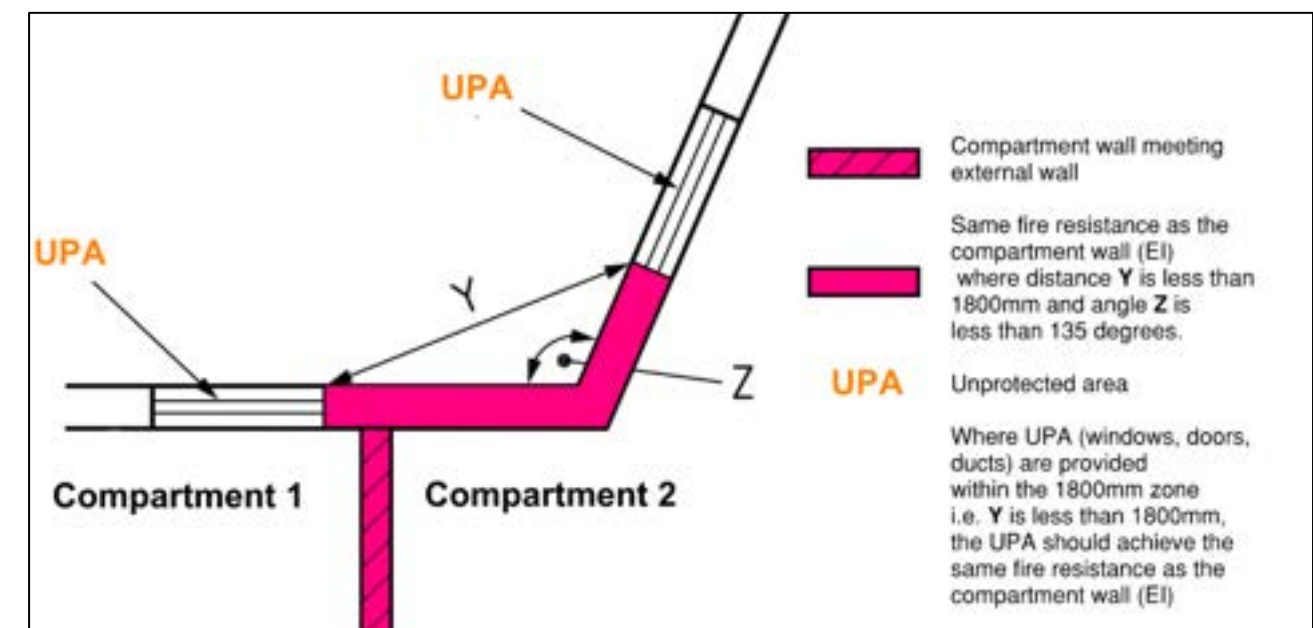


Figure 69: Compartment Re-Entrant Corners

The above figure provides a typical example; however, fire resistance requirements vary depending on the level of fire resistance.

- For compartment between apartments - 60 minutes and 1.8m.
- For compartment adjacent to firefighting shafts – 120 minutes and 5m.

There are a number of re-entrant corners within the development that should be provided with protection.

9.4 Ancillary Accommodation

Areas of ancillary accommodation should be separated from the remainder of the building by appropriately fire rated construction. Where single stairs are present such as to Building B no ancillary accommodation communicates with the stair. Buildings A and C stairs can communicate with ancillary accommodation subject to lobby protection where required as they are considered to be multi stair buildings.



Figure 70: Building B Ancillary Accommodation and Stair

Table 15: Fire Resistance Requirements for Ancillary Accommodation

Ancillary Accommodation	Minimum Fire Resistance
Storage areas greater than 1m ² in area but not greater than 450m ² (other than refuse areas).	Robust construction having a minimum standard of fire resistance of 30 minutes (REI)
Repair and maintenance workshops where flammable or highly flammable liquids are not used or stored	
Kitchens (separately or in conjunction with an associated staff restaurant or canteen)	
Transformer, switchgear and battery rooms for low-voltage or extra low voltage equipment	
Engineering services installation rooms	
Storage areas greater than 450m ²	Robust solid non-combustible construction having a minimum fire resistance of 60 minutes (REI)
Service installation rooms	
Places classified has high fire risk areas	
Repair and maintenance workshops where flammable or highly flammable liquids are used or stored	
Covered loading bays and storage areas other those previously mentioned	
Refuse storage areas	Robust solid non-combustible construction having a minimum standard of fire resistance equivalent to that required for the elements of construction of the building and in case less than 60 minutes (REI)
Boiler rooms	
Fuel storage areas	
Transformer and switchgear rooms for equipment above low voltage ^{Note 1}	
Rooms housing fixed internal combustion engines	
Any electrical substation or enclosure containing any distribution board, generator, powered smoke control plant, pressurization plant, communication equipment, and any other equipment associated with life safety and fire protection systems	Robust solid non-combustible construction having a minimum standard of fire resistance of not less than 120 minutes (REI)

Note: Any openings in the required construction should be protected by doors having a similar standard of fire resistance and capable of resisting the passage of smoke at ambient temperature.

Note 1: Generally, the fire resistance of any sub stations transformers is in excess of this figure and designated by the provider; to this end we have shown a worst-case scenario on the drawings of 240 minutes.

9.5 Fire Doors

Fire doors should be provided in all fire rated enclosures in accordance with BS 476: Part 22: 1987 and specified with cold smoke seals (only where smoke seals are required [S or Sa]) in accordance with the recommendations of BS 476, in accordance with Table 12 from BS9991. The fire resistance requirements for the doors are shown in the table below:

Table 16: Fire Door Requirements

Position of Door	Tested to BS 476-22	Tested to BS EN 1634-1
Firefighting Shaft	FD60S	E60Sa
Firefighting Stair	FD60S	E60Sa
Firefighting Lift	FD60	E60
Protected Stair to Dwellings	FD30S	E30Sa
Entrance to Flats	FD30S	E30Sa
Other Compartment Lines	The same rating as the wall in which it is sited with a smoke seal fitted to door	
Ancillary Accommodation	The same rating as the wall in which it is sited with a smoke seal fitted to door	
Cross corridor	FD30S	E30Sa
Cluster Protected Entrance Hall/Cluster Flat Kitchen	FD30S	E30Sa
Risers	FD30S	E30Sa
Smoke Shaft Door/ Vent	FD60S	E60Sa

Note: All fire doors on escape routes should be self closing except for doors into ancillary accommodation (plant, stores, risers etc) that should be kept locked shut and provided with appropriate signage.

A fire door that is needed to resist the passage of smoke at ambient temperature conditions (the fire doors with the S or Sa against them) should either.

- Have a leakage rate not exceeding 3m³/h per metre, when tested in accordance with BS 746-31.1 with the threshold taped and subjected to a pressure of 25 Pa: or
- Meet the classification requirement of Sa when tested in accordance with BS EN 1634-3.

Note: Smoke leakage control can be applied to non-fire-resisting doors.

Threshold gaps for timber doors should be in accordance with BS 8214. The gaps between the fire door and frame should be in accordance with manufacturer tests and BS 8214. Generally, the gaps should not exceed 3mm unless accompanied by test information from the manufacturer.

Note: Threshold gaps for all other door types are to be based on the principles set out in BS 8214.

9.5.1 Doors on Escape Routes

Where hold-open devices are used they should be installed in accordance with BS9991. Hold-open devices can be either, fusible link (not applicable within protected escape routes), an automatic release mechanism which is linked to the fire alarm or be a delayed closing device with a delay adjusted not to exceed 25 seconds.

10 Fire Rated Elements and Fire-Stopping

10.1.1 Fire-Stopping

Fire stopping is used for sealing gaps, imperfections or design tolerances between fire resisting walls, floors, and ceilings to restrict the passage of both fire and smoke. Fire stopping should achieve the same fire resistance (integrity and insulation (EI)) as the element into which they penetrate.

If the fire separating element is to be successful, every joint or imperfection fit, or opening to allow services to pass through the element, should be adequately protected by sealing or fire stopping so that the fire resistance of the element is not impaired.

10.1.2 Junctions to Fire Rated Elements

All joints between fire rated elements and all openings for penetrations to pass through any part of a fire separating element should be fire-stopped and.

- Kept as few in number as possible.
- Kept as small as practicable; and
- Fire stopped (which in the case of a flue or duct, should allow thermal movement) so that the level of fire resistance of the joint is not less than that of the fire separating element.

10.1.3 Fire Barriers

If the internal lining of the external wall does not achieve the same level of fire resistance as the required compartmentation; cavity barriers in the external cavity adjacent to compartment walls and floors should be included as fire barriers providing the same level of fire resistance (EI) to maintain the level of compartmentation.

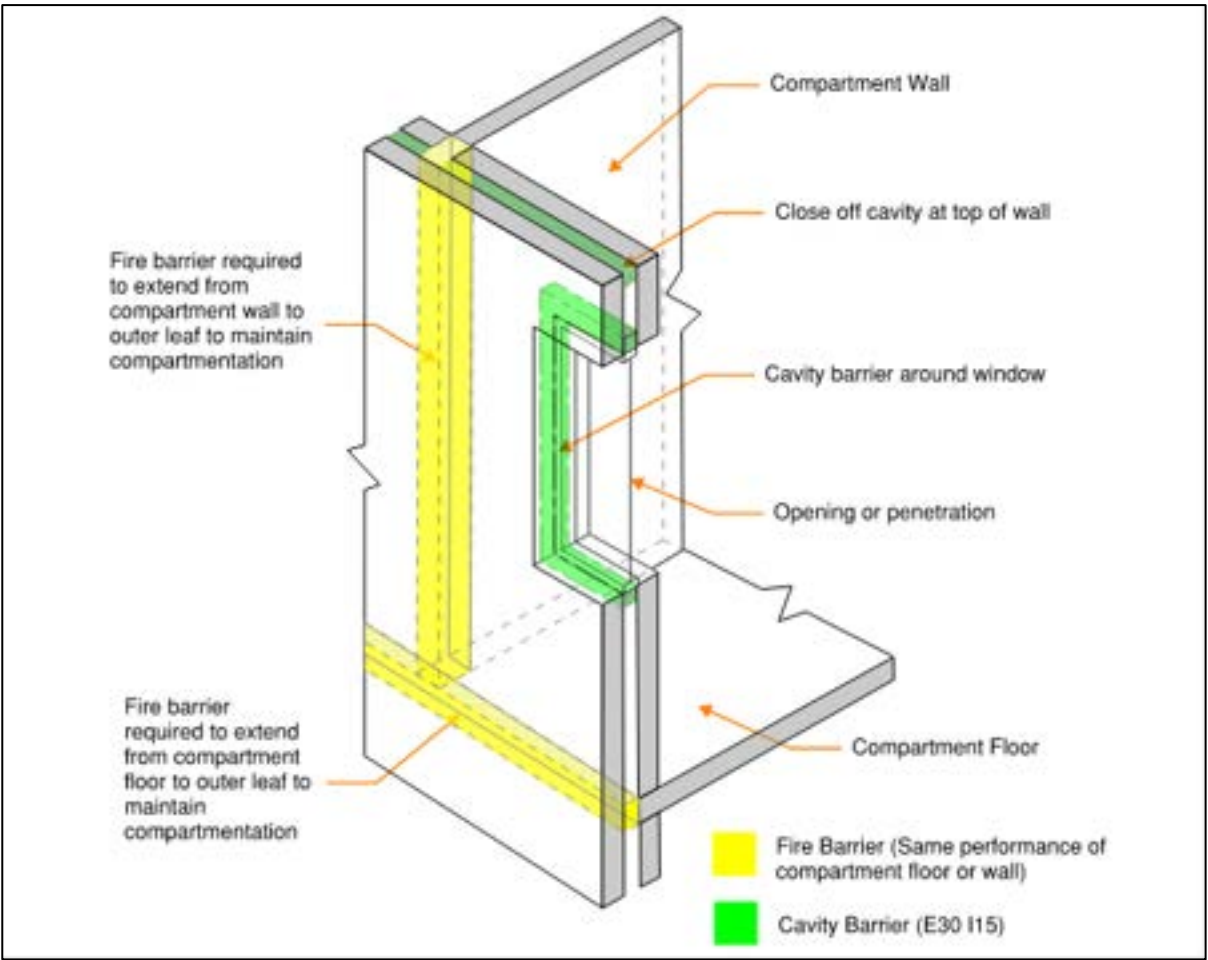


Figure 71: Fire Barrier Example

10.2 Penetrations to Fire Rated Construction

10.2.1 Pipe Penetrations

Pipes that pass through a fire separating element, should meet one of the following provisions.

10.2.1.1 Proprietary Seals

Provide a proprietary sealing system which has been shown by test to maintain the fire resistance of the wall, floor, or cavity barrier.

10.2.1.2 Restricted Pipe Diameters

Where a proprietary sealing system is not used, fire stopping may be used around the pipe, keeping the opening as small as possible. The nominal internal diameter of the pipe should not be more than the relevant dimension given in the table below.

Table 17: Maximum Nominal Diameter of Pipes Passing Through Compartments

Situation	Pipe Material and Maximum Nominal Internal Diameter (mm)		
	Non-Combustible Material	Lead, Aluminium, Aluminium Alloy, uPVC ⁽²⁾ , Fibre Cement	Any Other Material
Structure (but not a wall separating the existing and proposed building) enclosing a protected shaft which is not a stairway or lift shaft	160mm	110mm	40mm
Any other situation	160mm	40mm	40mm

Note: Any non-combustible material which, if exposed to a temperature of 800°C, will not soften or fracture to the extent that flame or hot gas will pass through the wall of the pipe.

Note 2: uPVC pipes that comply with either BS4514 or BS5255

10.2.1.3 Sleeving

A pipe of lead, aluminium, aluminium alloy, fibre-cement, or uPVC, with a maximum nominal internal diameter of 160mm, may be used with a sleeving of non-combustible pipe. The opening in the structure should be as small as possible and provide fire stopping between the pipe and structure. The sleeve should extend be no less than 1000mm either side of the structure.

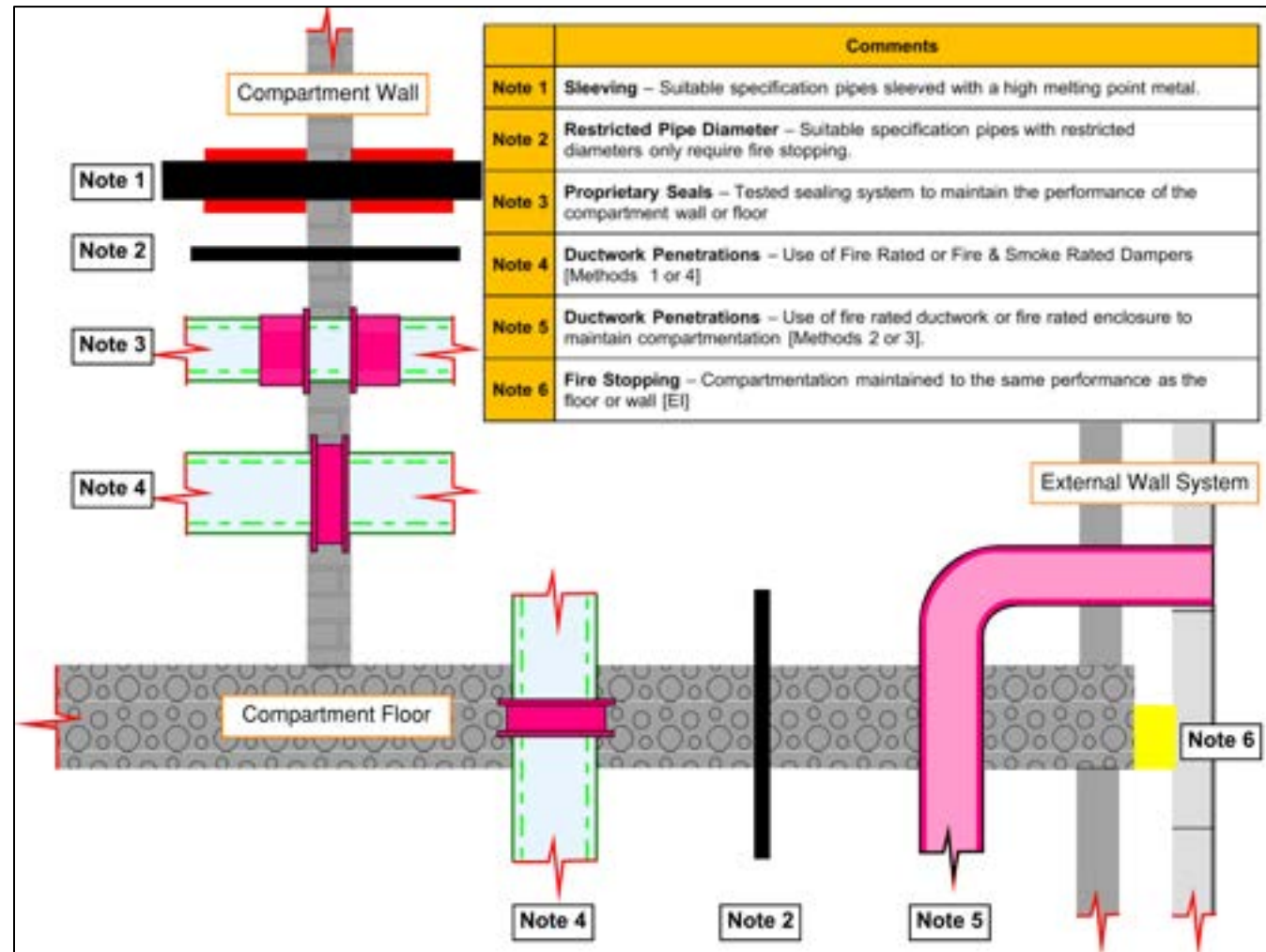


Figure 72: Proprietary Fire Stopping

10.2.2 Ductwork Penetrations

Where services and specifically ductwork passes through a fire separating element to maintain the integrity of the fire resisting element there should be a suitable means of maintaining that integrity, this can be done by the use of fire rated construction or suitable damper installations the suggested four methods of demonstrating compliance are noted below.

It should also be noted that around all penetrations in the fire separating elements including around dampers and ductwork this should be suitable fire stopped including every joint or imperfection fit or opening that allow ducts to pass through the element.

The detailed means of maintaining the fire integrity of the building is highlighted in BS 9999 as recommended in BS9991 and includes the full descriptions and additional information on how to protect the ductwork and air transfer grilles.

Any ductwork passing through a protected stairway, lobby, or corridor without an opening into that area should be fire resisting. For more information on how to protect the ductwork and air transfer grilles see Clause 32.5 of BS 9999 for additional commentary. The requirements for each option are indicated below.

The requirements for each option are indicated below.

10.2.2.1 Method 1 – Protection Using Thermally Activated Fire Dampers

- This method should not be used where ductwork passes through or serves protected escape routes.
- This method is not suitable for kitchen extract systems.
- Fire dampers should conform to BS EN 15650 and have an E Classification equal to or greater than 60 minutes.

10.2.2.2 Method 2 – Protection Using Fire Resisting Enclosures

The fire-resisting enclosures should achieve the same fire resistance as the wall/ floor the ductwork penetrates which forms a compartment known as a protected shaft.

- This method can be used in protected escape routes providing the ductwork does not serve the escape route it passes through.
- If any of the rooms that are being served by the ductwork are rooms requiring fire resistance, additional dampers are required. See Method 1 or 4 for the appropriate damper.
- The fire resisting enclosure should be classified EIX in accordance with BS EN 13501-2 (fire exposure from the duct side) (where X is the fire resisting rating (in minutes) of the walls of the protected route).

10.2.2.3 Method 3 – Protection Using Fire Resisting Ductwork

The ductwork itself forms a protected shaft. The ductwork should achieve the same fire resistance as the wall/ floor the ductwork penetrates. The fire resistance can be achieved by the ductwork material itself, or through the application of protective material.

- This method can be used in protected escape routes providing the ductwork does not serve the escape route it passes through.
- If any of the rooms that are being served by the ductwork are rooms requiring fire resistance, additional dampers are required. See Method 1 or 4 for the appropriate damper.
- The fire resisting ductwork should be classified EISX in accordance with BS EN 13501 (where X is the fire resisting rating (in minutes) of the walls of the protected route).

Note: The supporting hangers should be capable of supporting the ductwork for not less than the period of fire resistance of the ductwork.

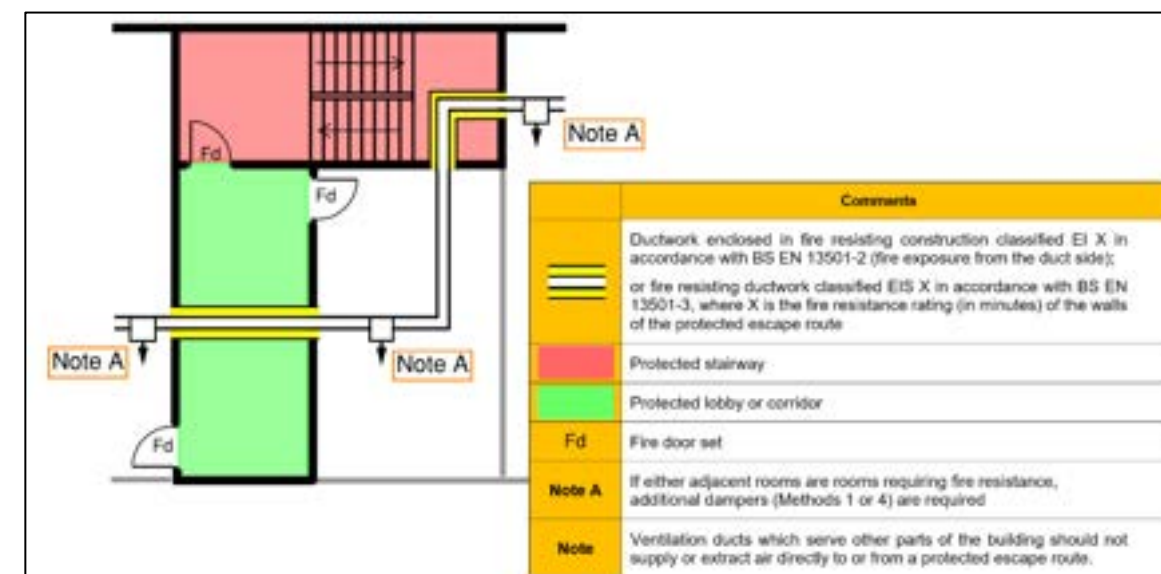


Figure 73: Method 2 or 3 Example

10.2.2.4 Method 4 Protection Using Automatically Actuated Fire and Smoke Dampers Actuated by Automatic Fire Detection

- This method may be used for extract ductwork passing through protected escape routes where the ductwork does and does not serve the protected escape route.
- This method is not suitable for kitchen extract systems.
- Fire and smoke dampers should conform to BS EN 15650, they should have an ES classification equal to or greater than 60 minutes.

Note: Suitable access should be provided for maintenance and inspection of all dampers.

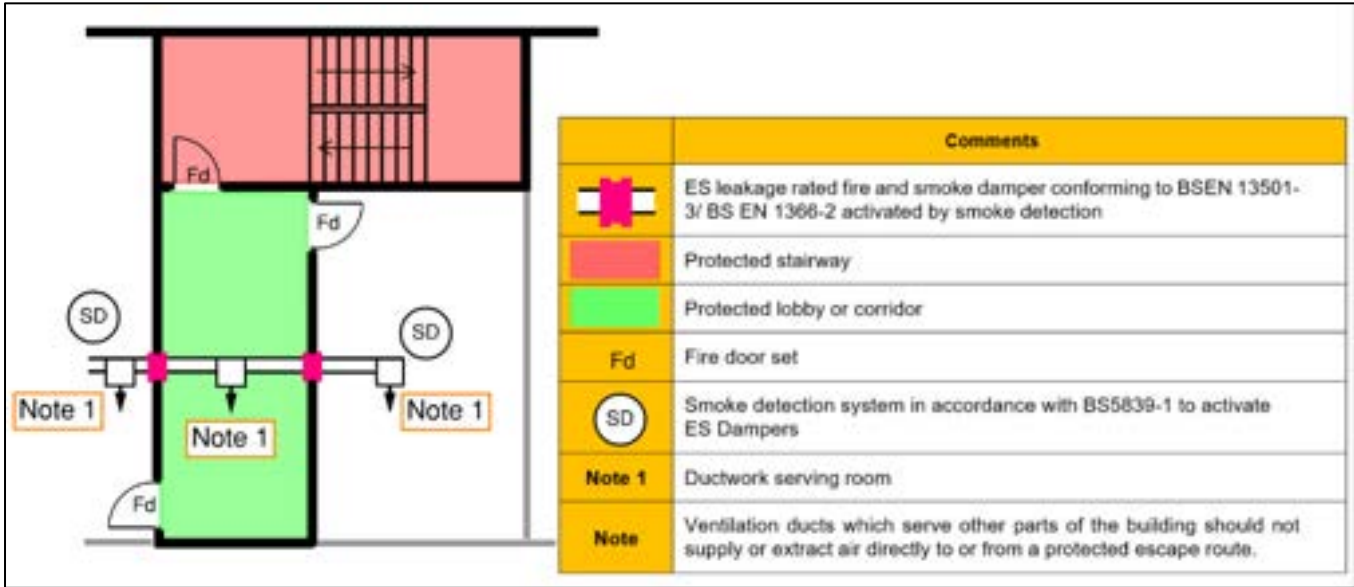


Figure 74: Method 4

10.2.3 Air Transfer Grilles

In general, the installation of air transfer grilles should be avoided in any construction required to be fire-resisting. Air transfer grilles generally should not be installed in:

- Elements of construction enclosing compartments or protected shafts.
- Enclosures to protected stairways, protected lobbies, protected corridors, fire-fighting stairways or fire-fighting lobbies.
- Bedroom walls or doors.

Air transfer grilles fitted in any construction or door that needs to be fire-resisting should be of the intumescent type or fitted with fire dampers. Where these grilles are within the enclosure of protected escape routes, they should incorporate fire and smoke shutters operated by adjacent automatic smoke detectors. Fire and smoke shutters should be in accordance with Method 4. Any transfer grilles fitted in fire doors will need to be accompanied by a test certificate provided by the door manufacturer.

11 Concealed Spaces

Concealed spaces or cavities in the construction of the building provide a ready route for smoke and flame spread, especially in voids above and below ceilings/floors. As the smoke or flames would be concealed it presents a greater danger. For more information on concealed spaces see Clause 19 from BS9991.

Cavity barriers should therefore be provided to sub-divide the cavities to restrict the spread of smoke and flame spread and should be provided in the following areas.

- Around openings such as windows, doors and service penetrations and to close off edges of cavities ^{Note 1}.
- At the junction between an external cavity wall and any wall, floor or door assembly which forms a fire resisting barrier.
- At the junction between every compartment floor and compartment wall.
- Within cavities that exceed the distances set out within the table below.

Note 1: Steel Framing Systems (SFS) is used, if the steel supports the structure, fire barriers (to the same fire resistance as the element structure) should be in place of cavity barriers around openings and to close top of cavities.

The provision above does not apply to the following figure, where two leaves of brick or concrete each at least 75mm thick is provided.

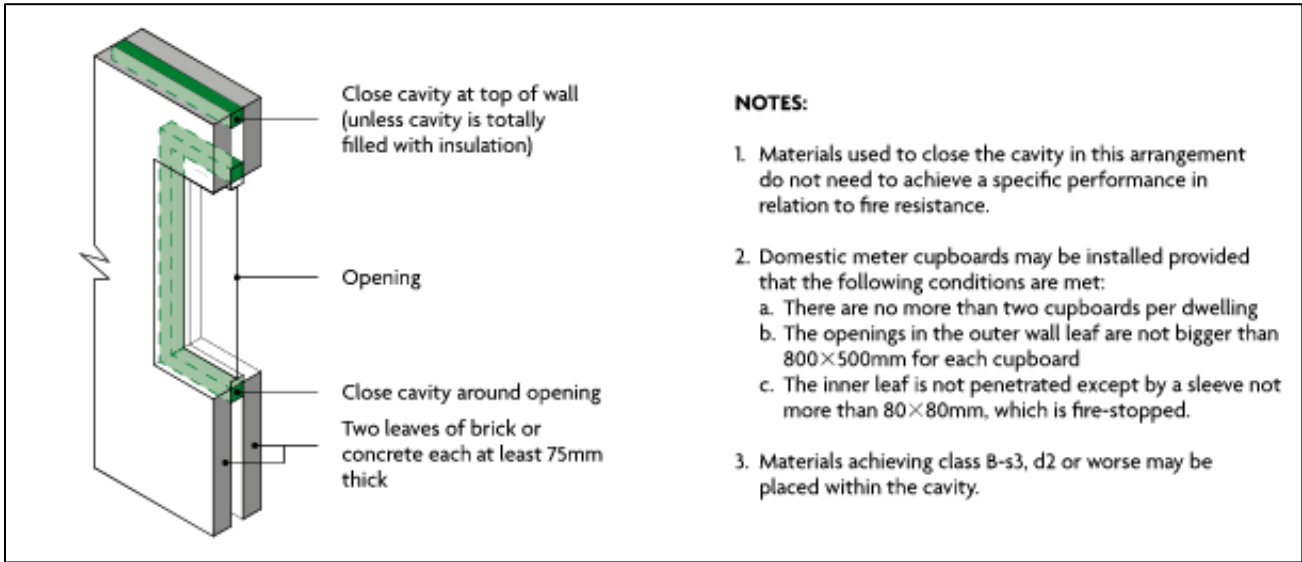


Figure 75: Cavity Walls Excluded from Provisions of Cavity Barriers

Note: It is recommended that cavity barriers are fitted still to around windows, penetration and to close off the top of cavities in this scenario.

Cavities that may exist above or below any fire resisting construction because the construction is not carried to full storey height or, (in case of the top storey) to the underside of the roof covering should be either:

- Fitted with cavity barriers on the line of the partitions (as indicated within the figure below); or
- For cavities above the partitions, enclosed on the lower side by a fire resisting ceiling which extends throughout the building, compartment, or separated part.

Note: it is important to continue compartment walls up through ceilings or roof cavity to maintain the standard of fire resistance. Therefore, the compartment wall should be carried up full storey height to a compartment floor or to the roof. It is not appropriate to complete a line of compartmentation by fitting cavity barriers.

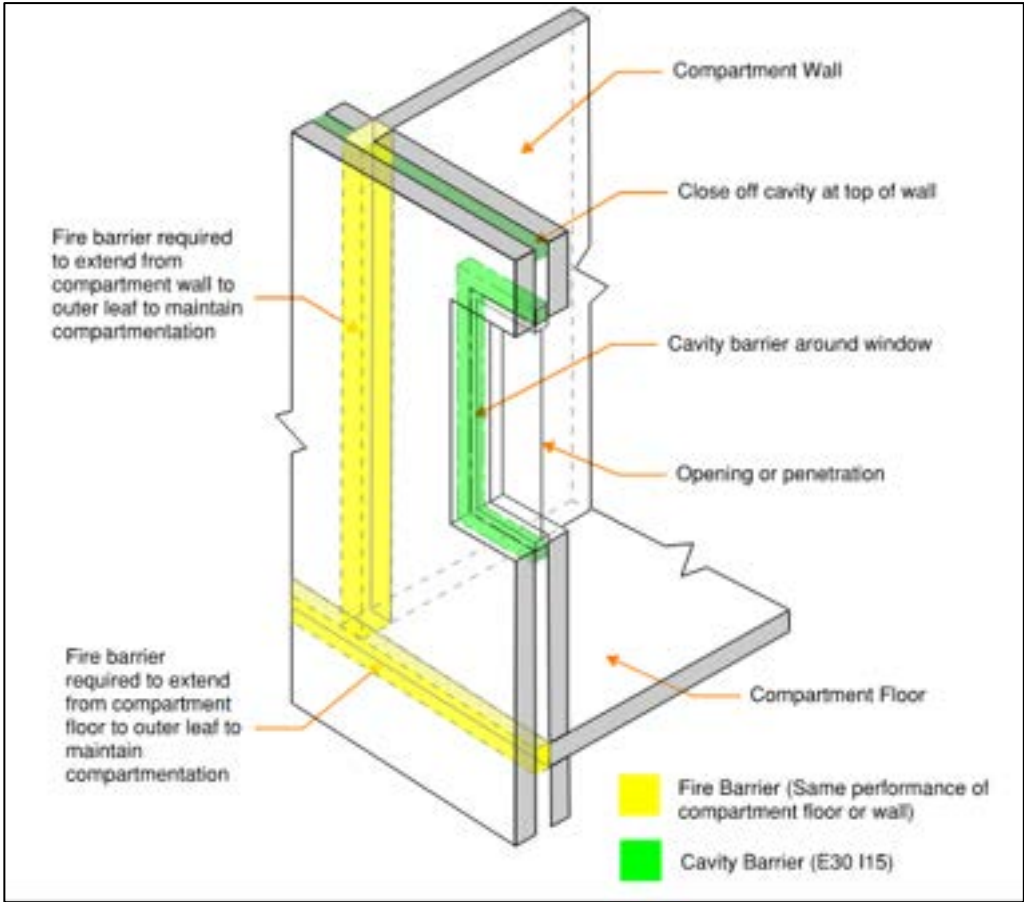


Figure 76: Provision of Cavity Barrier and Fire Barriers

Cavity barriers will also be used to subdivide any cavity within the external wall or inside the building. The maximum dimensions of concealed spaces are indicated within the table below.

Table 18: Maximum Dimensions of Cavities

Location	Class of Surface Exposed	Max Dimension in any Direction
Between a Roof & Ceiling	Any Class	20m
Any other Cavity	Class C-s3, d2 / Class 1	20m
	Any Class	10m

Every cavity barrier should be constructed to at least 30 minutes fire resistance as indicated in Section 8.1 from this report. It may be formed by any construction provided for another purpose if it meets the provisions for cavity barriers. Cavity barriers in a stud wall or provided around openings should follow the guidance from BS9991.

It may be formed by any construction provided for another purpose if it meets the provisions for cavity barriers. Cavity barriers in a stud wall or provided around openings may be formed of the following.

- Steel at least 0.5mm thick
- Polythene-sleeved mineral wool, or mineral wool slab, in either case under compression when installed in the cavity.
- Calcium silicate, cement based or gypsum-based boards at least 12mm thick.

The cavity barriers wherever possible be tightly fitted to a rigid construction and mechanically fixed in position. Where this is not possible the junction should be fire stopped. It is possible for door and window frames to be formed as cavity barriers is the frames are constructed of steel of the minimum thickness as appropriate.

12 External Fire Spread – External Wall and Roof Construction

BS9991 provides specific guidance based on building heights / type of occupancy and proximity to other buildings albeit this is not the most current guidance in relation to external wall combustibility and fire spread.

On this basis it is proposed to utilise the guidance in the amended Approved Document B 2019 as this is the most onerous guidance and is in line with current legislation; also, we must assess Regulation 7 of the Building Regulations relating to 'Materials and Workmanship' which outlines the general principals of materials being used being appropriate for the circumstances in which they are used and installed.

This guidance also has specific criteria to be applied for tall 'Relevant Buildings' in excess of 18m.

Table 19: Relevant Building Requirements – Regulation B4

Requirement Building Regulations B4	
External Fire Spread	
1.	The external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.
2.	The roof of the building shall adequately resist the spread of fire over the roof and from one building to another, having regard to the height, use and position of the building.

Table 20: Relevant Building Requirements – Regulation 7

Building Regulations - Regulation 7 Materials and Workmanship		
1.	Building work shall be carried out -	
	(a)	With adequate and proper material which -
	(i)	Are appropriate for the circumstances in which they are used,
	(ii)	Are adequately mixed or prepared, and
	(iii)	Are applied, used, or fixed so as adequate to perform the functions for which they are designed; and
	(b)	In a workmanlike manner.
2.	Subject to paragraph (3), building work shall be carried out so that materials which become part of an external all, or specified attachment, of a relevant building are of European Classification A2-s1, d0 or Class A1, classified in accordance with BSEN 13501 -1 2007 + A1 2009.	
3.	Paragraph (3) does not apply to	
	(a)	Cavity trays when used between two leaves of masonry:
	(b)	Any part of a roof (other than any part of a roof which falls within paragraph 4 of regulation 2 [6]) if that part is connected to an external wall;
	(c)	Door frames and doors;
	(d)	Electrical installations;
	(e)	Insulation and waterproofing materials used below ground level;
	(f)	Intumescent and fire stopping materials where their inclusion is necessary to meet the requirements of Part B of Schedule 1;
	(g)	Membranes;
	(h)	Seals, gaskets, fixings, sealants, and backer rods;
	(i)	Thermal break materials where their inclusion is necessary to meet the thermal performance requirements of Part L of Schedule 1; or
	(j)	Window frames and glass.

Building Regulations - Regulation 7 Materials and Workmanship		
4.	In this Regulation -	
	(a)	A 'relevant building' means a building with a storey (not including roof top plant areas or any storey consisting exclusively of plant rooms) at least 18m above ground level and which -
	(i)	Contains one or more dwellings;
	(ii)	Contains an institution, or
	(iii)	Contains a room for residential purposes (Excluding Hostels, Hotels or Boarding Houses); and
	(b)	"above ground level" in relation to a storey means above ground level when measured from the lowest ground level when measured from the lowest ground level adjoining the outside of a building to the top of the floor surface of the storey.

12.1 Fusion Requirements Relating to External Envelope/Wall

The Fusion requirements are believed to relate to all buildings, however, Fusion should confirm if they also apply to Building D.

Table 21: Fusion Standard Requirements

Component	Fusion Standard Requirement
Cladding	A1
Specified Attachments & Decorative Sections of Cladding	A2-s1,d0
External face of internal wall	A1
Insulation	A1
Insulation Below Ground	Exempt
Cavity trays	A2-s1,d0
Seals, gaskets, fixings, sealants, and backer rods	Exempt
Window frames and glass	Exempt
Louvres	A2-s1,d0
Balustrades / Guarding - As part of external wall [Does not include on a setback roof (3m+)]	A2-s1,d0
External signage	Exempt
Balconies [Incl Juliet]	A2-s1,d0
Curtain Walling [Dependant on sizing of framing and construction]	A2-s1,d0
Spandrels	A2-s1,d0
Brise soleil	A2-s1,d0
PV's on walls	A2-s1,d0
Membranes	B-s3,d0
Green Walls / Roofs - See 'Fire Performance of Green Roofs and Walls' & GRO Guide	GRO Guide

12.2 Combustibility of External Walls

Buildings B, C and D do not have a floor height in excess of 18m. Building A does have floors over 18m and would be deemed 'Relevant' as described in Regulation 7 and on that basis all materials which become part of an external wall, or specified attachment, of a relevant building will need to achieve a European Classification A2-s1, d0 or better, classified in accordance with BSEN13501 -1 2007 + A1 2009.

Based on Fusion requirements, Buildings B, C and D will also need to achieve Classification A2-s1, d0 or better.

There are some specific noted exceptions and areas to be taken note of in Paragraph 3 as noted within Table 20:but Approved Document B also provides additional guidance as noted below:

Membranes used within the external wall construction should have a minimum classification of class B-s3, d0.

- As per Regulation 7(3), window frames and glass (including laminated glass) are exempted from Regulation 7(2). Window spandrel panels and infill panels must comply with Regulation 7(2).
- Thermal breaks are small elements used as part of the external wall construction to restrict thermal bridging. There is no minimum performance for these materials. However, they should not span two compartments and should be limited in size to the minimum required to restrict the thermal bridging (the principal insulation layer is not to be regarded as a thermal break).
- While Regulation 7(2) applies to materials which become part of an external wall or specified attachment, consideration should be given to other attachments to the wall which could impact on the risk of fire spread over the wall.

The external walls of buildings as described in Regulation 7(4) of the Building Regulations should achieve the ratings as noted above and additionally assessments made as noted below:

- External Surfaces – Covered under Regulation 7(4) of the Building Regulations
- Materials and Products - Covered under Regulation 7(4) of the Building Regulations
- Cavities and Cavity Barriers – Guidance Contained in BS 9991 & Approved Document B.
- Additionally, from BS9991 – External balconies that are enclosed should be constructed and separated from other balconies with compartmentation and fire resisting construction in accordance with Annex D.

12.3 External Surfaces – Surface Spread of Flame

The surface spread of flame across the external surface of a wall is based directly on the type of building, proximity to site boundaries, height, and its occupants. These categorisations are used to address specific concerns e.g., taller buildings are more difficult for firefighting and have increased evacuation times; assembly buildings where the occupants are generally unfamiliar with the escape routes have increased evacuation times and where buildings are in close proximity to boundaries etc., they are at risk of rapid fire spread from adjacent buildings.

The surface spread of flame rating should be based on Table 12.1 of Approved Document B and the criteria noted above.

Table 22: External Surface Spread of Flame Provisions

Building Type	Building Height	Less Than 1000mm from the Relevant Boundary	1000mm Or More from the Relevant Boundary
Residential Building	18m or more	Class A2 – s1, d0 or better	Class A2 – s1, d0 or better
Residential Building	Less than 18m	Class A2 – s1, d0 or better	Class A2 – s1, d0 or better
Residential Building	Less than 11m	Class B – s3, d2 or better	No provisions

See Section 12.1 for Fusion Requirements.

12.4 Materials and Products

In relation to the compliance of the built-up system for combustibility we must assess the Approved Document B guidance but also as noted in this guide regardless of height and use a general assessment of combustibility of the building and any associated risks.

'12.4 In relation to buildings of any height or use, consideration should be given to the choice of materials (including their extent and arrangement) used for the external wall, or attachments to the wall, to reduce the risk of fire spread over the wall.'

This is also reiterated in Regulation 7 where the assessment should be based on the fact that materials should be appropriate for the circumstances in which they are used, prepared, and installed in a workmanlike manner.

Approved Document B and Regulation 7 have specific criteria for buildings that exceed 18m in height 'Relevant Buildings' i.e. Any cladding material, insulation product, filler material (not including gaskets, sealants and similar) etc. used in the external wall construction should be of limited combustibility [European Class A2 – s1, d0 or better] unless the wall is of masonry construction. Clause 18.2 BS9991:2015, Approved Document B and Regulation 7.

When assessing the current wall proposals based on the guidance noted in Approved Document B, 12.4 and Regulation 7 all products in the through wall build up should be Class A2 – s1, d0 or better.

12.5 Cavities Barriers and Fire Barriers

Cavities in the external walls provide a ready route for smoke and flame spread, additionally the smoke or flames would be concealed and presents a greater danger.

Cavity barriers /fire barriers should therefore be provided to sub-divide the cavities to restrict the spread of smoke and flame spread (See Section 10.1.3 and 11 above).

12.6 Roof Coverings

Roof covering refer to the external material layers, not the roof structure as a whole. The table below describes the separation distances from the boundary according to the type of roof covering as described within BS9991. The closest boundary is less than 6m.

Table 23: Classification of Roof Coverings

Designation of Roof Covering	Minimum distance from any point to Relevant Boundary			
	Less than 6 m	At least 6m	At least 12 m	At least 20 m
B _{Roof} (t4)	Acceptable	NA	NA	NA
C _{Roof} (t4)	Not acceptable	NA	NA	NA
D _{Roof} (t4)	Not acceptable	NA	NA	NA
E _{Roof} (t4)	Not acceptable	NA	NA	NA
F _{Roof} (t4)	Not acceptable	NA	NA	NA

The worst-case boundary is approximately 2.1m and on this basis the roof should achieve B_{ROOF}(t4).

12.6.1 Photovoltaic Panel Arrays

Not specifically mentioned in the Building Regulations if PV arrays are to be included on the roof areas, although these are generally not a controlled item, consideration should be given to:

- Locations of inverters and their installation in proximity to combustibles.
- Localised shut off for the panels as the DC sections will still be live in sunlight and this can cause issues for firefighting.
- Do not allow mounting systems for PV panels to straddle heat expansion joints.
- Careful planning is required and assessment of substrates when mounting arrays over fire separating construction or fire compartment walls.
- The layout of the panels on the roof should be such that areas of panels are separated by panel-free areas so that effective firefighting is possible. This will allow firefighters to open the roof to allow both internal and external attack on a fire.
- PV panels on the roof can prevent the dissipation of heat and smoke; additionally, the spread of the fire may be accelerated by a chimney effect beneath the panels. Careful consideration should be given to breaks within extensive arrays to allow dissipation of heat and smoke.

13 External Fire Spread – Space Separation

To prevent the risk of external fire spread to and from adjacent buildings it is necessary to assess the façade and calculate the maximum area of that façade that is allowed to remain unprotected [Non-Fire Rated] based on the maximum radiating panel that could be involved in a fire.

To calculate the maximum unprotected area, we have used the enclosing rectangle method from BR 187 (second edition) to assess the space separation requirements.

13.1 Relevant Boundaries

When considering the boundary distances for assessing external fire spread between neighbouring buildings 'Relevant Boundary' distances need to be established to accurately calculate the areas requiring protection. There are two types of boundaries which can be considered, these are:

- Site boundary – where the site boundary is adjacent public roads, pathways, train tracks or waterways the boundary can be extended to the mid-point of that feature.
- Notional boundary – this is an imaginary line drawn between two buildings on the same site. This occurs between all of the buildings on the site.

The relevant boundaries are noted below.

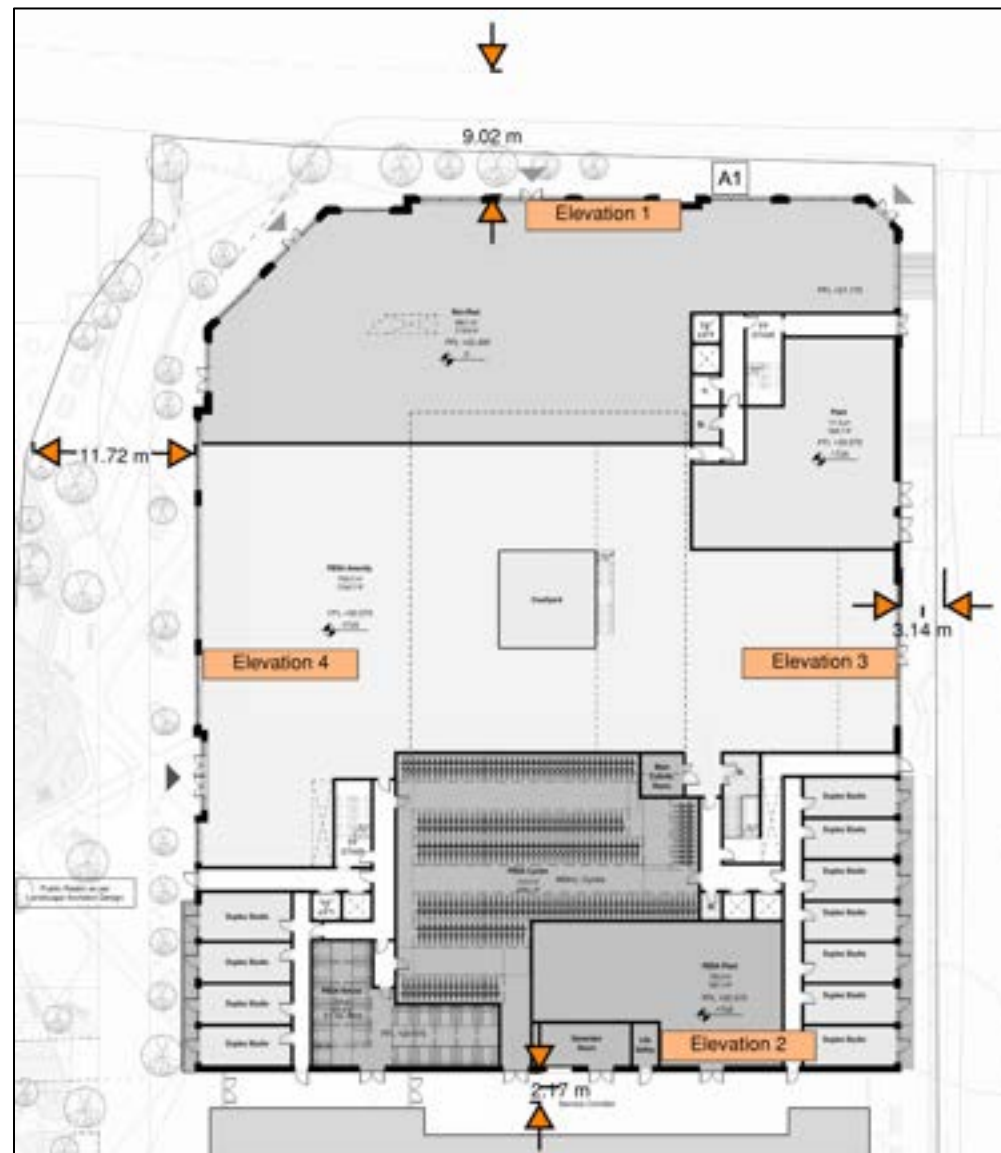


Figure 77: Relevant Boundaries Building A

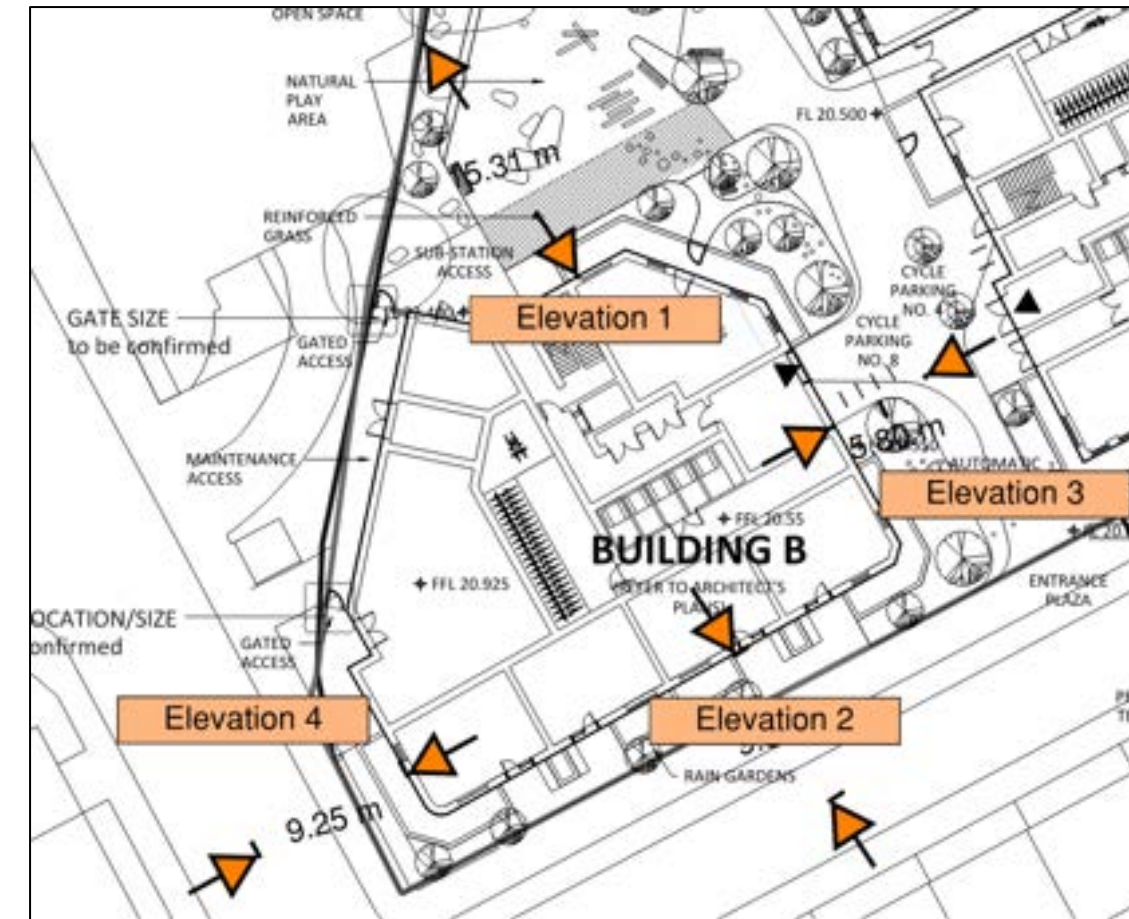


Figure 78: Relevant Boundaries Building B

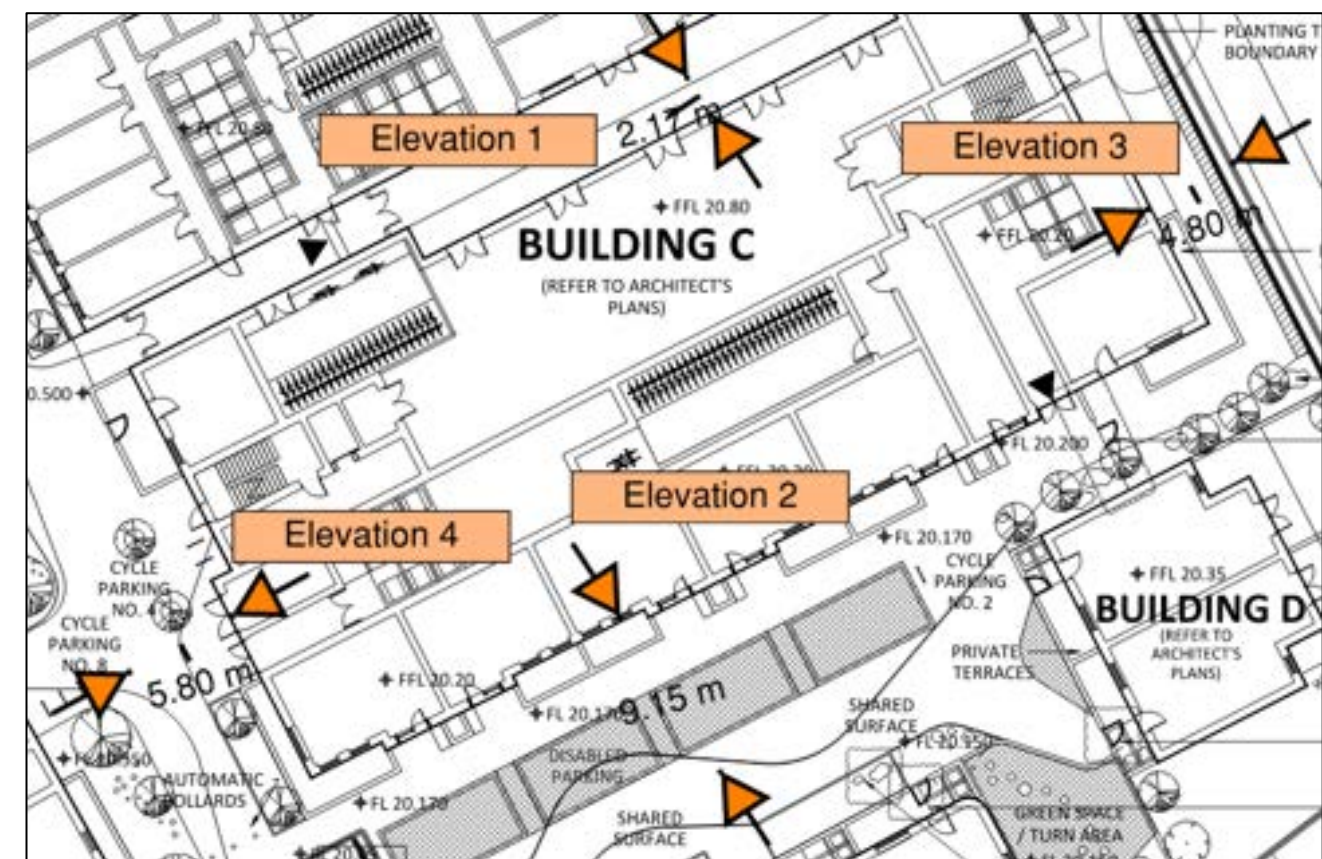


Figure 79: Relevant Boundaries Building C

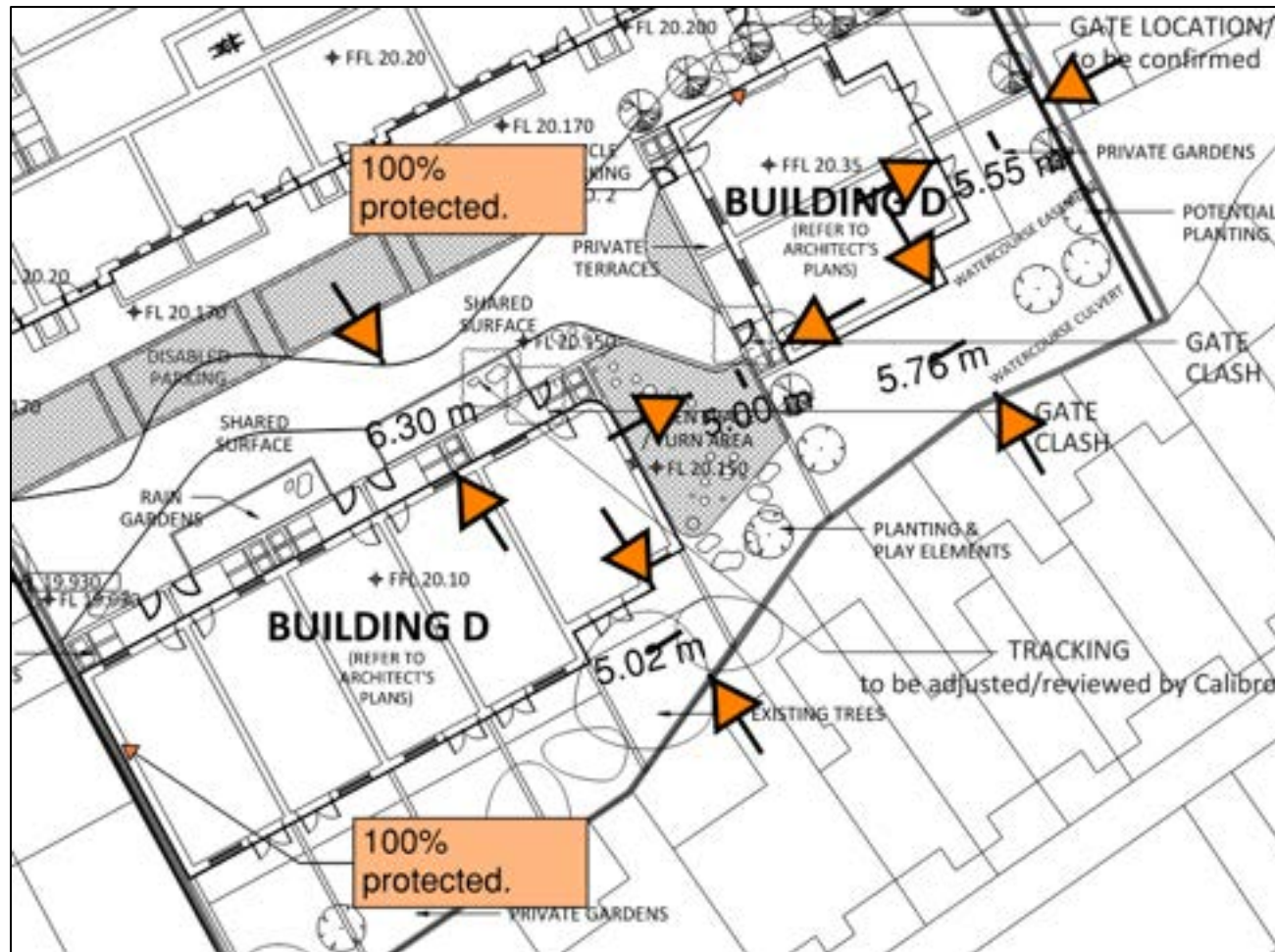


Figure 80: Relevant Boundaries Building C

13.2 Space Separation

The allowable amount of unprotected area on the elevations has been calculated by using the BR 187 Enclosing Rectangle method, this method is based on the distance to the relevant boundary and size of the smallest rectangle which encloses all the unprotected areas within a single compartment on each elevation.

Unprotected areas are considered to be the following.

- Any part of the external façade that has a period of fire resistance less than the appropriate level noted within Section 9.2.
- Included within the unprotected area calculation is any section of the external wall which has a combustible material more than 1mm thick as its external surface. 50% of the total area should be counted as unprotected.

The following does not contribute to the unprotected areas.

- Any part of the external wall of a stairway in a protected shaft (same fire resistance as Section 9.2).
- Small, unprotected areas in a fire rated façade in accordance with BS9991.

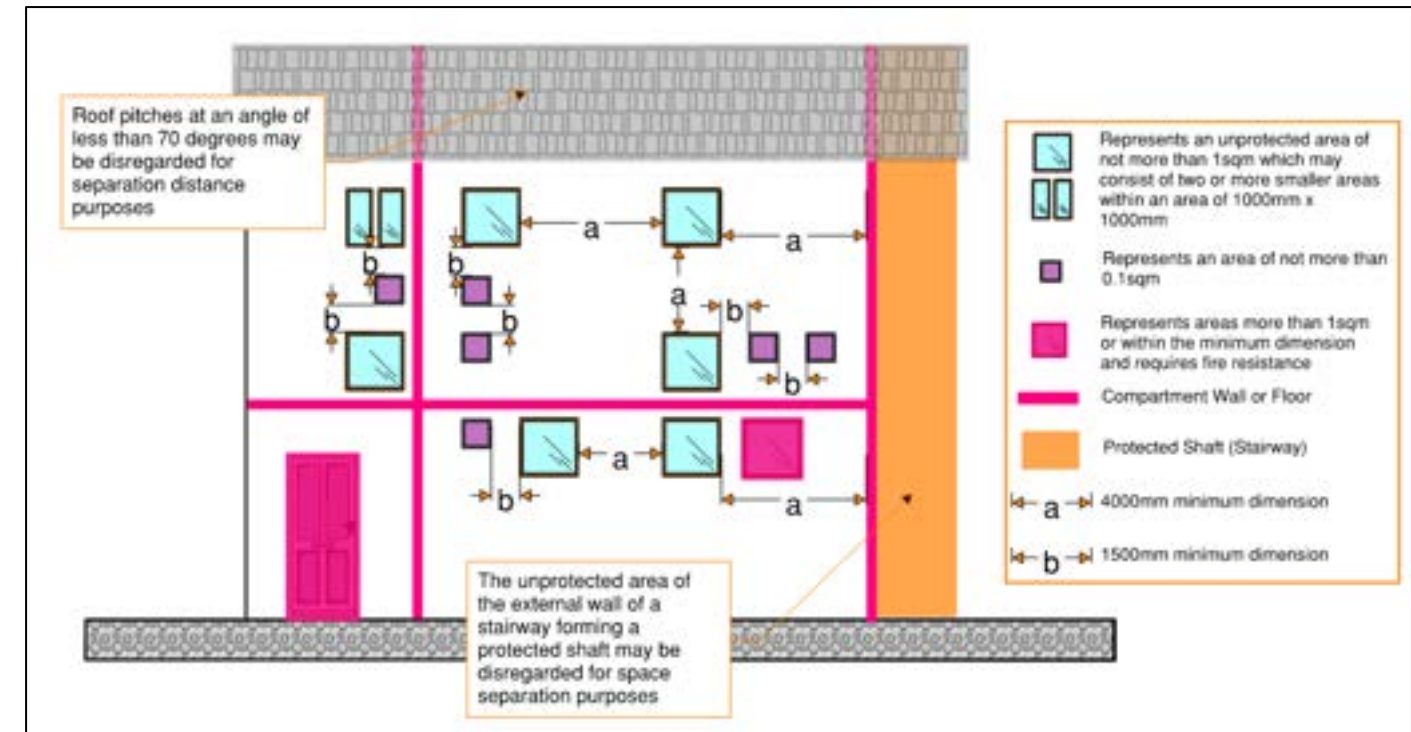


Figure 81: Small Allowable Unprotected Areas

Initial calculations have been carried out based on the following assumptions.

- Calculations are based on a radiation intensity of 84 kW/m²
- With the provision of AWFSS, the allowable unprotected area can be doubled for Buildings A, B and C.
- The worst-case compartments will be calculated to start, which will be reflected across all the other compartments on the elevations. *Where protection is required, these will be further developed within the next design stage.*
- Compartment floors are provided at all floors other than Building D.
- Every apartment is considered an individual compartment.

13.2.1 Space Separation Calculations

Below are typical compartments that have been calculated to determine whether the openings on the facades meet the allowable unprotected area from BR187.



Figure 82: Building A Elevation 1



Figure 85: Building A Elevation 4

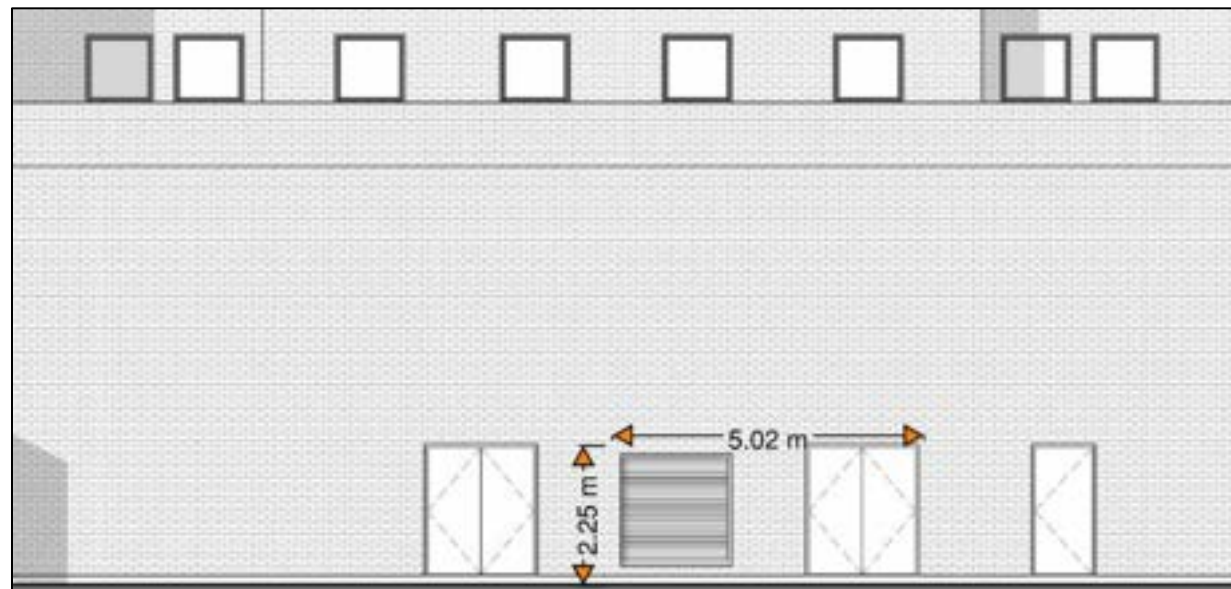


Figure 83: Building A Elevation 2

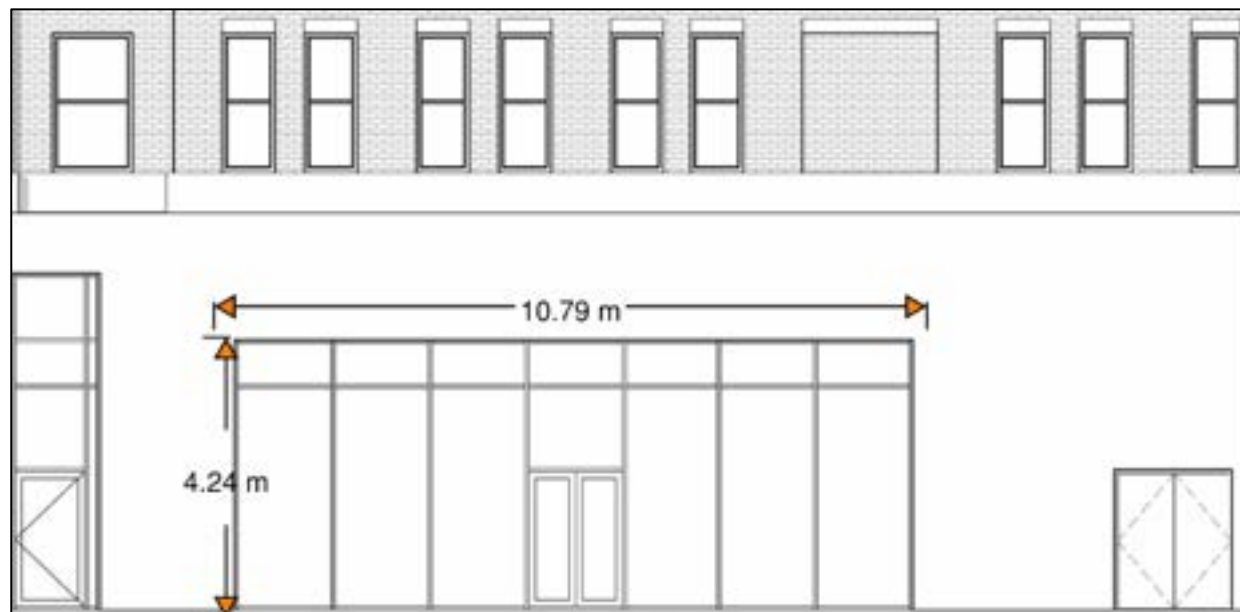


Figure 84: Building A Elevation 3

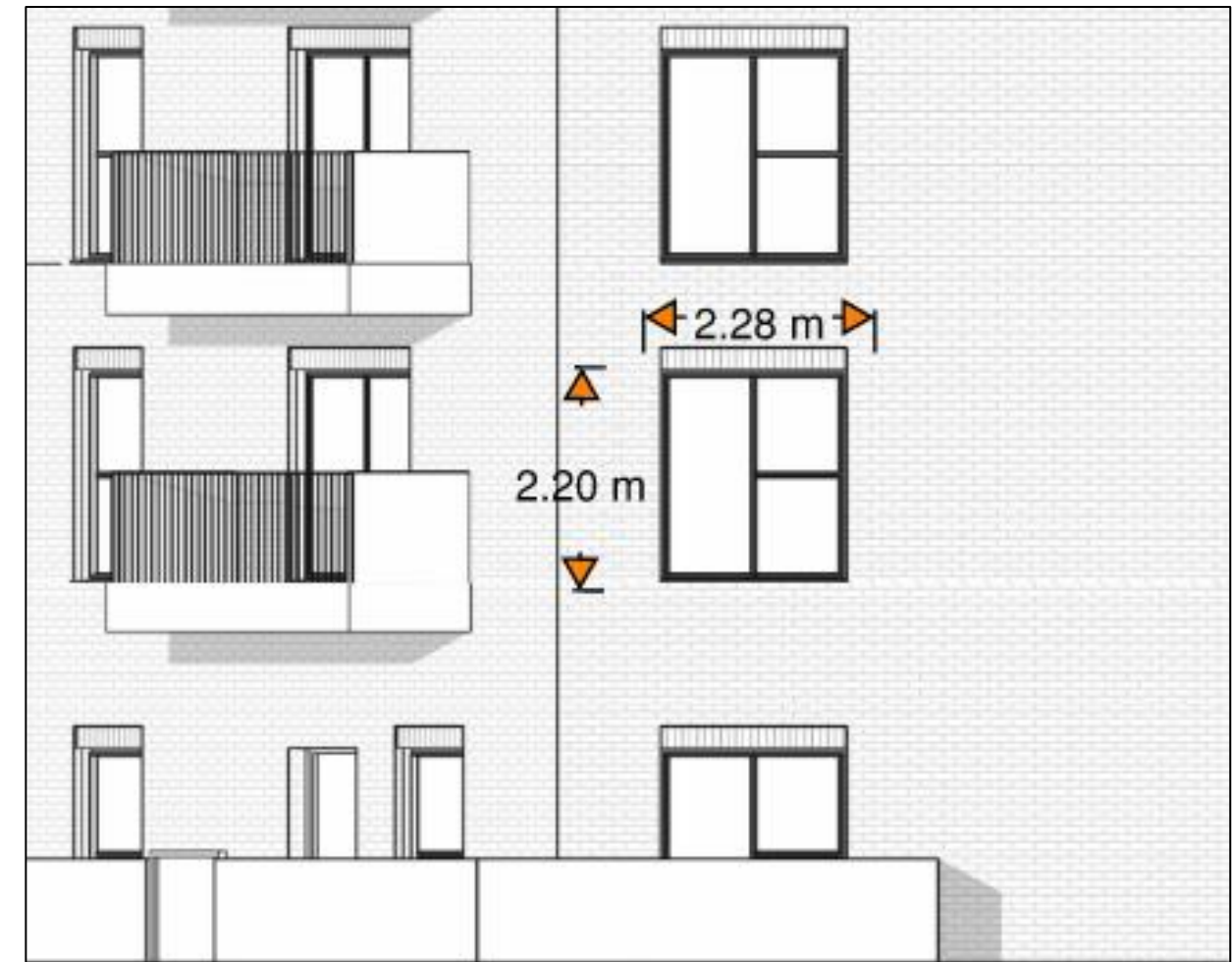


Figure 86: Building B Elevation 1



Figure 87: Building B Elevation 2



Figure 89: Building B Elevation 4

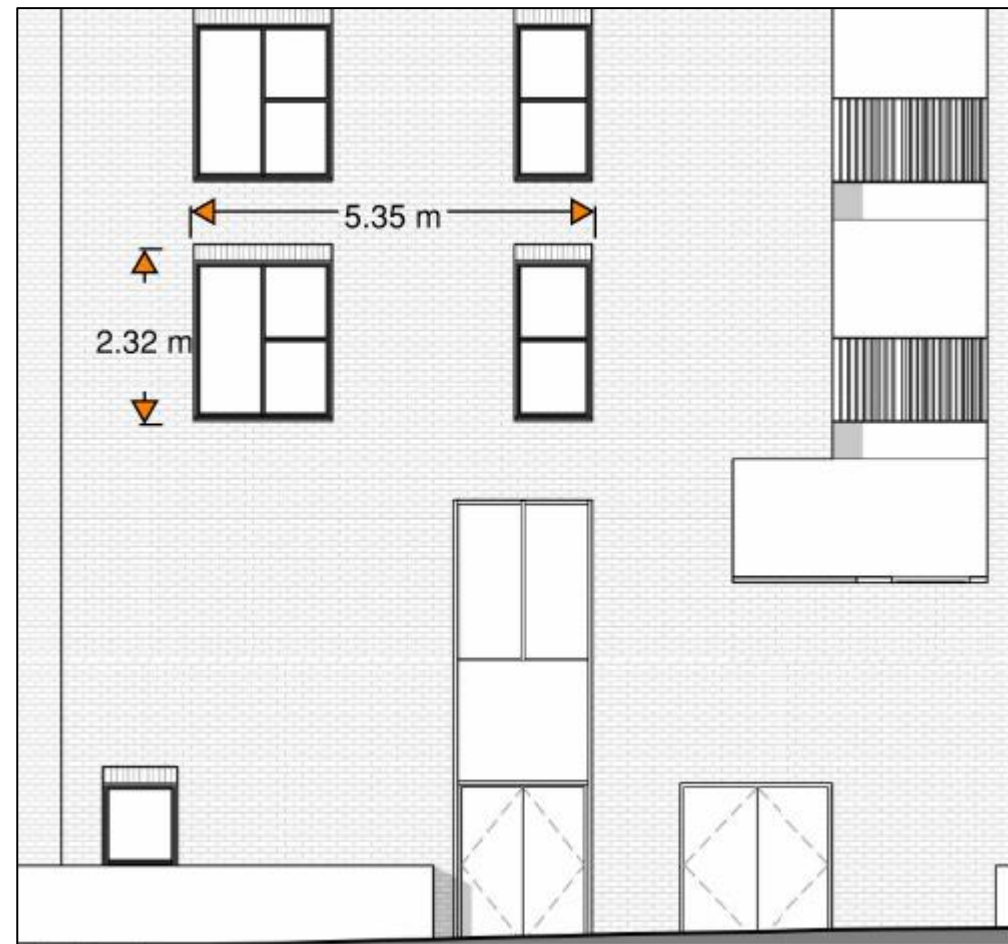


Figure 88: Building B Elevation 3

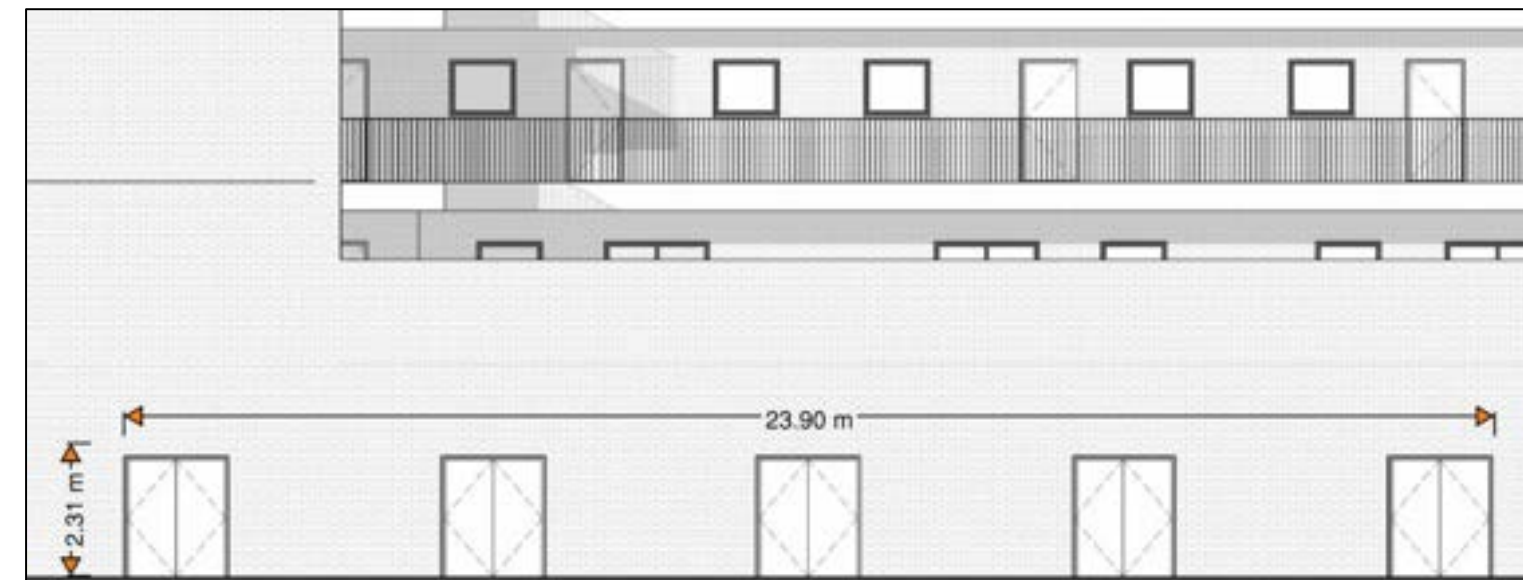


Figure 90: Building C Elevation 1



Figure 91: Building C Elevation 2



Figure 93: Building C Elevation 4

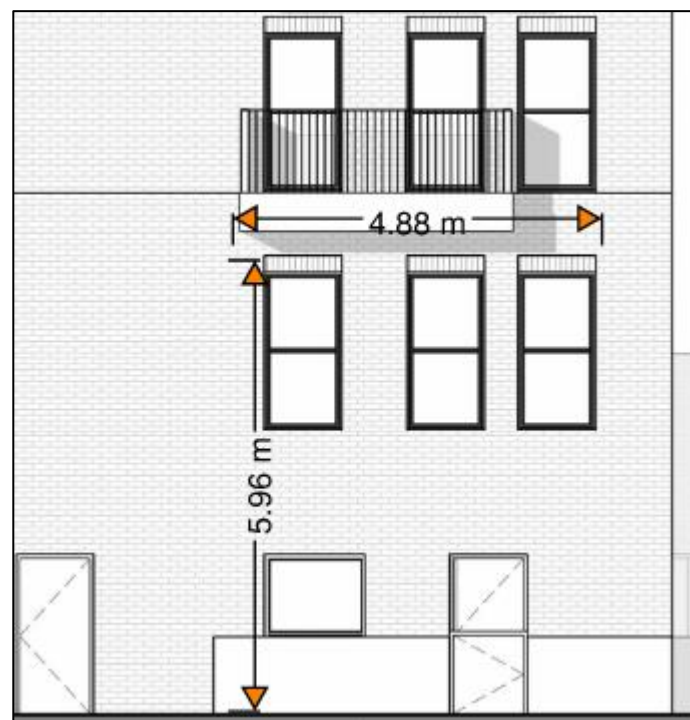


Figure 92: Building C Elevation 3

Table 24: Space Separation Calculations

Elevation/ Compartment Assessed	BR 187 Enclosing Rectangle	Required Boundary Distance for 100% UPA Note 1	Actual Boundary Distance (Approx)	Allowable Unprotected Area	Comments
Building A1	6 x 50	7.5m	9.02m	100%	Assessed base on 168kW/m ² No restrictions in regard to boundary
Building A2	3 x 6	1.5m	2.17m	100%	No restrictions in regard to boundary
Building A3	6 x 12	2.75m	3.1m	100%	No restrictions in regard to boundary
Building A4	6 x 40	4.25m	11.7m	100%	No restrictions in regard to boundary
Building B1	3 x 3	1m	15.31m	100%	No restrictions in regard to boundary
Building B2	6 x 6	2m	9.54m	100%	No restrictions in regard to boundary
Building B3	3 x 6	1.5m	5.8m	100%	No restrictions in regard to boundary
Building B4	3 x 6	1.5m	9.25m	100%	No restrictions in regard to boundary
Building C1	3 x 24	2.25m	2.17m	90%	The plant room will be split into smaller compartments so that a residential sprinkler system can be used. This will then allow for a 100% unprotected boundary.
Building C2	6 x 9	2.5m	9.15m	100%	No restrictions in regard to boundary
Building C3	6 x 6	2m	4.8m	100%	No restrictions in regard to boundary
Building C4	6 x 6	2m	5.8m	100%	No restrictions in regard to boundary

Note 1: Required boundary distance has been halved on the basis of AWFSS.

As per the plan below Building D has two elevations that are required to be 100% protected as they are situated on the boundary. The other elevations can all be 100% unprotected without the provision of sprinklers. The largest elevation for a dwelling in Building D would accommodate an enclosing rectangle of 6m x 9m which would require a boundary of 5m to be 100% unprotected; this distance is exceeded.

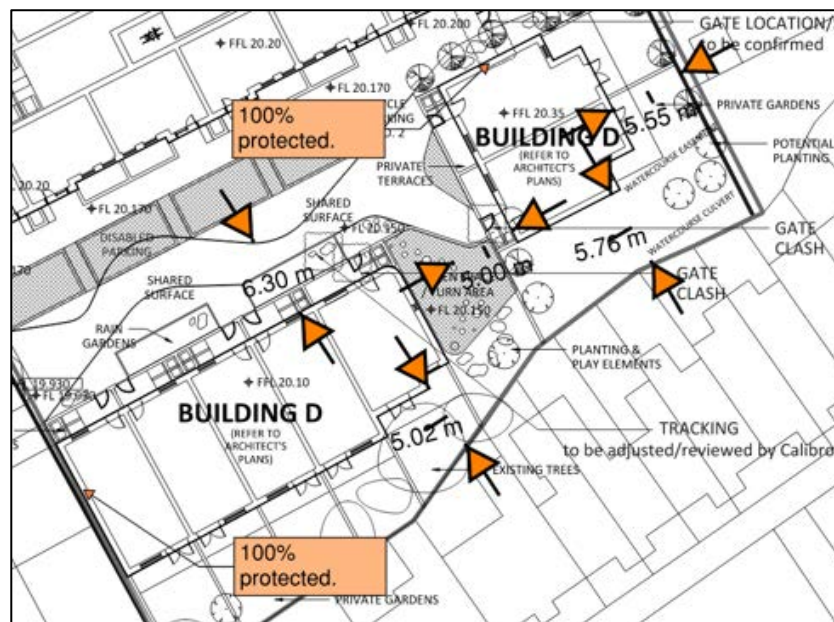


Figure 94: Building D

14 Fire Safety Management

14.1 Management Level and Requirements

14.1.1 Management

Fire safety management is an essential factor in achieving and maintaining suitable fire safety measures in premises. The fire safety design guidance assumes a suitable level of fire safety management.

It is assumed that the end user has adequate management structure which means that the management will conform with the minimum requirements the legislation. However, fire risk management documentation is likely to exist at two levels:

- Fire risk management at an organisational level.
- Fire risk management at a premises level.

The fire risk management strategy at an organisational level will define the organisation's fire risk management system, and method of implementing policy.

14.1.2 Fire Risk Management Strategy

The fire safety manager / nominated person to monitor and control management of fire safety should define the organisation's fire risk management system, and method of implementing the overarching policy within a fire risk management strategy. The subsequent bullet points below are not an exhaustive list but highlight some of the key issues that need to be addressed when documenting a fire risk management strategy.

- **Fire Risk Assessment** – Those responsible for the design and construction of the building should provide fire safety information to the responsible person at the completion of the project or when the building or extension is first occupied. A pre-occupation fire safety assessment should be made in identifying the fire safety strategy provisions have been implemented and if the premise is likely to be fit for occupation. Thereafter, regular fire risk assessments should be undertaken, any alterations / refurbishments to the building should trigger a review of a fire risk assessment in determining if the current fire precautions present are adequate in accommodating the change.
- **Resources and Authority** – Any resources necessary to implement, maintain and improve the fire risk management system should be determined. In determining the necessary resources, account should be taken of the organisational hierarchy, the role of the fire safety manager and communication and collaboration with other users of the building. In order to ensure robustness, those with fire safety responsibilities should be empowered and given adequate resources to carry out their duties in maintaining the system.
- **Fire Safety Training** – A sufficient number of staff should be trained in fire prevention, fire protection and evacuation procedures, and be able to use the appropriate extinguishing equipment (and media). This is in order to provide full coverage of the building, with provisions in place for contingencies such as staff absences.
- **Control of Work on Site** – The means by which the end user / occupier will control work on site should be determined, e.g., repairs to structure, and in particular hot work. A work control system should include clear lines of responsibility communicated to contractors; a permit system which takes in account the risks to relevant persons; logging and work control audit processes; and routing checking and supervision.
- **Maintenance and Testing** – Processes should be in place for the maintenance and testing of fire safety systems.
- **Communication** – It is important to determine the need for internal and external communication procedures, this is to ensure that all of those involved in an incident, are provided rapidly and effectively the relevant information. These procedures should include defined lines of communication of significant findings arising from fire risk assessments and should stress the importance of maintaining fire safety information.

- **Emergency Planning** – Procedures for identifying and responding to unplanned events, potential emergencies / disasters should be established, documented, and maintained. Where fire is concerned, liaison with the fire and rescue service should include emergency shutdown of equipment, effective arrangements for notifying the fire and rescue service of changes to the occupancy, periods of abnormal occupancy, fire growth characteristics, and another relevant factor. The arrangements should also consider post-incident plan and contingency plan.
- **Designing fire risk management into buildings** – The management system level proposed should be proportionate to the level of risk arising from the organisation's activities. Confirmation of its suitability should be sought from the owner / end user / nominated representative(s) to ensure that the designer specifies a management system that can be practically and physically managed post-handover.

14.1.3 First Aid Firefighting Provisions

Hand-held first aid firefighting provisions, which are not required under Building Regulations legislation, should be included to satisfy the requirements of the RR(FS)O in accordance with the end user's policies and fire risk assessment. Where provided, a fire point should be located towards each storey exit and suitable facilities associated with identified risks.

For guidance on provision of firefighting equipment reference should be made to BS5306-8:2012.