



Developed for:
Bellway Homes

Detailed Fire Safety Strategy

Comag Works

West Drayton
London

Issue 05
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Detailed Fire Safety Strategy

Comag Works West Drayton
London

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The checker has provided an internal review of the technical content of the report.

The approver confirms the report has received quality assurance in accordance with the principles of ISO 9001 and authorises external release of the document on behalf of Ashton Fire.

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EXECUTIVE SUMMARY

Ashton Fire has been commissioned by Bellway Homes to provide fire safety consultancy services for the proposed residential development located in London, West Drayton.

This document details the fire safety strategy design as developed for the scheme, intended to assist the design team in progressing the detailed fire safety provisions for the project through to construction. This report may also be submitted to the building control body in support of the projects’ Building Regulations submission.

This report (Issue 05) is also intended to support the planning application for which comments from London Fire Brigade have been received. This is discussed in Section 1.4.

This fire safety strategy details the minimum fire safety provisions required for the proposed development to meet the functional requirements of the Building Regulations 2010 (as amended). This has been achieved by applying the prescriptive recommendations for life safety contained within Approved Document B Volume 1 and BS9999 in the first instance. The strategy has not been developed to include specific measures for the protection of property. However, features included for life safety will to some extent contribute to property protection and continuity of use following a fire.

Apart from where noted in this report, the design will be in accordance with the recommendations of ADB. The key fire safety challenges and / or variations from the prescriptive guidance documents are identified in Summary Table 1. These items constitute a project risk until they are discussed and agreed with the relevant authorities having jurisdiction (AHJs).

The proposed works is a residential development comprising two blocks, with each being of various heights and no. of storeys. The proposal is to provide 105 new homes with a mix of flats and maisonettes. There will be a car park at ground floor that will consist of 50 spaces.

There will be two blocks present across the development, Block A and Block B/C, Block A will be standalone and will form no connections with any ancillary areas. Block B/C will be connected on the upper floor levels, Core B and Core C will form connections with the car park at ground floor level.

There will be three stairs serving the development, a single escape stair serving Block A and two firefighting stairs serving Block B/C, the firefighting stair in Core B terminates at the sixth floor with Core C extending to the roof. Block B/C cores will also each have a firefighting lift, in addition to this there will be three evacuation lifts provided: one in each core.

Within the development there will be three refuse stores, three LV stores, four cycle stores, two substations and two sprinkler / tank room. All ancillary accommodation is located at Ground Floor level.

At First Floor level, an external podium which shall include a gym area and play area, open to air, is provided. An enclosed car park is located beneath the podium at Ground Floor level which is accessed via protected lobbies which connects to the residential entrance lobby. The podium is accessible from the residential block B and C.

The upper floors will be served by three cores, all three cores will be provided with an escape stair and an evacuation lift. There is also a roof terrace located, this is served by Core C and an external stair which leads into Core B.

The top floor height of the building, measured from the adjacent ground level to the finished floor level of the topmost occupied storey is approximately 22.1m.

A defend-in-place evacuation regime is utilised for each residential unit, while a simultaneous evacuation would occur from the ancillary areas and the residential roof terrace. The flats will be provided with an automatic fire detection and alarm system, while the common and ancillary areas will feature central fire detection in support of the smoke control system.

Natural and mechanical smoke ventilation systems will be provided to the residential corridors, protected lobbies and lift lobbies to protect the escape stairs and evacuation lifts. A 1.0m² AOV will be provided at the head of each stairway.

An automatic suppression system will be provided throughout all areas of the building, as it has a top storey more than 11m above ground level.

All elements of structure will be designed to achieve a 90-minute fire resistance and all floors will be designed as 90-minute compartment floors (except for internal floors within maisonettes).

External elevations of the building should be designed to comply with Regulation 7(2), as it will incorporate residential storeys more than 18m above ground level.

Vehicular access for the fire and rescue service shall be provided via Tavistock Road to the development to within 18m and within sight of each dry riser inlet located on the face of the Blocks B/C. However, access to the dry riser inlet of Block A has an extended distance of 10m from the recommended 18m (26m to dry riser inlet).

Access will be provided internally via the general circulation routes, escape stairs and firefighting shafts. Block A will be provided with a dry fire man and an escape stair and Block B/C being provided with a firefighting lift, a firefighting stair and dry fire main to each core (Core B & C).

Sufficient coverage will be provided internally to all areas on the floorplate, when measured on a hose laying route from a fire main outlet located within escape stair and firefighting shafts. Access to the ground floor ancillary spaces and maisonettes will be provided externally, via perimeter doors.

Suitable water supplies to support firefighting operations will be provided via fire hydrants sited so that they are within 90m of a building entry point and within 90m of a dry riser inlet.

To facilitate ease of review, the proposed fire safety systems are outlined in Summary Table 2.

Summary Table 1 – Key fire safety strategy challenges

Item	Description	Ref.
Extended travel distances	The residential corridors of Block A features extended travel distances in excess of the recommendations in ADB. It is proposed that the common corridors are provided with mechanical ventilation systems, which has been substantiated by CFD modelling.	3.3
Evacuation lift lobby design	On each upper floor of Block B/C, a fire engineered solution shall be employed in support of the evacuation lift lobby design.	3.4.4
External fire spread	The venting strategy for the neighbouring Red Row site is unknown and there are ventilation openings close to the ground floor car park, however due to the provision of sprinklers and close to the ventilation opening façade being protected, this would be considered reasonable as a defensive measure for external fire spread.	7.4.9 and Figure 18

Extended hose length	Hose laying distances exceed the maximum recommendations of ADB.	8.2
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Summary Table 2 – Fire safety systems

Item	Description	Ref.
Fire detection and alarm systems	Grade D Category LD1 to BS 5839-6 within flats. Common residential areas (i.e., lift lobby) provided with a Category L5 system to BS 5839-1. The ancillary areas and car park will be provided with a minimum L2 system, and the non-residential areas will be provided an L3 (m) system with both conforming to BS 5839-1. Sounders will be provided to the podium and roof terrace.	3.1
Sprinkler systems	A category 4 sprinkler system conforming to BS 9251 will be provided within the residential areas. Non-residential areas in excess of the maximum floor areas detailed in Tables 3 and 4 of BS 9251, will be provided with a sprinkler system in accordance with BS EN 12845. The car park will be provided with a (minimum) Category OH2 sprinkler system in accordance with BS EN 12845.	3.2
Smoke control systems	Automatic smoke ventilation will be provided to the lift lobbies, protected lobbies separating stairs from common residential corridors and escape/firefighting stairs. A 0.4m ² permanently ventilated lobby or a mechanical alternative will separate the non-residential spaces from the residential areas (i.e., the car park). A natural smoke ventilation system in accordance with BS 7346-7 will be provided to the car park. Each stair will be provided with a 1.0m ² AOV at the head of the staircase.	3.3 - 3.5
Evacuation alert systems	An evacuation alert system will be provided in accordance with BS 8629.	3.7
Firefighting lift	A lift which will be designed as a firefighting lift should be provided conforming to BS EN 81-72.	3.8
Evacuation lift	A type 2 evacuation lift will be provided in accordance with BS EN 81-70.	3.9
Emergency lighting	Emergency lighting will be provided through occupied areas and escape routes.	3.11
Fire safety signage	Fire safety signage will be provided in accordance with Section 3.45 of ADB Vol.1. Firefighting wayfinding signage to meet updated recommendations in ADB.	3.12
Emergency voice communication systems	Each protected refuge space shall be provided with an EVC system with a Type B outstation.	3.14
Stand-by power	Suitable back-up supplies to all fire safety systems in accordance with BS 8519.	3.15

Item	Description	Ref.
Rising mains	A dry riser main provided within the escape stair and firefighting shafts will be designed in accordance with BS 9990.	8.3.5
Water supplies	Hydrants to be provided within 90m of a building entry point and within 90m of each dry riser inlet.	8.4

1. INTRODUCTION

1.1 General

- 1.1.1 Ashton Fire have been commissioned by Bellway Homes to provide fire safety consultancy services on the proposed Comag works development.
- 1.1.2 This document is confidential and for the exclusive benefit of Bellway Homes (the Client). It may not be assigned to or relied upon by a third party without agreement of Ashton Fire Ltd (Ashton Fire) in writing. Ashton Fire retains all copyright and other intellectual property in the document and its contents unless transferred by written agreement between Ashton Fire and the Client.
- 1.1.3 Following full coordination and implementation, this strategy report may be used to support the end user of the building in the development of any fire safety management procedures and plans considered necessary to fulfil their responsibilities under the Regulatory Reform (Fire Safety) Order 2005 (FSO) and any other applicable fire safety legislation.
- 1.1.4 This document is not intended to portray detailed design information for fire safety systems or construction specifications. As a strategic document supporting and informing the wider design, it should be read in conjunction with the wider project design documentation.
- 1.1.5 It should be noted that any alternative design solutions proposed within this report are subject to agreement and subsequent approval by the relevant authorities having jurisdiction (AHJs).
- 1.1.6 This report (Issue 05) is intended to support the planning application for which comments from London Fire Brigade have been received. This is discussed in Section 1.4.

1.1 Legislation and basis of design

- 1.1.1 Fire safety in buildings is mainly governed by two primary pieces of legislation in the UK. The Building Regulations 2010, Part B (fire safety) applies to building design, whilst for fire safety management in buildings, compliance with the Regulatory Reform (Fire Safety) Order 2005 (FSO), including new duties introduced as part of the Fire Safety (England) Regulations 2022 (FSR), is required.
- 1.1.2 This strategy has been developed to meet the level of fire safety expected under the Building Regulations 2010 (as amended), which are set out under Part B, namely:
 - B1 – Means of warning and escape
 - B2 – Internal fire spread (linings)
 - B3 – Internal fire spread (structure)
 - B4 – External fire spread
 - B5 – Access and facilities for the fire and rescue service
- 1.1.3 The building will have a top storey more than 18m above ground and will contain one or more dwellings, and it will therefore be classified as a 'relevant building' under Regulation 7(4).
- 1.1.4 The fire safety strategy will be developed to satisfy the requirements for fire safety as set out by the Building Regulations. The strategy has not been specifically developed to address property protection or insurer's requirements. However, the features that are included for life safety, as required by the Building Regulations 2010, will contribute in some extent to business and property protection.
- 1.1.5 In general, the necessary level of life safety will be achieved utilising the guidance in Approved Document B Volume 1 (ADB Vol.1) [1] within the residential areas, BS 9999:2017 [2], for the non-residential parts and documents referenced therein in the first instance.

- 1.1.6 Fire engineering principles may be employed to support alternative solutions where strict adherence to the guidance would conflict with the wider aspirations for the scheme. Unless otherwise stated, it is expected that all aspects of the design will be in accordance with Approved Document B, applicable British Standards and codes of practice.
- 1.1.7 On the basis that recommendations made within the guidance documents are followed, it is considered that the life safety requirements of the Building Regulations 2010 (as amended) will be satisfied, and that an adequate level of fire safety will be provided throughout the premises.
- 1.1.8 Where departures from the guidance documents are identified, alternative proposals (including associated analysis) are documented for facilitating review with the project's approvers. In accordance with the fire safety engineering principles detailed in the PD 7974 [3] codes of practice, it is considered appropriate that all fire precautions are determined based on there being one seat of firer.
- 1.1.9 Unless specifically covered in this report please refer to the adopted design guidance for further details.

1.2 Construction, Design and Management (CDM) Regulations 2015

- 1.2.1 The strategy has been developed in cognisance of the Construction (Design and Management) Regulations 2015 (CDM 2015) [4], which sets out what designers are required to consider to protect anyone involved in the construction or ongoing use of a project. A summary of management and maintenance issues are provided in Section 9.
- 1.2.2 This strategy does not provide a comprehensive assessment of site fire safety during the building works or the phasing of these works. The Fire Protection Association and the Health and Safety Executive (HSE) issue guidance on identifying and managing fire precautions during the works, which should be consulted by the contractor or their specialist advisor when developing their construction fire safety plan.

1.3 The London Plan – Policy D12

- 1.3.1 The London Plan sets out various planning requirements to be applied to new and refurbished buildings. It contains relevant policies for fire safety that have been considered as part of the planning application for the development at RIBA Stage 3, such as Policy D5 and Policy D12 (A and B).
- 1.3.2 A separate document has been prepared as the Fire Statement that is referenced in Policy D12 and has been submitted as part of the planning application. This report provides further detailed design information based on the principles developed at the previous stage. However, as this document is intended to serve as strategic guidance, detailed design information such as the methods of construction or the selection of specific products will not be included within this document and can be obtained from other members of the design team.
- 1.3.3 In accordance with Policy D5 (Inclusive Design) of the London Plan, safe and dignified emergency evacuation is required to be incorporated into the building for all building users. As this building shall have passenger lifts installed, the aforementioned policy stipulates that a suitably sized lift should be provided for evacuation. Where a firefighting lift is to be installed (due to the height of the Block exceeding 18 m), the evacuation lift will be installed in addition to the firefighting lift. Therefore, three evacuation lifts (one in each of blocks A, B/C) in addition to two fire-fighting lifts (in blocks B/C) will be installed within the Blocks. Fire evacuation lifts and associated provisions should be appropriately

designed and constructed and should include the necessary controls suitable for the purposes intended. Furthermore, the operation of the lifts should be supported by appropriate management procedures. The end client shall need to understand and provide a suitable management plan for the evacuation lifts within the building.

1.3.4 In accordance with Clause 3.12.9 of Policy D12 of the London Fire Plan, Fire Statements are to be produced by qualified engineers with relevant experience in fire safety such as a chartered engineer or suitably qualified and competent professionals with demonstrable experience to address the complexity of the design being proposed. The relevant experience of the authors and authorisers of this document are displayed in the table below.

1.3.5 As this document is a performance-based strategic document which is used to inform other members of the design team. As such, when reviewing the Policy D12 requirements, this document should be read in line with other supporting documentation produced by other members of the design team.

Table 1 - Qualifications and relevant experience

Name	Role	Academic qualifications	Membership of professional bodies	Relevant experience
Liam Kelly	Fire Engineer	BEng (Hons) Fire Engineering	Associate Member with the Institute of Fire Engineers (AIFireE) Member of the Society of Fire Protection Engineers (MSFPE)	2 years' in the design of fire strategies for residential buildings including high-rise buildings.
David Connaughton	Senior Fire Engineer	MEng (Hons) Mechanical and Manufacturing Engineering	Associate Member with the Institute of Fire Engineers (AIFireE)	9 years' experience as a consultant fire engineer with experience in the design of fire safety strategies for commercial, residential and high-rise buildings in Ireland and the UK.

1.4 London Fire Brigade Comments on planning application

1.4.1 LFB comments received on the planning submission in letter dated 3rd November Ref: 24843/APP/2024/2656 are addressed in Table 2 below.

Table 2 - LFB Consultation comments

LFB Comment	Ashton Fire response
<p>It should be ensured that the roof coverings are in accordance with table B2 of Approved Document B: 2019, with substrate depths provided as necessary.</p> <p>Furthermore, it should be confirmed that, where no permanent irrigation system is installed, the organic content is limited to less than 20% of the growing medium and peat free organic material is used.</p> <p>Please also note the requirements for fire breaks on green roofs which should be provided around perimeters, openings and every 40 metres on larger roofs.</p>	<p>Roof coverings are addressed in Section 7.2 of this report which is based on the recommendation of Approved Document B (Vol. 1). Green roofs are addressed in Section 7.3 (with new bullet point to address irrigation requirements.</p> <p>The recommendations in the abovementioned sections shall be followed and incorporated in the design of the roofs by the relevant design team members, e.g. architects and specialist designers.</p> <p>The green roof will also be subject to ongoing maintenance, to be included in the management plan. Please also note Section 1.3.5.</p>

1.5 Reference information

1.5.1 This detailed fire strategy is based on information provided by the design team to Ashton Fire as listed in Table 3. Additional contradictory information or subsequent design variations to the information supplied may render the findings and recommendations of this report invalid.

1.5.2 The figures used within this report are indicative and used to express the principles of the fire safety strategy. They may not be representative of final arrangement. The principles contained within this report are required to be maintained through any design amendments during the life of the building.

Table 3 - Project documentation referenced

Description		Reference	Rev.	Author
Fire Strategy Drawings	Ground Floor	71805-BM3-XX-L0-DR-A-500	C1	BM3
	First Floor Plan	71805-BM3-XX-L1-DR-A-501	C1	
	Second Floor Plan	71805-BM3-XX-L2-DR-A-502	C1	
	Third Floor Plan	71805-BM3-XX-L3-DR-A-503	C1	
	Fourth Floor Plan	71805-BM3-XX-L4-DR-A-504	C1	
	Fifth & Sixth Floor Plan	71805-BM3-XX-ZZ-DR-A-505	C1	
	Seventh & Eighth Floor Plan	71805-BM3-XX-ZZ-DR-A-506	C1	
	Site Plan	71805-BM3-XX-ZZ-DR-A-507	C1	
LFB Consultation letter	Comments on planning submission	24843/APP/2024/2656	n/a	London Fire Brigade

2. PROJECT OVERVIEW

2.1 Building description

- 2.1.1 This detailed fire safety strategy is for the proposed works for to construct a new residential building comprising two blocks: Block A, and B/C which is located in West Drayton, London.
- 2.1.2 The proposal is to provide 106 new homes with a mix of flats and maisonettes. There will be a car park at ground floor that will consist of 50 spaces.
- 2.1.3 There will be two blocks present across the development, Block A and Block B/C, Block A will be standalone (although structurally connected to B/C) and will form no connections with any ancillary areas. Block B/C will be connected on the upper floor levels, Core B and Core C will form connections with the car park at ground floor level. The height of each core is indicated in Table 4.
- 2.1.4 There will be three stairs serving the upper floors development, a single escape stair serving Block A and two firefighting stairs serving Block B/C, the firefighting stair in Core B terminates at the sixth floor with Core C extending to the roof. Block B/C cores will also each have a firefighting lift. In addition to this there will be three evacuation lifts provided: one in each core.
- 2.1.5 Within the development there will be a three refuse stores, three LV stores, four cycle stores, two substations and two sprinkler / tank room. All ancillary accommodation is located at Ground Floor level.
- 2.1.6 Residential accommodation is provided across all floors between ground floor and sixth floor.
- 2.1.7 At First Floor level, an external podium which includes a gym area and play area, open to air, is provided. An enclosed car park is located beneath the podium at Ground Floor level which is accessed via protected lobbies which connects to the residential entrance lobby. The podium is accessible from the residential blocks B/C.
- 2.1.8 The upper floors of Block B/C will be served by two cores, with Block A served by a single core. All three cores will be provided with an escape stair and an evacuation lift. There is also a roof terrace located at seventh floor, this is served by Core C and an external stair which leads into Core B.
- 2.1.9 The fire strategy does not rely on any permanent on-site management in the development as it will not be provided.
- 2.1.10 The no. of storeys and the height of each block is shown in Table 4. Indicative layouts of the development are illustrated in Figure 1 to Figure 8.

Table 4 - No. of storey and height of cores

Block	Core	No. of storeys	Approximate Height
A	A	4 (GF+3)	9.5m
B/C	B	7 (GF+6)	18.7m
	C	8 (GF+7)	22.1m



Figure 1 - Indicative Ground Floor layout



Figure 2 - Indicative First Floor layout

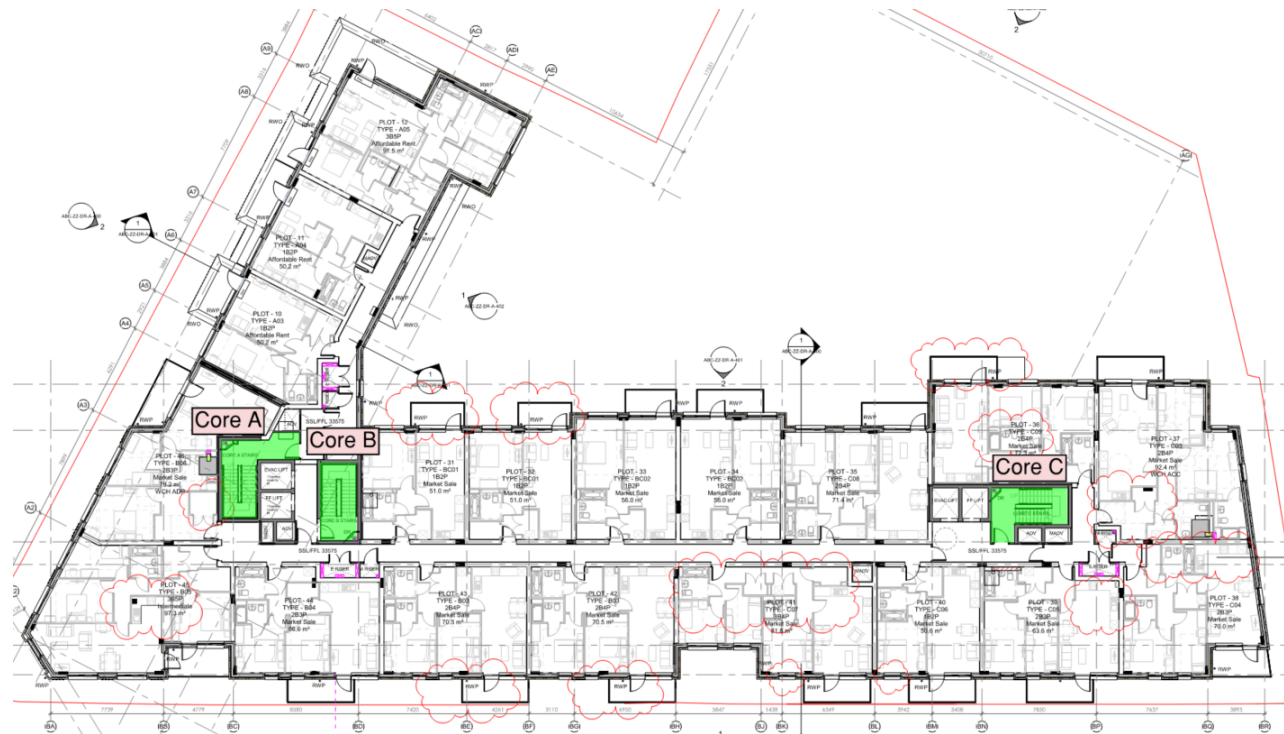


Figure 3 - Indicative Second Floor layout

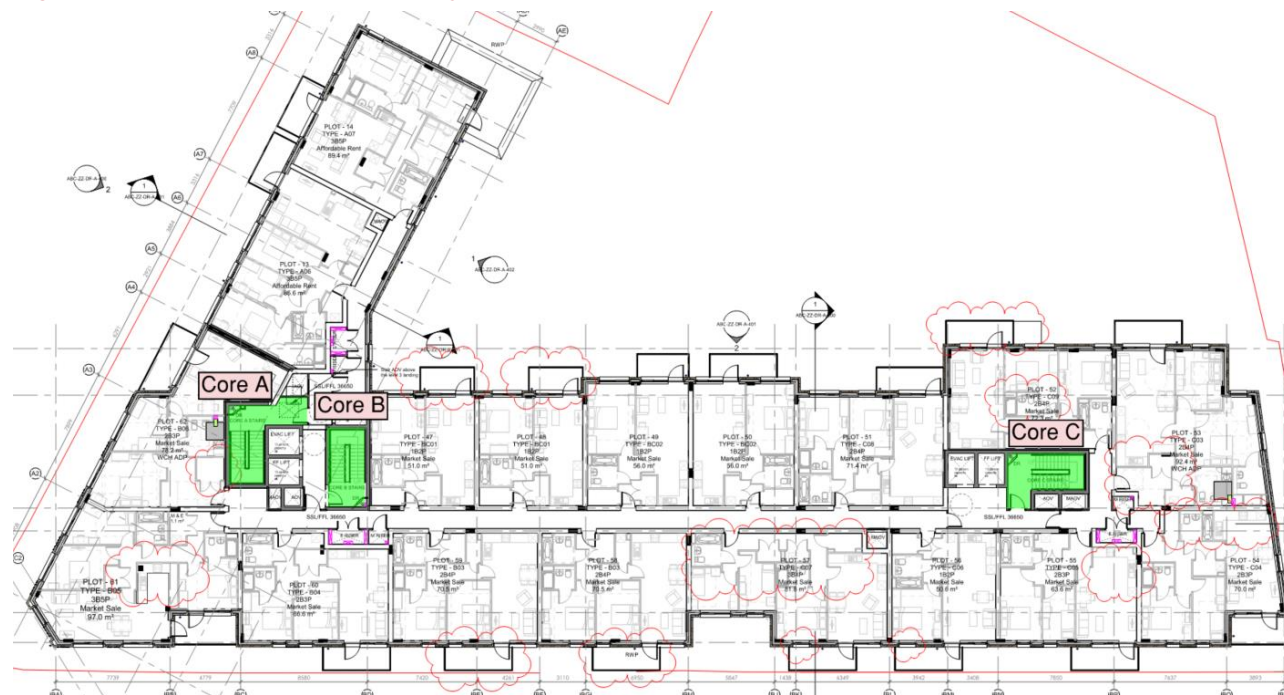


Figure 4 - Indicative Third Floor layout

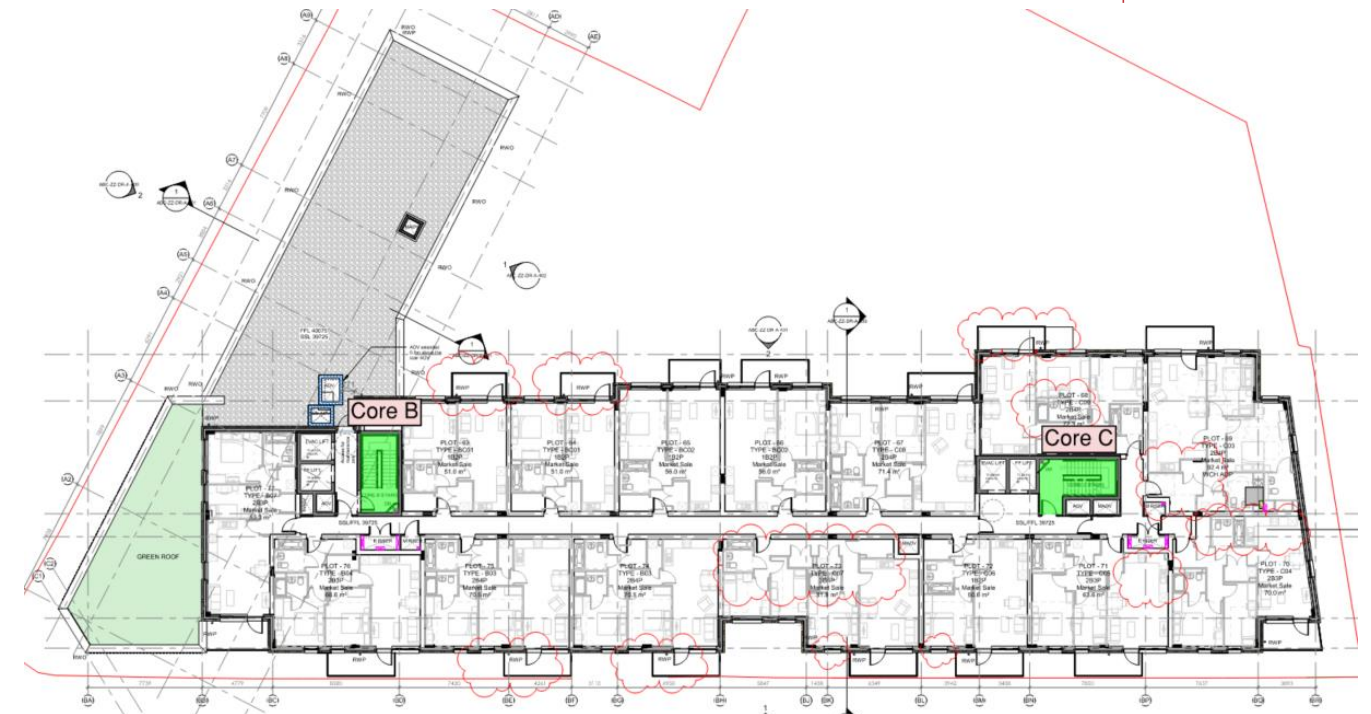


Figure 5 - Indicative Fourth Floor layout

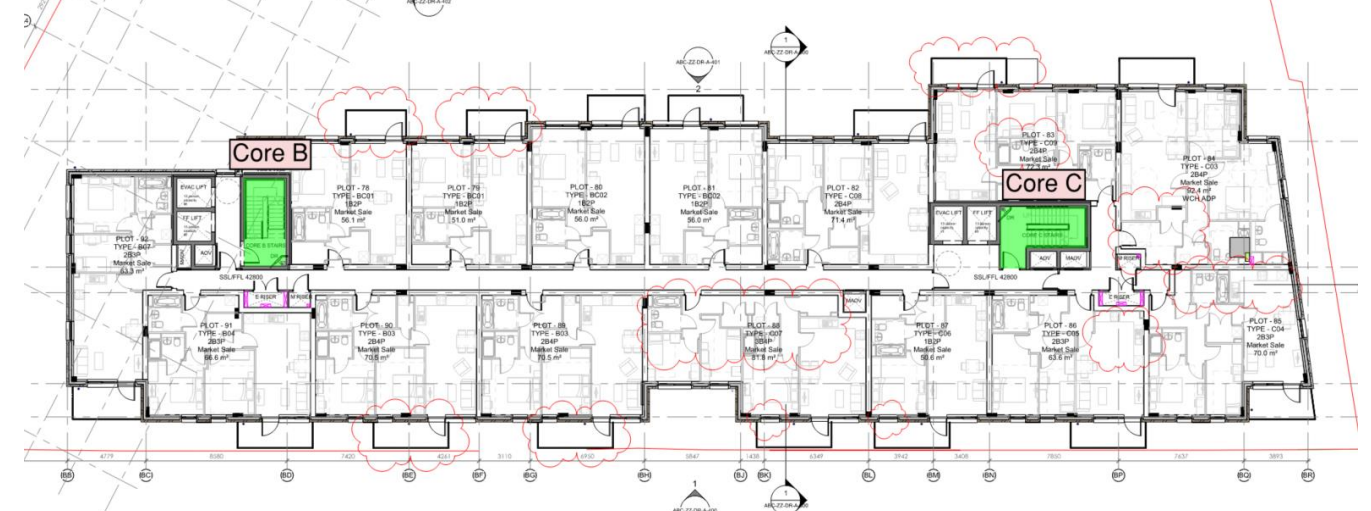


Figure 6 - Indicative Fifth Floor layout

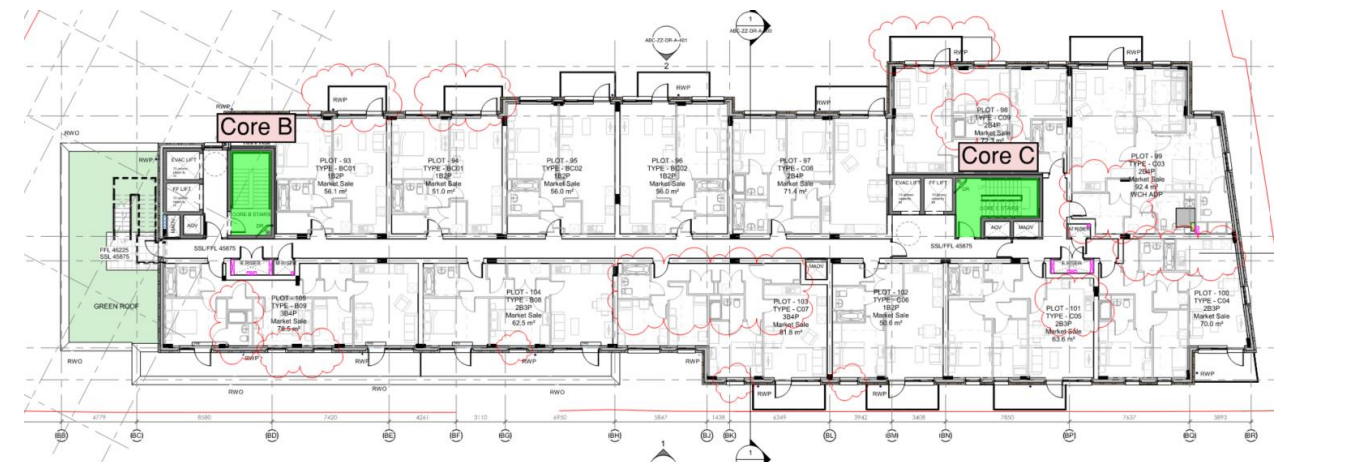


Figure 7 - Indicative Sixth Floor layout

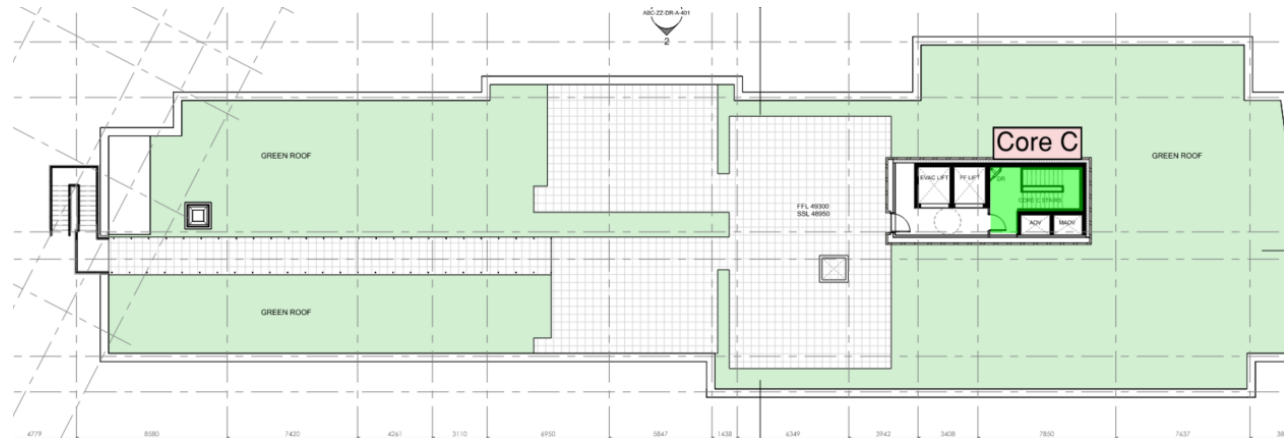


Figure 8 - Indicative Seventh Floor layout

2.2 The non-residential areas and the car park – Risk Profile

- 2.2.1 The car park and ancillary areas shall be designed in accordance with the guidance contained in BS 9999:2017.
- 2.2.2 As per the guidance contained in BS 9999, a risk profile is established to determine appropriate means of escape and other relevant fire safety provisions for life safety. The risk profile is a function of the occupancy characteristic and the fire growth rate.
- 2.2.3 The risk profiles of the different non-residential areas are summarised in Table 5.

Table 5 - Risk profile summary

Areas	Occupancy characteristics	Fire growth rate	Risk profile
Car park	A – Awake and Familiar	1 ⁽¹⁾	A1
Plant room/refuse stores etc	A – Awake and Familiar	2 ⁽¹⁾	A2
Notes: 1) Based on provision of sprinkler system in accordance with Section 3.2.			

2.3 Design occupancy – Non-residential areas

- 2.3.1 The number of occupants expected in the non-residential areas is necessary to be calculated to ensure that the number and width of exits have sufficient capacity for means of escape purposes. Plantrooms, refuse stores, cycle stores and similar ancillary spaces will be occupied infrequently by residents or members of staff and therefore the escape arrangements have been premised on a transient occupancy.
- 2.3.2 The maximum design occupancy noted in table below has been calculated based on the floor space factor provided in BS9999, and for the car park based on 2 person/ parking space.

Table 6 - Design occupancy

Room / Space	Area	Floor space factor	Maximum design occupancy
Car park	50 parking spaces	2 person/ parking space	100 persons
*Where only one exit is provided the occupancy for the space is limited to 60 people.			

3. ACTIVE FIRE SAFETY SYSTEMS

3.1 Means of detection and alarm

3.1.1 The fire detection and alarm system requirements within the development are summarized in Table 7.

Table 7 - Minimum fire detection and alarm system

Accommodation	Minimum requirement
Residential flats	Grade D, Category LD1 conform to BS 5839-6 [5].
Residential communal corridors	L5 system conform to BS 5839-1 [6]. The purpose of this system is to activate the smoke ventilation systems within the communal corridors only, i.e., it will not provide an audible alarm within the building. It is recommended that the detector head spacing for the L5 system within the corridors is in accordance with the recommendations for a category L4 system.
Ancillary areas / Car Park	L2 system conforming to BS 5839-1.
Roof Terrace	Sounders are to be provided on the Residential Terrace, which are to sound upon activation within the residential communal corridors of Block B/C.
Level 1 Podium	Sounders are to be provided to the Podium which are to sound upon activation within the car park or within the associated common corridor of Blocks A, B/C at first floor level.

3.2 Automatic suppression system

3.2.1 Within the development, all Blocks shall be provided throughout with a sprinkler system as follows:

- A sprinkler system designed and installed in accordance with BS 9251:2021 [7] for the residential areas in all Blocks;
- A sprinkler system in accordance with BS EN 12845 [8] for the enclosed car park and ancillary areas.

3.2.2 A Category 4 sprinkler system conforming to BS9251:2021 should be provided throughout all residential areas as the building height is over 18m. In accordance with Table 2 of BS9251. The minimum duration of supply for a category 4 sprinkler system is 60 minutes.

3.2.3 Ancillary areas in the building may be protected by the associated residential sprinkler system in accordance with the recommendations of BS 9251 [7] for non-residential areas, where the ancillary areas are classified in accordance with Table 4 of BS 9251. Ancillary areas outside of these criteria should be protected by a sprinkler system designed, installed and maintained in accordance with BS EN 12845 [8].

3.2.4 In accordance with BS EN 12845, the car park should be provided with a (minimum) Category OH2 sprinkler system.

3.2.5 The design of the sprinkler system shall be carried out by a sprinkler specialist.

3.3 Smoke ventilation system – General

3.3.1 A smoke ventilation system is required to be provided within the portions of the communal corridors serving the escape stairs, the lift lobbies and at the head of each stairway.

3.3.2 In accordance with Approved Document B, the lobbies / portion of corridor in front of the stair is required to have a smoke ventilation. However, no guidance is currently provided in Approved Document B for the inclusion of an evacuation lift.

3.3.3 As the blocks of flats will be provided with evacuation lifts, the lift lobbies will be designed to protect the lift shafts and provide a place of relative safety for escaping occupants to seek refuge and wait for the lift car's arrival. Each lift lobby will be served by a separate smoke control system. As such, an engineered approach has been undertaken to demonstrate adequate design for the protection of each evacuation lift, associated refuge space and firefighting lift / lobby. The philosophy of the engineered approach is to:

- The lobby in front of the firefighting / escape stairs and evacuation lifts shall be used as a place of refuge whilst occupants await the lift;
- A smoke control system will be provided in each of the adjoining corridors to the lift lobby. This system is designed to protect the lift lobbies from the ingress of smoke and ultimately return the lift lobbies and common corridors to tenable conditions.
- Provide a smoke shaft/ AOV within each of the lift lobbies to be used as fresh air inlet for the smoke extract system within the common corridor. This will also facilitate the removal of any small quantities of smoke entering the lift lobby during the initial means of escape and firefighting phases. It should be noted that the system is not designed or intended to have the lift lobby doors 'pulled' open by the extract fans in the corridor; and
- By appropriately protecting the lift lobby, the stair and lift shafts will also be appropriately protected from the ingress of smoke.

3.3.4 Automatically opening vents shall conform to BS 12101-2 [9].

Residential connections to the car park

3.3.5 The car park connects to both residential Cores B/C at ground level, therefore protected lobbies will be provided, these lobbies should be provided with 0.4m² permanent ventilation ducted directly to the outside or be provided with a mechanical alternative.

Residential stairways

3.3.6 All escape stairs serving the upper floors within the development are required to be provided with a 1.0m² AOV at the head of the stairway.

Residential communal corridors & evacuation lift / fire-fighting lobbies

3.4.1 The proposed smoke ventilation arrangements are described in Table 8 and Figure 9 and Figure 10.

Table 8 – Summary of smoke control design principles the residential development

Block / Core	Floor level	Smoke control system description
A	01 *	<u>Lobby:</u> 1.5 m ² AOV <u>Corridor:</u> 1.5 m ² AOV
	02 to 03	<u>Lobby:</u> Natural smoke shaft <u>Corridor:</u> Mechanical extract shaft & wall-mounted AOV inlet
B	01 to 06	<u>Lobby:</u> Natural smoke shaft <u>Shared corridor (B and C):</u> Two shafts operating on a reversible principle, where one shaft mechanically extracts and the other naturally supplies depending on smoke is first detected
C	01 to 06	<u>Lobby:</u> Natural smoke shaft <u>Shared corridor (B and C):</u> Two shafts operating on a reversible principle, where one shaft mechanically extracts and the other naturally supplies depending on smoke is first detected. <u>Corridor (C only):</u> Single mechanical extract shaft with variable speed fan, linked with pressure sensors
* Note: The provision marked with an asterisk (*) denote natural smoke control solutions which are not to be assessed as part of the CFD modelling. These areas are considered to align with the recommendations of guidance and therefore do not require a computational assessment.		

Block A

3.4.2 On first floor the communal corridor and the evacuation lift lobby will be vented naturally via a 1.5m² AOV window.

3.4.3 On second floor and third floors, a fire engineered solution shall be employed in support of the excessive travel distance of approx. 16m within the communal corridor based on the principles of Figure 9, with a mechanical smoke extract shaft and an AOV air inlet. A natural smoke shaft will be provided in the lift lobbies serving the second and third floor.

Block B/C

3.4.4 On each upper floor of Block B/C, a fire engineered solution shall be employed in support of the evacuation lift lobby design, to provide adequate protection to the lifts and waiting area where the top storey height of the block is over 18m. Therefore, it will be provided with an MSVS in accordance with the principles of Figure 10. This system will comprise of two mechanical smoke shafts forming a “push-pull” system in the common corridor, whereby one will provide smoke extract and the other will provide inlet air, depending on where smoke is detected within the corridor. A natural smoke shaft will be provided in the lift lobbies.

3.4.5 The mechanical smoke control solutions have been assessed as part of the CFD modelling and detailed in the Ashton Fire report: AF3009 – Comag_West_Drayton-Detailed_CFD-Issue_01.

3.4.6 The outline specification of the MSVS can be found in Ashton Fire report: AF3009 – Comag_West_Drayton-Detailed_CFD-Issue_01. The final detailed design of the system shall be carried out by the specialist designer.

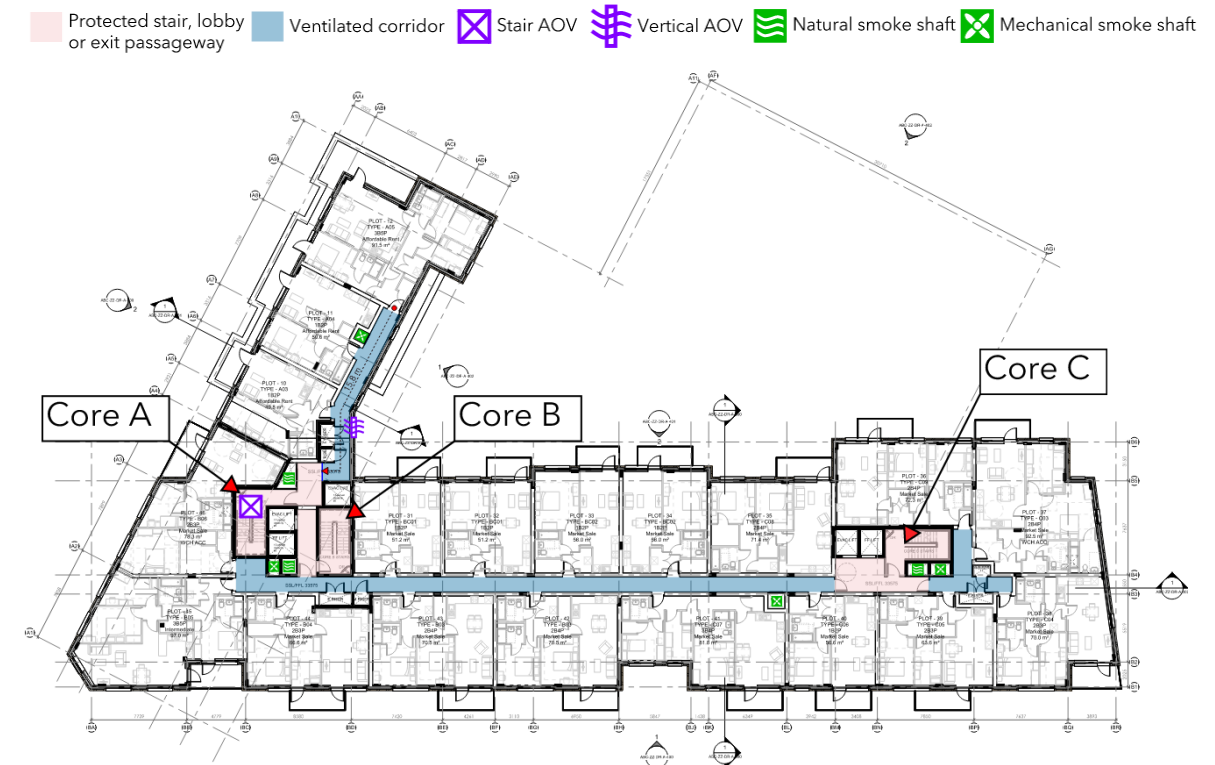


Figure 9 - Proposed common corridor smoke control arrangements Level 02

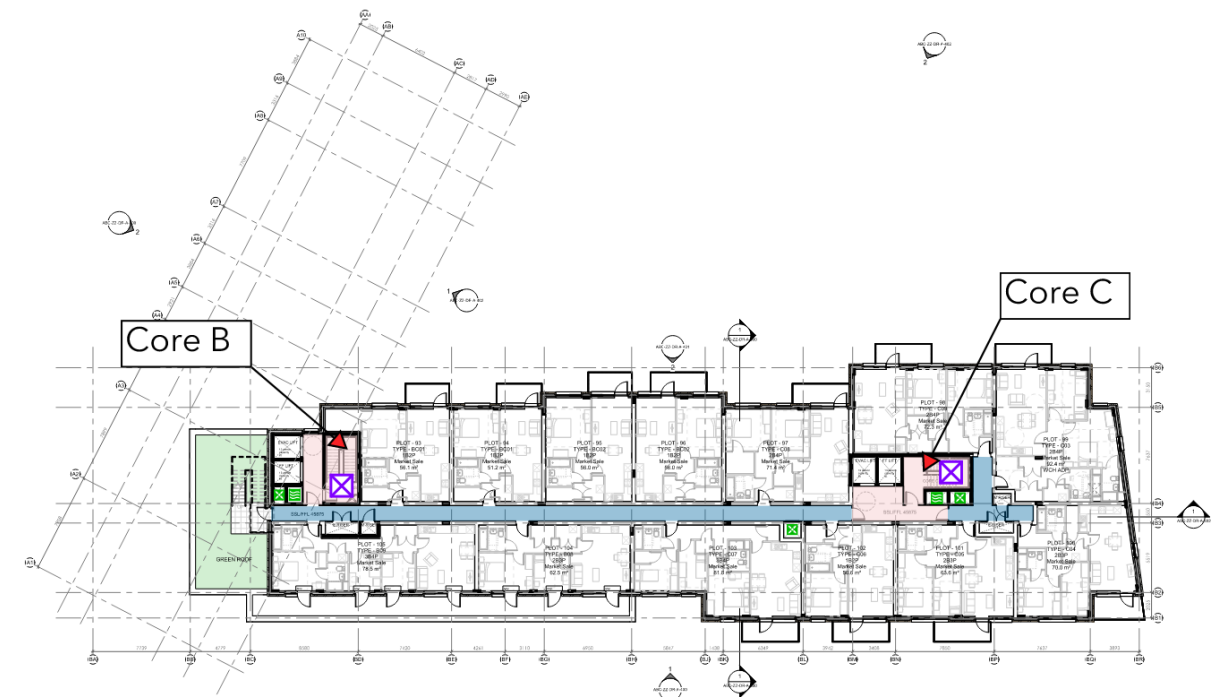


Figure 10 - Proposed common corridor smoke control arrangements Level 06

3.5 Smoke Control System – Car park

3.5.1 Natural smoke ventilation (cross-flow) will be provided to the car park in accordance with BS 7346-7 with the objective of smoke clearance during the fire and after the fire has been suppressed. Natural ventilation will be provided by permanent openings with an aggregate equivalent area of 2.5% of the car park floor area (2.5% or 1715 m² = 43 m²).

3.5.2 The openings will be distributed such that an aggregate equivalent area of 1.25% (21.75 m²) is equally provided between two opposing walls to provide crossflow ventilation. The remaining ventilation area of 1.25% will be distributed across other walls and through the podium.

3.6 Electric vehicles – car park

3.6.1 Electric vehicle charging points will be provided to each parking space. The car park will be protected with a sprinkler system in accordance with BS EN 12845 which will assist in mitigating the potential effects of fire within the car park due to electric vehicles. There are multiple firefighting access routes as discussed in Section 8. Emergency isolation switches for vehicle charging will be located where they can be accessed in an emergency.

3.7 Evacuation alert systems (EAS)

3.7.1 As the building has a top storey more than 18m above ground, an evacuation alert system in accordance with BS 8629 [11] should be provided to Block B/C, to support the fire brigade during firefighting and rescue operations and facilitate early evacuation of the building should it be deemed necessary.

3.8 Firefighting lifts

3.8.1 The building will have a top storey more than 18m above ground and should therefore be provided with a firefighting lift, designed and installed in accordance with BS EN 81-20 and BS EN 81-72 [12]. The lift landing doors shall be within 7.5m of the firefighting stair door and the lift will be enclosed in 120 minutes fire resistance construction provided with FD60 fire doors. A firefighting lobby will be provided at ground level to separate the firefighting lift from the firefighting stair in buildings with a top storey more than 18m above ground.

3.9 Evacuation lifts

3.9.1 The residential areas of the building will be provided with evacuation lifts serving each storey – refer to Section 4.10 for further details. It is recommended that evacuation lifts will be designed and installed in accordance with the relevant provisions of BS EN 81-20 [13] and BS EN 81-70 [14] and provided with a secondary power supply. A type 2 evacuation lift car is recommended, as outlined in Table 3 of BS EN 81-70.

3.9.2 The lobby in front of the lift will include a refuge point provided with an emergency voice communication system (EVC). The refuge point will be directly in front of the evacuation lift in each lift lobby.

3.10 Electromagnetic locking / hold-open devices

3.10.1 As a recommendation for future provisions, where doors are provided with electromagnetic locking or hold-open devices, these devices are to operate (either release the door to close normally, or release the door to be opened) upon:

- Activation of the detection and alarm system;
- Failure of the power supply;
- Operation of a hand operated switch located to the side of the door;
- Malfunction.

3.11 Emergency lighting

3.11.1 Emergency lighting (within the common areas of residential areas only and all ancillary / non-residential areas) will be installed to provide temporary illumination in the event of failure of the

primary power supplies to the normal lighting system. As part of the emergency lighting system, escape lighting will be provided to ensure the escape routes (including external escape routes) are illuminated at all material times. Adequate artificial lighting will be provided in all common escape routes and will be of a sufficient standard to enable persons to see to escape.

3.11.2 Emergency lighting will be installed in accordance with the recommendations of BS 5266-1 [15], BS EN 1838 [16] and BS EN 60598-2-22 [17]. It will also illuminate a safe exit route including fire exits, changes in level or direction and fire-fighting equipment.

3.11.3 Lighting to escape stairs should be on a separate circuit from that supplying any other part of the escape route.

3.11.4 Primary and emergency lighting will be required for any external escape routes that will not be lit by surrounding street lighting.

3.11.5 Discharge lighting installations may operate at voltages that are a hazard to firemen. An exterior discharge lighting installation, or an interior discharge lighting installation operating unattended or operating at a voltage exceeding low voltage (as defined in Statutory Instrument number 1018, part of the Building Regulations), should be controlled by a fire-fighter's emergency switch.

3.12 Fire safety signage

3.12.1 Fire safety signs will be installed where necessary (common areas and ancillary spaces) to provide clear identification of fire precautions, fire equipment and means of escape in the event of fire. All parts of the development will be fitted with appropriate fire safety signage to comply with The Health and Safety (Signs and Signals) Regulations 1996 [18], i.e. signage to be specified in according to BS ISO 3864-1 [19], BS 5499-4 [20] and BS 5499-10 [21].

3.12.2 The purpose of fire signs is to direct persons towards fire exits, or to provide specific information or warning about particular equipment, doors, rooms or procedures.

3.12.3 Fire notices should be permanently displayed in conspicuous positions throughout the building, including storey exits, and should be specific to it.

3.12.4 All fire doors, other than bedroom doors and lift landing doors, will be marked with the appropriate fire safety sign, according to whether the door is:

- to be kept closed when not in use ('FIRE DOOR - KEEP SHUT').
- to be kept locked when not in use ('FIRE DOOR - KEEP LOCKED'), or
- held open by an automatic release mechanism ('AUTOMATIC FIRE DOOR - KEEP CLEAR').

3.12.5 Any emergency securing device fitted to doors on escape routes are to be provided with instruction notices, adjacent to the device, indicating the method of operation.

3.13 Wayfinding signage

3.13.1 The building will have a top storey more than 11m above ground and should therefore be provided with appropriate signage to assist the fire service to identify each floor and flat.

3.13.2 Wayfinding signage should be provided throughout the building in accordance with Clauses 15.13 to 15.16 in ADB, including:

- Floor identification signs at each landing of the protected stair and each common corridor accessed from the firefighting lift, formatted in accordance with Section 15.14 and 15.15 in ADB.
- Flat indicator signs, located beneath the floor indicator signs and indicating the flats present and each level. These should be formatted in accordance with Section 15.16 in ADB.

3.14 Emergency voice communication systems (EVC)

- 3.14.1 Each refuge space shall be provided with an emergency voice communication system (EVC system). The system should comply with BS 5839-9 [22] and should consist of a Type B outstation which communicates with a receiving station (typically located next to the main fire alarm panel or a concierge desk).

3.15 Emergency (life-safety) power supplies

- 3.15.1 All life-safety systems shall be provided with robust power supplies in accordance with BS 8519 [23].
- 3.15.2 The following fire safety systems shall comply with their respective British Standards regarding secondary power supplies:
- Automatic fire detection and alarm system;
 - Emergency lighting and signage;
 - Evacuation alert systems.
 - Automatic smoke ventilation systems;
 - Emergency Voice Communication system (EVCs);
 - Evacuation lifts;
 - Firefighting lifts;
 - Sprinkler systems.
- 3.15.3 There must be a minimal delay in change over if the main power fails and it must occur automatically.

4. MEANS OF WARNING AND ESCAPE

Building Regulations requirement B1:

"The building shall be designed and constructed so that there are appropriate provisions for the early warning of fire, and appropriate means of escape in case of fire from the building to a place of safety outside the building capable of being safely and effectively used at all material times."

4.1 Evacuation philosophy

4.1.1 A summary of the applicable evacuation policies across the development, in accordance with ADB, are outlined in Table 9.

Table 9 – Evacuation philosophy

Accommodation	Minimum requirements
Residential units (including open-plan flats and maisonettes)	<p>A 'stay-put' (also known as 'defend-in-place') strategy will be implemented in all residential units, whereby, in the event of fire, only the unit of fire origin will receive a signal to evacuate, though should residents become aware of a fire they may leave the building if they wish to do so.</p> <p>Further evacuation of other units may be enacted by the Fire and Rescue Service, as needed depending on the development of the fire.</p>
Car park & ancillary areas	<p>The car park and ancillary areas will operate completely independently from the residential areas. Evacuation from these areas shall be based upon simultaneous evacuation, whereby, upon activation of the detection, all areas within the relevant demise (and adjoining inner rooms) shall receive a signal to evacuate. The alarm signal shall not extend to any other areas.</p>
Residential Roof Terrace	<p>Sounders are to be provided on the residential roof terrace, which are to sound upon activation of the alarm system within the residential communal corridor at Sixth Floor adjacent to Core B and the lift lobby at Seventh Floor in Core C.</p> <p>The terrace shall operate a local simultaneous evacuation, whereby upon activation of the detection and alarm system, only the terrace shall receive a signal to evacuate. All other areas shall not receive a signal to evacuate.</p>
Level 1 Podium	<p>Sounders are to be provided to the Podium which are to sound upon activation of the fire alarm within the car park or the common corridors of Block B/C at first floor level.</p> <p>The podium shall operate a local simultaneous evacuation, whereby upon activation of the detection and alarm system, only the podium shall receive a signal to evacuate. All other areas shall not receive a signal to evacuate.</p>

4.1.2 Notwithstanding the information from above, provision of an evacuation alert system, as detailed in 3.7 will enable the fire service to trigger evacuation of each block in part or in full.

4.1.3 The automatic fire detection and alarm system shall be configured to support the evacuation philosophy discussed above.

4.2 Horizontal means of escape – Residential areas

Internal flat layout summary

4.2.1 Internal layouts of flats across the development are to be provided as follows:

- Maisonettes (Duplexes).
- Flats with entrance halls.
- Studio flats.

Maisonettes (duplexes)

4.2.2 Maisonettes are situated across ground – first floor, with access given directly from the outside.

4.2.3 All maisonettes will be provided with a protected stairway which shall be enclosed within 30-minutes fire resisting construction.

Flats with entrance halls

4.2.4 All flats in the residential blocks are to be provided with an entrance hall by which all habitable rooms are accessed directly from , however, the entrance hall will not be separated from the rest of the flat by 30 minutes fire-resisting construction as recommended in Section 3.18 and Diagram 3.2 of ADB. This arrangement is supported by the open plan flat guidance set out in Section 4.2.7 and 4.2.8.

Studio flats

4.2.5 The studio flat located on the first floor adjacent to Core B has an extended travel distance(10.4m) to the flat entrance door, however the layout is considered acceptable by the guidance set out in Section 4.2.7 and 4.2.8.

Cooking facilities in flats

4.2.6 ADB recommends that cooking facilities are located remotely from the internal flat escape route. As such, it is recommended the cooking facilities are located such that they are at least 1.8 m from the internal escape routes within the studio flats and escape routes from the balconies which lead only through the kitchen living spaces.

Open Plan Flats

4.2.7 The building will comprise flats layouts as mentioned above which are not consistent with guidance contained within ADB Vol.1. However, the layouts are considered acceptable on the basis that:

- The maximum dimensions of an open plan flat should not exceed 16m by 12m, or 192m² in floor area;
- All flats will be provided with an automatic fire detection and alarm system to a category LD1 standard in accordance with BS 5839-6;
- Cooking facilities will be sited remote from the escape route (minimum 1.8m away from a 0.9m wide route); and
- All flats will be provided with a sprinkler system designed in accordance with BS 9251.

4.2.8 The design is also substantiated by further research carried out by the BRE and commissioned by the NHBC Foundation on open plan flat design – NF19 [24] and Hopkin et al.

Communal corridors - Upper Floors

- 4.2.9 The upper floors of Block A will be served by a single stair. The stair shall be separated from the communal corridor serving the flats by a protected lobby.
- 4.2.10 The upper floors of Blocks B/C will be served by two stairs,
- 4.2.11 In accordance with applicable guidance within ADB at the time of writing this report, provision of an evacuation lift is not required. However, each core will be provided with an evacuation lift in order to align with the requirements of London Plan Policy D5.
- 4.2.12 ADB does not provide guidance in regard to protection of the evacuation lift. However, additional fire safety provisions shall be provided in support of this arrangement.
- 4.2.13 In support of the evacuation lift arrangements, the following shall be included in the design:
- The communal corridor serving the flats shall be provided with a smoke ventilation system in accordance with Section 3.3 of this report.
 - The protected lobby providing access to the evacuation lift should not access anything other than:
 - The staircase;
 - The lifts;
 - The adjoining ventilated corridor;
 - Service risers (unless the risers contain electrical equipment, motors, etc which pose a higher ignition risk than cables alone).
 - The travel distance across the protected lobby should not exceed 7.5m.
 - The protected lobby shall be provided with a smoke ventilation system in accordance with Section 3.3 of this report.
 - The protected lobby shall include an emergency voice communication system.
- 4.2.14 The travel distance within the communal corridor on the second and third floor in Block A exceed the maximum recommended travel distance of 7.5 m, which are supported by fire engineering justification including a mechanical smoke extract system substantiated by CFD modelling as referenced in Section 3.4.5.
- 4.2.15 Indicative layouts of a typical upper floor are shown in Figure 11.
- ### 4.3 Horizontal means of escape - Ancillary areas / Car park
- 4.3.1 The car park is located at Ground Floor level. Egress from the car park will be provided via three means of escape that lead directly to the outside.
- 4.3.2 Within the car park areas, the maximum permitted travel distance is limited to 65m in multiple direction and 26m in single direction. Based on the estimated occupancy as detailed in Table 6, and the number of available exits, each exit should have a minimum clear width of 850mm. An indicative car park layout is shown in Figure 12.

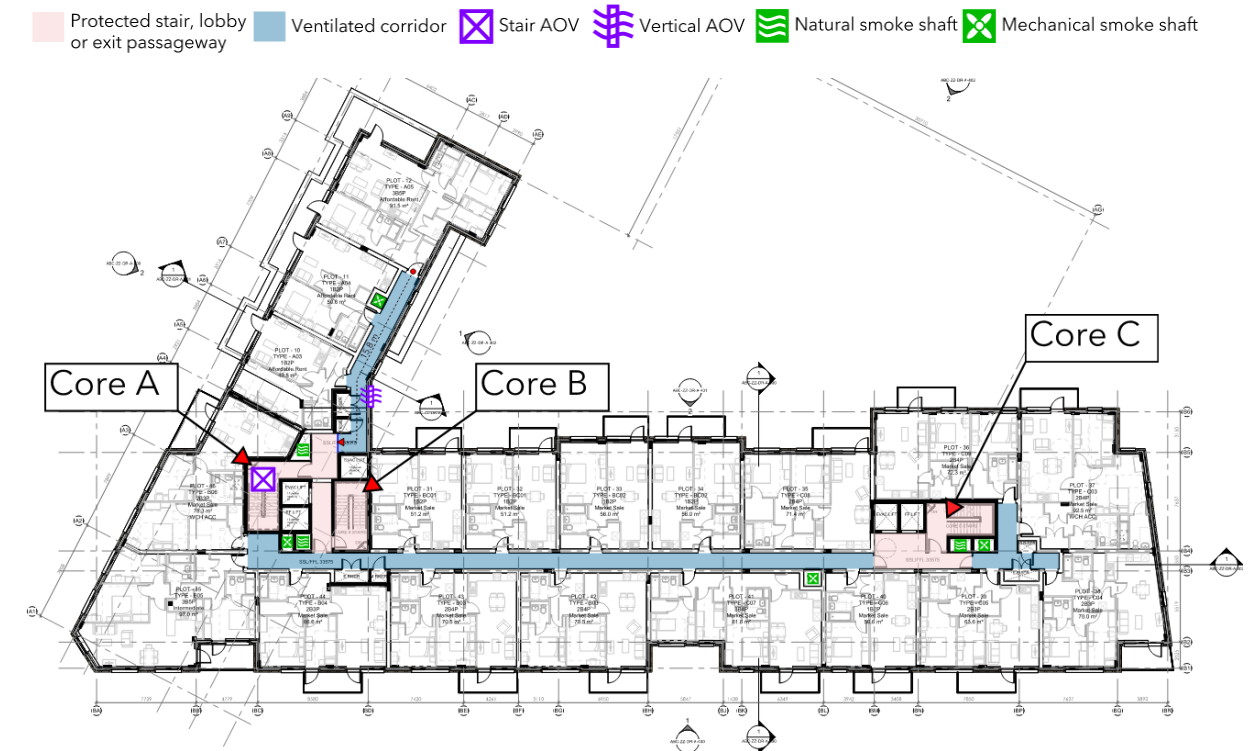


Figure 11 - Means of escape - indicative typical upper floor layout



Figure 12 - Car park means of escape

- 4.3.3 Ancillary accommodation is located at Ground Floor level and comprises refuse stores, cycle stores, and various plant rooms.
- 4.3.4 Where a single exit is available, the number of occupants within these areas shall not exceed 60 persons at any time. The maximum permitted travel distances for ancillary areas are summarised in Table 10. The travel distances are achieved within the current design of the ancillary areas.
- 4.3.5 The exits are required to have a minimum clear width of at least 800mm or 850mm where unassisted wheelchair users are expected.

Table 10 - Maximum permitted travel distances within ancillary rooms

Risk Profile / Space	Maximum travel distance in single direction [m]	Maximum travel distance in multiple directions [m]
A1 / Car park	26	65
A2 / Plant room /refuse stores etc	22	55
Notes: Where the internal layout is unknown, the travel distance allowance should be assumed to be two-thirds of the above figures.		

- 4.3.6 Where an area has an occupancy of greater than 60 people, at least two exits are to be provided. The largest exit provided is to be discounted when calculating the required width for the remaining exits. The car park will potentially have greater than 60 people based on 2 people per parking space and will be served by 3, 850 mm wide storey exits providing sufficient exit capacity for the estimated occupancy.
- 4.3.7 Doors hung to swing against the flow of escaping occupants are to serve a maximum of 60 people, irrespective of the available clear exit width. Where wheelchair users are expected, doors should have at least 850mm clear width.

4.4 Podium

- 4.4.1 Between Blocks A, B, and C, a podium is formed at first floor level.
- 4.4.2 The podium access doors to cores B and C will be designed to fail safe open on activation of the fire alarm system within the common corridors or lift lobbies at first floor.
- 4.4.3 Means of escape from the podium can be accessed through Block B/C as can be seen below in Figure 13.



Figure 13 - Podium means of escape

4.5 Horizontal means of escape - Residential Roof Terrace

- 4.5.1 The residential roof terrace is located at seventh floor and can be accessed via a firefighting stair in Core C via the communal corridor and an external stair located at the remote end of the corridor of Core B. The doors to the corridor should be a minimum of 850mm where unassisted wheelchair users are present.
- 4.5.2 The escape route via the external stair will have a short distance in the common corridor at Sixth Floor to reach Stair B. However, this escape route will be protected with the mechanical smoke ventilation system and the alternative escape route directly into Core C at seventh floor will be available.
- 4.5.3 The travel distances on the roof terrace are within the maximum recommended limit of 45m from anywhere on the roof terrace to the evacuation lift lobby is provided for disabled persons.
- 4.5.4 A refuge space with an EVC system (Type B) will be provided to the residential roof terrace within the lift lobby of Core C.
- 4.5.5 Beacons and sounders shall be installed within the residential terrace, which are to be interlinked with the fire detection and alarm system installed within the residential communal corridor at Sixth Floor adjacent to Core B and the lift lobby at Seventh Floor in Core C., thus, in the event of a fire in any of these areas, the residential terrace area shall be notified to evacuate the area at the same time as the communal corridor.
- 4.5.6 Any security doors on the residential terrace shall be designed to fail safe open on activation of the fire alarm, or where there may be a power failure.

4.6 Inner rooms

- 4.6.1 The cycle stores, sprinkler tank and plant rooms accessed via the car park will be classified as an inner room. In support of the "inner-room" arrangement, a suitably sited vision panel not less than 0.1 m² will be located in the door or walls of the inner rooms, to enable occupants of the inner room to see if a fire has started in the outer room. This will be inherently achieved by the cycle store mesh walls and

incorporated into the sprinkler tank and plant room. The inner rooms will also receive an audible alarm (and visual alarm where required by BS 5839-1) on activation of a detector within the car park.

4.7 Vertical means of escape

- 4.7.1 In accordance with ADB guidance, a stair of acceptable width for everyday (as designed to Approved Document K) use will be sufficient for escape purposes.
- 4.7.2 Where a firefighting stair is provided in Block B/C, the stair should be designed to have a minimum clear width of 1100mm.
- 4.7.3 Vertical means of escape from each block will be supported by an evacuation lift in accordance with London Plan policy requirement. The final escape route from the evacuation lift should have the same level of protection at ground floor as the evacuation lift on the upper floors.
- 4.7.4 The vertical means of escape from the residential roof terrace will be facilitated via Core C which will be provided with a firefighting stair and an evacuation lift along with an external stair at the opposite end of the roof terrace. Only one evacuation lift is being provided at this level, however the single direction travel distance is within the 45m limit.
- 4.7.5 Where the handrails intrude 100mm or less, these can be ignored when assessing the clear width of the stair. The stair width should be kept clear for a vertical distance of 2m.
- 4.7.6 Post boxes are proposed to be provided within the main entrance lobby of each core. The post boxes will be designed out of non-combustible materials specified to achieve a 30-minute fire resistance and will be limited in size (e.g. only letters and not parcels) with sloped tops to prevent the storage of items on top. An additional fire door will be provided to separate the post boxes from the escape stair and evacuation lifts. This space will be provided with signage to prevent the use of the staircase/lobby space for delivering/storing parcels or combustibles of any kind.

4.8 External escape stairs

- 4.8.1 The external escape stair should be designed in accordance with Diagram 2.7 of ADB Vol.1 and should comply with the following conditions:
 - Doors should be specified as FD30 fire doors (expect for a single exit at the top landing of a downward leading stair);
 - Fire resisting construction should be provided within 1,800mm horizontally, 9m vertically below and 1,100mm above the top landing of the stair (except where leading from a basement storey to ground);
 - Fire resisting construction should be provided within 1,800mm of the escape route from the foot of the stair to a place of safety;
 - Stairs more than 6m in height should be protected from adverse weather to prevent the build-up of snow or ice; and
 - Glazing in areas of fire resisting construction should be fixed shut and fire resisting (30 minutes integrity, E30).

4.9 Private balconies, roof terraces & podiums

- 4.9.1 Private balconies should meet the following recommendations:
 - The escape route from the balcony should not pass through more than one access room;
 - A fire detection and alarm system in accordance with BS 5839-6 is provided to the access room with an alarm system on the balcony;

- Maximum permitted travel distance from the balcony access door to the furthers point on the balcony is 7.5m.
- The cooking facilities should remain remote from the balcony escape route (min. 1.8 m allowing for an escape route of 900 mm).

- 4.9.2 Balconies roof terraces and podiums should be designed in accordance with BS 8579:2020 [25] Section 12.3. In Buildings 11m above the lowest ground level, guardings on any terrace or access terrace within 3m of an extensive vertical façade should be constructed from materials class A1 or A2-s1, d0 or better in accordance with BS EN 13501-1.
- 4.9.3 In accordance with BS 8579, vertically stacked balconies and any balconies within buildings with a top floor located above 11m are to be constructed of materials class A2-s1, d0 or better. Terrace build-ups should achieve B_{ROOF}(t4).
- 4.9.4 Note that blocks of flats with a topmost occupied floor located above 18m are subject to Regulation 7(2).

4.10 Evacuation of disabled and mobility impaired persons (MIPS)

- 4.10.1 To ensure an inclusive design, evacuation lifts are provided adjacent to each protected stair. Where firefighting lifts are required, a second lift for evacuation will be provided in addition to the firefighting lift and the firefighting lifts will also be provided with the necessary control provisions to enable them to be used as an evacuation lift prior to the fire service arriving on site.
- 4.10.2 As occupants using the evacuation lift will be required to wait for a short period of time for the lift to be called and land at the floor, adequate protection to the lift and refuge / waiting area is required to be provided. This report is primarily concerned with ensuring suitable protection to the evacuation lifts and associate refuge areas. Each evacuation lift should be provided with a protected lobby which gives access to both the evacuation lift and the stair. A method of preventing smoke ingress into the lobby is required. More information on the ventilation requirements is given in Section 3.3.
- 4.10.3 The evacuation lifts should be designed in accordance with Section 3.7 and any associated refuge area should be provided with an Emergency Voice Communication (EVC) system as discussed in Section 3.14. As there is no dedicated onsite management the EVC's would be used to communicate with off site management / remote facility or the attending fire and rescue service.
- 4.10.4 Generally, evacuation lifts should be manually operated by a suitably trained, competent person, however it is recognised that a competent person may be absent in residential premises. In this instance, one of the following operation methods may be adopted:
 - Automatic evacuation operation.
 - Remote assisted evacuation.
- 4.10.5 Confirmation from the client / end user on the preferred operating sequence is required. The operation requirements and cause and effect arrangements may require consultation with a specialist vertical transport consultant.
- 4.10.6 It should be noted that under the Regulatory Reform (Fire Safety) Order 2005, it is the duty of the responsible person along with their appointed safety assistants to assist everyone to a place of ultimate safety outside the building in the event of an emergency.
- 4.10.7 All areas at ground floor will be provided with step-free, or ramp access. Any ramps should be designed in accordance with Approved Document M.

4.11 Escape beyond final exits

- 4.11.1 Travel beyond the building final exit must be away from the building, towards a place of safety, and not be jeopardised by unprotected openings of the building.
- 4.11.2 In general, the building should be provided with escape routes, upon exiting the building that are either directly away from the building or alternate paths along the building façade. Where the external escape route continues in a single direction along the façade, the external wall adjoining the escape route should have a minimum of 30 minutes fire resistance up to 1.1m (integrity and insulation). See Figure 14.
- 4.11.3 Final exits should not present a barrier for disabled people. Where the route to a final exit does not include a stair, a level threshold and, where necessary a ramp should be provided.

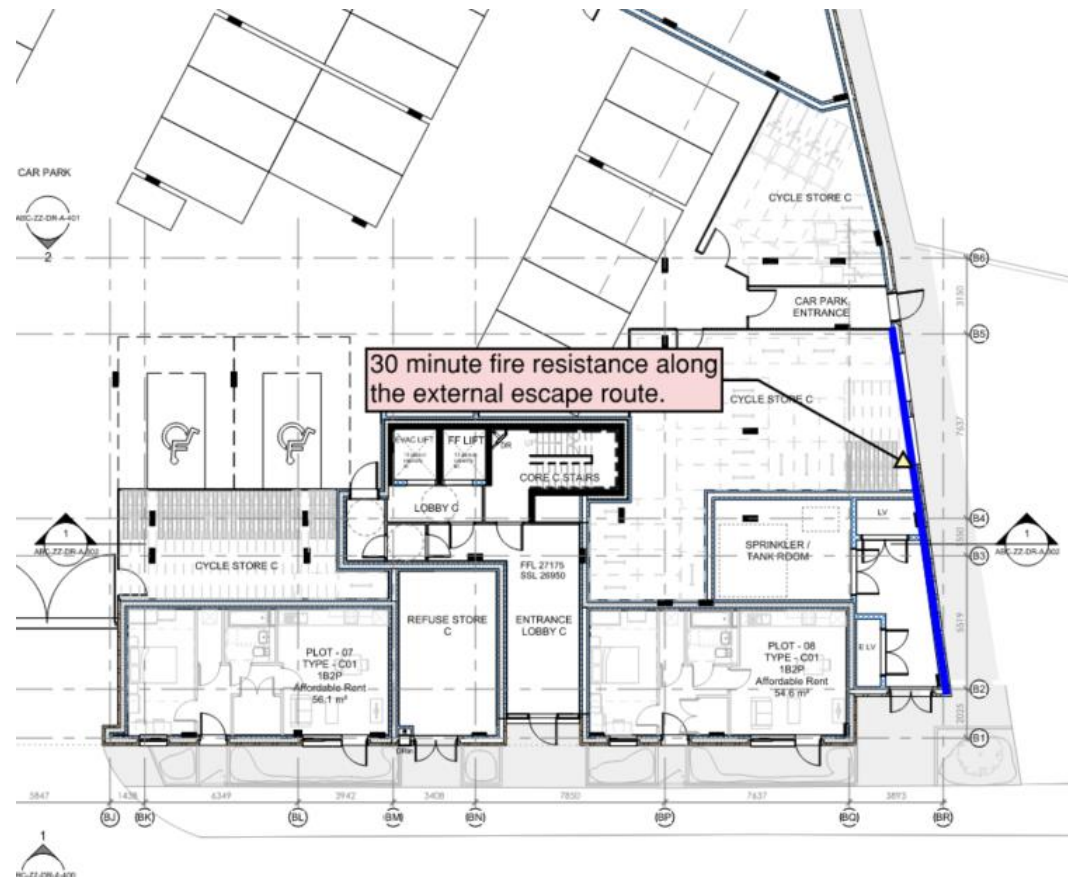


Figure 14 - External escape route

5. INTERNAL FIRE SPREAD – LININGS

Building Regulations requirement B2:

“(1) To inhibit the spread of fire within the building, the internal lining shall:

- a) Adequately resist the spread of flame over their surfaces; and
- b) Have, if ignited, either a rate of heat release or a rate of fire growth, which is reasonable in the circumstances.

(2) In this paragraph ‘internal linings’ means the materials or products used in lining any partition, wall, ceiling or other internal structure.”

5.1 Internal wall and ceiling linings

- 5.1.1 During the development of a fire in a building, the choice of material for the lining of walls and ceilings can significantly affect the spread of fire and its rate of growth.
- 5.1.2 Restrictions are placed on the wall and ceiling lining materials within certain areas of buildings to limit the spread of fire and production of smoke in these areas.
- 5.1.3 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.
- 5.1.4 All wall and ceiling linings within the building should meet the recommendations of Section 4 of ADB Vol.1 and Section 6 of ADB Vol.2 when tested under the European Classification (in accordance with BS EN 13501-1 [26]) as summarized in Table 11.

Table 11 – Classification of linings

Location	Euro Class
Small rooms $\leq 4\text{m}^2$ (residential and ancillary)	D-s3, d2
Small rooms $\leq 30\text{m}^2$ (non-residential areas)	D-s3, d2
Circulation spaces (communal)	B-s3, d2 ⁽¹⁾
Circulation spaces (within dwellings)	C-s3, d2
Other rooms	C-s3, d2
Note 1: Wallcoverings which conform to BS EN 15102, achieving at least class C-s3, d2 and bonded to a class A2-s3, d2 substrate will also be acceptable.	

- 5.1.5 The surface linings of walls and ceilings should generally conform to the classification recommended above for the appropriate location. However, parts of walls in rooms may be of lower performance, but not worse than class D-s3, d2. provided that the floor area of those parts in any one room does not exceed half of the floor area of the room, subject to a maximum area of 20m² in residential areas and 60m² in non-residential areas.

5.2 Rooflights and thermoplastic materials

- 5.2.1 Any non-plastic rooflights are to meet the recommendations of Table 11 above.
- 5.2.2 Where thermoplastic materials (i.e., rooflights, glazing, suspended ceilings and lighting diffusers) are used in the building, these are to comply with the various recommendations provided in Clause 4.7 and Clauses 4.12 to 4.17 of ADB Vol.1.

6. INTERNAL FIRE SPREAD – STRUCTURE

Building Regulations requirement B3:

“(1) The building shall be designed and constructed so that, in the event of fire, its stability will be maintained for a reasonable period.

(2) A wall common to two or more buildings shall be designed and constructed so that it adequately resists the spread of fire between those buildings. For the purposes of this sub paragraph a house in a terrace and a semi-detached house are each to be treated as a separate building.

(3) Where reasonably necessary to inhibit the spread of fire within the building, measures shall be taken, to an extent appropriate to the size and intended use of the building, comprising either or both of the following:

(a) sub-division of the building with fire resisting construction;

(b) installation of suitable automatic fire suppression systems.

(4) The building shall be designed and constructed so that the unseen spread of fire and smoke within concealed spaces in its structure and fabric is inhibited.”

6.1 Structural fire resistance

6.1.1 As Block B/C has a top storey height of 22.1m above ground, all elements of structure of the entire building (combined Block A, B/C and podium) should be designed and / or protected to achieve 90 minutes fire resistance in accordance with Table B4 of ADB Vol.1.

6.1.2 Elements of structure that only support a roof do not generally require fire resistance. The structure is considered to support more than only a roof if it supports a load other than the roof itself (i.e., heavy rooftop plant equipment), the roof performs the function of a floor or it is essential for the stability of the building, or other fire resisting element (internal or external). In these cases, the structural elements are required to achieve the minimum required structural fire resistance indicated in para. 6.1.1 above.

6.1.3 Where a construction element with lower or no fire resistance supports or provides stability to another element of structure, then the protection to the supporting structure should be at least the same as the structure it is supporting.

6.2 Compartmentation and fire-resisting construction

6.2.1 All floors within the block are required to be built as a compartment floor with at least 90 minutes fire resistance. All shafts (i.e., service risers, lift shafts, stair cores, smoke shafts) should be designed and constructed as protected shafts enclosed by compartment walls achieving a minimum of 90 minutes fire resisting construction which should be increased to 120-minutes for firefighting shafts (i.e., lift shaft and stair core).

6.2.2 Flats will be separated from each other and from other parts of the building by compartment walls achieving a fire-resistance rating of at least 60 minutes.

6.2.3 The non-residential areas shall be separated from the rest of the building by compartment walls and floors achieving at least 90 minutes fire resistance.

6.2.4 The building features re-entrant corners between different compartments at a 90° angle at the interface of Core C and Block A and also between flats and the lift lobby around Core C. At the re-entrant corners compartmentation is to be extended to achieve a separation distance of 1.8m between any unprotected areas of the adjoining compartments or a compartment and a protected stair core.

This will be provided by extending fire rated construction along the external walls, either by 1.8 m or to the end of the external walls. The firefighting stairs will be concrete cores surrounded by construction rated to 120 minutes fire resistance which will meet Section 20.3.1 of BS 9999.

6.2.5 To reduce the risk of fire spreading over the roof, from one compartment to another, a 1,500mm wide zone of the roof, either side of the compartment wall, should have a covering classified as BROOF(t4), on a substrate or deck of a material rated class A2-s3, d2 or better. Further details and exceptions are given in Clauses 5.13 – 5.15 and Diagram 5.2 of ADB Vol.1.

6.2.6 Fire-resisting construction will be provided in accordance with the recommendations in Table B3 of ADB Vol.1 reproduced in Table 12 below and as indicated on the architects’ fire safety strategy drawings.

Table 12 – Fire resistance requirements for the block of flats

Part of Building	Minimum Fire Resistance rating when tested to the relevant part of BS 476 (mins)			Methods of Exposure
	Loadbearing	Integrity	Insulation	
Structural elements	90	n/a	n/a	Exposed Faces
Compartment floor	90	90	90	From underside From all exposed sides for loadbearing
Walls separating flats	60	60	60	Each side separately
Compartment walls separating non-residential areas	90	90	90	Each side separately
External walls:				
Any part less than 1,000 mm from a point in the relevant boundary	90	90	90	Each side separately
Any part more than 1,000 mm from the relevant boundary	90	90	15	From the inside
Any part adjacent to an external escape route or stair	30	30	n/a	From the inside
Protected shafts (risers, lifts)	90	90	90	Each side separately
Firefighting shafts				
Construction separating shaft from the rest of the building	120	120	120	From outside shaft
Construction separating firefighting stair, lift and lobby	60	60	60	From shaft side

Part of Building	Minimum Fire Resistance rating when tested to the relevant part of BS 476 (mins)			Methods of Exposure
	Loadbearing	Integrity	Insulation	
Protected enclosure Not forming part of a compartment wall or shaft to a lobby or corridor	30	30	30	Each side separately
Cavity barriers	n/a	30	15	Each side separately

- 6.2.7 Areas defined as places of special fire hazard (i.e., oil-filled transformer, switch gear room, boiler room, storage space for fuel or other highly flammable substance, rooms that house a fixed internal combustion engine) should be enclosed in fire resisting construction achieving a minimum of 30 minutes in accordance with Clause 7.2 of ADB Vol.1.
- 6.2.8 Notwithstanding the above, it is recommended that ancillary accommodation within the building is to be enclosed within fire-resisting construction. The degree of separation required depends on the contents of the room / enclosure and is summarised in Table 13 below.

Table 13 - Ancillary accommodation fire protection requirements

Ancillary accommodation	Minimum fire resistance
Storage areas not greater than 450m ²	30 minutes
Transformer, switch gear and battery rooms for LV equipment	
Storage areas greater than 450m ²	60 minutes
Service installation rooms	
Repair and maintenance workshops where flammable liquids are used / stored	
Transformer and switchgear rooms for equipment above low voltage	90 minutes
Refuse storage areas	
Boiler rooms	
Fuel storage spaces	
Car park	
Rooms housing fixed internal combustion engine (s)	120 minutes
Any are that contains plant associated with life safety systems and fire protection systems	
Substation*	
*UKPN may require the substation be enclosed in 240mins fire resistance.	

6.3 Fire doors and doors on escape routes

- 6.3.1 Doors on escape routes should not be fitted with locks, latch or bolt fastenings or should only be fitted with simple fastenings that can be readily operated (without the use of a key) from the side approached by occupants making an escape without needing to manipulate more than one mechanism.
- 6.3.2 Doors should generally be hung to open in the direction of escape and should always do so where it is expected that the number of persons expected to use the door at the time of a fire is more than 60.
- 6.3.3 Vision panels should be provided where doors on escape routes sub-divide corridors, or where doors are hung to open in both directions. Further guidance on vision panels in doors across accessible corridors is provided in ADM and guidance on fire safety of glazing in contained in Approved Document K (ADK) [27].
- 6.3.4 Any fire doors fitted with automatic locking or hold-open devices should be designed as indicated in Section 3.9.1.
- 6.3.5 Where doors on escape routes need to be secured against unauthorised use by electrically powered access control measures (i.e., keypads, swipe or proximity card, biometric data etc.) when the building or part of the building is occupied, they should also be provided with a security mechanism override from the side approached by occupants making an escape.
- 6.3.6 Electrically powered locks should return to the unlocked position in the following situations:
- On operation of the detection and alarm system;
 - On loss of power or system error; or
 - On activation of a manual door release unit (Type A) that is designed to BS EN 54-11 [28] and is positioned at side of the door that is 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.
- 6.3.7 Fire doors are to be provided in accordance with the recommendations of Appendix C of ADB Vol.1, and as summarised in Table 14 below.
- 6.3.8 All fire doors should be self-closing except for doors within flats or dwellinghouses, fire doors to cupboards or doors which are normally locked shut, such as to places of special fire hazard or service risers, which may also need to be provided with appropriate signage.
- 6.3.9 Fire doors assemblies shall comply with:
- BS 476-22 [29] or BS EN 1634-1 [30] for door hardware & fire resistance; and where applicable
 - BS 476-31 [31] or BS EN 1634-3 [32] for smoke leakage.

Table 14 - Provision for fire doors

Position of Door	Tested to BS 476-22	Tested to BS EN1634-2
Enclosing ancillary accommodation	As per the wall it is fitted in	As per the wall it is fitted in
Enclosing the smoke shafts	FD 90 S	E 90 S _a
Enclosing service risers	FD 60 S	E 60 S _a
Flat entrance doors	FD 30 S	E 30 S _a
Enclosing a lift shaft	FD 60	E 60

Position of Door	Tested to BS 476-22	Tested to BS EN1634-2
Enclosing a firefighting lift	FD 60	E 60
Enclosing a firefighting stair	FD 60 S	E 60 S _a
Enclosing the protected lobby in front of the stair	FD 30 S	E 30 S _a
Door giving access to the external stair.	FD 30 S	E 30 S _a
Notes: Smoke seals are indicated by the suffix 'S' (to BS 476-31) or 'S _a ' (to BS EN 1634-3) and are required in all doors which form the enclosure to protected escape routes.		

6.4 Fire-stopping and penetrations through fire-resisting construction

- 6.4.1 Fire-stopping should be provided at the junction of fire-separating walls and external walls in order to maintain the fire resistance period of fire-separating walls, and thereby prevent a fire from travelling around the junction and into the neighbouring space. Penetrations through lines of fire-resisting separation should be fire-stopped using a system which will achieve the same fire resistance rating as the penetrated wall or floor.
- 6.4.2 In order to maintain the fire resistance of separating construction, any pipe or cable penetrations through lines of fire-resisting separation should be fire-stopped in accordance with one of the following methods set out by Section 9 of ADB Vol.1, unless located within a protected shaft. Figure 15 is provided to assist in the interpretation of the recommendations below.
- for pipes of any diameter, a proprietary seal which has been shown by test to meet the fire-resistance rating of the wall, floor, or cavity barrier; or
 - for pipes with a restricted diameter, keeping the opening as small as possible and providing fire-stopping around the pipe. The nominal interior diameter of the pipe should not be more than the relevant dimensions given in Table 9.1 of ADB Vol.1, also reproduced in Table 15; or
 - 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 a high melting point metal. The opening in the structure should be as small as possible and the sleeve should be class A1 rated and extend no less than 1000mm on either side of the structure.
- 6.4.3 As a recommendation for any future provision, any gas supply pipe in a protected shaft will be of a screwed-steel or all-welded steel construction, installed in accordance with the “Pipelines Safety Regulations 1996” [33] and the “Gas Safety (Installation and use) Regulations 1998” [34].

Table 15 - Maximum nominal internal diameter of pipes

Situation	Pipe material and maximum nominal internal diameter (mm)		
	High melting point metal ⁽¹⁾	Lead, aluminium, aluminium Alloy, uPVC ⁽²⁾ , fibre cement	Any other material
Structure enclosing a protected shaft which is not a stairway or lift shaft	160	110	40
Any other situation	160	40	40
Notes:			
1) Any metal (such as cast iron, copper or steel) 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.			
2) uPVC pipes conforming to either BS 4514 [35] or BS 5255.			

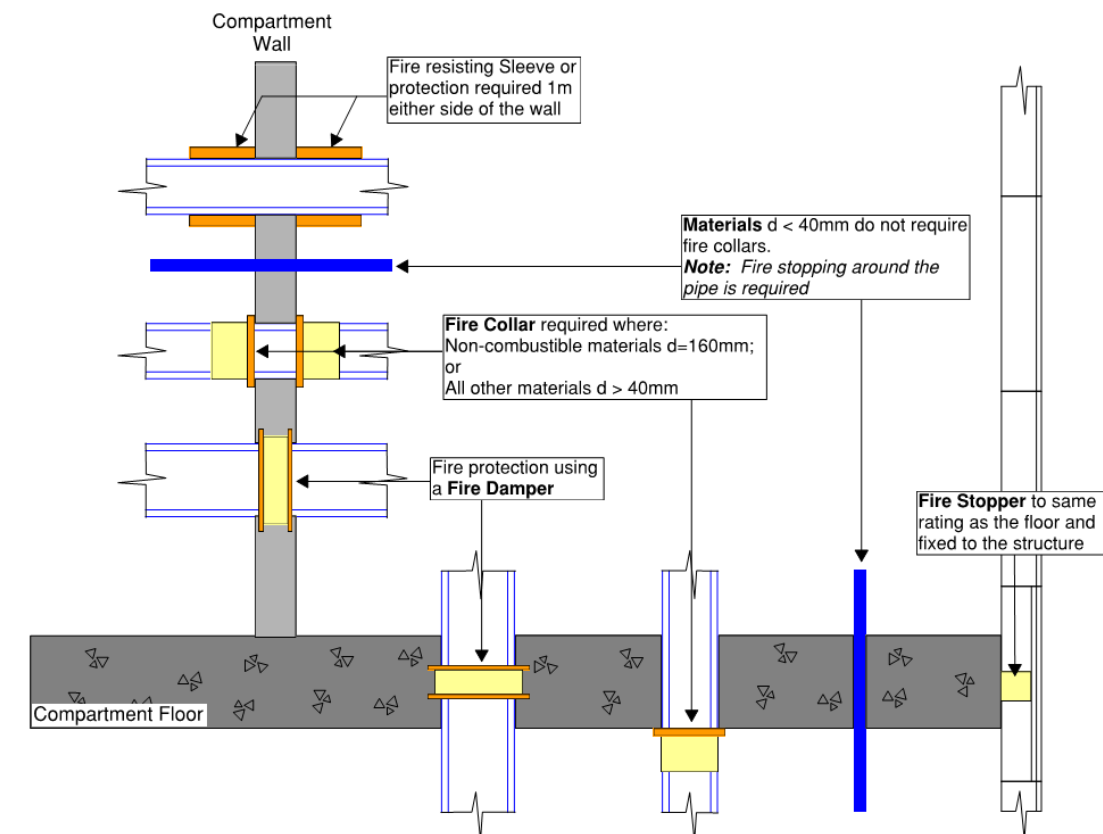


Figure 15 - Fire-stopping expectations

6.5 Protection of ductwork

- 6.5.1 One of the following methods is to be implemented where a ventilation duct passes through a fire resisting element to maintain the integrity of the element being breached:
- Thermally activated dampers (not suitable where passing through the enclosure of a protected escape route);
 - Protection using fire and smoke dampers activated by smoke detectors (ES-type dampers);
 - Protection using fire-resisting enclosure achieving the fire resistance rating equivalent to the highest rated compartmentation that is penetrated; or
 - Protection using fire-resisting ductworks achieving the fire resistance rating equivalent to the highest rated compartmentation that is penetrated.
- 6.5.2 If dampers are the preferred form of ductwork protection, smoke detector operated fire and smoke dampers (ES-type) shall be provided where the ductwork enters fire-separated or smoke-separated sections of escape routes and where it enters in each dwelling. Where ducts pass between fire-separating elements to serve multiple flats or dwellings, fire dampers or fire and smoke dampers should be actuated by both of the following.
- Smoke detector-controlled automatic release mechanisms.
 - Thermally actuated devices.
- 6.5.3 Fire dampers should conform to BS EN 15650 [36] and achieve an 'E' classification equal to or greater than the resistance of the element that it penetrates, but not less than 60 minutes in accordance with BS 13501-3 [37].

- 6.5.4 Fire and smoke dampers should conform to BS EN 15650 and achieve an 'ES' classification equal to or greater than the resistance of the element that it penetrates, but not less than 60 minutes in accordance with BS 13501-3.
- 6.5.5 The fire resistance of duct and dampers should be equal to the fire-resistance required for the element that is penetrated. All ducts should be fire-stopped where they penetrate compartments and fire-resisting enclosure of escape routes.
- 6.5.6 Any air transfer grilles required as part of a ventilation system should not be provided within any wall, door, floor or ceiling enclosing a protected entrance hall, protected corridors, firefighting stairways and lobbies, protected shafts and compartment walls or floors. Air transfer grilles located within fire hazard rooms should be provided with both fire and smoke containment. Any transfer grilles fitted in doors will need to be accompanied by a test certificate provided by the door manufacturer.
- 6.5.7 Any extraction ductwork serving a kitchen is recommended to avoid passing through fire-resisting construction where possible. If this cannot be avoided, then the ductwork should not be fitted with dampers, and should instead be fire-resisting or be enclosed within fire-resisting construction.

6.6 Cavity barriers and concealed spaces

- 6.6.1 Cavity barriers should be provided in order to prevent the rapid spread of unseen fire or smoke in voids, and to prevent the spread of fire around compartmentation via voids. Cavity barrier should be provided in accordance with Section 8 of ADB Vol.1:
- To close the edges of cavities, including the top of the cavity wall and around openings (windows, doors and exit/entry points for services) in the external wall;
 - At the junction between an external cavity wall (except where the cavity wall is twin-leaf masonry/concrete constructed in accordance with Diagram 8.2 of ADB Vol.1) and every compartment floor or compartment wall; and
 - At the junction between an internal cavity wall (except where the cavity wall is twin-leaf masonry/concrete constructed in accordance with Diagram 8.2 of ADB Vol.1) and every compartment floor, compartment wall or other wall or door assembly which forms a fire resisting barrier.
- 6.6.2 Figure 16 is provided to assist with the interpretation of these requirements.
- 6.6.3 Extensive internal concealed cavities (i.e., roof voids or the void between suspended ceilings and the soffit of the floor above) generally require cavity barriers to sub-divide them. In general, cavity barriers should be at 20m centres in cavities with exclusively class C-s3, d2 linings or better. For other linings, the spacing between cavity barriers should be reduced to 10m. Various exceptions are provided in Clause 9.10 of ADB Vol.2 with respect to extensive cavities in non-domestic premises.
- 6.6.4 All cavity barriers should have a fire resistance rating of at least 30 minutes for integrity (E) and 15 minutes for insulation (I) and should be fitted to a rigid construction and mechanically fixed into position.
- 6.6.5 Cavity barriers in a stud wall or partition, or provided around openings may be formed of:
- steel at least 0.5mm thick;
 - timber at least 38mm thick;
 - polythene-sleeved mineral wool, or mineral wool slab, under compression when installed in the cavity; or
 - calcium silicate, cement-based or gypsum-based boards at least 12mm thick.

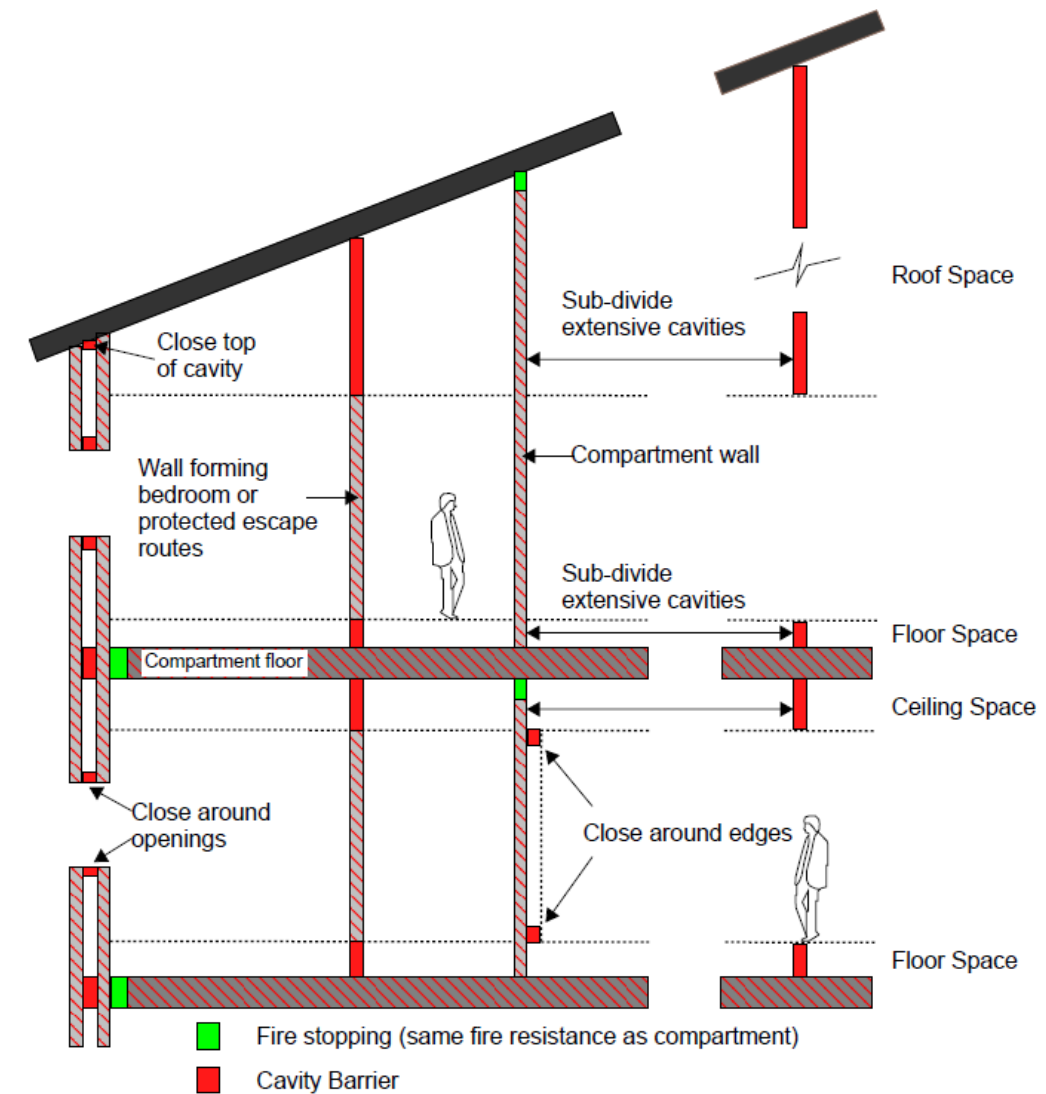


Figure 16 - Cavity barrier and fire-stopping locations

7. EXTERNAL FIRE SPREAD

Building Regulations requirement B4:

“(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 use and position of the building.”

7.1 External wall construction - ‘Relevant buildings’

- 7.1.1 The definition of external walls contained within the Building Regulations also includes windows and doors within the wall and any decorations applied to the external surface of the walls.
- 7.1.2 As the building will contain one or more dwellings, an institution or a room for residential purposes and will have a floor at a height greater than 18m above ground level, it will be classified as a ‘relevant building’ under Regulation 7(4) of the Building Regulations.
- 7.1.3 The building will comply with the requirements of Regulations 7(1) and 7(2), which state that:
- [...] “(1A) building work shall be carried out so that relevant metal composite material does not become part of an external wall, or specified attachment, of any building.”
 - “(2) building work shall be carried out so that materials which become part of an external wall, or specified attachment, of a relevant building are of European Classification A2-s1, d0 or A1 (classified in accordance with the reaction to fire classification).”
- 7.1.4 In accordance with Regulation 7(3) the following items are exempt from Regulation 7(2):
- Cavity trays when used between two leaves of masonry;
 - Any part of a roof (other than any part of a roof which falls within paragraph (iv) of regulation 2(6)) if that part is connected to an external wall;
 - Door frames and doors;
 - Electrical installations;
 - Fibre optic cables;
 - Insulation and water proofing materials used below ground level or up to 300mm above that level;
 - Intumescent and fire stopping materials where the inclusion of the materials is necessary to meet the requirements of Part B of Schedule 1;
 - Membranes;
 - Seals, gaskets, fixings, sealants and backer rods;
 - Components associated with a solar shading device, excluding components whose primary function is to provide shade or deflect sunlight, such as the awning, curtain or slats;
 - Thermal break materials where the inclusion of the materials is necessary to meet the thermal bridging requirements of Part L of Schedule 1;
 - Window frames and glass; or
 - Materials which form the top horizontal floor layer of a balcony which are of European classification A1fl or A2fl-s1 (classified in accordance with the reaction to fire classification) provided that the entire layer has an imperforate substrate under it.

7.1.5 In addition to the recommendations set out by Regulations 7(1) and 7(2) above, the building should also comply with requirement B4 of the Building Regulations and the external walls of the building should meet the following recommendations:

- External surfaces should meet the recommendations in Table 10.1 of ADB Vol.1 reproduced in Table 16 below; and
- Cavity barriers should be provided in accordance with Section 6.6 of this report.

7.1.6 The provisions in Table 16 apply to each wall individually in relation to its proximity to the relevant boundary.

Table 16 – Reaction to fire performance of external surface of walls

Building type	Top storey height	Less than 1 m from boundary	More than 1 m from boundary
Relevant buildings as defined in Regulation 7(4)		Class A2-s1, d0 ⁽¹⁾ or better	Class A2-s1, d0 ⁽¹⁾ or better
<p>Note 1: The restrictions for these buildings apply to all the materials used in the external wall and specified attachments.</p> <p>Although external walls will meet the Regulations 7(2) requirements, certain exempt items may be subject to additional controls as set out in this table (see para. 7.1.1).</p>			

7.1.7 Particular attention is drawn to the following points:

- Membranes used as part of the external wall construction above ground level should achieve a minimum of class B-s3, d0. Roofing membranes do not need to achieve a minimum of class A2-s1, d0 when used as part of a roof connecting to an external wall;
- Internal linings should comply with the guidance provided in Section 5.1;
- Any part of a roof should achieve the minimum performance detailed in Section 7.2;
- 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);
- Regulation 7(2) only applies to specified attachments. Shop front signs and similar attachments are not covered by the requirements of Regulation 7(2), although attention is drawn to the point below;
- 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;
- Any material achieving class A1fl or A2fl-s1 in accordance with BS EN 13501-1 is exempted when it meets both of the following conditions:
 - It forms the top horizontal floor layer of a balcony; and
 - It is provided with an imperforate substrate under it which extends to the full size of the class A1fl or A2fl-s1 material.

7.2 Roof coverings

- 7.2.1 Roof coverings are recommended to be resistant to fire spread where either close enough to a boundary to be at risk of ignition from a fire in other buildings or where needed to avoid fire spread between compartments via the roof covering.
- 7.2.2 The relevant test and classification standards for the external fire performance of roof systems are BS EN 13501-5 (European class) or BS 476-3 (national class). If required, Table B2 of ADB Vol. 1 provides further information on the transposition to the BS 476-3 classification.
- 7.2.3 Roof coverings refer to a construction that can consists of one or more layers of material but does not refer to the roof structure as a whole.
- 7.2.4 Table 17 below summarises the separation distances from the boundary according to the type of roof covering as described in Table 12.12 of ADB Vol.1.

Table 17 – Limitations on roof coverings

Distance from relevant boundary	European Class	B _{ROOF} (t4)	C _{ROOF} (t4)	D _{ROOF} (t4)
Less than 6m		✓	✗	✗
At least 6m		✓	✓	✗
At least 20m		✓	✓	✓

7.3 Green roofs

- 7.3.1 The building will comprise roofs and terraces classified as green roofs, which will consist of substrates including a growing media and waterproofing layers. Guidance for the design of green and biodiverse roofs is provided in the GRO Green Roof Guide [38], and the DCLG Fire Performance of Green Roofs and Walls [39] guide. In summary, the general recommendations for consideration in the design of green roofs are as follows:
- the waterproofing layer at the base of the substrate layers should achieve a classification no less than the roof covering designation (see Table 17);
 - the substrate and growing media should be a minimum depth of 80mm and consist of no more than 20% organic content, where this should not consist of peat;
 - fire breaks of at least 500 mm should be provided from the perimeter edge as well as from any openings (doors, windows, vents, etc.) and vertical elements of all types;
 - fire breaks of at least 1.5m should be provided either side of compartment walls below, or otherwise, the roof covering and waterproofing classifications should be at least B_{ROOF}(t4) for 1.5m either side of the compartment wall below; and
 - fire breaks should be provided in 1m wide strips every 40m across extensive green roofs.
 - Specific irrigation and ongoing maintenance requirements will be confirmed by the specialist designer.
- 7.3.2 Fire breaks on green or biodiverse roofs may be provided using 20-40mm rounded pebbles with a minimum thickness of 50mm. Paving slabs may also be used as fire breaks. The formation of fire breaks should have a depth of not less than 75mm.

- 7.3.3 Provided that the structural deck and roof coverings comply with requirements B3, the presence of a green roof should not adversely affect the designation and the minimum relevant boundaries provided in ADB are applicable.

7.4 Space separation and unprotected areas of the façade

- 7.4.1 Should a fire occur in a building, heat will radiate through non-fire resisting openings in the external walls. This heat can be enough to set fire to nearby buildings. In order to reduce the chance of this occurring, the Building Regulations place limits on the area of the external elevation with no fire resistance, known as the unprotected area.
- 7.4.2 The relevant boundaries are the reference point at which the potential for fire spread, being:
- the site boundary;
 - a notional boundary created on the centreline of an adjacent carriage way; or
 - a notional boundary created midway between this building and the nearest adjacent building.
- 7.4.3 In accordance with ADB guidance, only small unprotected areas in an otherwise protected façade do not contribute to the extent of unprotected area. These are shown in Figure 17.
- 7.4.4 Where the external elevation required to be protected, the external wall within the relevant elevation should be fire rated in accordance with Table 12 and Table 13.
- 7.4.5 It should be noted that where an external wall is within 1.0m from the relevant boundary, that external wall shall have 0% unprotected area and is required to have the same fire resistance as the structure of the building.
- 7.4.6 Where an external wall has the appropriate standard of fire resistance but has a surface material classified as less than European Class B-s3, d2 and is more than 1mm thick, that part of the wall shall be classified as an unprotected area equating to half its area.
- 7.4.7 In accordance with ADB guidance, the external fire spread assessment shall be carried out using the enclosing rectangle method as detailed in BRE Report 187 [40].
- 7.4.8 The amount of unprotected area depends on height and width of the fire compartment and the distance between the façade and relevant boundary.
- 7.4.9 The neighbouring Red Row site has numerous large openings which open onto the development, the Red Row strategy for venting their car park is unknown and could not be confirmed whether the ventilation openings are protected to mitigate against external fire spread to the development. However due to the provision of sprinklers in this development and full protection (120 minutes to the sprinkler tank room and 90 minutes to the car park with no openings) to the façade in these areas, it is considered reasonable for this to provide adequate defensive protection for external fire spread from the Red Row site.
- 7.4.10 Measurements between the building elevations and associated relevant boundaries are shown in Figure 18.
- 7.4.11 The results of the analysis representing the worst-case scenarios are presented in Table 18 . This table indicates the allowable unprotected area for the fire compartments on each elevation in relation to their distance from the relevant boundary.

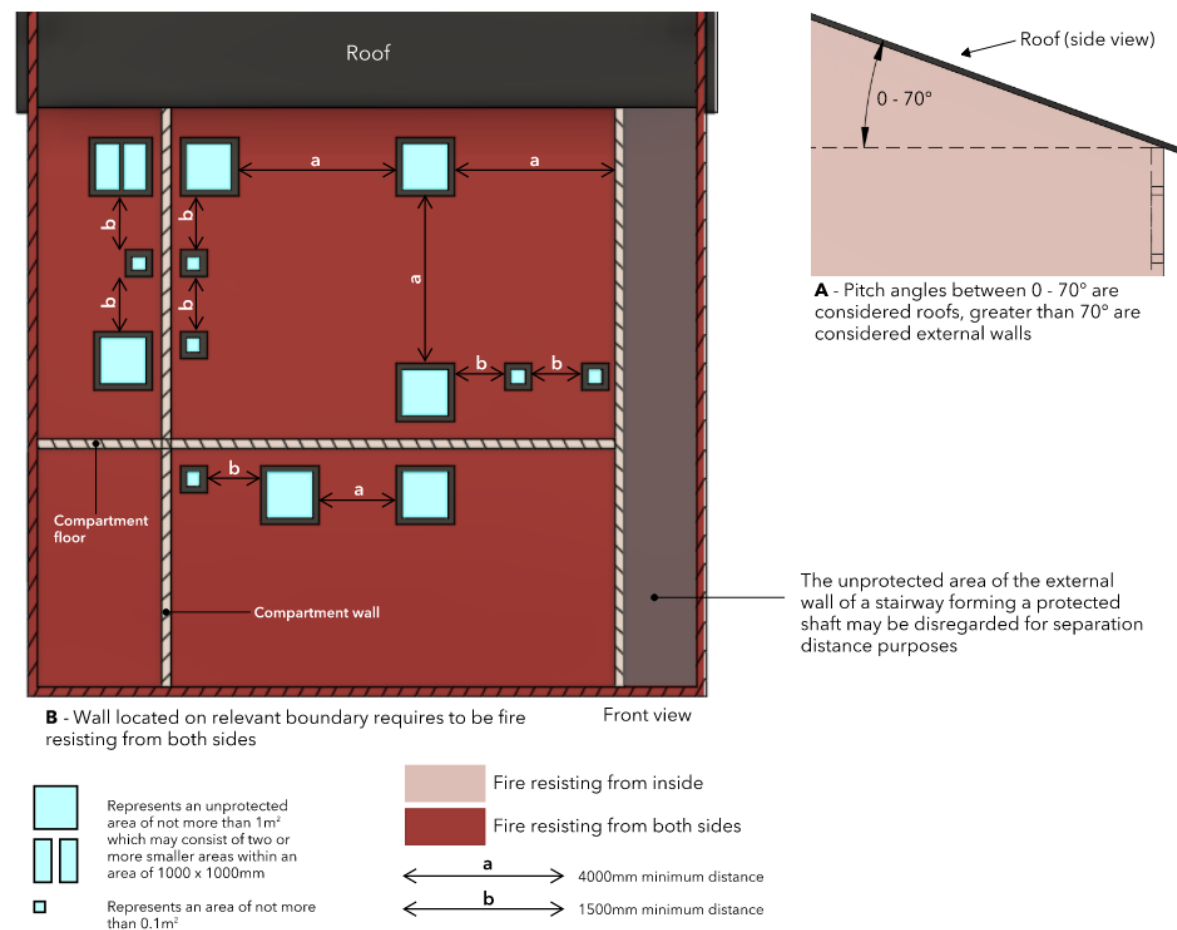
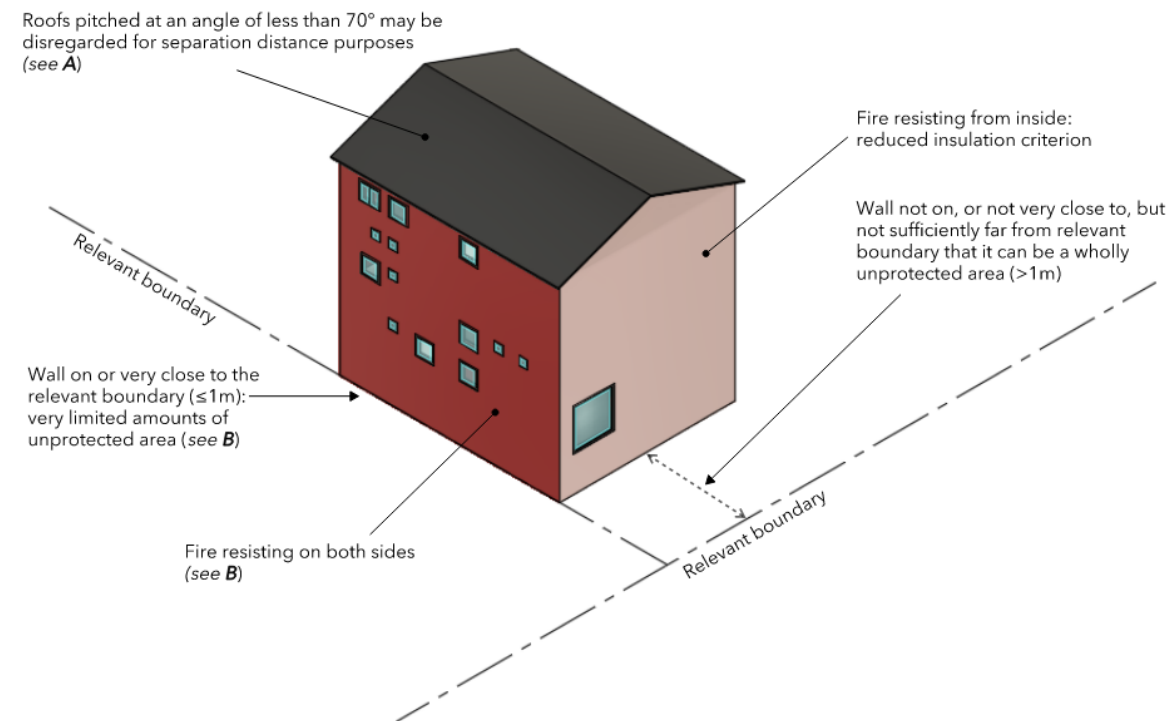


Figure 17 -Exclusion from unprotected area calculations

Table 18- Summary of external fire spread assessment.

Elevation	Area / compartment	Radiation intensity [kW/m ²]	Enclosing rectangle [m]		Boundary distance [m]	*Allowable unprotected area [% / sqm]
			Width	Height		
North	Car park	168	16.4	2.3	1.9	53% / 20
North	Car park	168	27.9	2.3	1.2	34% / 22
North	Car park	168	14.4	2.3	1.7	48% / 16
North	Duplex flat	84	8.5	6.4	1.7	51% / 27
East	Car park	168	30.3	2.3	1.2	34% / 24
East	Flat (upper floor)	84	11.3	3.1	1.8	82% / 28
South	Flat (ground floor)	84	12.6	3.3	6.0	100% / 41
South	Refuse store	168	4.3	3.3	5.6	100% / 14
West	Duplex Flat	84	8.0	6.4	4.9	100% / 51

Note* This assumes the openings are distributed evenly over the elevation.

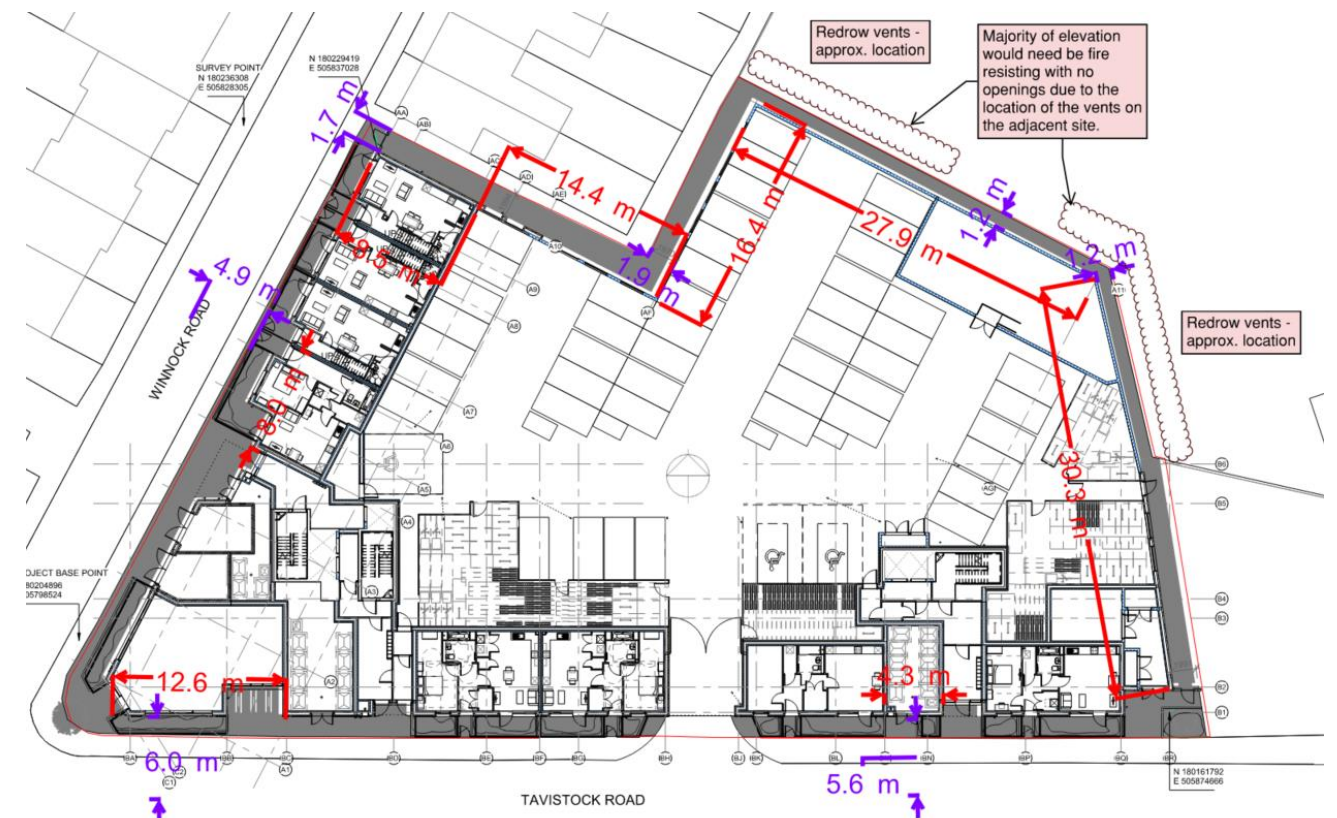


Figure 18 - Spatial separation from relevant boundaries (North is at top of image)

8. ACCESS AND FACILITIES FOR THE FIRE AND RESCUE SERVICE

Building Regulations requirement B5:

- (1) The building shall be designed and constructed so as to provide reasonable facilities to assist fire fighters in the protection of life.
- (2) Reasonable provision shall be made within the site of the building to enable fire appliances to gain access to the building."

8.1 Overview

- 8.1.1 In the event of fire, the fire and rescue service will be notified by a resident or, where applicable, by a member of management staff or a 'Redcare' or similar monitoring agency (if provided).

8.2 Vehicle access to and around the site

- 8.2.1 The vehicle access routes are indicated in Figure 19, based on the vehicle tracking information provided by the transport consultant (Ardent). Due to the existing parking positions, suitable fire vehicle access along the length of Winnock Road has not been confirmed. As such, vehicle access is considered to be only reliably available up to the corner of Winnock Road.
- 8.2.2 To comply with ADB, any point in the duplexes and the car park should be within 45m of FRS vehicle parking position, measured on a route suitable for laying hose. The dry riser inlets should also be within 18 m of the FRS vehicle parking position. However, based on vehicle access routes described above, the hose laying distances to certain areas and distance to the dry riser inlet in Block A exceed the recommended limits within the guidance from the FRS vehicle parking position.
- 8.2.3 The hose length from the FRS vehicle parking position to the dry riser inlet is 26m and from the FRS vehicle to every point within the furthest duplex is estimated to be 65m. The car park also has extended hose distances of up to 49m and 60m. As the whole development is provided with a suppression system throughout, the hose laying distance extension is considered acceptable. This would be a departure from the guidance and should be discussed and agreed with building control and the Fire Service.
- 8.2.4 Fire and rescue service appliances should not reverse more than 20m, otherwise, suitable turning facilities shall be provided.
- 8.2.5 Vehicle access route will comply with the minimum specification indicated in Table 19 for a pump-type appliance. Fire and rescue service appliances are not standardised, therefore vehicle access provision should be discussed and agreed with the local fire and rescue service to ensure their vehicle complies with the parameters listed in Table 19.

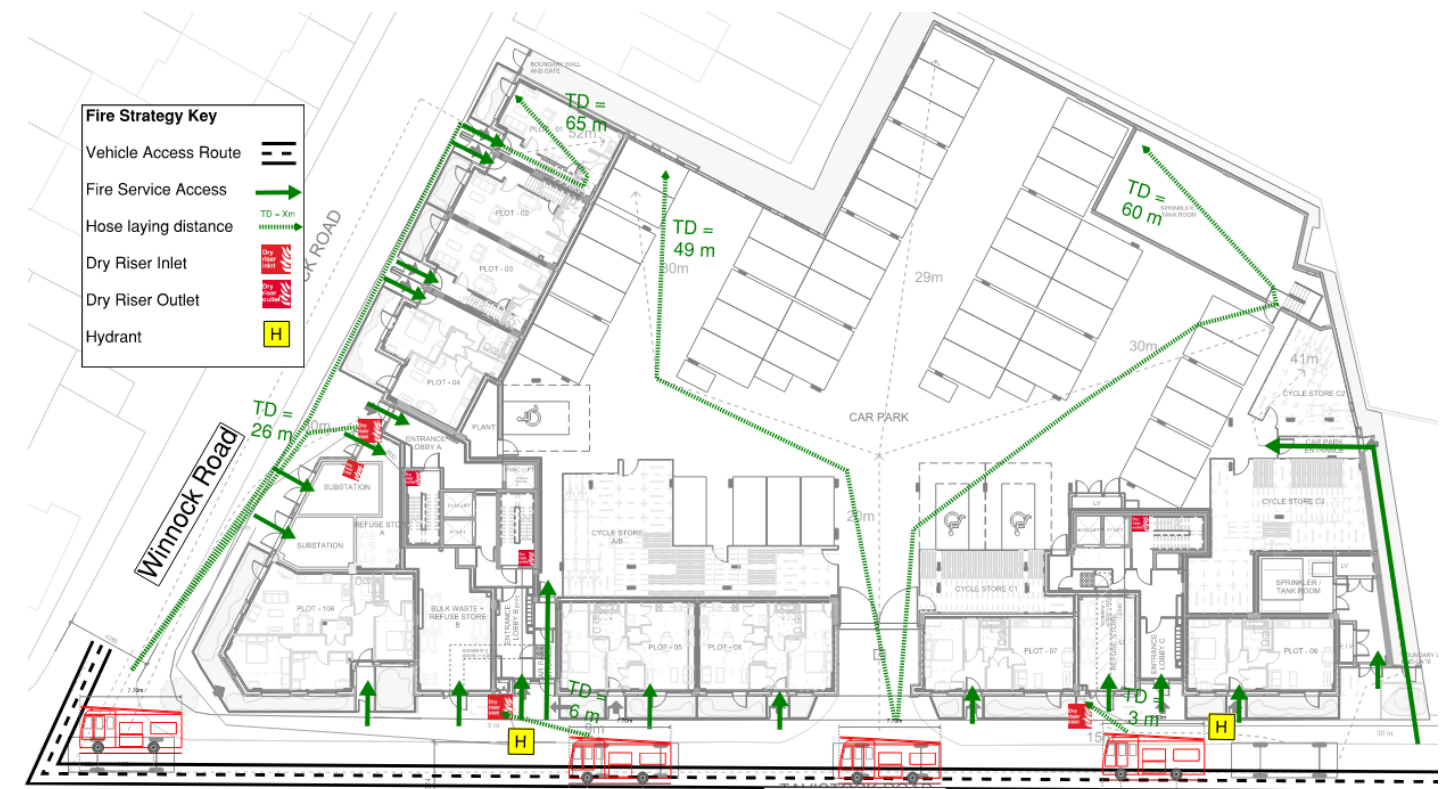


Figure 19 - Indicative fire track access route

Table 19 -Typical pump-type firefighting appliance access requirements

Minimum access route specification	Dimension
Width between kerbs	3.7 m
Width between gateways	3.1 m
Turning circle between kerbs	16.8 m
Turning circle between walls	19.2 m
Clearance height	3.7 m
Carrying capacity	14.0 tonnes (as per London Fire Brigade Guidance Note 29 - GN29 [41])

8.3 Access into and through the building

- 8.3.1 Access into each Block is provided at ground floor level, via the protected stair and firefighting shafts.
- 8.3.2 Block A will be served by a protected stair with a dry rising main. Firefighting operations within Block B/C shall be supported by a firefighting shaft. The firefighting shafts shall each comprise a firefighting stair, a dry rising main and a firefighting lift.
- 8.3.3 The communal corridor in front of the protected and firefighting stairs shall be provided with a smoke ventilation system in accordance with Section 3.3, in order to protect the stair from the ingress of smoke.
- 8.3.4 The building will be provided with three dry riser mains (one in each block), which will be designed in accordance with BS 9990 [42]. Riser outlets should be provided at each floor level, including the ground levels, and on the full landings of the required stair.
- 8.3.5 The dry-rising inlet should be within 18m and within clear sight, typically on the face of the building close to the entrance, from the FRS vehicle parking position which is not currently achieved in Block A. Dry-riser mains outlets should be located within the stairway on the full landing at each level. The maximum horizontal pipe run permitted for a dry rising main is 18m in accordance with BS 9990 [42].
- 8.3.6 Access to any point on the floor plate at ground / upper floors and the car park should not be more than 45m distance, measured on a route suitable for laying hose, from the FRS vehicle parking position or 60m from the dry rising outlet within the firefighting shaft. Flats and maisonettes accessed directly from outside at Ground Floor shall be within 45m distance, measured on a route suitable for laying hose, from the FRS vehicle parking position. Based on the access routes indicated in Figure 19, this is not currently achieved in some parts of the development. See Section 8.2.3 for more information on Hose distances.
- 8.3.7 Access to any point on the floor plate on upper floors should be no more than 45m and 60m, measured on a route suitable for laying hose, from the dry rising outlet within the protected stair of Block A and the firefighting shafts for Block B/C respectively. This is also true for the ground floor car park area, where the fire and rescue service deem it appropriate to use the outlet within the stairs to fight a fire in the car park. However alternative routes, as discussed in Section 8.2, are available which do not rely on doors being opened between the stairs and the car park.
- 8.3.8 All doors giving access to the interior of the building will have a minimum width of 750mm.

8.4 Water supplies

- 8.4.1 Hydrants will be required in the vicinity of the building to support firefighting operations.
- 8.4.2 As the blocks shall be provided with dry rising mains, hydrants should be located not more than 90m of each dry-rising main inlet as can be seen in Figure 19. The location of existing hydrants have been taken from the information on the Fire Strategy Site Plan (71805-BM3- XX-XX-DR-A-507). The operational status of the hydrants should be confirmed on site.
- 8.4.3 A water supply capable of providing a minimum of 1,500 litres per minute at all times is recommended. Water supplies will be designed and installed in accordance with BS 9990

8.5 First-aid firefighting

- 8.5.1 First-aid firefighting provisions should be assessed and provided as part of the fire risk assessment for the building, including consideration for the day-to-day management of these provisions.
- 8.5.2 In general, fire points should be located within the ancillary areas presenting a significant fire risk and to ensure coverage of at least one fire point for every 200m² of floor area. The type and size of extinguisher(s) at each fire point should be chosen in accordance with the guidance given in BS 5306.

9. FIRE SAFETY MANAGEMENT

9.1 Overview

- 9.1.1 Management procedures have a pivotal role to play in fire prevention, control and evacuation of occupants should a fire incident occur. This management is the responsibility of the responsible person, supported by the building fire safety design and handover of fire safety information. In all other areas, the Regulatory Reform (Fire Safety) Order 2005 (FSO) places legal obligations on management.
- 9.1.2 This section is intended to introduce the FSO, its obligations and provide initial guidance in fulfilling these duties. It is the responsibility of the landlords/ building management to ensure that all fire safety systems are tested and maintained to ensure their continuous effectiveness. Building management need to be aware of all fire safety features provided and their purpose.
- 9.1.3 It is important that management are aware of their responsibilities detailed in this document and agree that they are sufficiently capable of adequately performing them. Effective arrangements should be put in place to manage all aspects of fire safety in the premises and the details of those arrangements need to be recorded, i.e., within a fire safety management plan.
- 9.1.4 In accordance with BS 9999 [2], there are two management system levels. One of which should be implemented and are summarised in Table 20.

Table 20 - Management levels

Level	Management	Robustness	Minimum assurance	Conformity
1	Enhanced	Best Practice	High level of assurance	Conformity with a management level such as BS 9997 [43]
2	Adequate	Good Practice	Adequate level of assurance	Conformity with requirements of legislation

9.2 Regulatory Reform (Fire Safety) Order 2005 & Fire Safety Regulations 2022

- 9.2.1 The Regulatory Reform (Fire Safety) Order (FSO) applies to all non-domestic premises in England and Wales, including the common parts of blocks of flats or houses in multiple occupation. Under Article 24 of the Order, The Fire Safety Regulations 2022 (FSR) has been introduced to extend the scope of the FSO in high-rise and multi-occupied residential buildings to include:
- flat entrance doors
 - walls and floors separating residential units from each other and other parts of the building
 - plant rooms and
 - external walls.
- 9.2.2 The FSR also introduces new additional requirements (see 9.2.4 and 9.2.5) that are applicable in these residential buildings.
- 9.2.3 The 'responsible person' as defined within the FSO has a duty to make the premises safe and must undertake regular fire risk assessments. It is the responsible person who will be held accountable under the new legislation for any breaches in fire safety. It is expected that the building is managed and maintained to a standard in accordance with the expectations of the FSO and the FSR.

- 9.2.4 For high-rise residential buildings these obligations require the installation of wayfinding signage, a secure information box within the building, and the placement of plans and information in the box, as well as regular inspections of firefighting equipment.
- 9.2.5 In all multi-occupied residential buildings, the responsible person is to provide information to residents and to install fire doors in all residential buildings with communal areas. Certain information (design and materials in external walls, floor plans and building plan and other elements listed in the FSR) must be also provided to fire and rescue authorities.
- 9.2.6 In workplaces, the responsible person is the employer. In other cases, the owner or person in control of the premises is the responsible person, i.e., landlord, building management company.
- 9.2.7 Under the Order, the 'responsible person' must carry out a fire safety risk assessment and implement and maintain a fire management plan. The assessment should be kept under regular review and reassessed if the use of the building has been varied or a material alteration has been made. The significant findings must then be recorded, along with the measures taken to address the risks identified. A competent person should carry out the fire risk assessment.

9.3 Management responsibilities in support of the fire strategy

- 9.3.1 Management of fire safety must be integrated with all other management systems. If this management is lacking, then there is a danger that all the other areas such as security measures and alarm systems will be ineffective. To ensure there is no doubt as to where the responsibility for fire safety rests, and to enable consistency of approach, it is important that each establishment appoints a designated Fire Safety Manager. It may be possible to appoint a professional to take on this role but that will depend on the size of the premises, costs, etc.
- 9.3.2 The appointed person should have the necessary authority and powers of sanction to ensure that the standards of fire safety are maintained. The main duties of the Fire Safety Manager include:
- management to minimise the incidence of fire; i.e., good housekeeping and security;
 - producing an Emergency Fire Plan;
 - being aware of all of the fire safety features provided and their purpose;
 - being aware of any particular risks on the premises (i.e., issues relating to hot work);
 - being aware of their responsibilities towards disabled people;
 - attendance at the premises when members of the public are present, or the building is occupied. It is acceptable for a competent person other than the fire safety manager to be in attendance, provided that this person has been delegated in writing and that cover is not interrupted;
 - liaising with, and where necessary seek the advice of, the fire authority, the licensing authority and other relevant enforcing authorities;
 - having powers to deal with individuals who sabotage or tamper with safety systems, who ignore any smoking policy or who block exits;
 - liaising with other fire safety managers in a multi-occupancy arrangement;
 - ensuring that tenants, concessionaires and caretakers are appropriately briefed;
 - ensuring that appropriate communication systems are in place to deal with any fire incident;
 - checking the adequacy of fire-fighting equipment and ensuring its regular maintenance;

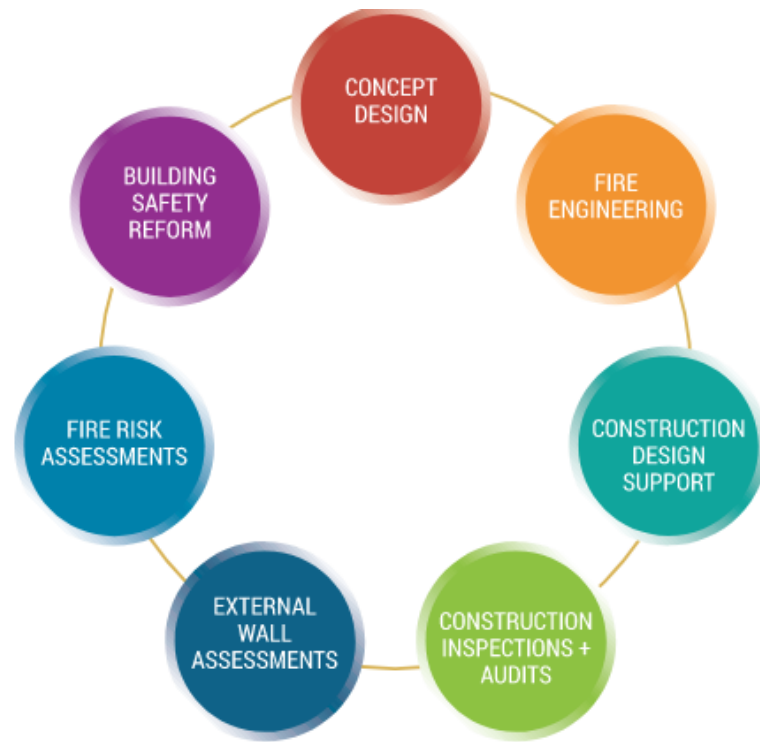
- ensuring fire escape routes and fire exits are unobstructed and doors operate correctly;
- ensuring that fire detection and protection systems are maintained, tested, with records kept; and
- ensuring any close down procedures are followed.

- 9.3.3 Good housekeeping is to ensure that the effectiveness of the fire safety provisions is not adversely affected, including the adequate provision for the disposal of waste and / or rubbish. Maintenance procedures are to be enacted so that equipment will operate effectively. Maintenance staff are to be trained in the importance of the fire safety systems and planned maintenance.
- 9.3.4 Suitable assembly points outside the building should be identified. These should be remote from the access routes used by the FRS.
- 9.3.5 Internal escape routes should generally have wall and ceiling linings achieving a European class B-s3, d2 surface spread of flame standard, apart from permitted exceptions noted in this report. These finishes must be maintained for the lifetime of the building. Display features or items such as posters, artwork pieces, etc. may be included with appropriate consideration, justification and on-going control.

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