ORIONFIRE
ENGINEERING

RIBA 4 DESIGN FIRE STRATEGY

PROJECT NAME: Holloway Head – Blocks C & D, Birmingham

DATE: 5th September 2022

REF: OF-000328-DFS-01-A

Contents

Quality Assurance

Rev	Date	Prepared/Updated By	Reviewed By	Comments
-	11/07/22	Ellis White	Ben Cooper	Initial report issue
A	05/09/22	Stuart Hutchinson	Oskar Dzielak	Updates following design team comment, summary cause and effect included

1 Project Brief

1.1 Introduction

1.1.1 Orion Fire Engineering have been appointed by Winvic Construction Limited to produce the RIBA 4 fire strategy for the Holloway Head development, Birmingham. This report details the recommended fire safety features to be incorporated into the design of the building. This fire strategy applies to blocks C & D only.

1.1.2 The recommendations within this report are based on meeting the functional requirements of Part B of the Building Regulations only. No additional insurance requirements or employer's requirements have been incorporated into the report.

1.1.3 Where any aspect of the report deviates from the prescriptive guidance documents referenced in Section 1.2, they have been listed in Section 1.5 for ease of reference. Any element of the design not referenced within Section 1.5 should be in full accordance with the prescriptive codes referenced in Section 1.2.

1.1.4 The Building Regulations set a minimum acceptable standard for a building in England. As the recommendations within this report are based on complying with Building Regulations only, this report should be seen as a minimum fire safety standard for the building. Therefore, all recommendations given within this report must be incorporated into the design of the building in order to meet Building Regulations. Should any aspect of the report be unachievable, Orion Fire Engineering should be contacted at the earliest opportunity to review that aspect of the design.

1.1.5 Building Regulations approval can only be granted by a Building Control Body (BCB), and approval of this report is subject to the review by the BCB. As part of the Building Regulations approvals process, the BCB must undertake a formal consultation with the Fire Safety Enforcing Authority (FSEA) for any building that would be subject to The Regulatory Reform (Fire Safety) Order 2005 (RR(FS)O) as amended by the Fire Safety Act 2021 upon completion of the works. Although the FSEA cannot enforce under the Building Regulations, they may provide observations under Building Regulations in addition to items that they would consider as enforceable under the Fire Safety Order on completion of the building and any best practice recommendations for the building that would not be enforceable under any regulations.

1.1.6 A summary of the report has been provided in Section 8, that lists the key fire safety features and systems that are to be provided within the building, alongside references to relevant sections within this report for those systems and also references to the applicable British Standards. This is to serve as a reference for the Responsible Person for the building to aid in discharging their duties under the RR(FS)O. The summary may also provide an aide-mémoire for designers; however, the detailed performance specification for fire safety systems is contained within the main body of the report.

1.2 Legislation and Design Guidance

1.2.1 This report has been developed to provide sufficient advice for the design of the development to meet the functional requirements of Part B of the Building Regulations 2010. The Building Regulations 2010 contains functional requirements that are broad statements that describe how the development should perform to meet the requirements of the Building Regulations. Prescriptive codes, such as Approved Document B and BS 9991 provide specific recommendations for the majority of typical buildings. The adoption of one of these prescriptive codes is one way to achieve compliance with the Building Regulations.

1.2.2 This fire strategy has been prepared using BS 9991:2015 (incorporating Corrigendum No.1): "*Fire safety in the design, management and use of residential buildings – Code of practice"* as the primary fire safety guidance document for the residential accommodation and residential amenity areas of the building.

1.2.3 The non-residential accommodation (Girl Guides and Shop) have been prepared using Approved Document B Volume 2 (2019 Edition incorporating 2020 amendments) (ADB).

1.2.4 The recommendations made within this report are based upon the recommendations given within BS 9991, ADB and the various supporting British Standards.

1.2.5 Upon occupation of the development, the common areas will be subject to the RR(FS)O. The RR(FS)O places a legal responsibility on the Responsible Person of the building to ensure that the building is properly maintained with regard to fire safety. Upon completion of the project, this fire strategy will provide a summary of the fire safety provisions that should be in place within the building, to assist the Responsible Person in discharging their duties under the RR(FS)O.

1.2.6 The responsible person on occupation should provide adequate fire safety information to all eventual residents of the flats. This could be in the form of a home user guide to include basic prevention measures and the fire evacuation strategy and procedures. Further information on advice to occupiers of dwellings in residential buildings including an example fire evacuation plan is provided in Annex F of BS 9991:2015.

1.2.7 The fire emergency plan ought to be communicated to each resident on occupation. Residents ought to have a clear understanding of what actions to take should a fire situation change, and they need to evacuate the building.

1.3 Project Information

1.3.1 The drawing information listed in Table 1 has been reviewed whilst producing this fire strategy. Any information not listed in Table 1 has not been reviewed by Orion Fire Engineering. All recommendations made within this report are based on the drawings listed below. Any revisions to those drawings may invalidate this report.

Table 1: Drawing Information Reviewed

Produced By	Drawing Number	Drawing Title	Rev	Date Reviewed
Corstorphine & Wright	P21043-CW-XX-XX-DR-A-0202	Site Plan	C01	11/07/2022
	P21043-CW-CD-LG-DR-A-2710	Fire Strategy Level LG	C00	11/07/2022
	P21043-CW-CD-MZ-DR-A-2711	Fire Strategy Level MZ	C00	11/07/2022
	P21043-CW-CD-UG-DR-A-2712	Fire Strategy Level UG	C00	11/07/2022
	P21043-CW-CD-01-DR-A-2713	Fire Strategy Level 01	C00	11/07/2022
	P21043-CW-CD-02-DR-A-2714	Fire Strategy Level 02	C00	11/07/2022
	P21043-CW-CD-03-DR-A-2715	Fire Strategy Level 03	C00	11/07/2022
	P21043-CW-CD-04-DR-A-2716	Fire Strategy Level 04	C00	11/07/2022
	P21043-CW-CD-05-DR-A-2717	Fire Strategy Level 05	C00	11/07/2022
	P21043-CW-CD-06-DR-A-2718	Fire Strategy Level 06	C00	11/07/2022
	P21043-CW-CD-07-DR-A-2719	Fire Strategy Level 07	C00	11/07/2022
	P21043-CW-CD-08-DR-A-2720	Fire Strategy Level 08	C00	11/07/2022
	P21043-CW-CD-09-DR-A-2721	Fire Strategy Level 09	C00	11/07/2022
	P21043-CW-CD-10-DR-A-2722	Fire Strategy Level 10	C00	11/07/2022
	P21043-CW-CD-11-DR-A-2723	Fire Strategy Level 11	C00	11/07/2022
	P21043-CW-CD-12-DR-A-2724	Fire Strategy Level 12	C00	11/07/2022
	P21043-CW-CD-13-DR-A-2725	Fire Strategy Level 13	C00	11/07/2022
	P21043-CW-CD-RL-DR-A-2726	Fire Strategy Level RL	C00	11/07/2022
	Elevations			
	P21043-CW-CX-XX-DR-A-2727	Fire Strategy Elevations Block C (N & E)	C00	11/07/2022
	P21043-CW-DX-XX-DR-A-2728	Fire Strategy Elevations Block D (S & W)	C00	11/07/2022
	P21043-CW-CD-XX-DR-A-2729	Fire Strategy Elevations Block C & D Courtyard (N & S)	C00	11/07/2022
	P21043-CW-CD-XX-DR-A-2730	Fire Strategy Elevations Block C & D Courtyard (E & W)	C00	11/07/2022
	P21043-CW-CD-XX-DR-A-2731	Fire Strategy Elevations Block C & D Courtyard (SW & NE)	C00	11/07/2022
	P21043-CW-CD-XX-DR-A-2732	Fire Strategy Elevations Block C & D Courtyard returns	C00	11/07/2022

1.4 Site and Building Description

1.4.1 Blocks C and D of the Holloway Head development comprises of two blocks of residential accommodation located in Birmingham which is bound by Holloway Head, Blucher Street, Brownsea Drive and Ellis Street. The development is 16 storeys (Lower Ground, Mezzanine, Upper Ground, Level 1 to Level 13) and has a height of 43.1m to the topmost occupied storey when measured from the lowest adjacent ground level. The block setting out and building heights are illustrated below on Figure 1 and Figure 2.

1.4.2 Blocks C and D are connected at Lower Ground and Mezzanine levels, but then rise independently from Upper Ground level either side of a central courtyard. For the purpose of this report, the Mezzanine is to be treated as a floor/storey.

1.4.3 The non-residential accommodation consists of two storeys of Girl Guide accommodation and a single Shop/retail unit. The Girl Guide covers the entire Lower Ground and part of the Mezzanine and is provided with two protected stairs, has two exits to fresh air at Mezzanine and one exit to fresh air at Lower Ground. The Shop is also located on the mezzanine and is provided with direct access from external. The remainder of the Mezzanine contains a residents enclosed car park, various plant rooms, storage rooms.

1.4.4 The residential accommodation is located on Upper Ground to Level 13 in the form of single level open plan apartments. Each block is designed with a single escape stair from the residential accommodation.

1.4.5 There is a two-storey amenity space at Upper Ground and Level 1 comprising the main entrance foyer, offices, parcel store, lounge/co-working space and TV room with an accommodation stair providing access between the levels. A communal access terrace is provided at Level 7. The main roof levels are maintenance only to the associated brown roof areas and photovoltaics.

1.4.6 Parts of the floors of the Lower Ground and Mezzanine are more than 1200mm below the highest level of ground beside the outside wall and would be considered basement storeys. However, the development is on a split level with the lowest point at Lower Ground being the Southeast corner at the junction of Ellis Street and Holloway Head. Due to the slope of ground, a large portion of the lower ground and mezzanine levels are open to the external.

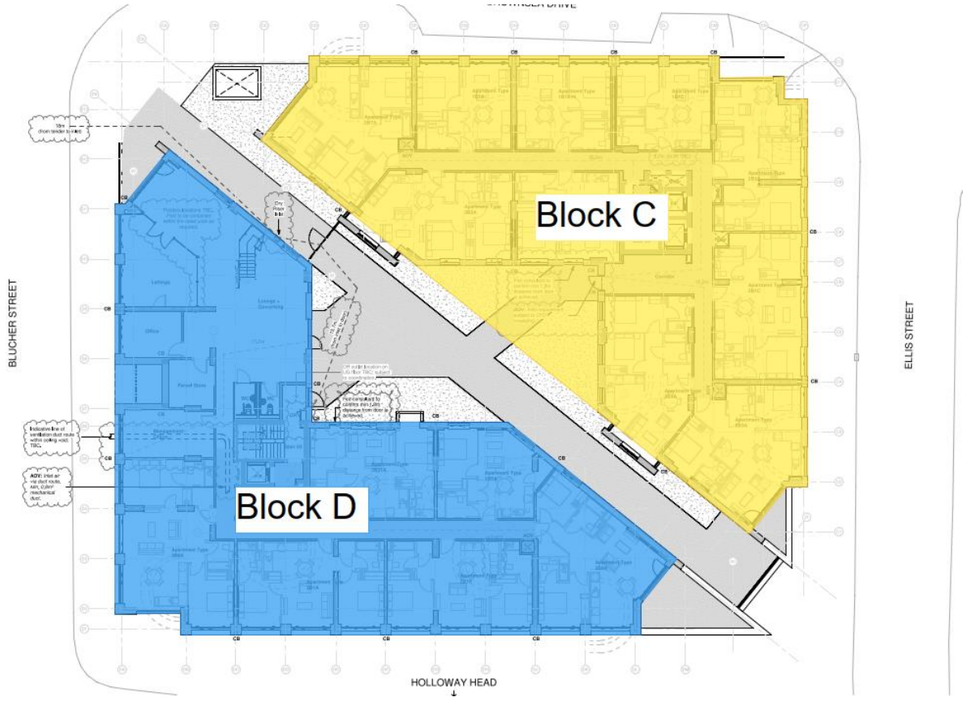

Figure 1: Block Designation

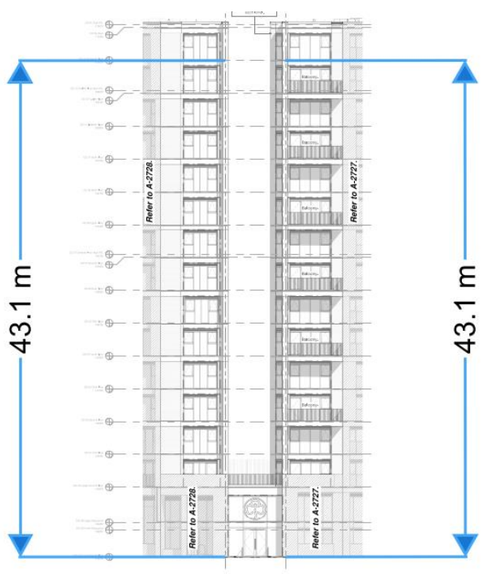

Figure 2: Development Height

1.5 Variations from Prescriptive Guidance

1.5.1 The layout of the development is generally in accordance with the prescriptive recommendations given within BS 9991 for residential areas and ADB for non-residential areas. All alternative approaches from the recommendations of the prescriptive codes used to develop this strategy have been summarised in Table 2 for ease of reference. Unless listed below, no other aspect of the design should deviate from the relevant recommendations of BS 9991.

Table 2: Variations to the prescriptive guidance

Variation	Report Section
Open plan apartments greater than 8m x 4m provided with unenclosed kitchen. The requirements for the kitchen enclosure condition, relative to the size of apartments are based on NHBC study on open plan apartments. Based on the research conducted, the size of the apartment is not considered to have a significant impact on the means of escape, with the general principle being that the larger the apartment, the better the conditions in the event of a fire.	2.4.2
The Girl Guides apartment would classify as non-residential accommodation, however as the apartment is similar in design to an open plan apartment and is provide with the same fire protection measures as a standard apartment, is considered acceptable as it is separated from all other non-residential accommodation by a protected ventilated lobby.	2.4.4
Category B curt off devices are proposed to apartments where the hob separation distances is not met, the cut off devices would limit the fire growth and therefore reducing the separation distances would offer tenable escape subject to approvals authority agreement.	2.4.6
The common corridor travel distances on the upper ground to 13th floor exceed the prescriptive travel distance recommendations of 15m in a single direction, measuring up to 23.6m in Block C and up to 26.1m in Block D. Therefore, an enhanced mechanical smoke ventilation system designed to meet the criteria of Annex A of BS 9991 and the SCA guide is to be provided in the common corridors. The performance specification for the mechanical systems is subject to validation via Computational Fluid Dynamics (CFD) analysis and modelling to validate that the system can maintain tenable conditions in a fire scenario.	2.4.13
The single direction travel distance from Activity 01 and Activity 02 are extended to 23.8m and 21.8m respectively. The extension of travel distance is considered acceptable from these areas given the occupants will be awake and familiar and L1 detection is provided to all areas of the Girl Guides. Additionally, the protected corridor makes up for at least 50% of the total travel distance so the actual travel distance through the risk area is considerably below the 18m limitation in a single direction (c.11m in both rooms).	2.4.30

Variation	Report Section
The tank room, refuse stores, comms rooms would be classified as inner rooms to the car park, however the car park would be considered a place of special fire hazard and should not provide access to inner rooms. However the arrangement is deemed acceptable subject to the following provisions; • The inner rooms are transient areas which would only be periodically used and would be of short duration use. • The inner rooms are to be linked to detection within the car park (L1 standard) immediately alerting occupants to a fire in the car park. • The car park is to be provided with a BS EN 12845 sprinkler system which would control fire growth and reduce smoke output. • The car park is also to be provided with a smoke ventilation system which would assist in clearing smoke in the incipient stages of fire once the fire detection system has activated.	2.4.34
Protected Stair 5 serving the Girl Guides accommodation does not discharge direct to external however, the stair provides access to alternative means of escape either via the protected corridor at Mezzanine Level onto Brownsea Drive or via the protected corridor at Lower Ground on to Holloway Head.	2.5.9
In single stair buildings the stair should not continue down and communicate with a basement level, however, the configuration is deemed acceptable due to the following; • The basement is not a true basement level due to the sloped ground level a large portion of the lower ground and mezzanine levels are open to the external. • The basement is offered multiple escape stairs. • The car park is provided with a BS EN 12845 sprinkler system which would suppress a fire and reduce smoke production. • Access lobbies to each stair is provided with a smoke ventilation system and a smoke ventilation system within the car park that will be designed to prevent smoke ingress to the stair from a car fire. It is noted that prescriptive guidance also requires that stair serving residential floors, should not communicate with covered car parks, however, this is deemed acceptable due to the reasons stated above.	2.5.16 & 2.5.17
Upper Ground floor apartment windows adjacent to Stair 3 final exit are not proposed to be fire-resisting on the basis they are a minimum of 2.0m from the stair door, the remainder of the external wall to the apartment will be 120-minute fire-resisting for 5m horizontal distance and the apartment is sprinklered so a fire can be suppressed at source in the early stages to control to fire, keep smoke and radiant heat at low temperatures and reduce the risk of flashover and significant amount of heat escaping the apartment externally.	2.5.20
Where bin stores are accessed internally, in accordance with BS 5906 they should be accessed via a protected lobby provided with at least 0.2m^2 permanent ventilation, however as the refuse stores are accessed directly from the car park which is to be provided with a ventilation system which would exceed the 0.2m^2 permanent ventilation it is deemed acceptable to omit the 0.2m^2 permanent ventilation. Further CFD might be required to demonstrate this approach is acceptable.	2.7.27

Variation	Report Section
The car park also provides access to the platform lifts of both Blocks C & D, the platform lifts should be accessed via a lobby with 0.4m^2 permanent ventilation, however in lieu of a protected ventilated lobby, a fire and smoke curtain is to be provided in front of the FD60s lobby doors.	2.7.29
The firefighters lift within Block C is currently extended above the 7.5m limitation from the associated stair, the distance measures approximately 8.7m. Orion would deem this extension acceptable based on it being a slight extension and the fire protection measures provided, refer to full detail in Section 6.2.	6.2.3 - 6.2.4
Basement floors would require ventilation equalling 2.5% of each floor area served or a mechanical equivalent, however, due to the provision of the car park smoke ventilation system and the windows of the external facades it is considered acceptable for no further ventilation provisions as all areas can be ventilated for firefighting operations.	6.8

1.6 Further Works

1.6.1 This fire strategy has been produced to provide a performance specification suitable for progression to RIBA Stage 4, however, there are multiple areas of the fire strategy that will require further development as well as areas of the Architect's GA Floor Plans that will need to be developed alongside this fire strategy. These areas have been summarised below:

Table 3: Further Works to be developed

Further works	Report Section
A number of alterations are required to the GA/fire strategy plans to comply with the fire strategy. Refer to Orion comments made on C&W fire strategy plans (ref: OF-000328-DRC-03).	N/A
An EACIE system is recommended due to the blocks exceeding 18m in height. Client to confirm acceptance of introduction of the EACIE system.	2.1.7
Client to confirm the occupancy numbers proposed are in line with the expected occupancy.	2.2
The non-residential/ancillary accommodation including the car park and Girl Guides demise should be provided with a Category L1 alarm and detection system to BS 5839-1 consisting of detection in each non-residential/ancillary area. It should be confirmed if each area is to have a separate system and is to be managed separately.	2.3.14
Client to confirm how fire alarm signals will be managed from residential and Shop/Girl Guide accommodation (on-site or linked to an off-site alarm receiving centre). Given the complexity of the building it may be beneficial for the fire alarm panels to be linked between the various uses/areas for notification purposes and this should be confirmed by the client.	2.3.16
Design team to confirm fire alarm panel and repeater panel provisions and locations.	2.3.16
Architect to review hob separate distances in apartments. There are a number of instances where the recommended separation distances have not been achieved. Layout will need altering or additional fire protection measures to the cooking facilities (Category B cut-off's) may be required.	2.4.7
Confirm internal lining of external wall provides 60-minutes fire resistance as per the locations identified.	2.4.15
The internal layout of some ancillary accommodation is not yet known. Some of the direct escape distances are exceeded currently, however travel distances will need to be verified once internal layouts are known.	2.4.17
Cross-corridor door to be provided along alternative escape route from Main Hall as per location identified in section of report.	2.4.29
Disabled refuge should be provided to Stair 5 on Lower Ground.	2.6.7
Confirm if communal lounge/dining at Level 1 and the roof terrace at Level 7 are to be occupied only by residents and their guests. If other public/non-residents are to accessed these spaces then additional disabled egress provisions may be required.	2.6.10
Design team to confirm the agreed residential smoke ventilation strategy approach and additional replacement air inlet locations.	2.4.4 2.7 Table 10
The performance of the residential mechanical smoke systems should be assessed using CFD analysis to validate the performance of the system. This report to be updated following completion of CFD analysis.	2.4.14 2.7 2.7.14
The corridor doorway immediately adjacent to the Girl Guides apartment should be omitted to allow the smoke ventilation system in the firefighting lobby to serve the corridor giving access to the Girl Guides apartment.	2.7.8
The performance of the car park smoke extract system should be assessed using CFD analysis to validate the performance of the system.	2.7.20
Further CFD might be required to demonstrate omitting the 0.2m^2 refuse lobby ventilation is acceptable.	2.7.27
Door between Block C Platform Lift and Car Park should be provided with a EW60Sa fire and smoke curtain.	2.7.29
Confirm the recommendations for above corridor ceiling services within this report have been allowed for to avoid the need for fire-resisting corridor ceilings.	3.3.3
Structural engineer to confirm no additional fire protection layers are required to protect the RC frame.	4.2.4
Confirm approach to the fire protection method to service voids in common corridor ceilings.	3.3.3
Life safety plant rooms should be enclosed in 120-minute compartmentation, this is currently shown at 60 minutes in some locations.	4.4
The contractor and wider design team should confirm the preferred solution on design and construction of the service risers and the method of fire stopping.	4.6
Confirm the external wall protected area requirements have been incorporated into the Lounge/co-working space.	5.1.10
The specific external walls materials and build-ups used within the building should be confirmed by the architect and specialist façade designer. A schedule of all materials and components of the external walls and any specified attachments is created along with the corresponding fire classifications of each product for reference should be provided.	5.2
Architect and Green/Brown roof consultant to confirm that the recommendations relating to fire performance of green roofs can be incorporated into the design.	5.4
Architect and M&E consultant to confirm that the recommendations relating to PV installations can be incorporated into the design	5.4
Confirm allowance for additional signage is provided to clearly indicate dry riser inlets for the Fire Service from the appliance parking location.	6.1.5 6.1.6
Confirm method of preventing water ingress into lift well	6.3.2
Confirm dry riser provided in Stair 5 both levels	6.4.1
The design team should confirm the flow rate and suitable of the existing fire hydrant provisions.	6.5
The secondary supply is to be provided by an alternative utility supply from a separate sub-station on a different supply network. The supplies will be diversely routed through each building. As the supplies will be fed from a different network the only way a power cut would affect both substations if the full grid went offline. This is reasonable from a fire perspective but there may be other considerations under CDM to allow the safe maintenance of electrical safety systems and then also the robustness of the solution from an ongoing maintenance perspective with regard to potential damage to equipment within the building. This should be assessed by the electrical engineer.	7.1

2 Means of Warning and Escape

2.1 Evacuation Principle

Residential

2.1.1 The principal mode of evacuation for the residential accommodation is a 'stay put' strategy whereby only the occupants of the apartment of fire origin will evacuate. This standard approach reflects the high degree of compartmentation present in these types of building and minimises the impact of false alarms – an important consideration in residential accommodation.

2.1.2 The means of escape from the apartments relies on automatic fire detection and fire protection measures incorporated in the common escape route design. Further evacuation of the remaining apartments throughout the building will only be conducted under instruction from the Fire Service or the independent actions of the occupants.

Ancillary Areas and Non-residential Accommodation

2.1.3 The ancillary and non-residential accommodation will operate on a simultaneous evacuation strategy, i.e., when the alarm is activated by the detection systems in these areas, it will result in the evacuation of all occupants within the fire affected area.

2.1.4 Ancillary areas include the following:

- Substation
- LV Switch
- Car Park
- Refuse Stores
- Generator Room
- Comms Room
- Tank Room
- Lounge/Co-working
- Lettings Office
- Office & Management Office
- Parcel Store
- Level 7 Communal Terrace

2.1.5 The non-residential accommodation includes:

- Girl Guide Demise
- Shop Demise

2.1.6 The areas adopting simultaneous evacuation are to be separated into zones as per Table 4. The fire alarm within the ancillary areas should be programmed such that fire detection in the affected zone should not trigger sounders in an unaffected zone or non-residential accommodation and vice versa.

Table 4: Simultaneous Evacuation Areas

Evacuation Zone [1]	Area	Floor(s)
1	Girl Guides Demise	Lower Ground and Mezzanine
2	Shop Demise	Mezzanine
3	Car Park, LV Switch, Refuse Stores, Generator Room, Comms Room, Tank Room, Substation	Mezzanine
4	Lounge and Coworking, Letting Office, Office, Parcel Store, Management Office, TV Lounge, Coworking/Dining	Upper ground and Level 01

[1] *Fire alarm activation in an ancillary area will also activate the fire warning signal on the accessible roofs.*

Evacuation Alert System

2.1.7 Although not required under the current iteration of BS 9991, an evacuation alert system is recommended to be provided at the development due to the height of the top storey in each block exceeding 18m. An evacuation alert system is provided for use by the Fire and Rescue Service for manually alerting individual or multiple floors to evacuate should the need arise during firefighting operations. The evacuation alert system is not to be confused with a common fire alarm system and such systems should be separate from any common fire detection system.

2.1.8 An EACIE system should meet the following requirements:

- An evacuation alert system is to be designed and installed in accordance with BS 8629:2019 – *Code of Practice for the Design, Installation, Commissioning and Maintenance of Evacuation Alert Systems for use by the Fire and Rescue Service in Buildings Containing Flats*, to be provided within the residential demise.
- A compliant BS 8629 system should not be regarded as a fire detection and alarm system and should be a completely separate system.
- The evacuation alert system is for sole use by the Fire and Rescue Service and it is to act as a means to assist in the initiation of either a partial or full evacuation of a high-rise residential development.
- The system should be simple to use but designed in a way to prompt the incident commander of the fire and rescue service to follow a structured procedure in activating the system. Separate controls and indicators are to be provided for each floor/section of floor so that the operator can activate/cancel the sounders to each floor separately. The indicators are provided to show that the sounders on each floor are operating/faulting on a specific floor which would alert the fire and rescue personnel to manually alert the residents within the development.
- Within new-build residential developments, BS 8629 recommends that the system is wired due to it being more cost effective over the longevity of the building.
- It is recommended that audible sounders are specified for each apartment and that appropriate visual/tactile devices are provided for people who may be deaf or hard of hearing. It is also recommended that an interconnection with a social alarm system is provided for residents who may require assistance to evacuate the building.

- The topmost control should be no more than 2.2m from the floor and the top of the cabinet should be 100mm above that. This effectively results in the maximum height of the cabinet being 900mm high.

2.2 Building Population

2.2.1 Based on the accommodation schedule there are a mix of one, two and three-bed apartments with occupancies between one and four persons per apartment. Block C has an intended permanent occupancy of 324 persons across 130 apartments. Block D has an intended permanent occupancy of 286 persons across 101 apartments. This gives a combined permanent occupancy of the residential accommodation of 610 persons.

2.2.2 As the residential parts of the building will operate on a stay put policy, the number of residents within the building does not impact on the size of the escape route from the residential areas on the principle that only one apartment would need to evacuate at any one time.

2.2.3 The occupancy of the ancillary and non-residential accommodation has been based on the floor space factors given in ADB. Although this fire strategy adopts BS 9991 as the main prescriptive code, BS 9991 does not provide any guidance on the occupancy levels within the ancillary accommodation. The occupancy of all ancillary areas is unlikely to occur concurrently with full occupancy of the apartments, but the theoretical maximum area/room occupancies has been provided in Table 5 below in order to conduct the escape capacity assessment in Section 2.4.

2.2.4 There are a number of areas within the building where the occupancy would be deemed as transient. These include but are not limited to storage areas, plant rooms, comms rooms, toilets and other sanitary accommodation and common access/egress routes. The occupancy within these areas is not permanent and has already been accounted for elsewhere in the building.

Table 5: Building Population Summary

Floor	Use	Total Floor Area (m^2)	Occupancy Load Factor	Occupant Capacity
Lower Ground	Main Hall	241	1m^2 per person	241 *
	Common Room	62.1	1m^2 per person	60 **
	Office	6.3	6m^2 per person	2
	Secretary Office	18.3	6m^2 per person	4
	CC Office	10.7	6m^2 per person	2
	Kitchen	23.9	7m^2 per person	4
			Total Lower Ground	313
Mezzanine	Shop	60.7	2m^2 per person	31
	Shop Kitchen	6.5	7m^2 per person	1
	Activity 1	75.3	2m^2 per person	38 ***
	Activity 2	69.7	2m^2 per person	35 ***
	Activity 3	50.4	2m^2 per person	26 ***
	Girl Guide Apt	n/a	2 per double bed 1 per single bed	5
	Car Park	790.5	2 persons per parking space	42
			Total Mezzanine	178
Upper Ground	Lounge/Co-Working	113.7	2m^2 per person	57
	Office	13.4	6m^2 per person	3
	Lettings	41.5	6m^2 per person	7
	Management office	21.7	6m^2 per person	4
			Total Upper Ground	71
First Floor	Lounge	22.6	2m^2 per person	12
	TV Lounge	21.1	2m^2 per person	11
	Coworking/dining	17.1	2m^2 per person	9
			Total First Floor	32
Seventh Floor	Communal Terrace	138	1m^2 per person	60 **
			Total	654

** When main hall is subdivided by folding partition, the occupancy to each side of the partition will be limited to 110 persons.*

*** Limited to 60 persons due to single direction of escape.*

*** The combined occupancy of the Activity Rooms is limited to a total of 60 persons due to the single direction of escape.

2.3 Fire Detection and Alarm Systems

Residential Apartments

2.3.1 The scheme contains open plan apartments. The apartments are to be provided with a fire detection and alarm system achieving Grade D1 Category LD1 in accordance with BS 5839-6.

2.3.2 Open-plan apartments must have at least one smoke detector in the access room containing the kitchen and living area which forms part of the escape route from the bedrooms. However, where the dimensions of the open-plan living area require more than one automatic fire detector, then it is proposed the detector sited closest to the kitchen area to be a heat detector so long as the other detector is a smoke. If the living area is only large enough for one detector, smoke detection is required as a minimum. A multi-sensor detector may be used instead of a smoke detector providing it gives equivalent protection as a smoke detector to alert sleeping occupants and located to minimise the occurrence of false alarms.

2.3.3 The fire alarm sound notification should be audible throughout the apartment and to a level that is not less than:

- 75dBA at the bedhead (measured with doors to the room closed)
- 65dBA in living areas (measured with door to the room closed)
- 65dBA on private balconies (measured with access door open)

2.3.4 Where the audibility on the balconies cannot be achieved with the integral sounder bases to the detector heads in the open plan area, an additional sounder closer to the balcony door may be required. External sounders should be avoided where practicable on private terraces as it would be

undesirable for the warning to be audible to other occupants not within the dwelling and may cause confusion.

Residential Common Escape Routes

2.3.5 Smoke detection should be provided in the common residential escape routes (common corridors, stair landings, head of lift shafts) to a Category L5 standard in accordance with BS 5839-1.

2.3.6 As the building operates on a stay-put evacuation strategy, there should be no sounders or Manual Call Points within the common residential escape routes, unless explicitly stated otherwise in this report. The system is provided to activate the building's smoke ventilation systems only and will not act as a means of warning occupants of a fire in these areas. The smoke detectors should be spaced along the common corridors in accordance with the recommendations of BS 5839-1 in that all areas of the corridors must be no more than 7.5m from a smoke detector. In the event of a smoke detector activating within a ventilated corridor, the smoke vents within that corridor and at the head of the stair should open simultaneously.

2.3.7 Additionally, it should be ensured a detector on the corridor is provided within 1m of the apartment doorways that are closest to each escape stair. Each detector should be located between the apartment doorway and the nearest stair.

2.3.8 Smoke detectors should also be located on each full landing of the stair in each block. In the event of a smoke detector activating within the stair enclosure, the vent at the head of the stair should open.

2.3.9 In residential buildings, there is no requirement for a common alarm system other than to activate the smoke control systems and therefore the base design standard for Part B of the Building Regulations would allow for the lift to remain in use in the event of a fire within the building. This is due to the design approach for residential buildings being based on maintaining normal conditions within the building.

2.3.10 Although no fire alarm interface is required with the lift to meet the minimum requirements of the Building Regulations, it is proposed that a smoke detector is provided at the head of each lift shaft. To allow wheelchair users and other non-ambulant residents to make a dignified escape from the building, the lift should only be recalled in the event of a smoke detector activating within the lift shaft, or in the exit level lobby serving the lift. On detection of fire within a lift shaft, the lift should be sent to the final exit level in accordance with BS EN 81-73. Should fire be detected on the exit level corridor serving the lifts, the lift should return to the floor above as an alternative designated landing.

Residential Ancillary Areas

2.3.11 The ancillary accommodation to the residential areas should be provided with a Category L1 fire detection and alarm system designed and installed in accordance with BS 5839-1 including manual call points and sounders. If a detector or manual call point in these areas is activated an alarm will sound throughout the affected ancillary zone and should also sound the alarm on all accessible rooftop levels (refer to Table 4 above).

Accessible Rooftops / Communal External Amenity

2.3.12 The maintenance-only rooftops and the communal roof terrace should be provided with audible and visual fire warning. The sounders should be linked to the detection within the ancillary areas, non-residential accommodation, common lobbies and stairs. Activation of detection in these areas should be programmed to activate all accessible rooftop sounders. If a sprinkler head activates within the building, a signal should be sent to the fire alarm panel via an interface linked to the flow switch. The system should be programmed to activate the sounders on the roof terrace should this occur to provide early fire warning to persons on the roofs. Additionally, activation of the L5 smoke detection on the common residential corridors used to activate the smoke control systems should be programmed to activate all rooftop sounders.

Non-Residential Accommodation

2.3.13 The Girl Guides and Shop should be provided with a Category L1 fire detection and alarm system designed and installed in accordance with BS 5839-1 including manual call points and sounders. If a detector or manual call point in these areas is activated an alarm will sound throughout the affected zone and should also sound the alarm on all accessible rooftop levels.

2.3.14 It should be confirmed if the Shop and Girl Guides are to have a separate fire detection and alarm system and if the systems in these premises are to be managed separately. A notification may be sent to the respective fire panels if the systems are to be interlinked between one another, or to an alarm receiving centre to manage fire alarm signals whilst the units are unoccupied.

General

2.3.15 Manual call points (MCP's) should be located on escape routes and storey exits leading directly to external (applicable to non-residential and ancillary accommodation only). The positioning of MCP's should be designed so that no occupants need to travel more than 45m in any direction to reach the nearest call point. MCP's need to be provided on final exit doors, regardless of these doors not being designated as fire doors.

2.3.16 As per the recommendations of BS 5839-1, the fire alarm panel should be located at an appropriate location, suitable for staff and firefighters attending site. Typically, this provided adjacent to the main entrance or designated fire service access point. Note, the exact positioning of the main fire alarm panel and location should be discussed and agreed with local Fire Authority and Building Control. Each stair core should be provided with a suitable repeater panel. All fire alarm panels should be accompanied by a diagrammatic zone plan adjacent to the control and indicating equipment. The design team should confirm the alarm panel provisions.

2.3.17 As the building is provided with a number of fire safety systems, it is crucial that adequate interfaces and connections are provided between these facilities for correct operation and monitoring purposes. The fire alarm interfaces need to be designed in accordance with BS 7273 and should include the following fire safety systems:

- Access control, hold open devices and magnetic locks on fire doors (in accordance with BS 7273-4)
- Lifts and their respective plant
- HVAC systems
- Sprinkler systems
- Smoke Ventilation systems
    - Common Corridor Smoke Ventilation

- AOV at the head of stairs
- Car Park smoke extract system

- Active compartmentation
- Any non-fire related sound systems

2.3.18 A summary of the fire detection and alarm systems provided within the building has been provided below in Table 6.

Table 6: Fire Detection and Alarm Systems

Area Covered	System	Notes
Apartments	Grade D1 Category LD1	BS 5839-6. Automatic detection in all habitable rooms. Sounders to achieve the required audibility at the balcony with the door open such that it negates additional sounders in the balcony itself. Also, link to cut off devices where applicable.
Common escape routes (Stairs, Common Corridors, Lifts)	Category L5	BS 5839-1. No sounders or manual call points should be provided on this system, it is provided to activate the smoke ventilation systems only. Smoke detectors to corridors, stairs and lift shafts. Smoke detectors in the lift shafts and in exit level lobby to descend lifts, no other detectors should descend the lifts. Detection should be linked to sounders in the rooftop maintenance and external amenity areas.
Ancillary Accommodation	Category L1	BS 5839-1. Detection throughout the ancillary areas including the car park. Detection should be linked to sounders in the rooftop maintenance and external amenity areas.
Accessible Rooftops and External Common Terrace	Category L5	BS 5839-1. Audible and visual fire warning linked to the detection within the ancillary areas, non-residential accommodation as well as the detection in the common corridors and stairs. Sprinkler system to be interfaced with fire alarm to alert rooftops on sprinkler activation.
Non-residential Accommodation	Category L1	BS 5839-1. Detection throughout the non-residential accommodation.

2.4 Horizontal Means of Escape

Open Plan Apartments

2.4.1 Due to the provision of a BS 9251 sprinkler system and Category LD1 alarm and detection system, travel distances within open plan apartments should be limited to a maximum of 20m. This has been achieved within every apartment.

2.4.2 Under the current iteration of BS 9991 open plan apartments exceeding 8m x 4m, the kitchen area should be enclosed, this is not achieved at the development. However, BS 9991 is to be updated and is currently in draft format, the draft format removes the requirement for enclosed kitchens in open plan apartments providing the following conditions are met;

- The size of the open-plan flat should not exceed 16 m × 12 m.
- Open-plan flats should be situated on a single level only.
- The ceilings within the open-plan flat should have a height of not less than 2.25 m.
- Cooking Facilities should be remotely from the apartment entrance/exit.

2.4.3 Orion are of the opinion that the requirement for enclosed kitchens was removed due to the following reasons, and therefore would adopt the approach as per the draft format of BS 9991 subject to BCB approval;

- The enclosed kitchen requirement was introduced following an NHBC foundation study commissioned to assess life safety in the event of a fire in open plan flat layouts. The NHBC study was not aimed at setting an upper limit on unenclosed kitchen open plan flat size, the 8m by 4m stipulated in the guidance is due to these dimensions being the largest open plan flat layout used within the study, featuring an unenclosed kitchen.
- The study concluded that through the provision of a BS 9251 or BS EN 12845 sprinkler system and an LD1 automatic detection alarm system to BS 5839-6, the conditions within an open plan flat are significantly improved over a code compliant design as stated in prescriptive guidance.
- Open plan apartments exceeding 8m x 4m where unenclosed kitchens are present, would offer a larger area for the smoke plume to develop and therefore the tenability conditions such as plume temperature and visibility would be improved over a code compliant design.
- Enclosing the kitchen does not eliminate the risk of a fire within the open plan apartment and therefore a fire risk within the open plan area remains, regardless of whether the kitchen is enclosed.
- There is no requirement placed on the fire rating of the enclosure provided to the kitchen area, therefore the enclosure could fail immediately at the onset of a fire within the apartment and therefore offering no protection to the kitchen area.

Girl Guides Apartment

2.4.4 A 3-bed open plan apartment is provided in the Girl Guide Accommodation. The Girl Guides apartment would classify as non-residential accommodation and would adopt the evacuation strategy adopted for the Girl Guides (simultaneous evacuation), however as the apartment is similar to an open plan apartment as described above, Orion consider the design and layout of the compartment as a residential apartment and deem this acceptable, subject to BCB approval, due to the following;

- The apartment is to be accessed via a corridor that is separated from the other non-residential by fire-resisting construction.
- The corridor serving the apartment also acts as the firefighting lobby serving the residential levels and should be provided with ventilation in the form of a 0.8m^2 mechanical smoke shaft or a 1.5m^2 vertical natural smoke shaft. The corridor door is to be omitted as per Figure 3.
- The nature of the occupancy is to be similar to a residential apartment.
- The layout is commensurate of a residential apartment and meets the requirements of an open plan apartment as detailed in section 2.4.1 - 2.4.3.

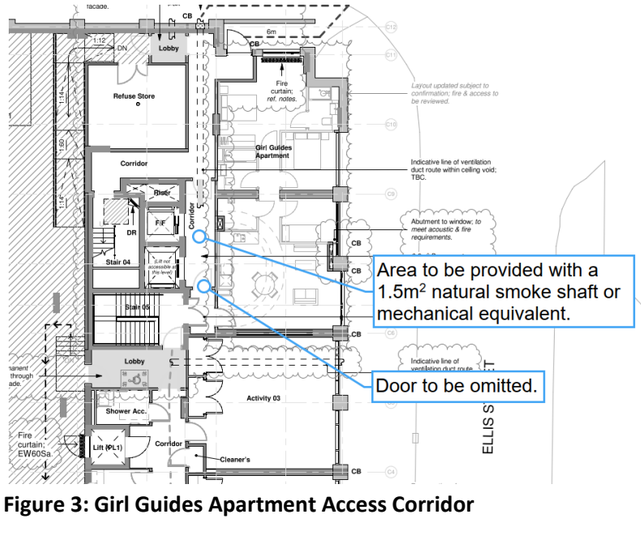

Figure 3: Girl Guides Apartment Access Corridor

Cooking Facilities (Open Plan Apartments and Balcony Escape)

2.4.5 Currently, BS 9991 does not quantify what is regarded as an acceptable hob separation distance, and therefore the distance required as not to prejudice the escape route. Although currently in draft format, the upcoming revision of BS 9991 details hob separation distances required for tenable escape conditions within an open plan kitchen layout. As highlighted on Figure 4, All egress routes adjacent to hob facilities in unenclosed kitchens should be at least 1.8m plus;

- 0.9m (the 0.9m excludes fixed obstructions such as radiators);
- 0.3 m should be provided between the leading edge of the door and the 1.8 m.

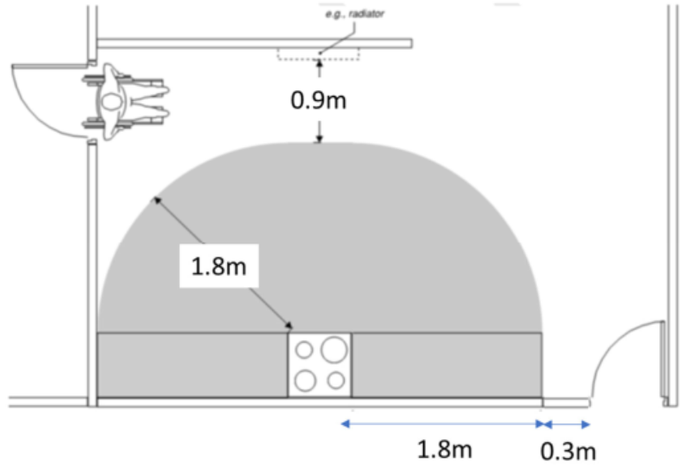

Figure 4: Hob Separation Distance

2.4.6 A radiative heat assessment has been conducted to demonstrate that where the hob separation distance is less than the 2700mm as described above, the radiative heat received by occupants escaping past a hob, does not pose an increased risk to life safety, subject to the provision of a life safety cut-off device and a minimum separation distance of 1650mm. The calculations used to conduct the analysis has been provided in Appendix A.

2.4.7 There are a number of instances where the recommended separation distances have not been achieved, although the separation distance is not less than the minimum 1650mm. The layout will need altering or additional fire protection measures should be provided to the cooking facilities (life safety cut offs). No separation distances are currently less than 1650mm.

2.4.8 The cut off devices should be tested as per the criteria given in BS EN 50615 for a Category B device (for preventive power cut-off of the appliance). Category B cut-off devices are tested for multiple criteria. These are:

- The device must sense the heat of the pan and cut the power to the hob before ignition
- The device must allow the pan of oil to reach a temperature of 200^{o}C before activating. This is to prevent nuisance false alarms that could lead to the device being disabled by the user.
- After the device cuts the power to the hob, the test is continued for 10-minutes, and oil must not ignite in that time.

Private Balconies

2.4.9 There are projecting private balconies on Levels 2, 4, 6, 8, 10 and 12.

2.4.10 Balconies should be accessed directly from the access room and should not pass through more than one access room. Where travel distance on the balcony/terrace exceeds 7.5m, an alternative escape route should be provided without going via the same access room or the access room should be provided with automatic smoke detection and audible alarm system extended to the balcony.

2.4.11 As all apartments are provided with automatic fire detection to LD1 coverage, detection is provided to all access rooms. Travel distances are within 7.5m on all balconies therefore the fire alarm audibility on the balconies should comply with paragraph 2.3.3.

2.4.12 Where balconies are accessed via the kitchen/living area, the cooking facilities should be sufficiently remote from the escape route. This is achieved from each balcony in accordance with the recommendation hob separation distances above.

Means of Escape – Common Corridors

2.4.13 Blocks C and D are single stair buildings therefore the prescriptive travel distance requirements for the residential corridors in a sprinklered building are limited to 15m in a single direction for ventilated corridors. The travel distances are extended on all residential levels with travel distances up to 23.6m in Block C and 26.1m in Block D.

2.4.14 The smoke ventilation strategy to each corridor within the building has been included in Section 2.7. To compensate for extended travel distances, the corridors will be provided with an enhanced mechanical smoke ventilation system designed to meet the criteria of Annex A of BS 9991 and the SCA guide for extended corridors up to 30m in length. The performance specification for the mechanical systems is subject to validation via Computational Fluid Dynamics (CFD) analysis and modelling to validate that the system can maintain tenable conditions in a fire scenario. The results of the CFD analysis will be subject to approval from the Regulatory Authorities.

2.4.15 Apartment C.009 on Upper Ground is at a 90-degree internal angle to the common corridor. The unprotected opening (window) is a minimum of 1.8m from the corridor door which is acceptable providing the wall between the window and corridor door achieves 60-minutes fire resistance from the inside for the full height of the Upper Ground Floor external wall.

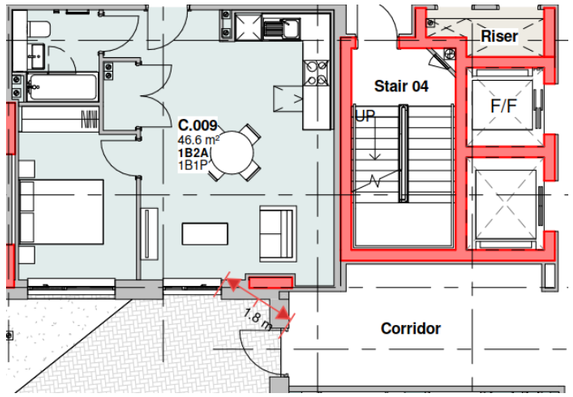

Figure 5: External Protection to Protected Corridor

2.4.16 Common corridors serving non-residential and ancillary areas should be constructed as protected corridors. Where ancillary/non-residential common corridors communicate with residential areas the common corridors between the uses should be provided with a smoke control system in accordance with Section 2.7.

Means of Escape – Ancillary & Non-Residential Areas - General

2.4.17 The maximum permitted travel distances within the building should conform to recommendations in Table 7 based on the limitations detailed in BS 9991 (ancillary) and ADB (non-residential). Where the internal fit-out is not known, direct distances, rather than travel distances, should be assessed. The direct distance should be assumed to be two-thirds of the actual travel distance. Without internal layouts shown to the ancillary accommodation, some of these distances are exceeded however, these will need to be verified once internal layouts are known.

Table 7: Travel Distance Limitations

Area	Single Direction (m)	More than one Direction (m)
Common Amenity and Offices	18	45
Girl Guide General Areas and Activity Rooms	18	45
Girl Guide Main Hall	18	45
Shop	18	45
Residential Refuse Store	9	18
Non-residential refuse stores	18	45
Cycle Store	18	45
Plant Rooms (within room)	9	18
Plant Rooms (overall distance)	18	45
Storage	25	45
Car Park	18	45
External Roof Terraces	45	N/A
Roof (maintenance only)	60	100

2.4.18 The minimum escape widths for escape routes and exits should conform to the recommendations in Table 8. This report only addresses the minimum in Part B of the Building Regulations and does not address Part M requirements.

Table 8: Widths of Escape Routes and Exits

Minimum number of occupants	Minimum escape width (mm)
60	750
110	850
220	1050
More than 220	5mm per person

2.4.19 The number of escapes routes and exits from any room or storey should be not less than the minimum recommended in Table 9 for the intended number of occupants. Note this is not applicable to the residential accommodation.

Table 9: Minimum number of escape routes and exits from a room or storey

Maximum number of persons	Minimum number of escape route/exits
60	1
600	2
More than 600	3

2.4.20 If a storey has two or more storey exits it should be assumed that a fire might prevent occupants from using one of them. The remaining exit(s) should be wide enough to allow all occupants to leave quickly.

Therefore, the largest exit should be discounted for the purpose of the assessment. The remaining exits should be wide enough to allow all occupants to leave quickly.

2.4.21 Where a single escape route is provided or the exit opens against the direction of escape, the occupancy will be limited to a maximum of 60 through that exit.

Means of Escape – Girl Guides

2.4.22 The Lower Ground Floor of the Girl Guides is provided with four horizontal exits; two exits via protected stairs to the Mezzanine Floor and two final exits direct to external.

2.4.23 This floor has a theoretical occupancy of 313 persons with the most populated area being the Main Hall. The Main Hall is provided with 5 exits although the minimum escape requirements have been summarised below.

2.4.24 Based on potential occupancy of 241 persons in the Main Hall when used as a single space, a minimum of two exits of 1250mm clear width would be required that are remote from one another. Discounting the largest exit, this would leave 1x1250mm exit providing sufficient escape capacity for the theoretical occupancy.

2.4.25 When the Main Hall is used as two separate spaces (separated by a folding partition), each side of the partition will be limited to 110 persons. A minimum of two 850mm exits should be provided from the left-hand side of the hall. To account for the occupants in the left-hand side of the hall escaping into the right-hand side of the hall, a minimum of 2x1050mm exits should be provided from the right-hand side such that there are sufficient exits for all occupants to escape via the right-hand side if required.

2.4.26 The minimum escape widths from the Main Hall have been illustrated in Figure 6.

2.4.27 Beyond the Hall additional doors are located along the escape routes. Overall, there are four escape routes from the main hall (one direct to outside, one to the back stair, one to Stair 5 and one into the reception) therefore it would be reasonable to assume during an evacuation that the Hall population would use multiple of these routes based on human behaviour to minimise queuing. All doors along the escape routes from the hall should achieve a minimum 850mm width so regardless of where the fire is, sufficient escape capacity is available.

2.4.28 The remaining accommodation on the Lower Ground includes a common room and office accommodation with a potential theoretical occupancy of 72 persons. Escape is available via the main entrance or into Stair 5. The Storey exit into Stair 5 should be a minimum 850mm. The exits via the main reception should provide a clear width of 1600mm.

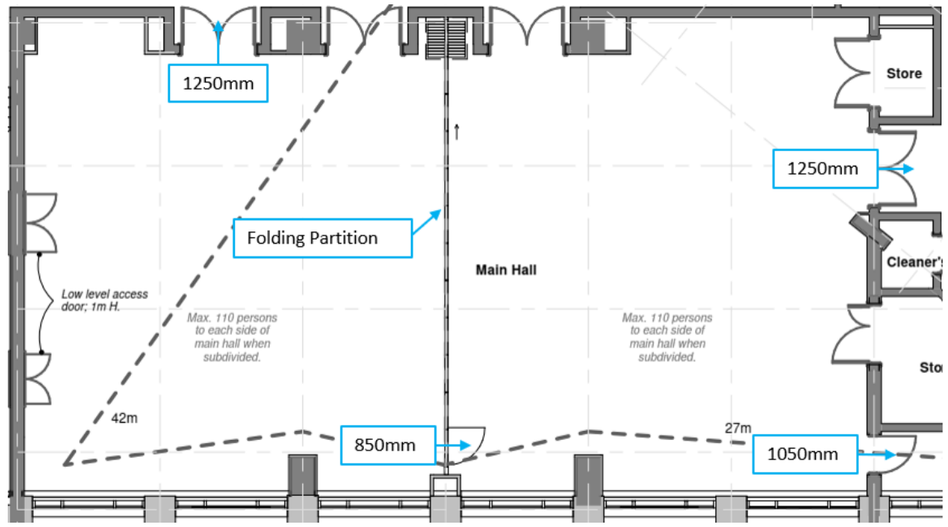

Figure 6: Main Hall Clear Exit Widths

2.4.29 The corridor to the rear of the main hall provides access to two means of escape and also provides egress for the Shop occupants, therefore a cross corridor door (FD30s) should be provided as highlighted below on Figure 7.

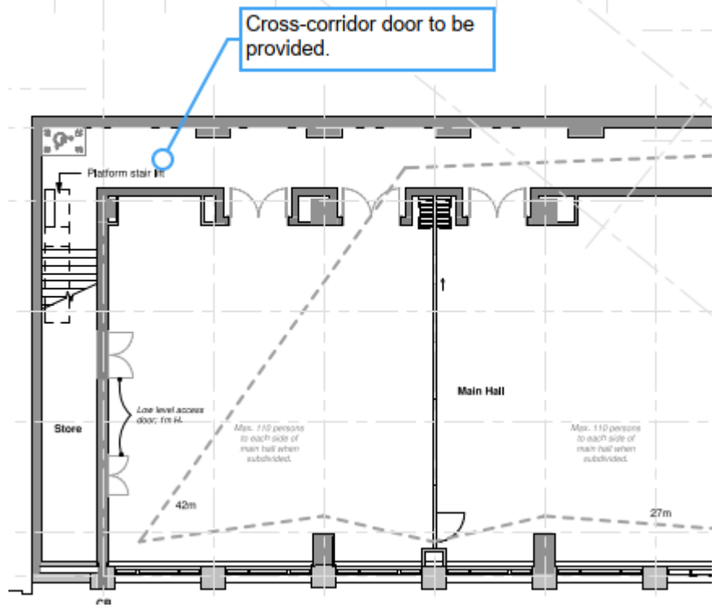

Figure 7: Main Hall Cross-corridor Doorway

2.4.30 On the Upper Ground Floor of the Girl Guides, a single horizontal means of escape is provided from Activity 01, Activity 02 and Activity 03 until alternative direction of escape becomes available, therefore, the combined occupancy of the Activity Rooms is limited to a total of 60 persons due to the

single direction of escape. The single direction travel distance from Activity 01 and Activity 02 are extended to 23.8m and 21.8m respectively. The extension of travel distance is considered acceptable from these areas given the occupants will be awake and familiar, L1 detection is provided to all areas of the Girl Guides and the areas will be staffed to assist/manage an evacuation. Additionally, the protected corridor makes up for at least 50% of the total travel distance so the actual travel distance through the risk area is considerably below the 18m limitation in a single direction (c.11m in both rooms). The additional 5.8m of travel would therefore be made within the protected corridor and would take an additional 4.9 seconds of travel time based on an evacuating occupant's walking speed at 1.2m/s in accordance with BS7974.

Means of Escape – Shop

2.4.31 The Shop is provided with two exits that each open against the direction of escape therefore the egress capacity would be limited to 60 persons. The theoretical occupancy is 32 persons therefore the is escape provisions are considered suitable.

Means of Escape – Ancillary Areas

2.4.32 The lounge/co-working area has an open plan stair leading to the lounge above, this is deemed acceptable as the lounge above has an alternative escape route which is separated from the lounge area and the stair is not to be used for means of escape as this area would be classified as a circulation zone.

Inner Rooms

2.4.33 There are a number of inner rooms in the ancillary and non-residential accommodation.

2.4.34 The plant rooms within the car park would be classified as inner rooms to the car park, however the car park would be considered a place of special fire hazard and should not provide access to inner rooms. However the arrangement maybe deemed acceptable subject to approval authority agreement subject to the following provisions;

- The inner rooms are transient areas which would only be periodically used and would be of short duration use.
- The inner rooms are to be linked to detection within the car park immediately alerting occupants to a fire in the car park.
- The car park is to be provided with a BS EN 12845 sprinkler system which would control fire growth and reduce smoke output.
- The car park is also to be provided with a smoke ventilation system which would assist in clearing smoke in the incipient stages of fire once the fire detection system has activated.

2.4.35 The lettings room, office, parcel store and management office would be considered as inner rooms to the lounge/co-working.

2.4.36 Where inner room arrangement exists (room within a room), additional fire safety provisions need to be considered in order to address the additional risk to occupants within the inner room. At least one of the below recommendations should be adhered to:

- The enclosures (wall or partitions) of the inner room are stopped at least 500mm below the ceiling
- The door or walls of the inner room contain a vision panel (minimum 0.1m^2), to allow occupants to inspect the conditions within the access room
- The access room is fitted with an automatic fire detection and alarm system

2.4.37 A Category L1 automatic fire detection and alarm system is provided within the ancillary accommodation therefore, these inner room scenarios are compliant with the above recommendations.

2.4.38 The above recommendations are not applicable to sanitary accommodation, toilets, etc.

Means of Escape – General Requirements

2.4.39 The minimum clear width for a door acting as an escape door is 750mm unless specified within this report. This requirement may be exceeded by the access and circulation requirements of Approved Document M, which are not covered within the scope of this document and are to be reviewed by the architect.

2.4.40 Doors should open to an angle not less than 90°, be provided with vision panels as required by Approved Document K and should be located such that opening the door does not reduce the effective width of any escape route. Ramps used on means of escape should not have a gradient steeper than 1:12.

2.4.41 Clear door widths within the scheme should be measured in accordance with Figure 8.

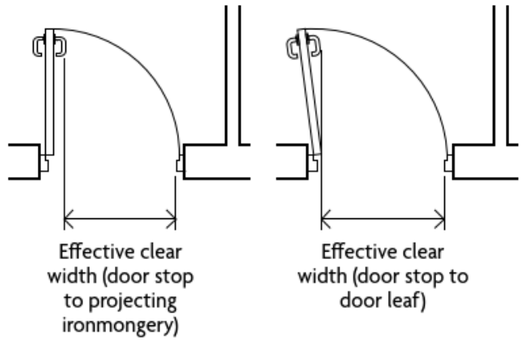

Figure 8: Measurement of Door Widths

2.4.42 Any access control or other door locking mechanisms incorporated within the design of the building should not adversely affect the ability of occupants to escape from the building. Where locking mechanisms are provided to doors on common escape routes they should be simple fastenings that are easy to operate from the escape-side without the use of a key or more than one mechanism.

2.4.43 If electronic locking mechanisms are provided, they should revert to the unlocked position in any of the following situations:

- The fire detection and alarm system operates; or
- There is a loss of power or system error; or

- The security mechanism override, such as a Type A call point in accordance with BS 7273-4 (Green Break Glass) is activated.

2.4.44 Where electromechanical locks are used for access purposes, these should be capable of being manually overridden with a simple thumb turn or lever handle on the escape side and occupants should not have to manipulate more than one release mechanism.

2.4.45 Security mechanism overrides for electrically powered locks should be a Type A call point, as described in BS 7273-4. The call point should be positioned on the side approached by the people escaping. If the door provides escape in either direction, a call point should be installed on both sides of the door.

2.4.46 If a secure door is operated by code or combination keypad, swipe proximity cards, biometric data, etc. a security mechanism override should be possible from the side approached by people escaping.

2.4.47 Where automatic hold-open devices or other magnetic systems are provided (normally on escape routes or giving access to escape routes) these should release automatically on activation of the fire alarm and detection system or power failure and failsafe release to return to neutral position. Hold-open devices should comply with the recommendations of BS 5839-3.

2.4.48 Where a door serves more than 60 persons the door is to swing in the direction of escape and should be provided with the appropriate panic escape hardware. Note that as the residential levels operate on a stay-put evacuation strategy, the number of occupants expected to use the stair from those levels is limited to a single apartment. The final exits from the main stairs should open in the direction of escape as these provides egress from the communal roof terrace and be provided with suitable push bars to accommodate the occupancy from the amenity areas.

2.5 Vertical Means of Escape

2.5.1 The main stair locations have been highlighted below on Figure 9 (Note, stair numbering follows the architectural drawings and there are no stairs designated as Stair 1 or Stair 2).

2.5.2 The residential accommodation in Blocks C and D are served by single stairs; Stair 3 serves Block D and Stair 4 serves Block C. Stair 5 serves the Girl Guide Accommodation.

2.5.3 Blocks C and D are both greater than 18m in height to the topmost occupied storey from the fire service access level and should each be provided with a firefighting shaft. The requirements for a firefighting shaft are covered in section 6.2.

2.5.4 The minimum width of a firefighting stair under BS 9991 for Part B requirements is 1100mm.

2.5.5 The stair width should be measured between the walls and/or balustrades (handrails and strings that do not intrude more than 100mm into these widths may be discounted). Where handrails protrude more than 100mm into the stair, the clear width of the stair will be taken between the handrails.

2.5.6 In accordance with BS 9991 a stair serving residential accommodation should discharge directly to the outside air or via a protected exit corridor. Both stairs achieve these requirements.

2.5.7 Both stairs should be vented at the head via an AOV achieving a minimum 1.0m^2 geometric free area.

2.5.8 The firefighting stairs should not provide access to any services/risers other than installations associated with the firefighting stair/shaft.

2.5.9 Stair 5 is less than 18m in height and connects the Mezzanine and Lower Ground level of the Girl Guide accommodation and should be constructed as a protected stair. The stair does not discharge direct to external however, the stair provides access to alternative means of escape either via the protected corridor at Mezzanine Level onto Brownsea Drive or via the protected corridor at Lower Ground on to Holloway Head. Based on the occupancy of the Girl Guidance accommodation, Stair 5 should have a minimum clear width of 1200mm.

2.5.10 Stair 3 also serves as an escape from the communal roof terrace at Level 7. As such, the final exit from the stair should open in the direction of escape.

2.5.11 Stair 4 serves as an alternative escape route from the Girl Guide accommodation and as such, the final exit from the stair should open in the direction of escape and provide a minimum clear width of 1050mm. Whilst this is less than the stair itself (1200mm), it is not considered a significant risk as there are multiple potential escape routes therefore, for the purposes of the means of escape assessment, occupancy will be distributed across all escape routes reducing the maximum capacity through any one exit.

2.5.12 Any final exit should be immediately apparent to any person using a common stair that serves storeys both above and below the point of final exit.

2.5.13 The alternative escape route from the Main Hall to the final exit at Mezzanine level is via a set of steps. Based on the maximum occupancy in the main hall of 241 persons, this stair should provide a minimum width of 1300mm in accordance with ADB.

2.5.14 There is an open stair in the residential ancillary space between Upper Ground and Level 1. This is not required for means of escape and is to be treated as an accommodation stair.

2.5.15 Additional steps/changes in level are also present at Lower Ground between the Girl Guides and the car park although this is not a designated escape route.

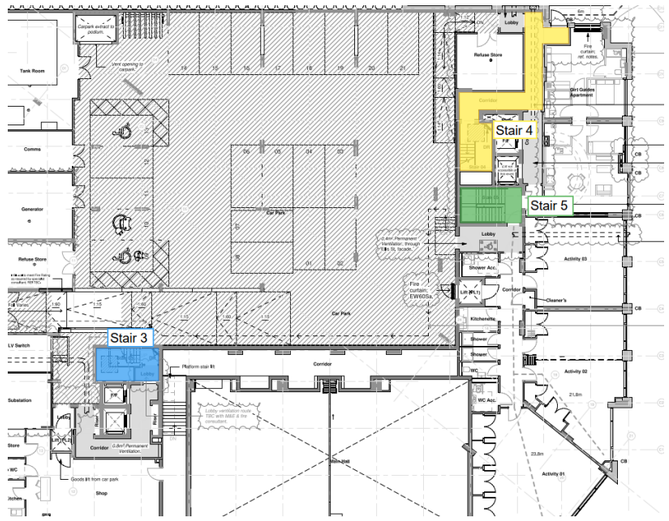

Figure 9: Stair Locality

2.5.16 Parts of the floors of the Lower Ground and Mezzanine are more than 1200mm below the highest level of ground beside the outside wall and would be considered basement storeys. Typically, in single stair buildings, the stair should not continue down and communicate with a basement level, however, the development is on a split level with the lowest point at Lower Ground being the Southeast corner at the junction of Ellis Street and Holloway Head. Due to the slope of ground, a large portion of the lower ground and mezzanine levels are open to the external. The configuration is deemed acceptable due to the following with is subject to agreement with the approvals authority:

- The basement is not a true basement level due to the sloped ground level a large portion of the lower ground and mezzanine levels are open to the external.
- The basement is offered multiple escape stairs.
- The car park is provided with a BS EN 12845 sprinkler system which would suppress a fire and reduce smoke production.
- Access lobbies to each stair are provided with a smoke ventilation system and a smoke ventilation system within the car park that will be designed to prevent smoke ingress to the stair from a car fire.

2.5.17 It is noted that prescriptive guidance also requires that stair serving residential floors, should not communicate with covered car parks, however, this is deemed acceptable due to reasons stated above.

External Protection to Stairs

2.5.18 Where a firefighting stair is sited against an external wall, if any glazed area of opening in the exterior wall of the firefighting stair is less than 500mm from the junction of the external wall with the firefighting stair, the fire resistance of the wall immediately adjacent to the glazed area or opening should be no less than 1hour fire resistance from both sides for a horizontal distance of 500mm.

2.5.19 If a firefighting stair projects beyond, is recessed from or is in an internal angle of the adjoining external wall of the building, then the minimum distance between an unprotected area of the building enclosure and an unprotected area of the stair enclosure should be 5m. Any enclosure/openings within these distances should be of fire-resisting construction for 120-minutes from inside the building.

2.5.20 The final exit from Stair 3 is at an internal angle to the Upper Ground apartment and as such the external wall and any openings should typically be provided with 120-minutes fire resistance for 5m from the firefighting shaft. Given the apartment is sprinkler protected, it is proposed that the apartment windows within the 5m distance do not need to be fire-resisting on the basis that:

- The external wall for the full height of the Upper Ground is to provide 120-minutes fire-resistance from the inside for a horizontal distance of 5m from the stair (see Figure 10 below).
- The closest apartment window is a minimum 2.0m from the door of Stair 3 and this therefore still at least a minimum of 1.8m between unprotected openings in the firefighting stair and adjacent accommodation which is compliant for protected stairs.
- The apartment is sprinklered so a fire can be suppressed at source in the early stages to control to fire, keep smoke and radiant heat at low temperatures and reduce the risk of flashover and significant amount of heat escaping the apartment externally.

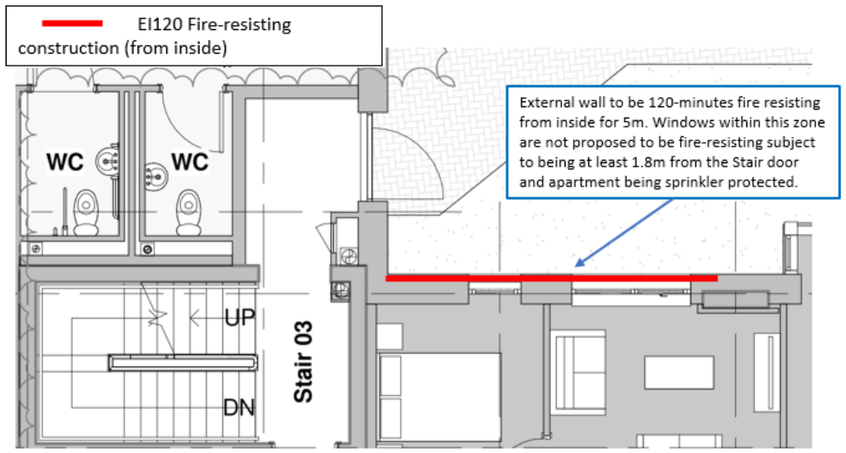

Figure 10: External Protection to Stair 3 (Upper Ground)

2.5.21 It is noted at Mezzanine Level the glazing adjacent to the Fire Service access to Stair 4 is to be fixed shut and fire-resisting to achieve 120-minutes (EI 120) fire resistance, see Figure 11 below.

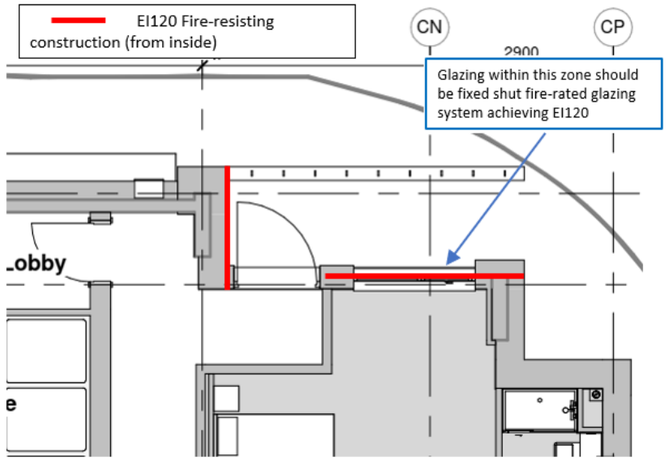

Figure 11: External Protection to Stair 4 (Mezzanine)

2.5.22 In all other instances the external protection to the firefighting stair should be in accordance with BS 9999.

2.6 Evacuation of Non-Ambulant Occupants

Residential Areas

2.6.1 There is no approved guidance that provides advice on the evacuation of non-ambulant occupants from residential buildings. This is primarily due to the lack of onsite management in residential buildings in comparison to commercial buildings. As there would be no on-site staff to assist non-ambulant residents in evacuating the building in the event of a fire within their dwelling, residential buildings are designed to facilitate self-evacuation with no reliance on onsite management as far is reasonably practicable.

2.6.2 The safety features required within residential buildings accommodate this approach via a high degree of compartmentation and the provision of smoke ventilation which should work in tandem to prevent fire spreading from the room of origin, with the smoke ventilation systems clearing any smoke that leaks from the fire room. This is to allow the building to remain in normal operation provided that the fire safety systems within the building operate as designed.

2.6.3 It is recommended that the fire alarm Cause and Effect matrix for the building does not result in the firefighters/passenger lifts descending to final exit floor level and being taken out of service in the event of smoke detection within the upper floor common escape routes. The smoke detection within the escape routes is to activate the smoke ventilation systems within the building only, and this should result in the conditions being returned to tenable limits, allowing for wheelchair users to exit the building via the lifts. To prevent wheelchair users or other non-ambulant residents using the lifts when it is not safe to do so, it is recommended that a smoke detector is provided at the head of the lift shaft. The lift should return to the designated landing and be taken out of service (typically the exit level) if the smoke detector at the top of the lift shaft is activated. If corridor smoke detection at the designated landing is activated, the lift should return to the alternative designated landing (floor level above).

2.6.4 On occupation, residents may be present with any combination of disabilities throughout the premises. Visitors to the flats will be the responsibility of the tenants. It is recommended the client informs the future responsible person for the premises, under the RR(FS)O to undertake an assessment towards a tenant's ability to react to a fire within the premises on taking up residence.

2.6.5 The responsible person under the RR(FS)O should provide information and regularly remind tenants on the fire procedures by providing leaflets and where necessary encouraging new tenants to have a home fire safety check by the local fire service. Specific measures regarding tenants with any disabilities identified can be discussed and implemented following the home fire safety check in conjunction with relevant local community services. The corridors and stair landings would be suitable as a temporary refuge for persons with severe mobility impairment to wait for assistance due to the layout and fire resisting construction (very few occupants should be using the stairs for evacuation at any one time, such that the implications of restrictions in the escape routes would be minimal).

Non-Residential and Ancillary Areas

2.6.6 The responsibility for safe evacuation of any persons needing assistance falls on the management. As part of RR(FS)O, specific fire evacuation policies and procedures should be developed such as Personal Emergency Evacuation Plans, accounting for a wide spectrum of persons who may be present.

2.6.7 Disabled refuges should be provided in the stairs at Lower Ground Floor of the Girl Guide accommodation and to the protected lobby adjoining Stair 5 at Mezzanine level.

2.6.8 Disabled refuges should measure 1400mm x 900mm which is fully accessible and should not reduce the width of the escape route. It should be clearly identified by appropriate fire safety signs. Where a refuge is in a stairway the sign should be accompanied by a blue mandatory sign worded "Refuge – keep clear".

2.6.9 Each refuge area is to be provided with an emergency voice communication (EVC) system so that the management is aware of anyone awaiting assistance in the refuge space. The EVC system is to comply with BS 5839-9 and consist of Type B outstations, which communicate with a master station located adjacent the fire alarm control panel and at the ground floor of each stair.

2.6.10 The designated escape routes from the car park should be via the ramp to the escape route via Core 4 or via Core 3. Escape via the vehicle gate should not be considered unless there is a sufficient designated route for pedestrians to escape past vehicles. Ramps in the car park along the escape routes should have a gradient not steeper than 1:12.

2.6.11 The firefighters lift will serve the floor levels containing the communal lounge/dining at Level 1, the roof terrace at Level 7 and the car park. These areas could be occupied by residents and their guests in a similar way to the occupation within the apartments. As such, the lifts are proposed to remain in use to allow wheelchair users and other non-ambulant residents to make a dignified escape from the building, the lift should only be recalled in the event of a smoke detector activating within the lift shaft, or in the exit level lobby serving the lift.

2.6.12 Where level access is available, no special provisions would be necessary. Where change of level occurs, either a refuge point or a management strategy to be provided/implemented.

2.7 Smoke Ventilation Systems

Summary of Required Systems

2.7.1 Each residential stair will be provided with a 1.0m^2 AOV at the head of the stair with the top of the AOV being higher than the top of the door into the stairs.

2.7.2 All corridors from upper ground floor and above providing access to the residential stairs will be ventilated with an enhanced mechanical smoke ventilation system.

2.7.3 At mezzanine level, the lobbies are to be provided with either 1.5m^2 natural smoke shafts or a mechanical equivalent. A mechanical system maybe controlled on a pressure sensor, without the requirement for a separate inlet shaft.

2.7.4 The lower ground floor is for the use of non-residential accommodation only and there is no requirement for smoke ventilation at this level which has separate stairs from the residential accommodation.

2.7.5 The performance of the mechanical extract systems will need to be verified by CFD analysis.

2.7.6 The corridor smoke ventilation provisions to the residential stairs have been summarised in Table 10 and have been highlighted on Figure 12 - Figure 18.

2.7.7 The AOV at the head of the residential stairs will activate on smoke detection in any of the common parts of the building. The corridor ventilators will only activate on smoke detection within the corridor that the ventilator serves. Where the floor is served by the two mechanical extract shafts, the ventilators at either end of the corridor should activate on smoke detection, with one shaft acting as extract and the other providing supply air. The shaft extracting will depend on the location of the corridor smoke detector that is activated in relation to the stair door. No further vents on other floors should operate even if additional smoke detectors are subsequently activated in other parts of the building. A damper should be located before the extract fans at high level to external air so there is no resistance through the fans for air to be pulled through when the shaft is acting as the replacement air shaft to the extracting shaft.

2.7.8 The corridor doorway immediately adjacent to the Girl Guides apartment should be omitted to allow the smoke ventilation system in the firefighting lobby to serve the corridor giving access to the Girl Guides apartment as highlighted on Figure 12.

Table 10: Residential Smoke Ventilation Summary

Block	Floor	Compliant Corridor Travel Distance?	Smoke Ventilation Provision
C	Lower Ground	N/A	N/A
	Mezzanine	Yes	0.8m^2 mechanical smoke extract; or 1.5m^2 natural smoke shaft
	Upper Ground to Level 11	Extended single direction travel distance beyond 15m.	Enhanced mechanical smoke ventilation system consisting of 2 x 0.8m^2 mechanical smoke shafts located within 2m of each end of the corridor. One shaft will act as extract and the other will provide supply air. The shaft extracting is based on the side of the stair the initial smoke detector is activated on.
	Level 12 & Level 13	Extended single direction travel distance beyond 15m.	Enhanced mechanical smoke ventilation system. 0.8m^2 mechanical smoke shaft with external AOV to provide replacement air at opposite end of corridor (AOV free area TBC subject to CFD modelling). Inlet an extract points to be located within 2m of each end of the corridor.
D	Lower Ground	N/A	N/A
	Mezzanine	Yes	0.8m^2 mechanical smoke extract; or 1.5m^2 natural smoke shaft
	Upper Ground	Extended single direction travel distance beyond 15m.	Enhanced mechanical smoke ventilation system. 0.8m^2 mechanical smoke shaft with dedicated replacement air inlet at opposite end of corridor (method of inlet TBC). Inlet an extract points to be located within 2m of each end of the corridor.
	Level 1 to Level 6	Extended single direction travel distance beyond 15m.	Enhanced mechanical smoke ventilation system consisting of 2 x 0.8m^2 mechanical smoke shafts located within 2m of each end of the corridor. One shaft will act as extract and the other will provide supply air. The shaft extracting is based on the side of the stair the initial smoke detector is activated on.
	Level 7	Extended single direction travel distance beyond 15m.	Enhanced mechanical smoke ventilation system. 0.8m^2 mechanical smoke shaft with external AOV to provide replacement air at opposite end of corridor (AOV free area TBC subject to CFD modelling). Inlet an extract points to be located within 2m of each end of the corridor.
	Level 8 to Level 13	Extended single direction travel distance beyond 15m.	Enhanced mechanical smoke ventilation system. 0.8m^2 mechanical smoke shaft with dedicated replacement air inlet at opposite end of corridor (method of inlet TBC). Inlet an extract points to be located within 2m of each end of the corridor.

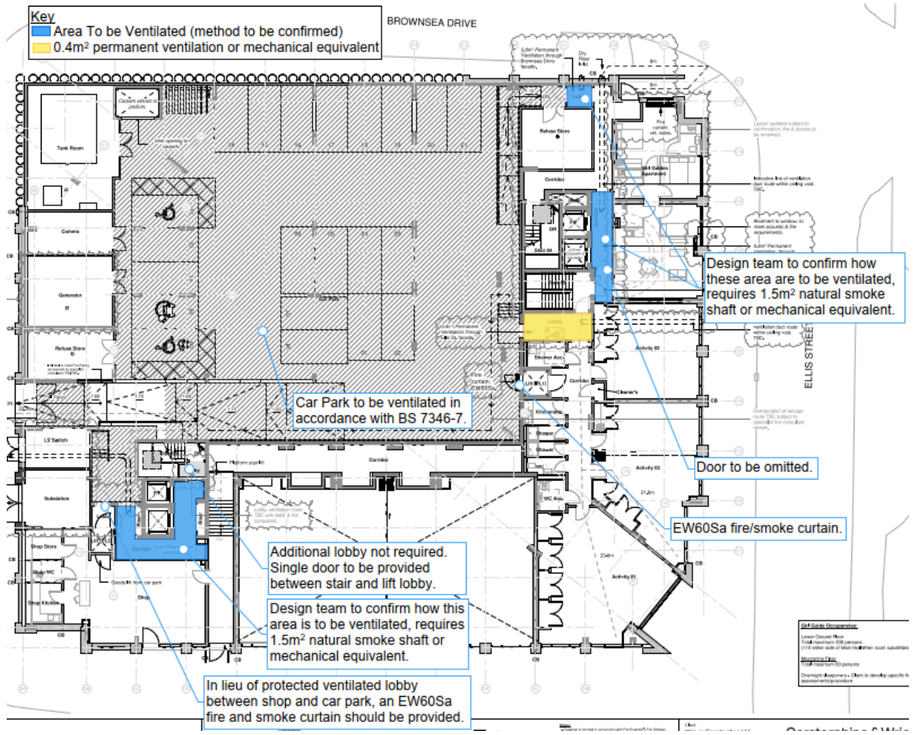

Figure 12: Mezzanine Level Ventilation Provisions

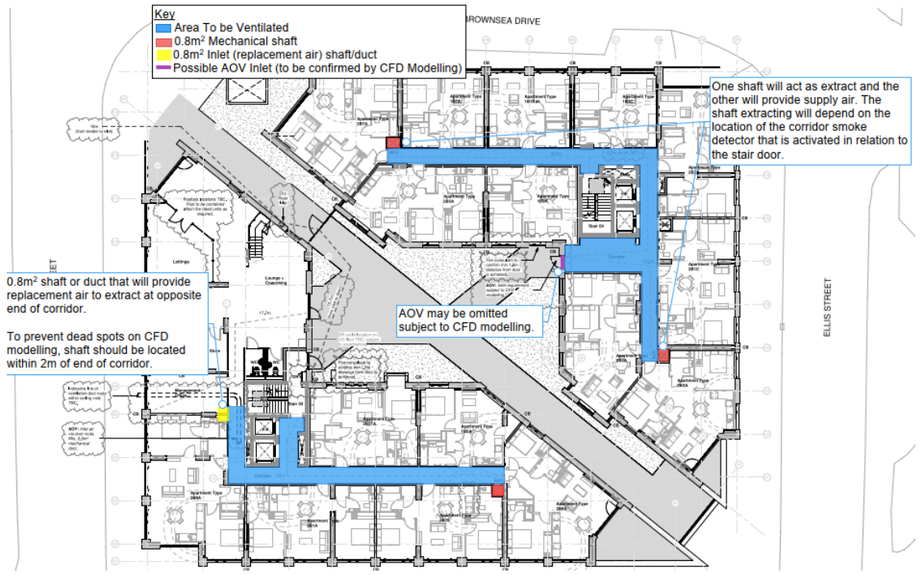

Figure 13: Upper Ground Floor Ventilation Provisions

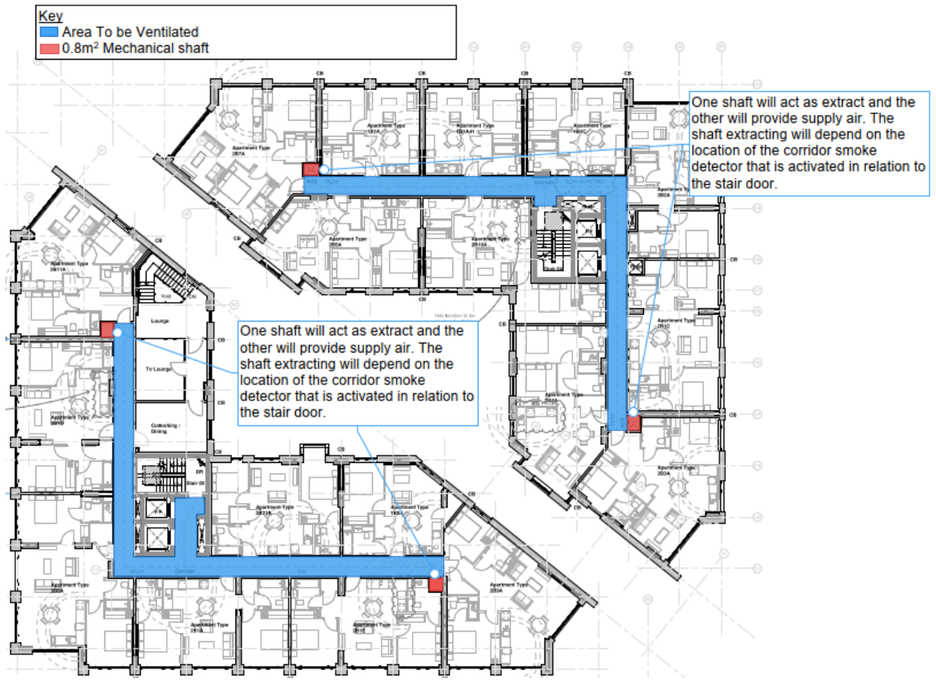

Figure 14: Level 1 – Level 6 Ventilation Provisions

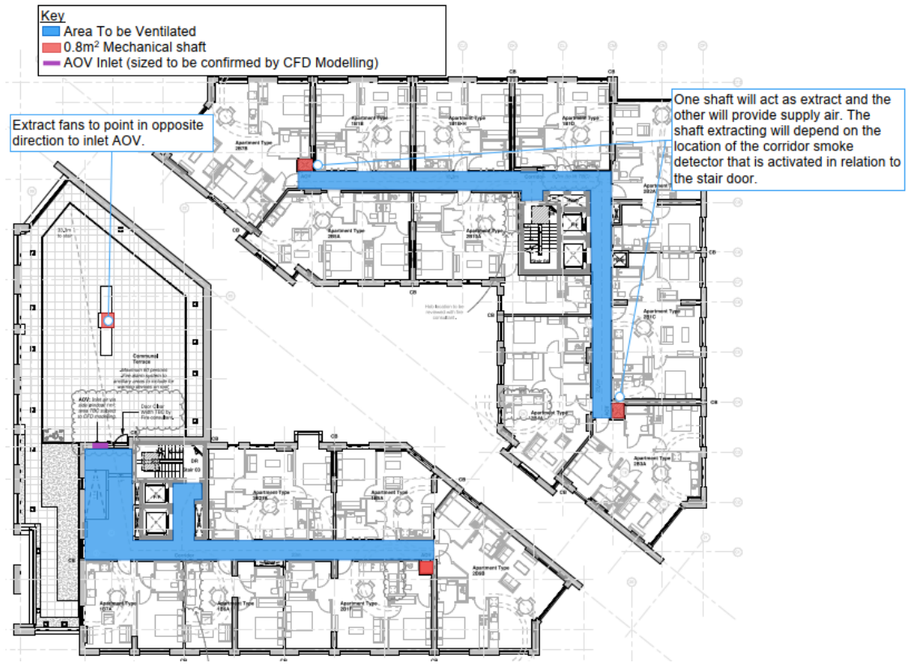

Figure 15: Level 7 Ventilation Provisions

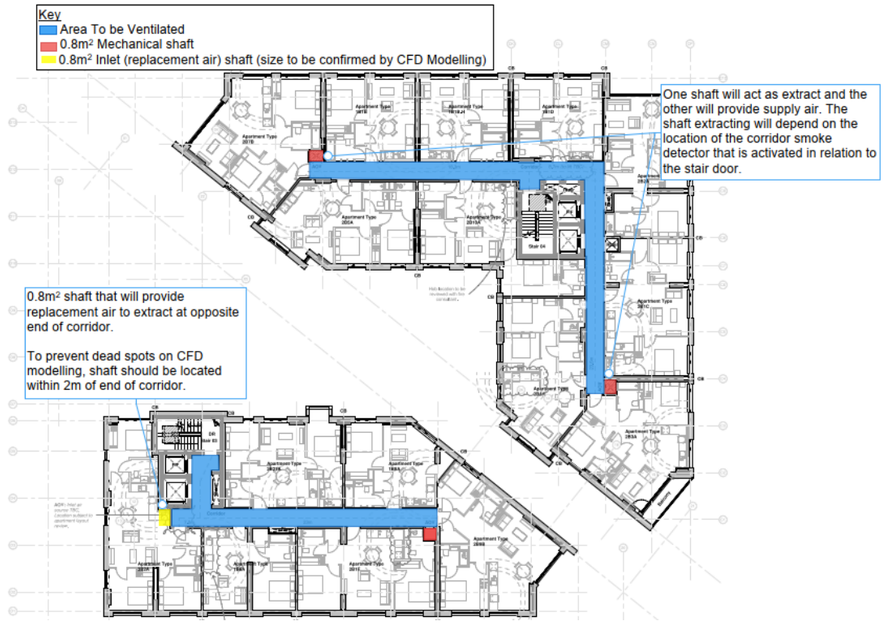

Figure 16: Level 8 – Level 11 Ventilation Provisions

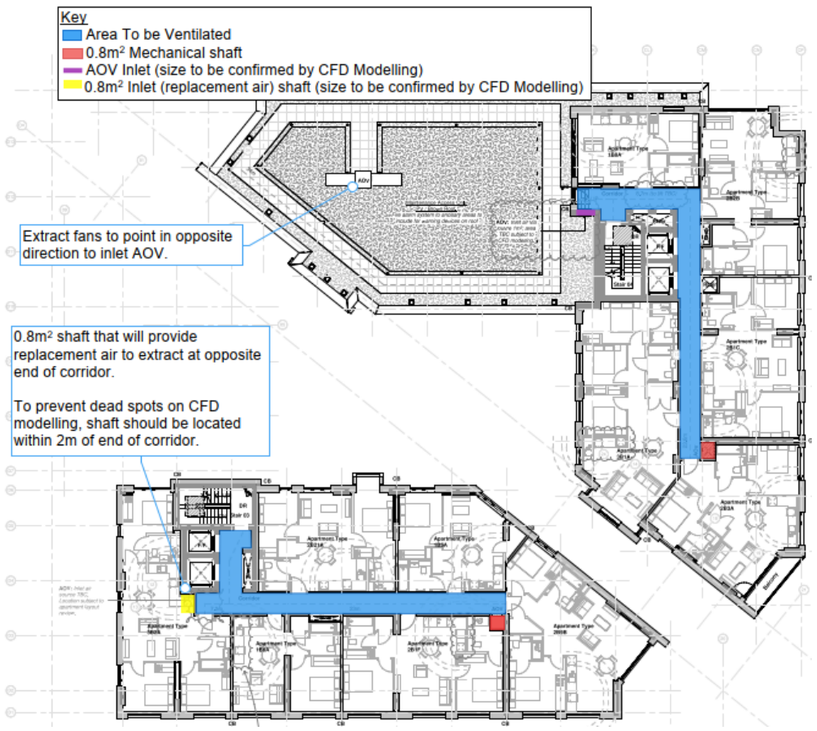

Figure 17: Level 12 Ventilation Provisions

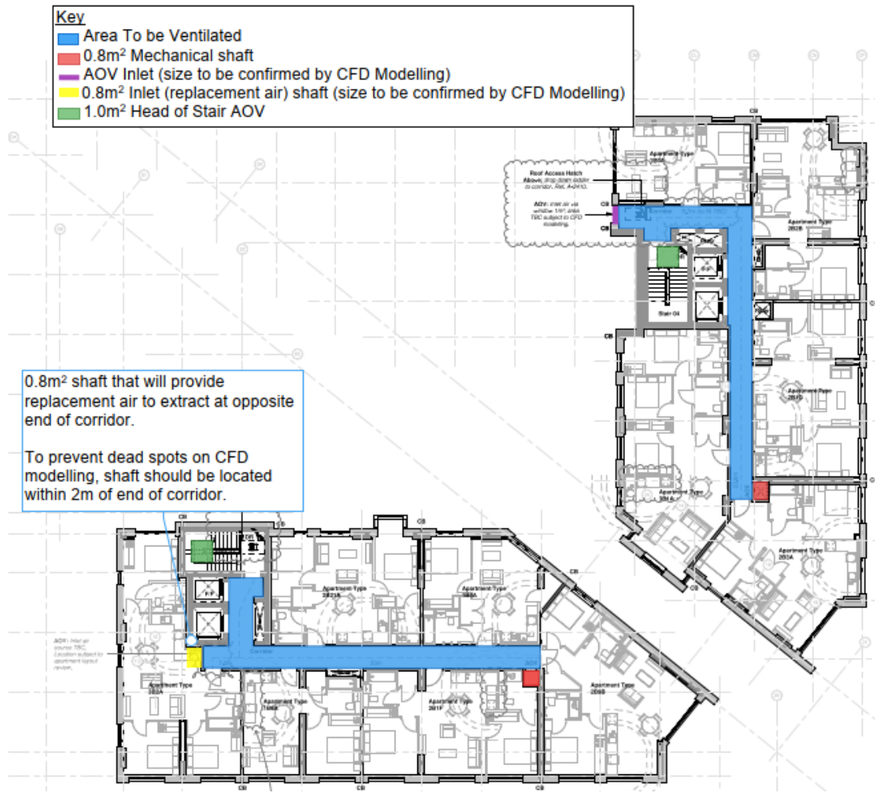

Figure 18: Level 13 Ventilation Provisions

Automatic Openable Vents (AOV)

2.7.9 AOV's fitted at the head of a stair should achieve a free area of 1.0m^2 geometric free area, or 0.7m^2 aerodynamic free area.

2.7.10 The AOVs for the purpose of inlet air for the mechanical extraction system, should be sized in accordance with the CFD analysis.

2.7.11 All AOV vents used within this project should be tested to BS EN 12101-2 and should:

- Be outward opening
- Not be top hung
- Open a minimum of 30°
- Be clearly identifiable and accessible

2.7.12 Where the opening sill is located below 1100mm measured from the ground floor level, suitable protection should be provided to prevent falling.

2.7.13 Vents on external walls and into smoke shafts should be located as close to the ceiling of the area served and should be at least as high as the top of the door connecting the corridor/lobby with the stair.

Mechanical Smoke Shafts

2.7.14 Allowance should be made for the smoke shafts to achieve a cross-sectional area of 0.8m^2 geometric free area with AOVs into the smoke shaft achieving 0.8m^2 geometric free area. The mechanical smoke shaft sizes, fan speeds, inlet AOV sizes and ventilator sizes for the mechanical ventilation system are to be determined via CFD analysis.

2.7.15 The mechanical ventilation system is to use duplicate fans – duty and standby. The system needs to be provided with primary and secondary power supplies, including fans, AOVs and control equipment. The fire rating of smoke extract fans should be in accordance with BS EN 12101-3 and be capable of handling temperatures of 300°C for continuous period of not less than 60 minutes.

2.7.16 As the smoke shaft passes via compartment floors, it will need to be enclosed in fire resisting construction, equal to the rating of the compartmentation it breaches. Note, in order to maintain the fire resistance between the accommodation and the smoke shaft, AOVs into the smoke shaft should achieve the same fire resistance as the compartmentation it breaches, see Section 4.4.

2.7.17 Mechanical smoke shafts should also meet the following design criteria:

- The smoke shaft should be fully open to the external air at the top and closed at the base.
- The smoke dampers to the shafts should be multi-compartment smoke dampers tested to EN 12101-8.
- The top of the lobby vent should be located as close to the ceiling of the lobby as is practicable, and should be at least as high as the top of the door connecting the lobby to the stairwell) The lobby vents, in the closed position, should either:
    - Have a minimum fire and smoke resistance performance of 120 minutes and a leakage rate no greater than 360 m^3/h/m^2 when tested in accordance with BS EN 1366-2; or
    - Be in accordance with BS EN 12101-8.
- No services other than those relating to the smoke shaft should be contained within the smoke shaft.
- The smoke shaft should be located at the remote end of the corridor away from the staircase, where possible.
- The smoke shaft should be constructed either of non-combustible materials conforming to BS 476-4 or of any material which, when tested in accordance with BS 476-11, does not flame or cause any rise in the temperature on either the centre of the specimen or the furnace thermocouples. Alternatively, smoke shaft should be constructed out of materials achieving Class A1 to BS EN 13501-1. No GRP or combustible materials used as grilles to prevent falling are permitted.

2.7.18 The mechanical extract exhaust point should be located at least 5m away from the replacement air inlet points and the AOVs at the head of the stairs and point in the opposite direction.

2.7.19 Upon detection of smoke in the common corridor, the vents on the fire floor, the vent at the top of the smoke shaft and the stair are to open simultaneously and mechanical smoke extract fans (in the extracting shaft) should begin to run at design speed. The vents from the corridor/lobbies on all other storeys will remain closed and locked shut i.e., they cannot open upon a second detector activating on another floor.

Car Park Ventilation

2.7.20 The car park is to be ventilated by a mechanical smoke ventilation system capable of achieving 10 air changes per hour and the system should be capable of handling gas temperatures of 300°C for a continuous period of at least 60 minutes.

2.7.21 The 10 air changes per hour is to be achieved via a single extract point in the car park, with inlet via the ramp and air circulation achieved via soffit mounted impulse fans.

2.7.22 The mechanical ventilation system should operate automatically either on activation of the sprinkler system (via a linked sprinkler alarm valve) or a fire detection and alarm system in the car park achieving a minimum coverage of a Category L3 system designed and installed in accordance with BS 5839-1. As the car park has been provided with a Category L1 system the requirement for actuation of smoke ventilation has been achieved.

2.7.23 As the system is to force smoke out of the enclosed car park, it should be provided with suitable replacement air activating simultaneously with the smoke extract system. Smoke extract points should not adversely affect means of escape routes or readily allow smoke spread back into the building.

2.7.24 The mechanical ventilation system is to use duplicate fans- duty and standby. The system needs to be provided with primary and secondary power supplies, including fans, AOV's and control equipment.

2.7.25 This system should be designed and installed by a suitable specialist. Note, the performance of the smoke extract system should be assessed using CFD analysis to validate the performance of the system.

2.7.26 In addition to the smoke ventilation system stated above, an environmental system will also be used, capable of providing 6 air changes per hour for the purpose of environmental ventilation. The environmental ventilation system should shut down on fire/smoke detection.

Other Ventilation

2.7.27 Where bin stores are accessed internally, in accordance with BS 5906 they should be accessed via a protected lobby provided with at least 0.2m^2 permanent ventilation, however as the refuse stores are accessed directly from the car park which is to be provided with ventilation for pollutant control which would exceed the 0.2m^2 requirement, it is deemed acceptable to omit the 0.2m^2 permanent ventilation subject to agreement with the approvals authorities. Further CFD might be required to demonstrate this approach is acceptable.

2.7.28 The lobby adjacent to stair 5 is to be provided with 0.4m^2 permanent ventilation as the lobby provides access to the car park.

2.7.29 The car park also provides access to the platform lifts of both Blocks C & D, the platform lifts should be accessed via a lobby with 0.4m^2 permanent ventilation. In lieu of a protected ventilated lobby, a fire and smoke curtain should be in accordance with section 4.5. The provision of fire and smoke curtains for this purpose would be subject to agreement with the approval authorities.

2.7.30 The ancillary basement areas also require smoke ventilation provisions for firefighting purposes, see section 6.8.

2.8 Emergency Signage

2.8.1 Emergency escape signage should be provided above every doorway or other exit that provides access to a means of escape, unless that exit is in ordinary use (e.g. the main entrances and primary circulation space). As such, there is generally no Building Regulations requirement to provide emergency escape signage within single stair residential buildings as all residents will be familiar with the escape routes.

2.8.2 Note, exit signage should be provided as per recommendations of BS ISO 3864-1 and BS 5499-4 to non-residential and ancillary accommodation. The following recommendations are intended to assist evacuating occupants in predicting the location of emergency signage along escape routes:

- Signs above doors or open spaces should be mounted between 2m and 2.5m from floor level, measured to the base of the sign and be sited as close to the centre line of the escape route as practicable.
- Signs sited on walls should be mounted between 1.7m and 2m from floor level to the base of the sign.
- Signs should be sited at the same height throughout the escape route, so far as is reasonably practicable.
- At least one escape route or doorway leading onto another escape roues should be visible from all points within every room or enclosure. If this is not achievable, additional signage should be provided where no direct field of vision onto the escape route is available. Where a single door is provided, no escape signage is required (as there is only one route to use for escape).
- Escape route signage takes precedence over all other signage provided in the building.
- All changes of direction in corridor, stairways and open spaces forming part of an escape route should be marked with intermediate signage. Any intermediate door or junction should also be signed appropriately.
- Exit signage should not be fixed directly to doors or located in a way that its visibility is obstructed by open doors.

2.8.3 It should be highlighted that provision of emergency signage within an area is subjective and open to interpretation. Therefore, this should be discussed and agreed with Building Control prior to installation on site.

2.9 Emergency Lighting

2.9.1 As per the recommendations of BS 9991 (residential areas) and ADB (non-residential areas), emergency escape lighting will need to be provided within main escape routes (stairs, lobbies, common corridors, external escape routes). Additionally, the following areas should also be provided with emergency lighting:

- External escape routes
- Windowless accommodation

2.9.2 All emergency lighting should conform to recommendations of BS 5266-1 and BS EN 1838 which provides further guidance on the provision of emergency lighting. The below list provides recommendations where emergency lighting should be provided:

- Within 2m of each exit door intended to be used in an emergency
- Within 2m of any change in levels including stairs so each flight/level change are adequately illuminated
- Externally illuminated escape route signs, escape route directional signs and other safety signs
- At change of direction of intersection of common escape routes
- Within 2m of each final exit and outside the building to a place of safety
- Within 2m of each MCP
- Within 2m of manual release control units which release electronically operated doors as per recommendations of BS 7273-4

2.9.3 Note, the distance of 2m is an approximation measured horizontally, as stated in BS 5266-1.

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

2.9.5 Emergency lighting needs to be provided with secondary power supply to maintain adequate illumination of an area for no less than 3 hours as per BS 5266-1. This may be achieved through provision of a battery back up to the emergency lighting.

3 Internal Fire Spread (Linings)

3.1 Classification of Wall and Ceiling Linings

3.1.1 To meet the functional requirement of Part B2 of the Building Regulations, the internal linings of a building should adequately resist the spread of flame over their surfaces and if ignited, have a rate of heat release or fire growth which is reasonable for the location in which the lining is. To achieve this requirement, the internal linings of walls and ceilings within the building should meet the classifications given in Table 11.

Table 11: Classifications of Lining Materials

Location	Classification
Small rooms with a maximum internal floor area of 4m^2 (30m^2 for non-residential)	Class D-s3, d2
Other rooms Circulation spaces within a dwelling	Class C-s3, d2
Other circulation spaces (including the common corridors to the apartments)	Class B-s3, d2

3.1.2 For the purposes of Table 11, the definition of a wall includes glazed screens and the internal surfaces of external glazing, and any part of a ceiling that slopes at an angle greater than 70° to the horizontal. Doors, door frames, frames for glazing (e.g. windows or screens), fitted furniture or narrow members such as architraves, skirtings, coving etc. do not need to achieve the requirements stated in Table 11.

3.1.3 Parts of walls in rooms may be of lower performance that stated in Table 11; however, they should be no worse than Class D-s3,d2. The total area of the lower performance wall lining should be equivalent to less than half the total floor area of the room, up to a maximum of 20m^2. Note that this relaxation is not permitted for ceiling linings.

3.2 Classifications of other Internal Surfaces

3.2.1 The flights and landings of common escape stairs should be constructed of A2-s3,d2 rated materials, as classified to BS EN 13501.

3.2.2 A1 rated materials, as classified to BS EN 13501, should be used in all of the following situations:

- As a sleeving where a pipe penetrates a compartment wall or floor;
- Walls of a flue that penetrates a compartment floor or wall;
- Construction of smoke shafts

3.3 Service Zones

3.3.1 All cables should be supported via non-combustible materials that can maintain the circuit integrity to the same degree as the cable it supports, i.e., cable fixings should be able to withstand exposure to similar temperatures and durations of fires to that of the cable whilst still providing support.

3.3.2 In accordance with BS 9991, wherever practicable, services should not run within common access corridors or should be run in fire-separating construction or in a secured fire-resisting method. As an alternative to running horizontal services within fire-resisting construction, it is proposed that following control measures provide an acceptable level of protection above common access corridors by controlling the fire load in the ceiling space through the specification and selection of low-risk materials:

- Electrical connections should not be located within the ceiling void unless essential to the corridor, e.g. lighting.
- All exposed surfaces within the ceiling void (i.e. the top of the ceiling, soffit of the floor above and vertical enclosures to the ceiling) must achieve a Class A2-s3,d2 reaction to fire rating or better; and
- Any pipe insulation within the ceiling void should achieve a Class A2-s3,d2 reaction to fire rating or better; and
- Any other materials within the ceiling void not listed above should achieve a Class A2-s3,d2 reaction to fire rating or better.
- The services to be located within the corridor ceiling void should be of low fire risk;
- Any electrical cabling will be laid in metal trays or metal conduit; and
- Access panels into ceiling voids to be secured (this can be by releasing devices or screw fixings to close).

3.3.3 It is recommended that the M&E contractor specifies services above the common corridors taking into account the control measures above. Should this not be achievable, a 60-minute (EI 60) fire-resisting ceiling should be provided to separate the services from the common access corridors.

4 Internal Fire Spread (Structure)

4.1 Fire Resistance Nomenclature

4.1.1 The periods of fire resistance given within this section may refer to one or more specific performance criteria for fire-resistance. Any period of fire resistance given within this section will be clearly defined with regard to the specific fire resistance criteria it must achieve. A definition of each criterion has been provided below, with the European equivalent letter code given in brackets:

- Loadbearing Capacity (R): The ability to resist collapse due to loss of structural strength caused by exposure to fire.
- Integrity(E): The ability to prevent flames or hot gases from physically passing through the fire-resisting element.
- Insulation (I): The ability to prevent a large rise in temperature on the non-fire-exposed side of the fire-resisting element.
- Radiance (W): The ability to prevent a large degree of thermal radiation being emitted from the non-fire-side of the fire-resisting element.
- Smoke Leakage (Sa): The ability to prevent smoke flowing through the fire-resisting element.

4.2 Structure

4.2.1 Buildings should be designed and constructed such that, in the event of a fire, the building will remain stable for a reasonable period of time. This is achieved by providing an adequate level of fire protection to all loadbearing elements of structure within a building.

4.2.2 As each block at the development is greater than 30m in height when measured from the lowest adjacent ground floor to the topmost occupied storey, all elements of structure in each block should achieve a fire resistance period of 120 minutes for Loadbearing Capacity (R120).

4.2.3 The period of fire resistance stated refers to the required performance of the structural elements that needs to be achieved, when tested in accordance with appropriate parts of BS 476, depending on the type of structure, for loadbearing members of the building's structure.

4.2.4 It is understood that the development will be constructed using a concrete frame, the fire resistance for the concrete frame structure is inherent with the type of materials used therefore, it is not envisioned that any additional fire protection layers are required to protect the concrete structure. Note, this would need to be confirmed by the structural engineer.

4.3 Automatic Water Fire Suppression System (AWFSS)

Residential

4.3.1 Apartment blocks exceeding 18m in height should be provided with a Category 4 BS 9251 sprinkler system throughout, including all ancillary and non-residential areas such as the basement plant rooms, unless stated otherwise in this report. A category 4 sprinkler system should be provided with;

- 60-minute water supply duration.
- Where the water supply is through a pump & tank;
    - There should be two or more tanks, each capable of providing 50% or more of the required water supply to the system, feeding two or more pumps and be configured such that each pump can draw water from each tank and be arranged such that any one pump or each tank can be isolated for maintenance.
    - Be provided with a back-up power supply and automatic changeover functionality.
- Where the system is mains fed the mains should have the following provisions;
    - Where fed from a single main, the main should be fed from both ends and each end be capable of satisfying the flow demands of the system; or
    - For mains fed from one end, the sprinkler system should be fed from two or more water mains; each feed should be capable of satisfying the flow demands of the system.

4.3.2 A compliant BS 9251 system should achieve the following requirements:

- Wet-pipe system permanently charged with water
- If cPVC pipework is used, it should be ensured by the specialist installer that the fire stopping materials applied around the pipe penetrations do not cause corrosive damage of the pipe.
- Fire collars or similar proprietary fire stopping systems designed to crush pipework should not be used on sprinkler pipework.

4.3.3 A sprinkler flow switch should be provided for:

- Every dwelling to signal the actuation of the sprinkler system within the dwelling; or
- A sprinkler alarm zone, rather than each individual dwelling, provided the following recommendations are met:
    - The sprinkler alarm zone should cover no more than a single floor; and
    - Sprinkler flow switches should be connected to suitable control and indicating equipment so that a signal is sent to management and any emergency action plan initiated.
- In multi-staircase buildings, the control equipment should clearly indicate the Floor level and appropriate staircase (where staircases serve different zones).

4.3.4 Sprinkler protection can be omitted from the following areas:

- bathrooms with a floor area of less than 5m^2 where provided with linings conforming to BS EN 13501-1:2018 Class A1, A2-s3,d2 and B-s3,d2, and which are not prepared for white goods, such as washing machines, dryers, electric showers or water heaters;
- cupboards and pantries with a floor area of less than 2m^2 or where the least dimension does not exceed 1m and not prepared for consumer units or electrical equipment (excluding a single light);
- crawl spaces;
- ceiling voids;
- external balconies permanently open to the outside;
- uninhabited loft/roof voids;

- Protected Stairways lined only with materials conforming to BS EN 13501-1:2018, Class B-s3 or better for construction materials and B(fl) or better for flooring, including subcategories such as d0, d1, d2 for construction materials and s1 and s2 for flooring, surface spread of flame and constructed as a fire-resistant separation.
- enclosed vertical shafts (e.g. lifts or service shafts) containing only materials conforming to BS EN 13501-1:2018, Class B-s3 or better for construction materials and B(fl) or better for flooring (including sub categories such as d0, d1, d2 for construction materials and s1 and s2 for flooring), surface spread of flame and constructed as a fire-resistant separation.

4.3.5 There is no requirement to allow for a separate sprinkler system in each block, therefore a single sprinkler system can be utilised to protect both blocks simultaneously, as a fire would only be expected to break out in one area.

4.3.6 The residential sprinkler system can be extended to the non-residential and ancillary areas providing no one protected area exceeds 100m^2, however, these areas will require an uplift as per section 5.4. & 5.5 of BS 9251:2021.

4.3.7 Any non-residential/ancillary areas exceeding 100m^2, require a BS EN 12845 sprinkler system. Based on the current layouts the Girl Guides, lounge/co-working area and car park accommodation exceeds 100m^2 and therefore, these areas would require a BS EN 12845 sprinkler system.

4.3.8 It is considered acceptable to omit the sprinkler protection to the substation due to the nature of the items within. Additionally, the substation is to be separated from the remainder of the building by 240-minute fire rated construction.

Car Park, Main Hall & Lounge/Co-working

4.3.9 The car park should be provided with an OH2 sprinkler system designed and installed in accordance with BS EN 12845. The OH2 sprinkler system should have a 5mm/min density and cover a minimum area of 144m^2 for a wet or pre-action system.

4.3.10 The Girl Guides and lounge/co-working areas should be provided with an OH1 sprinkler system designed and installed in accordance with BS EN 12845. The OH1 sprinkler system should have a 5mm/min density and cover a minimum area of 72m^2 for a wet or pre-action system.

4.3.11 Where exposed pipework is utilised the pipework in these areas should achieve the fire resistance rating of the compartment in which it is situated.

4.3.12 The BS EN 12845 sprinkler systems should be provided with sprinkler coverage throughout noting the following exceptions:

- Washrooms and toilets of non-combustible construction and linings, with no combustible storage within these rooms
- Enclosed staircases and vertical shafts (such a lift or service risers), containing no combustible materials within and constructed as a fully enclosed protected shaft (fire resisting enclosure)
- Rooms protected by other automatic extinguishing systems (e.g. gas, powder, foam, misting system)
- Areas or rooms where water discharge may present a hazard (such as electrical plant rooms). Alternative suppression may need to be considered (powder or gas suppression).
- Shallow roof/floor voids (less than 800mm deep, when measured between the underside of the roof/floor and the top of the suspended ceiling or between the floor and underside of the raised floor) with no combustible materials contained within the void (or be constructed out of). Note, electrical cables with voltage less than 250V, single phase, with a minimum of 15 cables per tray are exempt. Otherwise, a sprinkler suppression system should be provided within these areas.

4.3.13 A compliant BS EN 12845 system should achieve the following requirements:

- “Quick Response” sprinkler heads should be temperature rated between 68°C or 78°C (colour coded as red or yellow respectively as per BS EN 12259-1) for normal conditions
- Metal pipework
- Fire collars or similar proprietary fire stopping systems designed to crush pipework should not be used on sprinkler pipework

4.3.14 The BS EN 12845sprinkler system will be provided with independent water supply. The stored water for the car park sprinkler system should be sufficient to allow for continuous water supply duration of at least 60 minutes. The size of the stored water supply should be confirmed by a suitable specialist for a wet or pre-action system.

4.3.15 A duty and standby pump set should be provided to serve the car park sprinkler system.

4.3.16 A single BS EN 12845 sprinkler system can be utilised for the protected of the car park, Girl Guides and lounge/co-working space simultaneously as a fire would only be expected to break out in one area.

4.4 Compartmentation

Compartment Walls and Floors

4.4.1 A summary of the compartment wall and floor requirements for the development has been provided in Table 12. As the buildings provide residential accommodation, all floors within the building are to be constructed as compartment floors.

4.4.2 Where a fire separating element is required, this element of construction should provide the minimum level of fire resistance as stated when tested in accordance with the appropriate European Standard and classified to the relevant part of BS EN 13501 or, tested to the relevant part of BS 476.

4.4.3 Note that where one wall falls into more than one of the below categories, the higher rating should be applied.

Table 12: Compartment Wall and Floor Requirements

Location	National Classification	European Classification[1]	Method of Protection
Compartment Floors	120	REI 120	From underside
Car Park ceiling to courtyard above	120	REI 120	From underside
Firefighting Stairs	120	REI 120	Each side separately
Firefighters Lift	120	REI 120	Each side separately
Passenger Lift	120	REI 120	Each side separately
Substation	240	REI 240	Each side separately
Smoke Shaft	120	REI 120	Each side separately

Location	National Classification	European Classification[1]	Method of Protection
Service Risers (protected shafts)[2]	120	REI 120	Each side separately
Protected Stair 5	120	REI 120	Each side separately
Life Safety System Rooms	120	REI 120	Each side separately
External protection to firefighting stair	120	REI 120	From inside only
Double height ancillary to other accommodation	120	REI 120	Each side separately
Car Park	120	REI 120	Each side separately
Girl Guide & Shop to other accommodation	120	REI 120	Each side separately
Common Corridors	60	REI 60	Each side separately
Apartments	60	REI 60	Each side separately
External protection to common corridor	60	REI 60	From inside only
Girl Guide Protected Corridors	30	REI 30	Each side separately
Girl Guide Kitchen and Stores	30	REI 30	Each side separately
Girl Guide Archive	120	REI 120	Each side separately
Plant Rooms	60	REI 60	Each side separately
Storage Areas	60	REI 60	Each side separately
Refuse & Cycle Stores	60	REI 60	Each side separately
Protected areas of external walls > 1m from relevant boundary	120 Loadbearing and integrity, 15 insulation	RE 120, REI 15	From inside out

[1] 'R' rating applies to load bearing elements only.

[2] Where service risers are fire stopped at floor level to 120-minutes, the resistance rating can be reduced to match the surrounding compartmentation requirements.

4.4.4 Compartment walls should be taken from slab and continued up to the underside of the floor above or through to the underside of the roof and be appropriately fire stopped at the junctions. Compartment walls and floors should also extend to the inside face of the skin of the external wall and be fire stopped at the junction to achieve the same fire resistance as the wall/floor.

4.4.5 There is a glazed element within the separating wall between the Girl Guide common room and associated common escape route, this glazing should achieve a fire resistance rating of 30 minutes for integrity and insulation.

4.4.6 The Lounge/co-working space is provided over the upper ground and first floors as such where this area adjoins the residential accommodation the separating walls should be provided as 120-minute compartment walls.

Fire Doors

4.4.7 A summary of the fire door requirements has been provided below in Table 13. Fire doors should typically achieve a rating of half of the wall that they are fitted, rounded up to the next largest 30-minute interval. Any access panels fitted in floors/ceilings should achieve the same rating as the floor/ceiling that they penetrate.

4.4.8 Fire-resisting doors should be specified as complete fire doorsets and should achieve the minimum level of fire resistance when tested from both sides in accordance with either BS 476-22 or the appropriate European Standard and classified in accordance with BS EN 13501-2.

4.4.9 A fire door that is needed to resist the passage of smoke at ambient temperate conditions i.e. fire doors having suffix S/S_a should either:

- Have a leakage rate not exceeding 3 m^3/h per metre, when tested in accordance with BS 476-31.1 with the threshold taped and subjected to a pressure of 25 Pa; or
- Meet with the classification requirement of S_a when tested in accordance with BS EN 1634-3.

4.4.10 Threshold gaps for timber doors should be in accordance with BS 8214 and/or the specific manufacturers recommendations. Threshold gaps for all other door types should be based on the principles of BS 8214.

Table 13: Fire Door Requirements

Location	National Classification	European Classification	Additional Notes
Apartment Entrance Doors	FD 30S	E 30 Sa	Self-closing
Firefighting Stairs	FD 60S	E 60 Sa	Self-closing
Firefighters Lift	FD 60	E 60	N/A
Non-Firefighters Lift	FD60	E 60	N/A
Protected Stair 5	FD60s	E60 Sa	Self-closing
Protected Lobby/Corridor	FD 30S	E 30 Sa	Self-closing
Smoke Shaft	As per the rating of the wall it is fitted in		Tested smoke control damper/door to EN 12101-8
Service Risers (protected shafts)[1]	FD 60S	E 60 Sa	Locked shut and not easily openable
Life Safety Plant Rooms	FD 60S	E 60 Sa	Locked shut and not easily openable
Lounge/co-working to residential accommodation	FD 60S	E 60 Sa	Self-closing
Car Park	FD 60S	E 60 Sa	Self-closing
Cross-Corridors	FD 30S	E 30 Sa	Self-closing
Girl Guide Corridors, Kitchen, Stores	FD 30S	E 30 Sa	Self-closing. Stores to be locked shut.
Girl Guide Archive	FD 60S	E 60 Sa	Locked shut and not easily openable
Other Plant Rooms	FD 30S	E 30 Sa	Self-closing
Refuse & Cycle Stores	FD 30S	E 30 Sa	Self-closing
Other Ancillary Areas	FD 30S	E 30 Sa	Self-closing
Separating Demises (residential, ancillary, non-residential)	FD 120S	E 120Sa	Self-closing

[1] Where service risers are stopped at floor level to 120-minutes the resistance rating can be reduced to FD30S if the surrounding compartment walls are no greater than 60-minute rated.

Junction of a Compartment Walls and Roof

4.4.11 To reduce the risk of fire spreading over the roof from one compartment to another, a 1500mm wide zone of the roof, either side of the junction with the compartment wall (measured from the outer edge of the compartment wall), should have a roof covering classified as $B_{ROOF}(t4)$, on a substrate or deck of a material rated class A2-s3, d2 or better.

4.5 Active Compartmentation

4.5.1 A summary of the active compartmentation has been provided in Table 14 below.

Table 14: Activation Compartmentation Summary

Location	System	Fire Classification	Leakage Rated?	Test Standard
Girl Guide Kitchen	Fire shutter	E30	No	BS EN 1634-1
Girl Guide Office	Fire and Smoke Curtain	EW30	Yes	BS 8524 Pt 1 & 2
Lift PL1 to Car Park	Fire and Smoke Curtain	EW60	Yes	BS 8524 Pt 1 & 2
Lift PL2 to Car Park	Fire and Smoke Curtain	EW60	Yes	BS 8524 Pt 1 & 2

4.5.2 Instead of providing a protected lobby provided with 0.4m^2 permanent ventilation between the platform lifts and the car park, it is proposed to omit the lobbies by the inclusion of a fire and smoke curtain to prevent fire and smoke ingress to the lifts and adjacent accommodation. The curtains will be in addition to the FD60s doorsets.

4.5.3 Fire and Smoke Curtains should be designed and installed as per recommendations of BS 8524 Parts 1 and 2. The rating of the curtain should achieve EW60Sa (60 minutes integrity, 60 minutes irradiance and smoke seals).

4.5.4 A BS 8524 compliant active compartmentation system should descend immediately upon activation of the localised fire detector (or alarm zone). Typically, a fire curtain assembly should have a deployment speed ranging between 0.06m/s and 0.15m/s. The curtain should be self-closing under gravity upon loss of power.

4.5.5 The fire/smoke curtains should be provided with split/drop functionality which would descend initially to smoke layer height, allowing occupant to egress below and would then fully descend and should be provided with manual overrides and obstruction alarms.

4.5.6 As this is a life safety system it should be provided with an emergency power supply. This is usually achieved by a battery back-up or link to a secondary power supply in the building. Should batteries be a preferred secondary power provision, the fire and smoke curtain should have means to inspect the battery conditions. The system should also feature display panels which is capable of indicating faults, operation, battery replacement, etc.

4.6 Protection of Openings and Fire Stopping

4.6.1 Fire stopping is required to prevent the performance of fire-separating elements from being impaired by joints, imperfect fits and openings for services. A variety of fire stopping methods are available for different types of penetrations. This section summarises the standard fire stopping approach for various penetrations.

4.6.2 Pipes passing through fire-separating elements should be provided with a tested proprietary sealing system, such as an intumescent fire collar or sleeve wherever the internal pipe diameter exceeds the dimensions given in Table 15. Where the internal pipe diameter is less than the dimension given in Table 15, the penetration may be fire stopped with an intumescent mastic or cement mortar appropriately tested for the application around the pipe only provided that the annular zone around the pipe is kept as small as possible.

4.6.3 There are two main approaches for fire stopping of vertical service risers within a building:

- Option 1: Risers should be designed with a continuous fire resisting protection when penetrating via a compartment floor, enclosing the riser with adequate fire resistance. The fire resistance of the riser enclosure should be the same or higher to the fire resistance provided to the compartment floors and/or structure it breaches. All penetrations through vertical fire protection of service risers will need to be fire stopped achieving the same fire resistance as the wall they penetrate. Note, no floors are required within encased vertical service risers; however, access grilles or other means to prevent falling may be required; or
- Option 2: Risers should be fire stopped at floor level, achieving the same fire resistance as the compartment floor they penetrate through. All penetrations through horizontal fire protection of service risers will need to be fire stopped achieving the same fire resistance as the wall they penetrate. In this instance the walls of the riser should achieve the fire-resistance requirements of the surrounding walls.

4.6.4 Orion Fire would recommend that Option 1 is adopted for main service risers due to a large volume of services contained within them. The contractor and wider design team should confirm the preferred solution on fire stopping.

4.6.5 Additional methods of fire-stopping pipes are given within prescriptive guidance, such as sleeving pipes with high melting point metals for 1m either side of the penetration, or enclosing drainage or water supply stack pipes in a separate fire-resisting riser. However, due to the onerous buildability impact that these methods have, Orion Fire Engineering recommend using a proprietary sealing system in any situation where the internal diameter of a pipe exceeds the dimensions given in Table 15.

4.6.6 Examples of typical fire stopping arrangements can be seen in Figure 19 and Figure 20 for compartment walls and floors.

Table 15: Maximum Internal Diameter of Pipes not Fitted with a Proprietary Seal

Situation	Pipe Material and Maximum Internal Diameter (mm)		
	High Melting Point Metal[1]	Lead, aluminium, aluminium alloy, uPVC[2], fibre cement	Any other material
Structure (but not a wall separating buildings) enclosing a protected shaft that is not a stair or a lift shaft	160	110	40
Any other situation	160	40	40

[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 that comply with either BS 4514 or BS 5255

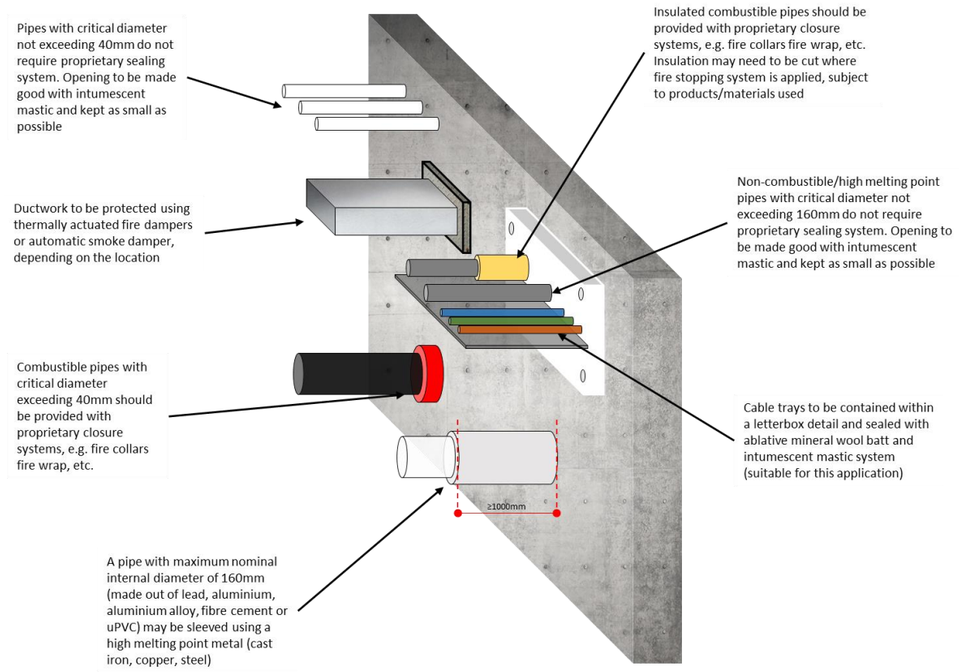

Figure 19: Example of Fire Stopping Methods – Compartment Wall

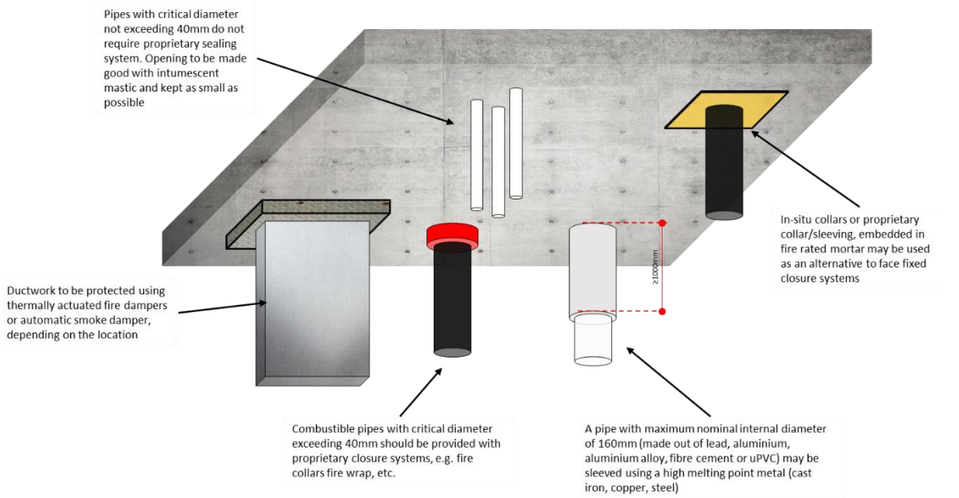

Figure 20: Example of Fire Stopping Methods – Compartment Floor

4.7 HVAC Systems

4.7.1 Ductwork should not provide a passage for fire and smoke to bypass compartment boundaries.

4.7.2 Wherever ductwork passes through a fire-separating element it should be provided with a fire damper or an automatic fire and smoke damper in accordance with BS 9991 and ASFP Grey Book: *Fire and smoke resisting dampers*.

4.7.3 Where dampers cannot be provided in general ductwork for any reason, the duct should be fire-rated or enclosed in fire-resisting construction (integrity and insulation) to the highest period of fire-rated construction through which it passes. Fire-rated ductwork or ductwork enclosed in fire-resisting construction would need to be fire rated from the point it penetrates the compartment wall of the compartment it serves (or furthest compartment it serves if multiple compartments are served) to the point it terminates.

4.7.4 Table 16 below provides a summary of the required locations for both fire dampers and fire and smoke dampers.

4.7.5 Note that where one location can be categorised as more than one of the situations listed in Table 16, the higher rating should be applied.

Table 16: Fire Damper and Fire and Smoke Damper Locations

Ductwork Route		Thermally Actuated Fire Damper	Automatic Fire & Smoke Damper
From	To		
Floor	Floor		X
Apartment	Any other Space		X
Ancillary Room	Ancillary Room	X	
Any Other Space	Common Escape Route		X
Between Occupancies (residential, non-residential or ancillary)			X

4.7.6 Thermally actuated fire dampers as well as automatic smoke dampers should confirm to BS EN 15650, be tested in accordance with BS EN 1366-2 and classified in accordance with BS EN 13501-3. Thermally actuated fire dampers will need to achieve the same fire resistance as the fire resisting element they are fixed in, subject to a minimum classification of E (integrity) of 60 minutes. Automatic smoke dampers will need to achieve the same fire resistance as the fire resisting element they sit in, subject to a minimum integrity and smoke rating (ES) of 60 minutes.

4.7.7 Smoke detectors and automatic release mechanisms used for activation of fire damper and/or automatic smoke damper, should conform to BS EN 54-7 and BS 5839-3 respectively.

4.7.8 Where ductwork exhausts terminate at an external wall, it should be sited away from any escape routes and final exits. Where the ductwork exhaust point terminates at an external wall/roof or is in close proximity to a final escape route, it should be surrounded by materials achieving a Class A2-s1, d0 or better. Any combustible ductwork would need to terminate on the internal face of an external wall as materials/services in the external wall should achieve a classification of A2-s1, d0 or better to conform to the requirements of Regulation 7(2) of the Building Regulations.

4.7.9 Where dampers are concealed within the internal fabric of the building, adequate maintenance access to the damper needs to be provided for inspection, testing and maintenance.

4.8 Cavities

4.8.1 Concealed cavities within a building provide an unseen passage for the spread of fire and smoke. Additional protection, such as the provision of cavity barriers, is required in some situations to maintain the compartmentation provided to a building. Cavity Barriers should be in full accordance with BS 9991.

4.8.2 Cavity barriers as referred to within this section should achieve a fire-resistance rating of 30 minutes to Integrity and 15 minutes to Insulation (E30, EI 15). This is independent of the rating of any compartment wall or floor that they are adjacent to. Please refer to Section 4.5 for further information on fire-stopping.

4.8.3 Cavity barriers should be provided in all of the following locations:

- At the edges of cavities, including around openings (such as windows, doors and service penetrations);
- At the junction between an external cavity wall and every compartment floor and compartment wall;
- At the junction between an internal cavity wall and every compartment floor, compartment wall or other wall or door assembly forming a fire resisting barrier.
- At the top of the cavity

4.8.4 Cavity barriers should also be provided to sub-divide extensive cavities as per the distances given in Table 17. Note, this is only applicable for non-residential areas and should not be adopted for the residential demise.

Table 17: Maximum Dimensions of Cavities

Location Cavity	Surface Spread Classification for exposed surfaces within the cavity	Maximum dimension in any direction (m)
Between a roof and a ceiling	Any	20
Any other cavity	Class C-s3,d2 or better	20
	Worse than Class C-s3,d2	10

4.8.5 Cavity barriers within a stud wall or partition, or formed around openings (such as windows, doors and service penetrations) need not necessarily be a proprietary tested fire barrier system, and can instead be formed of any of the following materials:

- 0.5mm thick steel;
- Polythene-sleeved mineral wool, or mineral wool slab, under compression when installed in the cavity;
- 12mm thick calcium silicate, cement-based or gypsum based boards.

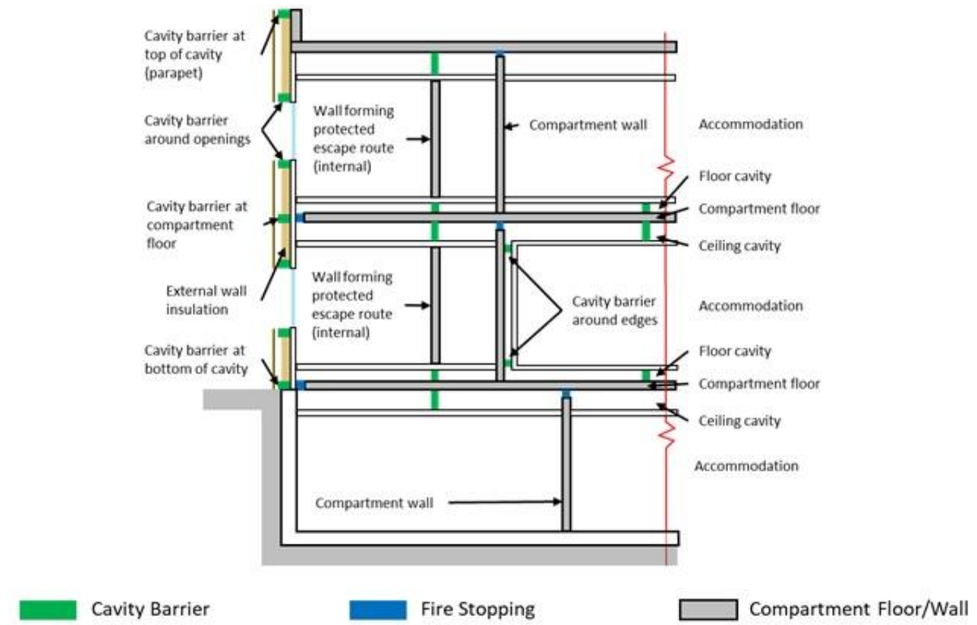

Figure 21: Provisions for Cavity Barriers

4.8.6 Cavity barriers should be tightly fitted to rigid construction and mechanically fixed in position in such a way that their performance is unlikely to be made ineffective by any of the following:

- Movement of the building due to subsidence, shrinkage or temperature change, and movement of the external envelope due to wind;
- During a fire, collapse of services penetrating the cavity barriers, either by the failure of the supporting system of through degradation of the service itself;
- During a fire, failure of the cavity barrier fixings;
- During a fire, failure of any material or construction to which cavity barrier abut.

4.8.7 Cavity barriers should be supported by materials that achieve an equivalent fire-resistance rating to the cavity barrier i.e. fire rated cavity barriers at floors and party wall junctions need to be fixed to equally fire-rated construction, but cavity barriers around a window opening (e.g. 12mm board/0.5mm steel) wouldn't necessarily have to be fire rated if the floor barriers are fixed back to the slab and the party wall barriers are supported by studs in the party wall.

5 External Fire Spread

5.1 Space Separation

5.1.1 The external fire spread relevant boundary has been illustrated in red below on Figure 22. The relevant boundary for external fire spread is typically the site boundary; however, it may be extended past the site boundary, where the adjacent land is an area unlikely to be developed upon, such as a road or canal, as such the site boundary has been extended at to encompass the surrounding roadways. A notional boundary has also been considered between the blocks as highlighted in blue on Figure 22.

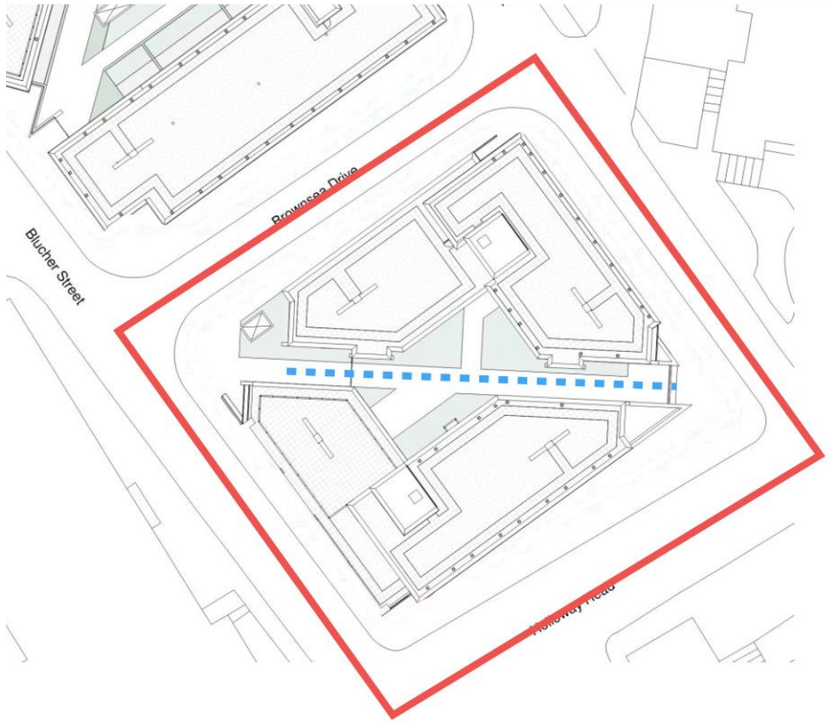

Figure 22: Relevant External Fire Spread Boundary

5.1.2 As part of External Fire Spread assessment, space separation between the building and its relevant boundaries has been evaluated to minimise the risk significant radiation affecting buildings on neighbouring sites. The main aspect of the assessment is calculating the required protected areas, to limit non-fire rated elements on the external envelope of the building. The external fire spread assessment is benchmarked against minimum requirements stated in BR 187 – *External Fire Spread, Building Separation and Boundary Distances,* using calculation methods outlined in Annex A of the document. An example of the calculation performed for each compartment can be seen below.

$$u = \frac{(d/f)^2}{(wh)}$$

Where:

d = distance to boundary

h= height of compartment

w = width of compartment

f = factor from Table 3 (BR 187)

5.1.3 The results for each compartment from the external fire spread analysis for the development have been calculated and tabulated in Table 18. Where a compartment has not been highlighted it should be assumed to achieve 100% unprotected area.

5.1.4 Where sprinklers are provided throughout, in accordance with BS 9251 or BS EN 12845, either of the following is permitted;

- The boundary distance can be halved, to a minimum distance of 1m.
- The amount of unprotected area can be doubled.

5.1.5 Protected stairs and lobbies where no fire load is present, are not required to be provided with protected areas on the external façade.

Table 18: External Fire Spread Analysis Results

Location	Use	Panel Width (m)	Panel height (m)	Boundary Distance (m)	Unprotected Area (%)	Unprotected Area (m^2)
Northwest - 1B8A	Residential	8.6	2.85	7.1	100%	24.51
Activity 02	Recreation	12.3	5.7	6.8	100%	70.11
Main Hall	Recreation	21.6	5.5	7.3	100%	118.80
Southwest - 2B1D	Residential	10.8	3.7	6.4	100%	39.96
Lounge/Co-Working	Other Non-Residential	12.5	5.7	2.35	55%	19.71
2B7A Ground Floor	Residential	8.45	2.85	2.35	100%	24.08
2B9A Ground Floor	Residential	10.4	2.85	3.7	100%	29.64

5.1.6 Apartment type 1B8A was assessed as this represents the largest compartment on the Northwest façade, as this area can be afforded with 100% unprotected areas, it is assumed that the remaining compartments on this façade can also be afforded 100% unprotected areas.

5.1.7 Activity 02 was assessed as this represents the largest compartment on the Northeast façade, as this area can be afforded with 100% unprotected areas, it is assumed that the remaining compartments on this façade can also be afforded 100% unprotected areas.

5.1.8 The main hall was assessed as this represents the largest compartment on the Southeast façade, as this area can be afforded with 100% unprotected areas, it is assumed that the remaining compartments on this façade can also be afforded 100% unprotected areas.

5.1.9 Apartment type 2B1D was assessed as this represents the largest compartment on the Southwest façade, as this area can be afforded with 100% unprotected areas, it is assumed that the remaining compartments on this façade can also be afforded 100% unprotected areas.

5.1.10 The notional boundary was assessed to the West which found the lounge/co-working space has a 55% protected area requirement, this has been highlighted in red below on Figure 23 & Figure 24. Protected areas required that are more than 1m from the relevant boundary should achieve 120-minutes for loadbearing capacity and integrity and 15-minutes insulation (RE 120, REI 15) from inside the building. The protected area requirements can be achieved by the solid external wall construction so this should be designed to achieve the fire resistance requirements. The glazed elements can remain unprotected in this compartment. The opposite residential apartment was found not to require any protected areas. As this is apartment is the largest on the Western portion of the notional boundary the remaining compartments can be assumed to allow 100% unprotected areas.

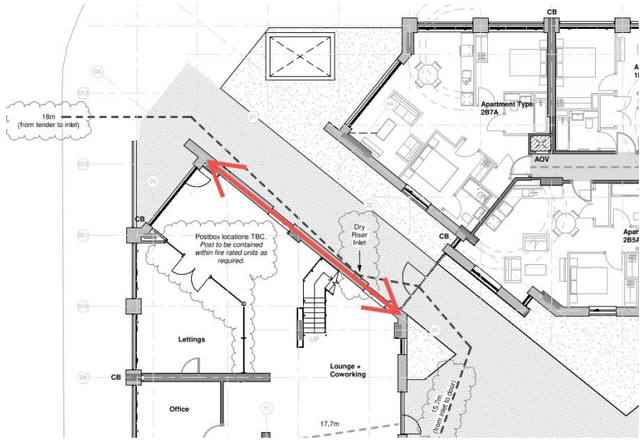

Figure 23: Lounge/Co-Working Protected Areas Lower Floor

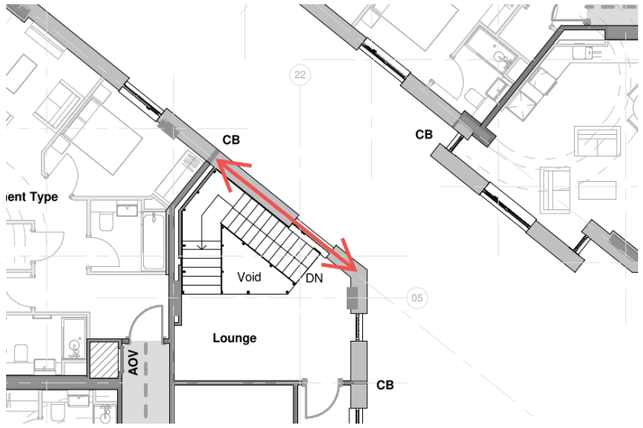

Figure 24: Lounge/Co-Working Protected Areas Upper Floor

5.1.11 The notional boundary to the East was also assessed and found not to require any protected areas.

5.2 External Wall Construction

5.2.1 The external envelope of the building should not contribute to excessive smoke and fire spread from one part of the building to another or to another building.

5.2.2 External walls are defined as the full external wall build up from the external surface of the wall to the internal surface (excluding any internal decorative finish).

5.2.3 As both blocks are over 18m in height and provide residential accommodation, it is deemed as a Relevant Building under Regulation 7 and the majority of materials used within the external walls must achieve an A2-s1,d0 rating or better. See Section 5.3 for details.

5.2.4 The external wall build up is dependent on location but generally consists of the below;

- External wall finishes are to be brick, Stofix brick slip system or AkzoNobel Interpon D2525 stone effect architectural powder coating.
- 2 layers of Insulation sandwiching CP board.
- Inner plasterboard and skim finish.

5.2.5 This is not intended as an extensive list of components forming the external wall construction and the specific external walls materials and build-ups used within the building should be confirmed by the architect and specialist façade designer to comply with Regulation 7.

5.2.6 A schedule of all materials and components of the external walls and any specified attachments should be created along with the corresponding fire classifications of each product for reference and agreement with the Building Control Body. A summary of the components will be listed in this section in the next revision to reflect the agreed design intent and their fire performance.

5.2.7 Parapet walls would classify as an external wall and would be therefore subject to Regulation 7, it is not anticipated that timber elements within the parapet wall would achieve a A2-s1,d0 rating or better therefore would not be suitable for use.

5.3 Regulation 7 Requirements

5.3.1 All materials used within the external walls of the building including balconies/loggias should achieve an A2-s1,d0 rating unless listed as an exemption in Table 19.

Table 19: Exception from Regulation 7(2)

Product	Definitions
Cavity Trays	Only where cavity trays are installed within two leaves of masonry construction.
Roofing Materials	Any part of a roof, or its components that extended to the junction of external walls.
Door Frames and Doors	Any door leaves, door frames and door sets located within the external wall construction, including glazing, features, fixings and ironmongery.
Electrical Installations	Defined in Building Regulations as “fixed electrical cables or electrical equipment, located on the consumer side of the electricity supply meter”.

Product	Definitions
Below Ground Insulation and Waterproofing	Materials used for insulation and/or waterproofing of below ground levels.
Intumescent Materials and Fire Stopping	All intumescent materials and fire stopping used to protect life safety of occupants within the building, including (but not limited to) fire sleeves, fire collars, open state cavity barriers, High Expansion Mastic, etc.
Membranes	Any vapour control layers, EDPMs, and other membranes commonly used in the construction industry. *Must still achieve a Class B-S3,d0 rating to BS EN 13501* Note that EDPM used as a seal around external wall penetrations such as windows would be exempt as a "Seal" and therefore the additional membrane requirements would not apply.
Seals, Gaskets, Fixings, Sealants and Backer Rods	Ancillary construction components used for sealing, bonding, fixing of two or more materials. Note, adhesives in general are not excluded from Regulation 7(2), unless: • Meet Class A2-s1,d0 or better; • Are part of a product/system which meets A2-s1,d0 or better rating; or • Are used in situation in which one of the other listed exclusions would apply.
Thermal Breaks	Materials and systems used in construction of external envelope of the building, preventing thermal bridging and meet requirements of Schedule 1 Paragraph L, provided that these elements are as small as is practicable.
Window Frames and Glass	Any glass, windows or glazing panels (including laminated, toughened and hardened) contained within a frame. Where Curtain Walling is used, transom and mullions are also excluded from Regulation 7(2). *Note that the exemption only applies to glazing that is acting as a window, i.e. if an occupant within the building cannot see the glazing or see through the glazing, it is not exempt and must achieve a Class A2-s1,d0 rating. This includes:* • *Glazed spandrel panels* • *Blanking panels or other opaque glazing* • *Glazed balustrades on balconies or roof terraces.*

5.3.2 Products classified as non-combustible (Class A1) without the need for testing may be used, as identified by the European Commission. A full list of materials can be found in Commission Decision 96/603/EC (OJ L 297 19.10.1966 p23) as amended by 2000/605/EC (OJ L 258 12.10.2000 p36) and 2003/424/EC (OJ L 144 12.6.2003 p9).

5.3.3 For any non-combustible metal components forming parts of the external walls that are powder coated, the powder coating should also achieve an A2-s1, d0 rating.

5.3.4 Consideration should be given to the choice of material used for any other parts of an external wall or attachments to the wall which could impact on the risk of fire spread over the wall.

5.3.5 Note: specified attachments are defined as follows:

- A balcony attached to an external wall;
- A device for reducing heat gain within a building by deflecting sunlight which is attached to an external wall; or
- A solar panel attached to an external wall.

5.4 Roofs

5.4.1 As the building provides residential accommodation and there will be a number of interfaces between compartment walls and the roof, it is recommended that a roof system achieving a $B_{ROOF}(t4)$ rating is to be provided.

Fire Performance Green Roofs

5.4.2 Fire performance of Green Roofs should be in accordance with recommendations outlined in The Green Roof Organisation – *GRO fire risk guidance document* and in the Ministry of Housing, Communities and Local Government (MHCLG) guidance document "*Fire Performance of Green Roof and Walls*".

5.4.3 The guidance reviewed generally states that green roofs should be designed to provide the necessary resistance to the external spread of fire by the following measures:

- increasing the non-combustible content of the growing medium
- decreasing the organic content of the growing medium
- preventing the system from drying out.

5.4.4 General advice includes:

- Compartment walls should meet the underside of a roof deck they should be fire–stopped and a zone of the roof 1500mm wide on either side of the wall should have a covering designation $B_{ROOF}(t4)$ on a substrate or deck of a material of limited combustibility
- Fire breaks around all openings and vertical elements at least 500mm wide, such as paving slabs or non-vegetated strips of pebbles, should be included in the following locations:
  - Around the perimeter of the roof
  - Around any openings through the roof construction
  - To sub-divide extensive areas of organic materials
- Firebreaks should be maintained to prevent overgrowth rendering them ineffective and breaks should be provided in 1m strips every 40m across extensive green roofs
- Plants should be regularly maintained to reduce the volume of organic materials increasing over time
- Growing mediums should contain no more than 20% organic matter
- Due consideration should be given to method of irrigation of green roofs to prevent plants from drying out and significantly increasing their fire risk. This should include contingencies in the event of water shortages such as temporary hosepipe bans.

5.4.5 As the development is a 'relevant building' as defined by Regulation 7, green wall systems are not permitted.

Photovoltaic Panels

5.4.6 Parts of the roof will incorporate PV panel installations. There is currently no guidance within the approved documents or British Standards relating to fire safety for PV installations. The RISC Authority guidance document RC62 provides guidance on the design, installation and maintenance of PV panels. This guidance is not statutory guidance or standard practice within the industry. Whilst it may not be feasible or appropriate to adopt the guidance in full, the recommendations below are considered to be reasonable to implement and are recommended as part of this fire strategy.

- A switch should be provided at in the main entry point to the building to isolate the DC side of the PV system that is easily identifiable and accessible to the fire and rescue service.
- PV Panels should be located such that they do not span compartment lines unless either:
    - The roof is constructed on a concrete deck that achieves 60 minutes fire-resistance to prevent a fire on the roof from penetrating downwards into the building below; or
    - The insulation materials used on the roof achieve an A2-s1,d0 rating or better to reduce the risk of the roof itself becoming involved in a fire initiated by the PV array. This is to mitigate the risk of a fire developing on the roof and penetrating downwards into the building.
- Any roof access points should be separated by a distance of 2.5m from any PV panels such that any firefighters accessing the roof to fight a fire in the PV array are separated from the potential fire location.
- A roof plan showing the extent of the PV array should be located within the premises information box. The ground floor plan located within the premises information box should include the location of the PV isolation switch.

6 Access and Facilities for the Fire Service

6.1 Firefighting Access to the Building

6.1.1 Firefighting vehicle access is provided via the existing roadways from Brownsea Drive, Ellis Street, Holloway Head and Blucher Street.

6.1.2 Where works to the existing infrastructure are proposed, these should be in accordance with Table 20. Note, fire appliances are not standardised and may vary from area to area. Consultation with the Local Fire Authority and Building Control are required to ensure these dimensions are true to the equipment available for fire crews.

Table 20: Typical Fire Appliance Access Route Specification

Appliance Type	Minimum Width of Road Between Kerbs (m)	Minimum Width of Gateways (m)	Minimum Turning Circle Between Kerbs (m)	Minimum Turning Circle Between Walls (m)	Minimum Clearance Height (m)	Minimum Carrying capacity (tonnes)
Pump	3.7	3.1	16.8	19.2	3.7	12.5

6.1.3 There are not envisaged to be any dead-end access roads for a fire appliance given continual access is proposed to all four sides of the development therefore turning facilities will not be required.

6.1.4 A summary of the key Fire Service access and provisions for the development have been highlighted on Figure 25.

6.1.5 As the dry riser inlet and fire service access point for Block D is within the internal courtyard and the entrance is 15m from the dry riser inlet, clear and adequate signage should be provided to alert the Fire Service to both the position of the dry riser inlet and the building Fire Service access point.

6.1.6 As the Fire Service entry point to Block D is within a recessed alcove clear and adequate signage from the dry riser inlet position should be provided to inform the Fire Service to the building Fire Service access point.

Non-residential and Ancillary Accommodation

6.1.7 The Shop and Girl Guide accommodation at Lower Ground and Mezzanine are less than 2,000m^2 and less than 11m in height, therefore pump appliance access is required to at least 15% of the perimeter which is achieved. Due to complexity of the project, it is advised that the dry riser main is extended from Stair 4 into Stair 5 which would serve LG and Mezz level and also aid in meeting the hose laying distances in the plant rooms in the car park.

6.1.8 With the addition of the outlets in Stair 5, all internal areas of the ancillary accommodation are either within 45m of a fire appliance parking location, on a route suitable for laying a hose, or are within 60m of a fire main outlet within a firefighting stair, or 45m of a fire main outlet with the protected stair.

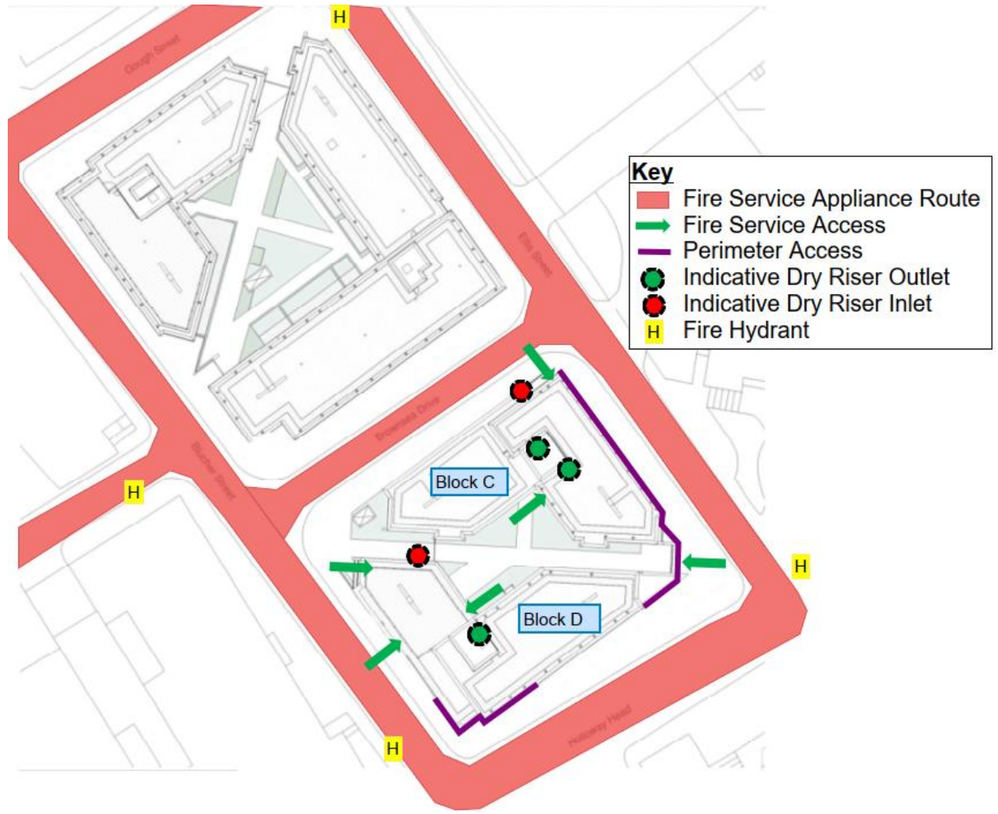

Figure 25: Fire Service Site Access

6.2 Firefighting Shaft

6.2.1 As each of the blocks exceed 18m in height and are separated on the upper floors, Stair 3 and Stair 4 are to be constructed as a firefighting stair forming part of a residential firefighting shaft.

6.2.2 A firefighting shaft should comprise of these basic components:

- A minimum clear width 1100mm wide stair, enclosed in 120 minutes fire resisting construction (REI 120) provided from outside to inside. The internal lining of the firefighting stair may be reduced to 60 minutes fire resisting construction (EI60)
- A protected ventilated lobby afforded with a smoke ventilation system, refer to Section 2.7 for further details.
- A 1.0m^2 geometric free area AOV at the head of stair
- A fire main provided within the stair at each level including the lower ground, mezzanine and upper ground floors.
- A firefighter's lift, located to provide access within 7.5m of the firefighting stair.

6.2.3 The firefighters lift within Block C is currently extended above the 7.5m limitation from the associated stair, the distance measures approximately 8.7m which is an extension of 1.2m. This is proposed to be acceptable on the following basis;

- The extension is only slightly above the 7.5m limitation which would result in an additional travel time of c.1 second based on a travel speed of 1.2m/s.
- All apartments are sprinkler protected and shall have a water duration of a minimum of 60 minutes. Sprinklers would control the fire growth in the compartment of fire origin and significantly reduce the temperature and cubic volume of smoke produced thus reducing the concentration of combustion products entering the protected corridor during the firefighting phase.
- The corridor in which the Fire Service Personnel are to travel is to be provided with an enhanced mechanical ventilation system, the primary objective of the systems is to return the extended corridor and associated staircase enclosure to tenable conditions for means of escape and rescue purposes. This is to be demonstrated by CFD modelling and analysis.
- Additional signage is proposed from the firefighters lift to the stair entry point to justify this slight extension to assist in directing fire service to firefighting stair.

6.2.4 Alternative to the above the stair door could be repositioned to be flush with the corridor wall which would reduce the firefighters lift distance to an acceptable distance, however, practically this would not change the distance a firefighter would need to walk from the lift doors to the actual stair treads, this would only be an exercise to meet code-compliance whilst not having any functional impact on the design.

6.2.5 Flooring and floor coverings within the firefighting shaft are to be provided in accordance with the recommendations of BS 9999. All floorings and floor coverings should be chosen so as to minimise loss of traction when wet, as resilient floor surfaces should be maintained in accordance with BS 6263-2, with only emulsion-based polishes used. Typically, a slip-resistance of R13, when tested to DIN 51130, is adequate to meet the requirements for firefighting shafts.

6.2.6 It is to be noted as the slip resistance of resilient floor surfaces is reduced by contamination by dust or materials such as oils or grease, it is essential that they are cleaned frequently. The flammability of any textile floor coverings needs to be low.

6.2.7 Textile floor coverings should:

- When tested together with any underlay, in accordance with BS 4790, suing the test procedure reflecting the method used for securing the floorcovering to the floor, either:
  - Not ignite; or
  - Have effects of ignition on both the use-and-under surfaces not exceeding beyond a circle of radius 35mm centred on the central point of application of the nut.
- Be firmly secured to the floor, with any adhesive being used non-water soluble; and
- Be interruptible at all doors to and within the firefighting shaft along the line of the threshold of the doorway with a metal or other non-combustible strip not less than 50mm in wide.

6.3 Firefighters Lifts

6.3.1 Where firefighter's lifts are provided, these should be designed and installed in accordance with BS EN 81-20 and BS EN 81-72. Absolute minimum dimensions and specification of the firefighter's lift should be no less than 1100mm wide by 1400mm deep with a rated load of 630kg. The clear entrance to the lift car should achieve at least 800mm.

6.3.2 Means to protect firefighters lifts and associated plant from water damage will need to be provided. As per recommendations of BS EN 81-72, permanent means of preventing water ingress are preferred, albeit if not feasible, active means to prevent water accumulation may also be adopted. There are three widely accepted permanent means for prevention of water ingress into the lift well, as per recommendations of BS EN 81-72 and BS 9999:

- The use of raised threshold to the lift entrance, of at least 25mm incline towards the lift entrance
- The use of drainage grid to the lift entrance
- The use of floor sloped away from the lift entrance, of at least 25mm incline towards the lift door and minimum fall of 1:100 for either slope.

6.3.3 Where a firefighter's lift sits within a lift bank, the same permanent means of water ingress methods will need to be applied to the non-firefighters' lifts.

6.3.4 The firefighters lift should be provided with the following features, not listed above (the list is not exhaustive and intended as guidelines only, listing out primary components):

- Ground floor manual override mechanism (BS EN 81-20);
- Secondary power supply
- Secondary power use indicator in proximity to the lift entrance at Fire Service access level;
- Internal communication system;
- Manual controls within the lift;
- Interface with AFDA for the building. Note that as it is proposed that the firefighter lift will remain in service to allow non-ambulant residents to self-evacuate from the building, the firefighter lift should only return to ground level if the fire service manually override the lift or smoke enters the lift well.

6.4 Dry Riser

6.4.1 Due to a building height in excess of 18m above fire service access level, the firefighting stair in each block will need to be provided with a dry riser in accordance with BS 9990, serving all floors. Orion would recommend that stair 5 is provided with a dry riser outlet on each level due to the complexity of the building and to assist with hose laying distances to the remote points of the car park.

6.4.2 Landing valves should be free of any potential obstructions and should not be mounted in areas where they are likely to reduce the overall effective escape width. For residential buildings, landing valves should be installed within the protected stair enclosure, at each full landing. The outlet valve should be installed with its lowest point around 750mm above floor level and should be flanged rather than threaded for ease of maintenance. Outlet valves for dry risers should conform to recommendations of BS 5041-1.

6.4.3 The dry fire main should be fitted with a two-way inlet breeching for 100 mm mains. Each breeching should conform to BS 5041-3. Such breeching should be accommodated in an inlet box conforming to BS 5041-5, the box being positioned with its lower edge between 400 mm and 600 mm above ground level.

6.4.4 The fire main inlet point should be located within 18m of the fire service access point to the site and sited on the external façade of the building, visible from fire service access point. A freestanding cabinet may also be utilised subject to discussion with local Fire Authority. Floor-mounted inlet positions are not deemed suitable for majority of fire main applications.

6.4.5 The hose laying distances, between the outlet in the stair and a furthest point on the floorplate, should not exceed 45m from a protected stair and 60m from a firefighting stair. This has been achieved.

6.4.6 Fire mains should have a minimum nominal bore of 100mm and be capable of withstanding operating pressures of up to 20 bar. The material used for construction of the fire mains risers should be of heavy quality steel material including galvanizing where necessary. Dry riser pipework outside of the stair cores should be enclosed in fire-resisting construction equivalent to the fire-rating of the core it serves.

6.5 Fire Hydrants

6.5.1 A fire hydrant should be located within 90m of the dry riser inlet point. For the non-residential accommodation, fire hydrants should be located within 90m of the building entry points. This appears to be achieved as highlighted on Figure 25.

6.5.2 Fire hydrants should ideally provide a minimum flow rate of between 20-35L/s, based upon the recommendations of the National Guidance Document on the Provision of Water for Firefighting 3rd Edition. The Water Company should inform the Fire and Rescue Service where they estimate sufficient flows cannot be met under normal demand conditions and a joint agreement reached as per the principles outlined in the National guidance document on the provision of water for firefighting.

6.5.3 Early consultation should be undertaken with the Water Authority, Fire and Rescue Service and Building Control on the nature of the water supply and quantities or capacity to be provided.

6.6 Premises Information Box

6.6.1 In order to assist the attending fire crews in obtaining the correct information efficiently upon arrival on site, it is advisable that the end-user/responsible person provides a Fire Service Information Box within the apartment block. This should be located adjacent or in close proximity to the entrance of the building most likely used by the attending fire crews. Location is to be discussed and agreed with local Fire Service. It should be ensured that the following crucial information is provided:

- Operational contingency plans
- Evacuation plans and procedures
- Simple schematics and/or line drawings representing the building layout, key locations for firefighting equipment/installations and relevant information for firefighting facilities provided within the building (fire resistance of structure, key access areas, firefighting facilities, services, hazards, etc.)
- Information about the nature of any lifts for use by the Fire Service
- Basic operating instructions for fire protection and fixed firefighting systems

6.6.2 The fire safety/operational systems indicated on any of these plans should be labelled. Where plan symbols are to be used they should follow the system outlined by the local Area Fire Safety Team and include a key with a suitable description alongside. When one or more of the same type of system is installed, they should be individually identified. For example where two different alarm systems are installed to BS 5839-1, these should be designated with different symbols.

6.6.3 The responsible person on occupation should liaise further with the local Area Fire Safety Team and Fire Station(s) with regards to the preferred format and content of the information to be provided within this.

6.6.4 The contents of the box should be kept up to date and kept under regular review.

6.7 Wayfinding Signage

6.7.1 To assist the fire service to identify each floor in a block of flats with a top storey more than 11m above ground level, floor identification signs and flat indicator signs should be provided. The floor identification signs should meet all of the following conditions.

- The signs should be located on every landing of a protected stairway and every protected corridor/lobby (or open access loggia) into which a firefighting lift opens.
- The text should be in sans serif typeface with a letter height of at least 50mm. The height of the numeral that designates the floor number should be at least 75mm.
- The signs should be visible from the top step of a firefighting stair and, where possible, from inside a firefighting lift when the lift car doors open.
- The signs should be mounted between 1.7m and 2m above floor level and, as far as practicable, all the signs should be mounted at the same height. The text should be on a contrasting background, easily legible and readable in low level lighting conditions or when illuminated with a torch.

6.7.2 The wording used on each floor identification sign should take the form Floor X, with X designating the number of the storey, as intended for reference by residents. The floor number designations should meet all of the following conditions.

- The floor closest to the mean ground level should be designated as either Floor 0 or Ground Floor.
- Each floor above the ground floor should be numbered sequentially beginning with Floor 1.
- A lower ground floor should be designated as either Floor –1 or Lower Ground Floor.
- Each floor below the ground floor should be numbered sequentially beginning with Floor –1 or Basement 1.

6.7.3 All floor identification signs should be supplemented by flat indicator signs, which provide information relating to the flats accessed on each storey. The flat indicator signs should meet all of the following conditions.

- The signs should be sited immediately below the floor identification signs, such that the top edge of the sign is no more than 50mm below the bottom edge of the floor identification sign.
- The wording should take the form Flats X–Y, with the lowest flat number first.

- The text should be in sans serif typeface with a letter height of at least half that of the floor indicator sign.
- The wording should be supplemented by arrows when flats are in more than one direction.
- The text and arrows should be on a contrasting background, easily legible and readable in low level lighting conditions or when illuminated with a torch.

6.8 Basement Smoke Ventilation

6.8.1 A storey would be considered a basement storey where a portion of the is more than 1.2m below the highest level of ground adjacent to the outside walls.

6.8.2 Due to the sloping nature of the surrounding ground level, the lower ground floor and mezzanine floors would be considered as basement storeys and therefore would require smoke ventilation for firefighting operations.

6.8.3 Basement floors would require ventilation equalling 2.5% of each floor area served or a mechanical equivalent.

6.8.4 However, it is considered acceptable to omit the smoke ventilation requirement from the lower ground as all areas, with the exception of the protected corridors, small stores and WCs are located on the external façade with a window/doorway with which the Fire Service would utilise for smoke ventilation.

6.8.5 At mezzanine level, the refuse stores and plant rooms are accessed directly from the car park, which will be provided with a smoke ventilation system, as noted in Section 2.7. It is considered that this area does not require any additional breakout panels/smoke ventilation given they can be indirectly vented via the car park smoke ventilation system.

6.8.6 It is considered acceptable to omit the smoke ventilation requirement from the remaining areas of the mezzanine level as all areas with the exception of the protected corridors, small kitchenette, small stores and WCs are located on the external façade with a window/doorway with which the Fire Service would utilise for smoke ventilation.

7 Secondary Power

7.1 General Requirements

7.1.1 It is crucial that all life safety systems provided within the building are capable of normal operation in any condition, including loss of primary power supply to the area/building. Since it is not possible to determine where a fire may occur, the power supplies provided to the life safety systems of the building will need to be adequately protected and additional resilience will need to be provided, in the form of secondary power supply, in order to maintain an acceptable level of safety and operation of all life safety systems in the building, regardless of the conditions present at a time of an emergency.

7.1.2 Recommendations of BS 9991 will be followed to provide detail and information on the performance specification of power supplies for life safety systems.

7.1.3 The electrical power supply to life safety and fire protection systems provided in the building should be separate from all other electrical circuits so that in the event of failure of non-life safety equipment, does not render the installation inoperative. The secondary power supply should be capable of providing emergency power to all life safety systems for at least 3 hours.

7.1.4 The following life safety systems have been installed in the building and therefore will require provision of primary and secondary power supplies:

- Automatic Fire Alarm and Detection Systems (AFDA)
- Smoke Ventilation Systems to Common Corridors and Stairs
- Emergency Lighting
- Electrically operated doors (including magnetic hold open devices)
- Firefighters Lifts
- Automatic Water Fire Suppression Systems (Both Residential and Commercial Systems
- Car Park Smoke Ventilation System
- Fire Shutters/Curtains

7.1.5 Primary power supply should be taken from the incoming public feed while secondary power supply should be provided by either:

- Batteries
- An uninterruptable power supply (UPS)
- A generator located within the building
- Alternative HV supply from a utility primary network

7.1.6 A number of life safety systems may be already installed with an integrated back up supply, such as AFDA, emergency lighting, electrically operated doors, etc. These should be in accordance with their respective British and/or European Standards.

7.1.7 Where an integrated back up supply cannot be provided, typically the prime recommendation for a secondary power supply for high load items such as the lifts and the water suppression systems is to use a generator in accordance with BS 8519:2020. However, it has been advised by others that it is not feasible to allocate sufficient space for either a generator or UPS in the scheme due to space restrictions and therefore the following proposal advises on the best approach without those two options.

7.1.8 The secondary supply is to be provided by an alternative utility supply from a separate sub-station on a different supply network. The supplies will be diversely routed through each building. As the supplies will be fed from a different network the only way a power cut would affect both substations if the full grid went offline. This is reasonable from a fire perspective but there may be other considerations under CDM to allow the safe maintenance of electrical safety systems and then also the robustness of the solution from an ongoing maintenance perspective with regard to potential damage to equipment within the building. This should be assessed by the electrical engineer.

8 Conclusion

8.1 Report Summary

8.1.1 This summary acts as a main conclusion to the report and as a summary of Regulation 38 requirements for Building Management and will outline the approval status at the time of report issue.

8.1.2 The layout of the development, based on the drawings listed in Table 1, is considered sufficient to meet the functional requirements of Part B of the Building Regulations, provided that the recommendations made throughout this report are incorporated in full.

8.1.3 The design of the building is not in full accordance with prescriptive codes; however, it is considered that the alternative solutions presented in this report demonstrate that the proposed design provides an equal or greater level of safety than a code-compliant design.

8.2 Approvals Correspondence

8.2.1 This report has not yet been commented on by the Approvals Authorities.

8.3 Key Fire Safety Information

8.3.1 Under Regulation 38 of the Building Regulations, the Responsible Person for the development should be provided with all essential fire safety information either when the project is complete, or when the premises are first occupied. This section summarises the fire strategy to provide the key information that will be required by the Responsible Person to allow them to:

- Understand and implement the fire safety strategy of the development.
- Maintain any fire safety provided in the development.
- Carry out an effective fire risk assessment of the development.

8.3.2 The information required to achieve this is provided within a collated Operation and Maintenance (O&M) Manual, which incorporates information produced by various consultants, and contractors. The fire safety strategy provides a performance specification for the development during the design phase and acts as a summary of the systems that should be in place within the development post-completion. The fire strategy alone is not sufficient to act as the package of fire safety information handed over the Responsible Person under Regulation 38.

8.3.3 A summary of the key fire safety features of the development has been provided in Table 21. The summary table is not intended to replace the fire strategy; however, it provides an aide-mémoire of the key information presented within this fire strategy, as well as a reference to the relevant section of this report that provides a detailed summary of the system/information. This summary table is intended to assist either the Responsible Person or their appointed Competent Person in producing and maintaining the fire risk assessment and other duties under the RR(FS)O.

8.3.4

Table 21: Key Fire Safety Features of the Fire Strategy

Key Feature	Summary	Section/ Reference
General Features		
Building Height	Both blocks measure 43.1m in height when measured from the lowest adjacent ground floor level to the topmost occupied floor.	Section 1.4
Escape Strategy	Residential apartments - stay-put strategy. Residential ancillary areas and non-residential accommodation - simultaneous evacuation strategy.	Section 2.1
Travel Distances	The common corridor travel distances in both blocks are extended above the allowable 15m but will be assessed through CFD analysis. Extended travel distances present on the Girl Guide Mezzanine Level. Minor extension of travel distance in water tank room. Travel distances generally compliant in remaining areas although ancillary area travel distances will need to be verified once internal layouts are known.	Section 2.4
Disabled Evacuation	Residential buildings are designed to facilitate self-evacuation with no reliance on onsite management as far as is reasonably practicable. The safety features required within residential buildings accommodate this approach via a high degree of compartmentation and the provision of smoke ventilation. Lifts are intended to remain in-use in the event of a fire unless recalled manually by the Fire Service or a detector in the lift shaft is activated. A similar approach will be adopted for the communal roof terrace and level 1 amenity which would be occupied by residents and their guests in a similar way to the occupation within the apartments. Disabled Refuges to be provided where there are changes in Level in Girl Guide Accommodation.	Section 2.6
Structure	The building structure will be concrete frame.	Section 4.2
External Wall Materials	All components used in construction of external walls will need to achieve Class A2-s1, d0 or A1, classified in accordance with BS EN 13501-1 unless listed as a permitted exemption in Table 19. The specific external wall materials used within the building are to be confirmed. A list of external wall components is provided in this report which will be updated as additional information is made available.	Section 5.2

Key Feature	Summary	Section/ Reference
Passive Fire Safety Measures		
Compartmentation	General requirements as follows: 240 minutes substation 120 minutes to firefighting stairs, firefighters lifts, passenger lifts, life safety plant, compartment floors, separation of demises, protected risers, smoke shafts. 60 minutes to apartments, common corridors, non-life safety plant, stores 30-minutes to Girl Guide kitchen, stores and protected corridors.	Section 4.4 Table 12
Cavity Barriers	Cavity barriers to be provided around openings, windows and junction of fire resisting walls and floors with external walls, additionally cavity barriers are required at the top of the cavity.	Section 4.8
Fire Doors	All doors on fire-resisting wall lines should achieve a minimum half the rating of the wall, subject to the next rounded up interval of 30 minutes. All fire doors other than internal apartment doors, service riser doors should be fitted with self-closing devices. All doors other than internal apartment doors should be fitted with smoke seals. Doors should meet the fire resistance of the wall in which it is situated where it separates uses and smoke shaft dampers/AOVS should be 120-minute fire rated.	Section 4.4.7 & Table 13
Fire Dampers	Any ductwork crossing a compartment line should be fitted with either a fire damper or fire and smoke damper as appropriate. A summary of the required locations for fire dampers has been provided in Table 16.	Section 4.5 Table 16
Escape Signage	Passive escape signage is generally not required within a single stair residential building as all residents should be familiar with the sole circulation and egress route. The non-residential & ancillary accommodation should be signed as per the recommendations of BS ISO 3864.	Section 2.8
Internal Linings	Class B-s3,d2 within common circulation spaces. Class D-s3,d2 in small rooms less than 4m^2. Class C-s3,d2 within apartment circulation spaces and rooms larger than 4m^2	Section 3.1
Structural Fire Protection	All elements of structure should achieve 120 minutes fire-resistance for loadbearing capacity.	Section 4.2
Fire Stopping	Any penetrations through a fire-resisting wall should be fire-stopped using one of the methods described in Section 4.6.	Section 4.6

Key Feature	Summary	Section/ Reference
Active Fire Safety Measures		
Fire Alarm	BS 5839-6 Grade D1 Category LD1 to all apartments Category L5 fire alarm consisting of smoke detection to common escape routes to activate the smoke ventilation systems only (no sounders or manual call points to be provided). An additional detector at the head of the lift shafts that will ground the lift when activated. Category L1 to residential ancillary accommodation, Girl Guide and Shop Category L5 to rooftops consisting of warning devices linked to the ancillary areas and common escape routes.	Section 2.3
AWFSS	A BS 9251 Category 4 sprinkler system to all areas of the development (compartments up to 100m^2 in area). The sprinkler system should be provided with back up pumps and power supplies, the BS 9251 sprinkler system can be extended to non-residential/ancillary areas providing the enhancements as per BS 9251 section 5.4 and 5.5 are adhered to. Car park to be provided with a BS EN 12845 sprinkler system, to an OH2 standard and OH1 to the Girl Guides, lounge/co-working area.	Section 4.3
Emergency Lighting	Emergency lighting should be provided within all common escape routes. In the residential ancillary areas, emergency lighting should also be provided in all windowless accommodation, open plan areas greater than 60m^2 in area, toilet accommodation greater than 8m^2 and plant rooms.	Section 2.9
Smoke Control	1.0m^2 AOV at the head of each firefighting stair. Mezzanine lobby smoke vent provisions to be confirmed by others. Enhanced mechanical smoke ventilation systems to common corridors on Upper Ground Level and above. 0.4m^2 permanent natural ventilation to lobby between Car Park and Girl Guide. Mechanical smoke extract system to car park achieving 10ACH	Section 2.7
Smoke Dampers	Any ductwork crossing a compartment line should be fitted with either a fire damper or fire and smoke damper as appropriate. A summary of the required locations for fire dampers has been provided in Table 16.	Section 4.5 Table 16
Secondary Power Supplies	Secondary power to be via alternate HV supply and back-up batteries.	Section 7

Key Feature	Summary	Section/ Reference
Firefighting Equipment and Features		
Firefighting Access	Firefighting vehicle access is provided via the existing roadways from Brownsea Drive, Ellis Street, Holloway Head and Blucher Street. Block C and D residential cores are designed as firefighting shafts. The non-residential accommodation at Mezzanine/Lower Ground is provided with sufficient perimeter access for a fire appliance.	Section 6.1
Firefighters Lift	Firefighters lifts to be provided in Block C and D designed and installed in accordance with BS EN 81-20 and BS EN 81-72.	Section 6.3
Dry Riser	Stair 3, Stair 4 and Stair 5 to be provided with dry rising main designed and installed in accordance with BS 9990. Dry riser inlets are to be located within 18m of fire appliance access point to each core. Landing valve to be provided at every floor level.	Section 6.4
Fire Hydrants	Existing Fire Hydrants appear to be located within 90m of the dry riser inlets and building entry points to the non-residential accommodation. The operational status and minimum flow of the hydrants is to be confirmed.	Section 6.5
Wayfinding Signage	Wayfinding signage shall be provided throughout the building to assist the fire service in identifying floors when within the stairs	Section 6.7
Basement Ventilation	The car park is to be provided by with a mechanical smoke extraction system. Smoke ventilation from most of the Lower Ground and Mezzanine areas has been omitted based on the justification provided.	Section 6.8
Evacuation Alert Control and Indicating Equipment (EACIE)	Due to the height of the top storey in each block exceeding 18m, it is recommended an EACIE system is provided to both blocks. Where provided, EACIE system is to be provided for use by the Fire and Rescue Service for manually alerting individual or multiple floors to evacuate should the need arise during firefighting operations. The EACIE system is not to be confused with a common fire alarm system and such systems should be separate from any common fire detection system.	Section 2.1

Appendix A - Hob Radiation Assessment

A.1 Scope

A.1.1 Prescriptive guidance stipulates that cooking facilities should not prejudice escape routes available to occupants, this can be achieved through enclosing kitchen areas or locating cooking facilities in an area remote from the escape route.

A.1.2 In many building applications it is impractical to enclose the kitchen and therefore, hobs are likely be located on escape routes. As stated above this is acceptable, however, prescriptive guidance requires a separation distance of 2700mm which can be difficult to achieve.

A.1.3 The following calculations are intended to identify the minimum required separation distance in order to minimise the risk of significant harm to occupants escaping to reach a place of relative safety, where a Category B cut off device is provided tested as per the criteria given in BS EN 50615.

A.2 Radiant Heat Flux

A.2.1 The following formula can be used to calculate the radiant heat flux from a flame providing that the subject is located more than double the flame diameter from centreline of the flame.

$$\dot{q}'' = \frac{X_r \dot{Q}}{4\pi R_0^2}$$

Where:
q'' is the heat input experienced by the occupant [kW/m2]
Xr is the radiative fraction
Q is the heat release rate of a fire [kW]
R0 is the distance to the point where radiation is to be measured [m]

A.2.2 The aim of this study is to calculate the minimum distance from the flame to the subject, where the radiant heat flux experienced by the subject is within the tolerable parameters, as identified in PD 7974-6.

A.2.3 To calculate the minimum distance, the equation has been transposed to make the distance(R0) the subject of the equation. The transposed formula is detailed below.

$$R_0 = \sqrt{\frac{X_r \dot{Q}}{\dot{q}'' 4\pi}}$$

A.3 Tenability Limits

A.3.1 The tenability limits extracted from PD 7974-6, Table I.4, are based on time to pain for unprotected skin for exposure to radiation (heat radiated from the source of a fire) and tolerance of occupants to the radiative heat exposure:

- <2.5kW/m2 for over 5 minutes exposure
- 2.5kW/m2 for 30 seconds exposure
- 10kW/m2 for 4 seconds exposure

A.3.2 It is envisioned that the overall escape time past the hob would not take more than 30 seconds (based on travel speed of 1.2m/s, a distance covered by an occupant in a straight line is c. 36m). This is highly overestimated as the escape past the source of a fire would be significantly shorter than the theoretical value. Therefore, the maximum tolerable heat exposure of 2.5kW/m2 tenability criteria will used. The aim is to demonstrate that if the thermal radiation received by the subject escaping past the source of a fire is less than 2.5kW/m2, then the hob position will not have a significant impact on life safety of occupants.

A.4 Radiative Heat Fraction

A.4.1 A radiative heat fraction [Xr] of 0.35 has been selected based on a conservative assumption taken from a plastic or wooden crib (expected to produce more soot than olive oil).

A.5 Heat Release Rate

A.5.1 Experimental test data conducted by Chow (Experimental Evaluation on Performance of Open Kitchen Fire Suppression Systems. Chow, W.K. & Ni, X. 2014) where a mix of cooking oils was used during the experiments with an average HRR between 24-27kW and peak value 44.8kW was demonstrated. Note that the peak value obtained by Chow in his experiment would only occur for a fraction of a second and therefore deemed as worst-case scenario. As a conservative figure, an initial heat release rate of 50kW will be used.

A.6 Fire Growth

A.6.1 As the fire develops there are two potential paths for heat transfer within this theoretical model; – 50% is expelled to the environment and 50% is reflected back into the fuel pool thus, not accounting for any losses and heat absorption by other materials. This energy reflected back into the base of the fire sustains the fire as the fuel is heated and undergoes pyrolysis, expelling flammable gas to fuel the fire.

A.6.2 In addition to the heat radiated back into the fuel from the fire itself, if the cooking facilities remain on, the fuel will be further heated by the hob and increase the rate of pyrolysis, which will in turn increase the heat release rate of the fire, which will then increase the heat radiated back into the base of the fire in a cycle.

A.6.3 However, a Category B cut off device would inhibit this cycle as the external heat source to the pan fire would be removed, limiting the fire growth to the energy output radiated back from the smoke plume. The heat release rate would steadily decrease as demonstrated in the experimental test data conducted by Chow (Experimental Evaluation on Performance of Open Kitchen Fire Suppression Systems. Chow, W.K. & Ni, X. 2014). Therefore, where a Category B cut off device is employed a heat release rate of 50kW can be used.

A.7 Peak Radiative Heat Flux

A.7.1 The required values for the transposed radiative heat flux equation have been determined as per the above, the values are;

q'' = 2.5 [kW/m2]
Xr = 0.35
Q = 50 [kW

$$R_0 = \sqrt{\frac{0.35 * 50}{2.5 * 4\pi}}$$

$$R_0 = 0.7463\text{m} \approx 0.75\text{m}$$

A.8 Minimum Hob Separation Distance

A.8.1 The distance measurement R_0 is taken from the centre of the closest power ring hob (with the largest diameter/power output) to the nearest solid, non-movable obstruction as highlighted on Figure 26. Any movable objects (table, chairs, sofas, etc.) are not deemed as an obstruction as their position can be changed with ease by occupants of the apartment. Therefore, it is not feasible to take into consideration all potential variations for the furniture layout, type, size or materiality. This is further reduced by an average width of a person taken as c. 900mm which is the effective escape route for occupants to use in the evacuation, whilst taking account of wheelchair users.

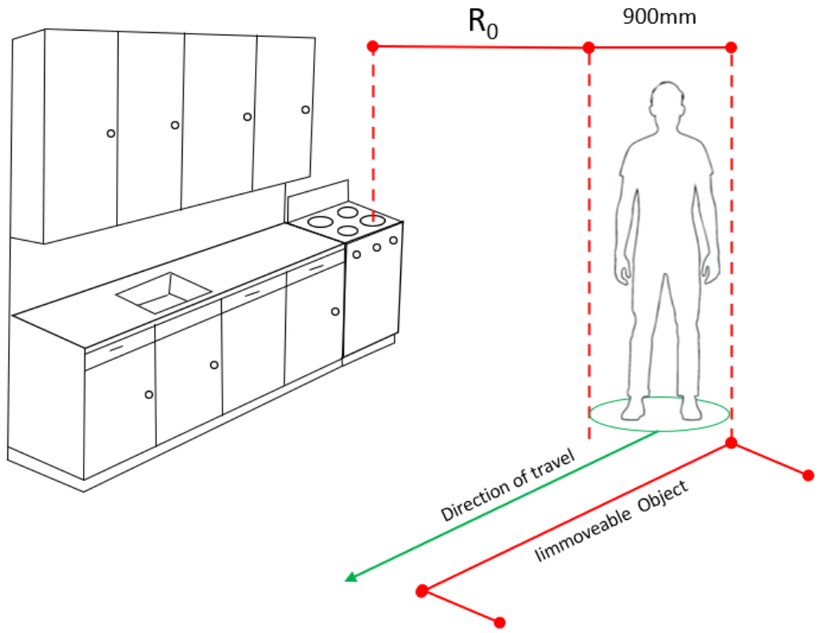

Figure 26: Distance to Hob Measurement

A.8.2 Based on the above assessment, where the separation distance is more than or equal to 0.75m + 0.9m, totalling 1.65m, the total radiative heat received by a person escaping would equal to 2.5kW/m^2 therefore, limiting the risk to life safety and exposure to excessive heat radiation from the cooking facilities, where a Category B cut off device is provided. The cut off device should be tested as per the criteria given in BS EN 50615 for a Category B device (for preventive power cut-off of the appliance).

A.8.3 Any further reduction, below 1.65m would result in the need to install a Category AB cut off and localised suppression device, as per BS EN 50615.

Appendix B - Summary Cause and Effect Matrix

Cause \ Effect		System Notification	Alert Systems					Lifts		Access Provision			Smoke Control				Active Systems		
		Signal Sent to Detection Control Panel (See Note 1 and Note 2)	Sounders and Flashing strobes in fire affected apartment only	Sounders and Flashing strobes in affected Ancillary Areas only (See Note 4)	Sounders and Flashing strobes on accessible roofs	Sounders and Flashing strobes in Shop Activate	Sounders and Flashing strobes in Girl Guides Activate	Lift to return to the final exit level	Lift to return to alternative designated landing (floor above exit level)	Hold open devices on escape routes - release	Electronically operated doors to failsafe open	Other Access control provisions to open/deactivate	Smoke Dampers activation (locations as identified in the fire strategy)	AOV on fire floor activates	AOV at head of stair activates	Ventilation within the car park activates	Smoke dampers activate	Relevant Fire Shutter / Fire and Smoke Curtain activate	Non-life safety plant shutsdown
System Type	Activation Type																		
Category LD1 (Apartment) BS 5839-6	Any		X																
Category L1 (Ancillary Areas) BS 5839-1	Any	X		X	X					X	X	X	X		X		X	X	X
Category L1 (Car Park) BS 5839-1	Any	X		X	X					X	X	X	X			X	X	X	X
Category L1 (Shop) BS 5839-1	Any	X			X	X				X	X	X	X				X	X	X
Category L1 (Girl Guide) BS 5839-1	Any	X			X		X			X	X	X	X	X	X		X	X	X
Category L5 (Common Corridor) BS 5839-1	Smoke Detector	X			X					X	X	X	X	X	X				
Category L5 (Stair) BS 5839-1	Smoke Detector	X			X					X	X	X			X				
Category L5 (Lift Shaft) BS 5839-1	Smoke Detector	X			X			X		X	X	X			X				
Category L5 (Final Exit Level lobby outside lift entrance) BS 5839-1	Smoke Detector	X			X				X	X	X	X	X	X	X		X		
Sprinkler activation (Anywhere)	Sprinkler head / flow switch	X			X														

Note 1: A notification may be sent to the respective residential/non-residential fire panels if the systems are to be interlinked between one another, or to an alarm receiving centre to manage fire alarm signals whilst the units are unoccupied.

Note 2: If there is not a constant management presence, out of hour signals should be sent to an off-site alarm receiving centre.

Note 3: Final exit level considered to be Mezzanine for Block C and Upper Ground for Block D

Note 4: Refer to Section 2.1 in Fire Strategy Report for Zoning of Ancillary Areas

Note 5: Both alert systems in the Shop and Girl Guides may need to activate simultaneously if both areas form part of the same demise. Client to confirm.