Richmond and Wandsworth Councils

North Lane Depot/East Car Park, Teddington

Stage 4 Fire Strategy

REPORT REFERENCE: 20137-FS-02-A

LAWRENCE WEBSTER FORREST

Fire Engineering & Fire Risk Management Consultants

LWF
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Richmond and Wandsworth Councils

North Lane Depot/East Car Park, Teddington

Stage 4 Fire Strategy

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Lawrence Webster Forrest (LWF) has been commissioned by Richmond and Wandsworth Councils to produce a Stage 4 Fire Strategy for the proposed development of a Community Centre at North lane depot/ East Car Park, Teddington.

An assessment has been carried out of the information provided by the design team; items of non-compliance have been identified and solutions provided based on the minimum requirements for a satisfactory level of fire safety in accordance with the statutory guidance.

The assessment has not considered any additional requirements associated with property protection and any discussions associated with variations to the prescriptive approach are on the basis of life safety.

This report sets out the performance requirements for various design aspects only. Detailed design to achieve compliance with the standards specified, including the review and selection of products and materials, will be undertaken by others.

It is considered that the outline recommendations in this report will provide sufficient guidance to obtain approval from the relevant authorities and achieve a satisfactory level of safety, commensurate with the risks for the occupied premises.

Table 1 provides an overview of the fire strategy and highlights any areas where the current design deviates away from the prescriptive requirements outlined within the relevant guidance documents. Where the fire strategy report deviates from standard guidance, suitable justification or alternative solutions have been proposed. Further detailed information regarding the areas of non-compliance and any associated justification or alternative solutions can be found in the related sections of this report, as summarised in the table below.

It should be noted that any deviations from guidance present a project risk until they have been agreed with the relevant stakeholders; this includes, but is not limited to:

- The client
- The Building Control Body
- The Local Fire Authority

Section	Compliant with relevant guidance?	Further Information
Means of Escape	No	Main entrance doors are open against the direction of escape. See Section 2.3.2. Occupancy of main hall limited to 120 persons. See Section 2.3.3. Occupancy of first floor limited to 60 persons. See Section 2.3.1. External gate to be reviewed. See Section 2.3.3.
Internal Fire Spread - Linings	Yes	N/A
Internal Fire Spread – Structural Fire Protection	Yes	N/A
External Fire Spread	No	Rear elevation exceeds the limitations of permitted unprotected area. See Section 5.2.2.
Fire Service Access & Firefighting Facilities	Yes	N/A

Table 1 Compliance Overview

1 INTRODUCTION

1.1 General Description of the Development

The proposal involves the creation of a new two storey community centre comprising ground and first floor levels. The main hall, kitchen, café space, lounge, office, storage and plant will be located at ground floor level whilst activity rooms, a staff room and further plant will be located on the first floor level. The first floor is served by a single protected stair and a lift which both discharge within the reception and orientation area.

The general layout of each floor can be seen in the drawings within Appendix A.

1.2 Purpose and Scope of the Report

The purpose of this report is to examine the proposed layouts in relation to fire safety precautions. On examination of the layouts, any deficiencies highlighted have been raised and solutions proposed. If a compliant design cannot be achieved, a fire engineering approach can be adopted to meet the functional requirements of Building Regulations.

The purpose of this document is to present the findings to the approval authorities, with a view to achieve outline Building Control approval incorporating approvals following consultation with the Fire Authority.

Based on the recommendations provided within this report, it is believed that the premises will be provided with an adequate level of fire safety. As previously stated, for the purpose of this report and in line with the Building Regulations, the report makes recommendations for life safety only; property protection is not an objective of the Regulations and has not been specifically identified as one of the project design objectives by the client.

1.3 Principle Guidance Documents

The principle guidance document used for the evaluation of fire safety precautions for the proposed development will be Volume 2 of Approved Document B: Fire Safety – 2019 edition incorporating 2020 amendments (ADB). Reference will also be made to relevant British and European standards where appropriate.

As outlined in Table 0.1 of ADB, the premises falls under Purpose Group 5 (assembly and recreation). The office space are less than 1/5th of the total floor area of the building and are therefore classed as ancillary.

The Building Regulations are fully functional. This means that the guidance given in ADB is not mandatory. Nevertheless, it is intended that due notice will be taken of the guidance and, where appropriate, deviations from the guidance will be discussed and justified based on compensatory measures and fire engineering design.

1.4 Reference Drawings

This report relates to the following plans provided by Clive Chapman Architects.

Description	Drawing Number	Rev
Location Plan	EHT-01	-
Master Plan Proposed Site Layout and roof plan	EHT-02	-
Proposed Ground and First floor plans	EHT-03	-
Proposed Elevation and Sections	EHT-04	-
Asset Location search water map	ALS/ALS Standard/2020_4251031	-

Table 2 Reference Drawings

2 MEANS OF ESCAPE

2.1 Evacuation Strategy

The building has been designed for simultaneous evacuation. This means that the activation of an evacuation signal will give an instantaneous warning from all fire alarm sounders for an immediate evacuation of the whole premises.

2.2 Occupancy Loads

The minimum required width of escape routes is dependent on the maximum number of people likely to use the escape route in the event of a fire. It is recognised that in this type of environment there is no single occupancy factor which covers all areas at any one time. The occupancy figures will fluctuate at different times.

Whilst the offices, main hall, café/ lounge are calculated at full capacity, the ancillary accommodation within the building such as the storage area, plant rooms, and WCs will only be occupied occasionally for short periods of time. Therefore, for the purpose of this assessment, it is considered reasonable to disregard the occupants within the ancillary accommodation to reflect a more realistic occupancy distribution.

The occupancy figure has been derived from the floor areas shown on the drawings provided by the design team. The estimate occupancies for each area are shown below.

Location	Approximate Floor Area[1] (m^2)	Floor space factor (m^2/person)	Occupancy [2] (persons)
Ground Floor			
Main Hall	143	0.5[3]	286
Admin Office	15	6	3
Kitchen	30	7.0	4
Café area	33	1	33
Lounge area	41	1	41
Specialist room	10	1	10

Location	Approximate Floor Area[1] (m^2)	Floor space factor (m^2/person)	Occupancy [2] (persons)
Specialist room	10	1	10
Quiet room	10	1	10
		Ground Floor Total	**397**
First Floor			
Activity room 08	39	1.0	39
Activity room 09	28	1.0	28
Staff room	17	6	2
		First Floor Total	**69**
		Building Total	**466**

NOTES:

1. Floor area of habitable space on each storey.
2. Rounded to the nearest whole number.
3. The floor space factor used is based upon a general purpose assembly hall. Should these areas be used for other activities such as dining and meeting spaces, the floor space factor should be changed to 1m^2/person, thus significantly reducing the occupancy within each of these areas.

Table 3 Occupancy Figures

It should be noted that although the floor space may permit the occupancy numbers outlined above, the exit widths will not. A full review of exit widths can be found in the following section with any limitations of occupancy numbers outlined.

2.3 Horizontal Escape

2.3.1 Number of Exits

In accordance with ADB, the number of escape routes and exits from any room or storey in the building should be provided as shown in Table 4 below.

Maximum number of persons	Minimum number of escape routes/exits
60	1
600	2

Maximum number of persons	Minimum number of escape routes/exits
More than 600	3

Table 4 Number of escape routes and exits

The current drawings show that the number of exits per room, area and storey are sufficient for the proposed numbers. The exception to this is the first floor; as this area only has a single exit, the total occupancy of this storey should not exceed 60 persons.

2.3.2 Direction of door openings

It should be noted that ADB requires all doors, which may be used by more than 60 people, to open in the direction of escape; if this cannot be achieved, regardless of the width, the maximum number of occupants able to use this door should be limited to 60. All inward opening doors within the building will be used by less than 60 persons, with the exception of the main entrance doors which are currently shown as inward opening and therefore opening against the direction of escape. In order to overcome this issue, the doors should either be altered to open in the direction of escape or alternatively should be linked to the fire detection and alarm system to power open automatically in the event of a fire anywhere within the building.

2.3.3 Exit Widths

The width of each exit should be sufficient for the proposed capacity. In order to calculate the required widths of any exits from an area that has more than a single exit, the largest exit is discounted. This ensures that in the event of a fire preventing occupants from using one of the exits, all occupants can still safely escape with the remaining available exits.

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

Table 5 Exit Widths

The main hall has the potential for the largest single occupancy, however, in the event of a fire preventing access to the final exit doors leading directly to outside, all occupants would have to

escape via the two 750mm doors. Each door can safely accommodate 60 persons therefore the occupancy within the hall should not exceed 120 persons; this must be robustly managed and strictly adhered to at all times. Although there are sliding bi –fold doors to the rear of the hall, these aren't not a suitable means of escape under guidance and therefore cannot be included when assessing the available escape widths.

All other doors within the premises are suitable for the proposed numbers.

It should be noted that there is a gate, which will be used as means escape to reach a place of ultimate safety; this gate should open in the direction of escape and the opening should achieved the same width as the corresponding final exits. The gates should also comply with the requirements outlined in Section 2.5 in relation to door fastenings.

2.3.4 **Travel Distances**

Travel distances are limited to the following when using Table 2.1 of ADB:

Description	One direction only (m)	More than one direction (m)
Assembly and recreation		
• Areas with seating in rows	15	32
• Elsewhere	18	45
Plant Room		
• Distance within the room	9	35
• escape route not in open air (overall travel distance)	18	45

Table 6 Travel Distances

Escape is only possible in a single direction at first floor level, therefore the travel distance should not exceed 18 metres. Most areas on ground floor are provided with an alternative means of escape. All travel distances are within the limits outlined above.

2.3.5 Inner Rooms

The specialist rooms and quiet room located at ground level are classed as inner rooms. ADB states that an inner room condition is acceptable when one of the following arrangements is in place:

- the enclosures (walls or partitions) of the inner room should be stopped at least 500mm below the ceiling; or
- a suitably sited vision panel not less than 0.1m^2 should be located in the door or walls of the inner room, to enable occupants of the inner room to see if a fire has started in the outer room; or
- the access room should be fitted with a suitable automatic fire detection and alarm system to warn the occupants of the inner room of the outbreak of a fire in the access room.

As a fire detection and alarm system will be fitted within the premises, the access room (café/lounge area) will be provided with suitable automatic detection, which will alert occupants within the inner room of a fire.

2.4 Vertical Escape

The first floor is served by a single protected stair; ADB states that a single escape stair may serve a building in the following situations.

- The travel distance from every point in each storey does not exceed the distance for escape in one direction only (as outlined in Table 6 above)
- The building has no storey with a floor level more than 11 metres above ground level.
- Any storey, served, by the stair, has no more than 60 people, where the limit on travel distance is in one direction.

As previously outlined, the occupancy of the first floor is limited to 60 persons. In addition the building has no floor above 11 metres from ground level and the travel distance at first floor level to the storey exit does not exceed 18 metres therefore a single escape stair is acceptable.

2.4.1 Stair Width

The first floor is served by a single 1100mm wide protected stair. ADB states that a 1100mm wide stair serving a single floor is able to safely accommodate 220 persons; as the occupancy of the first floor will not exceed 60 persons, the proposed stair width is considered suitable.

2.4.2 Protection of Stairs

The stair will be a protected stair and will therefore be enclosed in 30 minute fire resisting construction.

It should be noted that the entire stair enclosure should be free of potential sources of fire; for this reason any meters or service risers located within these areas should be enclosed in suitable fire resisting construction. There should also be no combustible materials stored within these area; they should remain sterile areas at all times. As the main reception area forms part of the stair enclosure, it must be ensure that this area is also kept sterile.

In addition, as the single stair forms part of the only means of escape from the first floor, the flights and landings should be constructed of materials achieving class A2-s3, d2 or better.

2.4.3 Merging Flows

Due to the layout of the building, there is a possibility of merging flows within the stair at ground floor level, therefore, the width of the final exit should be sufficient to enable a maximum evacuation flow rate equal to or greater than that from the storey exit and stair combined.

The equation given for the calculation of the minimum final exit width to account for merging flows in the escape stair at final exit level is as follows:

$$W = \frac{\left(\left(\frac{N}{2.5}\right) + (60S)\right)}{80}$$

Where:

W = width of final exit (m)

N = number of people served by the storey exit

S = stair width (m)

As the width of the final exit is known, the equation can be rearranged to establish the maximum number of people who may use the ground floor storey exit shared with the stair; the rearranged equation is shown below.

$$N = 2.5(80W - 60S)$$

$$N = 2.5\big((80 \times 1.65) - (60 \times 1.1)\big)$$

$$N = 2.5(132 - 66)$$

$$N = 165\ persons$$

The worst case scenario at ground floor level is if a fire occurs within the main hall area and prevents access to the double final exit doors. This means all 120 occupants of the hall would have to escape from the hall via the two single 750mm doors leading into the main reception area/protected stair enclosure; the staff within the admin office would also escape back into the reception area in this particular scenario. all other remaining occupants at ground floor level would be able to escape via alternative exit routes, therefore as the maximum number of persons using this storey exit at ground floor level is less than the permitted 165 persons, this arrangement is acceptable.

2.5 Door Fastenings

In general, doors on escape routes should be either of the following.

a. Not fitted with a lock, latch or bolt fastenings.
b. Fitted only with simple fastenings that are all of the following.
    i. Easy to operate; it should be apparent how to undo the fastening.
    ii. Operable from the side approached by people escaping.
    iii. Operable without a key.
    iv. Operable without requiring people to manipulate more than one mechanism.

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

Electrically powered locks should return to the unlocked position in all of the following situations:

a. If the fire detection and alarm system operates.
b. If there is loss of power or system error.
c. If the security mechanism override is activated.

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 people escaping. If the door provides escape in either direction, a call point should be installed on both sides of the door.

In places of assembly, doors on escape routes from rooms with more than 60 people should be either of the following.

a. Not fitted with locks, latches or bolts.
b. Fitted with panic fastenings in accordance with BS EN 1125.

2.6 Disabled Evacuation

Due to the provision of the lift within the building a refuge point should be provided at first floor level within the protected stair. The location of the refuge area should not reduce the width of escape route or access to the wheelchair space should not obstruct the flow of persons escaping.

The current drawings show a refuge point at first floor level adjacent the lift. The refuge point is located within the protected stair enclosure. The refuge should be sufficient size both to accommodate a wheelchair and allow the user to manoeuvre into the wheelchair space without undue difficulty. To accommodate the wide variety of wheelchairs in use, including powered wheelchairs, the space provided for a wheelchair in a refuge should be not less than 900mm x 1400mm allowing for manoeuvring. An emergency voice communication (EVC) system, complying with BS 5839-9: 2011 should be provided, allowing communication between the refuge point and the main receiver station. The design team has yet to confirm the location of the main receiver station.

As the project is currently at the design stage, the evacuation strategy for disabled persons has not yet been produced, however the strategy should take into account the evacuation of disabled persons to a place of ultimate safety.

Under current fire safety legislation, it is the responsibility of the person(s) having responsibility for the building to provide a fire safety risk assessment that includes an emergency evacuation plan for all people likely to be in the premises, including disabled people, and how that plan will be implemented. Such an evacuation plan should not rely upon the intervention of the Fire and Rescue Service to make it work.

Consideration should also be given to occupants with hearing and/or visual impairments. Personal Emergency Evacuation Plans (PEEPs) should be put in place for members of staff and regular visitors with disabilities including those with sensory impairments.

General Emergency Evacuation Plans (GEEPs) should also be put in place. A GEEP covers the same points as a PEEP, but instead of being focused on an individual person, it will accommodate any disabled or mobility impaired people who could have access to the building but may not necessarily be familiar with the premises.

2.7 Emergency Lighting

Emergency lighting should be installed in accordance with BS 5266:2016 and BS EN 1838:2013 throughout the premises. Emergency luminaries should be sited on escape routes to final exits, and external emergency lighting should be installed on those discharge points.

The emergency lighting system should be provided with testing facilities such as key operated test-switch for each circuit, to enable the un-switched supply to each luminaire/circuit to be isolated for test.

2.8 Signage

Every doorway or other exit providing access to a means of escape, other than exits in ordinary use (e.g. main entrances), should be distinctively and conspicuously marked by an exit sign in accordance with BS ISO 3864-1 and BS 5499-4.

3 AUTOMATIC FIRE DETECTION AND MEANS OF WARNING

A Category L3 fire alarm and detection system, in accordance with BS 5839-1:2017, will be fitted throughout the premises. This means that detection will be provided in escape routes and rooms opening onto escape routes. Manual break- glass call points should be provided adjacent to all storey exits and final exits from the building.

The fire alarm must be audible throughout the premises with the provision of supplementary visual beacons in locations where the background noise level necessitates the use of ear defenders (e.g. plant rooms). Consideration should also be given to alerting people with hearing and/or visual impairments. Personal Emergency Evacuation Plans (PEEPs) should be put in place for members of staff and regular visitors with disabilities including those with sensory impairments.

The alarm system will be interfaced with any hold open devices provided to self-closing doors and any other active devices that require local smoke detection to operate them by cause and effect. This includes the main entrance doors, which should automatically power open on the actuation of a detector anywhere within the building.

It is recommended that the main fire alarm control panel be situated within the main entrance to the building, where it will be easily accessible to the attending Fire Service.

4 INTERNAL FIRE SPREAD

4.1 Linings

In accordance with ADB, the internal linings for the proposed redevelopment should be as detailed below in Table 7.

Location	Classification
Small rooms with a floor area less than 30m^2 in non-residential accommodation	D-s3, d2
Other rooms	C-s3,d2
Other circulation spaces	B-s3, d2(1)
NOTES: (1) Wallcoverings which conform to BS EN 15102, achieving at least class C-s3, d2 and bonded to a class A2-s3, d2 substrate, will also be acceptable.	

Table 7 Classification of linings

It should be noted that parts of walls in rooms may be of lower performance than that stated in Table 7, but no worse than class D-s3, d2. In any one room, the total area of lower performance wall lining should be less than an area equivalent to half of the room's floor area, up to a maximum of 60m^2 in non-residential accommodation.

4.2 Structural Fire Protection

In accordance with the guidance given in ADB, all elements of structure will be provided with fire protection to achieve a minimum of 60 minutes fire resistance as outlined in BS 476 and Appendix B, Table B3 of ADB. This requirement also applies to any element of structure that supports or provides stability to another.

Purpose Group	Height of top occupied storey above ground floor level (metres)	Sprinklers provided?	Minimum period of fire resistance (minutes)
Assembly and Recreation	Up to 5	No	60

Table 8 Recommended Fire Resistance Period of Elements of Structure

An element of structure is any one of the following:

a) A member that forms part of the structural frame of a building, or any other beam or column;
b) A loadbearing wall or loadbearing part of a wall;
c) A floor;
d) A gallery (but not a loading gallery, fly gallery, stage grid, lighting bridge, or any gallery provided for similar purposes or for maintenance and repair);
e) An external wall;
f) A compartment wall (including a wall that is common to two or more buildings).

The following are excluded from the definition of 'element of structure'.

a) A structure that supports only a roof, unless either of the following applies.
   i) The roof performs the function of a floor, such as for parking vehicles, or as a means of escape.
   ii) The structure is essential for the stability of an external wall that needs to be fire resisting (e.g. to achieve compartmentation or for the purposes of preventing fire spread between buildings).
b) The lowest floor of the building.
c) A platform floor.
d) A loading gallery, fly gallery, stage grid, lighting bridge, or any gallery provided for similar purposes or for maintenance and repair.
e) External walls, such as curtain walls or other forms of cladding, which transmit only self-weight and wind loads and do not transmit floor load.

In accordance with Tables B3 and B4 of ADB, the fire rating of elements of structure should be as follows:

Element of structure	**Minimum provisions when tested to the relevant parts of BS 476 (minutes)**			**Method of Exposure**
	Load-bearing capacity [1]	**Integrity**	**Insulation**	
Structural frame, beam or column	60	N/A	N/A	Exposed faces

Element of structure	Minimum provisions when tested to the relevant parts of BS 476 (minutes)			Method of Exposure
	Load-bearing capacity [1]	Integrity	Insulation	
Load-bearing wall element	60	N/A	N/A	Each side separately
Floor	60	60	60	From underside
Roof that performs the function of a floor	60	60	60	From underside
Roof that form part of an escape route	30	30	30	From underside
External wall less than 1m away from the relevant boundary	60	60	60	Each side separately
External wall 1m or more away from the relevant boundary [2]	60	60	15	From inside the building
Compartment walls	60	60	60	Each side separately

NOTES:

1. Applies to load-bearing elements only
2. Such walls may contain areas that do not need to be fire resisting (unprotected areas).

Table 9 Recommended Fire Resistance Period for Elements of Structure

The fire resistance requirements outlined above should be achieved using tested systems. Further information regarding this should be sought from the relevant product manufacturer; an example of such information is "The White Book" produced by British Gypsum.

4.3 Compartmentation and Fire Resisting Construction

The main objective of compartmentation is to prevent rapid fire spread, which may prevent occupants of the building from escaping safely. Compartmentation reduces the chance of a fire becoming large thereby protecting the means of escape and also reducing the likelihood of fire spread to neighbouring buildings.

Maximum compartment size limits should also be adhered to; these limits are outlined in the table below.

Purpose Group	Height of top occupied storey above ground floor level	Single Storey	Multi-Storey
Assembly and Recreation	No limit	No limit	2000m^2

Table 10 Maximum Compartment Sizes

The proposals do not exceed the maximum compartment limits outlined above, therefore, no compartment walls and/or floors are required. In addition, the offices are less than 1/5th of the total floor area of the building and are therefore classed as ancillary. This means compartment walls and floors are not required to separate different purposes.

Although compartment walls and floors are not required, fire resisting construction should still be provided. The staircase should be enclosed in 30 minute fire resisting construction; all rooms opening into to the stair at both levels should be separated from the stair with a minimum of 30 minute fire resisting construction. In addition to the above, all stores, cleaner's cupboards, and plant areas will be enclosed in 30 minute fire resisting construction.

The fire resisting construction requirements are outlined in the table below.

Part of building	Minimum provisions when tested to the relevant parts of BS 476 (minutes)			Method of Exposure
	Load-bearing capacity [1]	Integrity	Insulation	
Protected stairway	30	30	30	From underside
Protected corridor/lobby	30	30	30	Each side separately
Other fire resisting construction	30	30	30	From underside
Cavity barriers	N/A	30	15	Each side separately

NOTES:

1. Applies to load-bearing elements only.

Table 11 Recommended Periods of Fire Resistance for Compartmentation Elements

4.4 Fire Doors

Location of door	Minimum period of fire resistance	Comments
Forming part of the enclosure of a protected stairway	FD30S	Must be self-closing.
Forming part of the enclosure of a protected corridor	FD30S	Must be self-closing.
Forming part of the enclosure of a riser cupboard or plant room	FD30	Self-closing devices are not required to cupboards and service ducts which are normally kept locked shut.
Forming part of the enclosure of a store room	FD30S	Self-closing devices are not required to cupboards and service ducts which are normally kept locked shut.
Within a cavity barrier	FD30	Must be self-closing.

Table 12 Fire Door Provision

All fire doors should be fitted with a self-closing devices, except for fire doors to cupboards and service ducts which are normally kept locked shut. Where a self-closing device may interfere with the day-to-day use of the building, the door may be held open with an automatic release mechanism provided in accordance with BS 5839-3:1988.

This device will hold the door open, however, will automatically close the door if any of the following occur:

- Smoke is detected by an automatic device of a suitable nature and quality in a suitable location.
- A hand-operated switch, fitted in a suitable position, is operated.
- The electricity supply to the device, apparatus or switch fails.
- The fire alarm system is operated.

In accordance with ADB, all fire doors should be marked with the appropriate fire safety sign conforming to BS ISO 3864-1 according to whether the door is:

- to be kept closed when not in use (Fire door keep shut);
- to be kept locked when not in use (Fire door keep locked shut); or

- held open by an automatic release mechanism (Automatic fire door keep clear).

Fire doors to cupboards and to service ducts should be marked on the outside. All other fire doors should be marked on both sides.

Doors forming part of the means of escape from, and within, the building should:

- be hung clear of any change of floor level;
- be hung so that they do not reduce the effective width of any escape route across a landing;
- if opening into a corridor, be recessed to the full width of the door;
- where hung to swing both ways (double swing), or subdividing corridors, be provided with a minimum of a vision panel;
- open to an angle not less than 90°.

4.5 Concealed Spaces

Concealed spaces and cavities in the building can allow the rapid unseen spread of fire and smoke to areas remote from the seat of an incident. To reduce the potential for fire spread, cavity barriers should be provided to divide cavities and to close the edge of cavities.

In accordance with ADB, cavity barriers should be provided in accordance with Figure 1 and includes, but is not limited to, the following:

- all junctions between an external cavity wall and every compartment floor and compartment wall;
- at the edges of cavities, including around openings (such as windows, doors and exit/entry points for services);
- all junctions between an internal cavity wall and every compartment floor, compartment wall, or other wall or door assembly which forms a fire-resisting barrier;
- for a protected escape route, i.e. protected corridor, a cavity that exists above or below any fire resisting construction should either be fitted with cavity barriers on the line of the enclosure to the protected escape route or for the cavities above the fire resisting construction, enclosed on the lower side by a fire resisting ceiling which extends throughout the building, compartment or separated part.

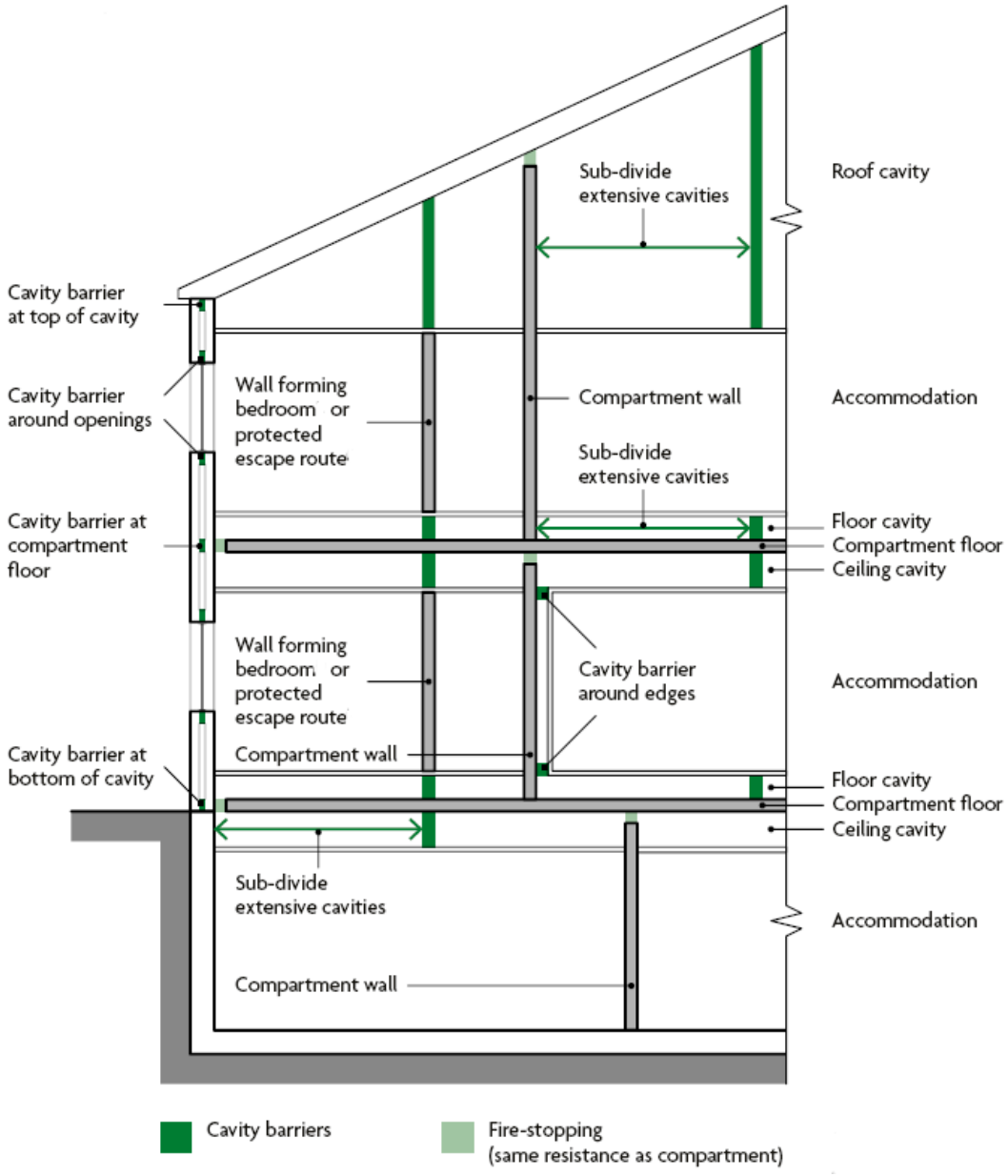
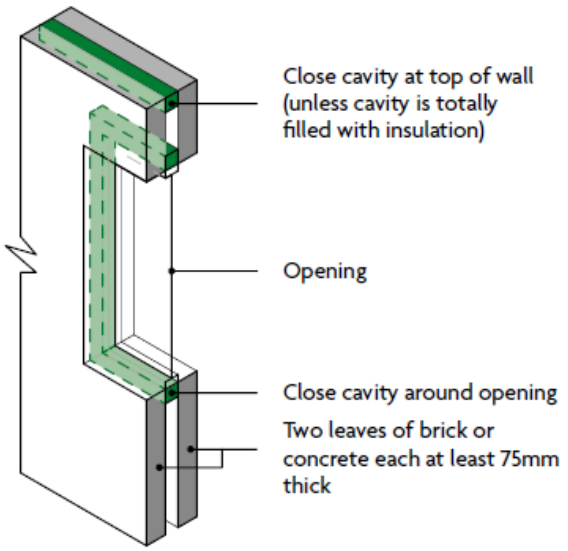


Figure 1 Provisions for Cavity Barriers

The above does not apply where a wall meets the conditions outlined in Figure 2 below.



NOTES:

1. Materials used to close the cavity in this arrangement do not need to achieve a specific performance in relation to fire resistance.
2. Domestic meter cupboards may be installed provided that the following conditions are met:
   a. There are no more than two cupboards per dwelling
   b. The openings in the outer wall leaf are not bigger than 800×500mm for each cupboard
   c. The inner leaf is not penetrated except by a sleeve not more than 80×80mm, which is fire-stopped.
3. Materials achieving class B-s3, d2 or worse may be placed within the cavity.

Figure 2 Cavity walls excluded from provisions for cavity barriers

If concealed spaces or cavities are created, cavity barriers will be required. The cavity barriers must provide a minimum of 30/15 minutes' fire resistance period in term of integrity and insulation respectively. Cavity barriers must be securely supported so as to guarantee integrity and insulations properties irrespective of the failure of un-rated components.

Cavity barriers should be tightly fitted to a rigid construction and mechanically fixed in position. If this is not possible (e.g. where a cavity barrier joins to slates, tiles, corrugated sheeting or similar materials) the junction should be fire-stopped.

Cavity barriers should be fixed so their performance is unlikely to be made ineffective by any of the following.

a. Movement of the building due to subsidence, shrinkage or temperature change, and movement of the external envelope due to wind.
b. During a fire, collapse of services penetrating the cavity barriers, either by the failure of the supporting system or through degradation of the service itself (e.g. by melting or burning).
c. During a fire, failure of the cavity barrier fixings. (In roof spaces, where cavity barriers are fixed to roof members, there is no expectation of fire resistance from roof members provided for the purpose of support.)
d. During a fire, failure of any material or construction to which cavity barriers abut. (For example, a suspended ceiling that continues over a fire resisting wall or partition collapses,

and the cavity barrier fails prematurely because the ceiling was not designed to provide a minimum fire resistance of EI 30.)

Cavity barriers in a stud wall or partition, or provided around openings, may be formed of any of the following:

a. Steel, a minimum of 0.5mm thick.
b. Timber, a minimum of 38mm thick.
c. Polythene-sleeved mineral wool, or mineral wool slab, under compression when installed in the cavity.
d. Calcium silicate, cement-based or gypsum-based boards, a minimum of 12mm thick.

It should be noted that these do not necessarily achieve the integrity and insulation performance specifications required (i.e. 30 minutes integrity, 15 minutes insulation).

Cavity barriers provided around openings may be formed by the window or door frame, if the frame is constructed of steel or timber of the minimum thickness in (a) or (b), as appropriate.

4.5.1 Extensive Cavities

Cavity barriers should be used to divide any cavity (including roof spaces). Table 13 sets out maximum dimensions for undivided cavities.

Location of cavity	Class of surface/product exposed in cavity (excluding the surface of any pipe, cable or conduit, or any insulation to any pipe)	Maximum dimension in any direction (m)
Between roof and a ceiling	Any	20
Any other cavity	Class C-s3, d2 or better	20
	Worse than Class C-s3, d2	10

Table 13 Maximum dimensions of cavities in buildings other than dwellings

Table 13 does not apply to any of the following cavities:

a) A cavity in a wall that is fire resisting only because it is loadbearing.
b) A cavity in a wall that meets the conditions of Figure 2.

c) A floor or roof cavity above a fire resisting ceiling that extends throughout the building or compartment to a maximum of 30m.
d) In a building not put to residential or institutional use, a cavity that does not contain materials achieving class B-s3, d2 or worse and is formed either:
    i. behind the external skin of an external cladding system with a masonry or concrete inner leaf a minimum of 75mm thick;
    ii. by overcladding an existing masonry (or concrete) external wall or an existing concrete roof.
e) A cavity below a floor next to the ground or next to oversite concrete, if either:
    i. the cavity is less than 1000mm in height;
    ii. the cavity is not normally accessible by people, unless there are openings in the floor such that it is possible for materials to accumulate in the cavity (in which case cavity barriers should be provided and access should be provided to the cavity for cleaning).

If a single room with a ceiling cavity or underfloor cavity exceeds the dimensions outlined in the table above, cavity barriers need only be provided on the line of the enclosing walls/partitions of that room, if both of the following apply:

a) The cavity barriers are a maximum of 40m apart.
b) The surface of the material/product exposed in the cavity is class C-s3, d2 or better.

4.6 Fire Stopping

All penetrations through fire separating elements should be adequately fire stopped or sealed to ensure that the integrity and performance of the element is not impaired. Areas that will require fire stopping will be around pipe and cable services, ventilation ducts and flues and junctions between fire separating elements.

All elements and services that penetrate a compartment wall, floor or other element of fire resisting construction are to be fire stopped using a method appropriate to the element penetrated and the surrounding construction.

Typical fire stopping materials include:

- cement mortar

- gypsum-based plaster
- cement-based or gypsum-based vermiculite/perlite mixes
- glass fibre, crushed rock, blast furnace slag or ceramic-based products (with or without resin binders) and
- intumescent mastics.

Systems used must be designed, installed, tested and maintained in full accordance with the relevant BS 476 standard and the ASFP Approved Code of Practice.

4.7 Openings for Pipes

Pipes passing through a fire-separating element, unless in a protected shaft, should comply with one of the following options:

Option 1: Provide a proprietary, tested sealing system that will maintain the fire resistance of the wall, floor or cavity barrier.

Option 2: Fire-stop around the pipe, keeping the opening for the pipe as small as possible. The nominal internal diameter of the pipe should not exceed the dimensions outlined in the table below.

Situation	Pipe material and maximum nominal internal diameter (mm)		
	High melting point metal (1)	Lead, aluminium, aluminium alloy, uPVC(2), fibre-cement	Any other material
Structure (but not a wall separating buildings) enclosing a protected shaft that is not a stairway or a lift shaft.	160	110	40
Any other situation	160	40	40

NOTES:

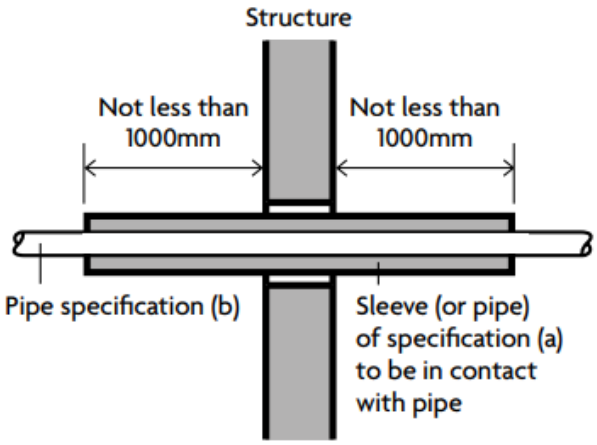
1. Any metal (such as cast iron, copper or steel) which, if exposed to a temperature of 800°C, will not soften or fracture to the extent that flame or hot gas will pass through the wall of the pipe.
2. uPVC pipes that comply with either BS 4514 or BS 5255.

Table 14 Maximum nominal internal diameter of pipes passing through a compartment wall/floor

Option 3: A pipe with a maximum nominal internal diameter of 160mm may be used with a sleeve made out of a high melting point metal, as shown below, if the pipe is made of one of the following:

- Lead
- Aluminium
- Aluminium Alloy
- Fibre-cement
- uPVC (pipes should also comply with either BS 4514 or BS 5255)

A high melting point metal means 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.



NOTES:

1. Make the opening in the structure as small as possible and provide fire-stopping between pipe and structure.
2. See Table 14 for materials specification.
3. The sleeve should be class A1 rated.

Figure 3 Pipes penetrating structure

4.8 Mechanical Ventilation and Ductwork

Ductwork should not help to transfer fire and smoke through the building. Terminals of exhaust points should be sited away from final exits, cladding or roofing materials achieving class B-s3, d2 or worse and openings into the building.

It should be noted that ventilation ducts supplying or extracting air directly to or from a protected stairway should not also serve other areas. A separate ventilation system should be provided for each protected stairway.

A fire and smoke damper should be provided where ductwork enters or leaves each section of the protected escape route it serves. It should be operated by a smoke detector or suitable fire detection system. Fire and smoke dampers should close when smoke is detected.

In a system that recirculates air, smoke detectors should be fitted in the extract ductwork before both of the following:

a) The point where recirculated air is separated from air to be discharged to the outside.
b) Any filters or other air cleaning equipment.

When smoke is detected, detectors should do one of the following.

i. Cause the system to immediately shut down.
ii. Switch the ventilation system from recirculating mode to extraction to divert smoke to outside the building.

Non-domestic kitchens and plant rooms should have separate and independent extraction systems; extracted air should not be recirculated.

Any ventilation ductwork will need to be fire protected where it penetrates a fire separating element. As ventilation ducts provide a potential route for fire spread through the duct consideration of how this will be fire stopped must also be made. Four basic methods should be considered:

- Method 1 - protection using thermally activated fire dampers;
- Method 2 - protection using fire resisting enclosures;
- Method 3 - protection using fire resisting ductwork;
- Method 4 - protection using automatically activated fire and smoke dampers triggered by smoke detectors.

Methods 1 and 4 should not be used for extract ductwork serving kitchens; the likely build-up of grease within the duct can adversely affect dampers.

Thermally activated fire dampers should not be used for extract ductwork which passes through the enclosure of a protected escape route; this is due to the fact that large volumes of smoke could still pass the thermal device without triggering them.

5 EXTERNAL FIRE SPREAD

5.1 External Wall Surfaces

The external wall of a building should not provide a medium for fire spread if that is likely to be a risk to health and safety. The requirements in this section reduce the risk of vertical fire spread as well as the risk of ignition from flames coming from adjacent buildings. The requirements can be achieved by constructing external walls so that both of the following are satisfied.

- The risk of ignition by an external source to the outside surface of the building and spread of fire over the outside surface is restricted.
- The materials used to construct external walls, and attachments to them, and how they are assembled do not contribute to the rate of fire spread up the outside of the building.

The external surfaces (i.e. outermost external material) of external walls should comply with the provisions in Table 15 below. The provisions apply to each wall individually in relation to its proximity to the relevant boundary. The boundary that a wall faces is the relevant boundary and may be one of the following:

a. The site boundary.
b. The centre line of a space where further development is unlikely, such as a road, railway, canal or river.
c. An assumed notional boundary between two buildings on the same site where either of the following conditions is met.
   i. One or both of the buildings are in the 'residential' or 'assembly and recreation' purpose groups (purpose group 1 or 5).
   ii. The buildings will be operated/managed by different organisations.

Building type	Building height	Less than 1000mm from the relevant boundary	1000mm or more from the relevant boundary
'Relevant buildings'		Class A2-s1(1), d0 or better	Class A2-s1(1), d0 or better
Assembly & recreation	More than 18m	Class B-s3(2), d2 or better	From ground level to 18m: class C-s3, d2(3) or better From 18m in height and above: class B-s3(2), d2 or better
	18m or less	Class B-s3(2), d2 or better	Up to 10m above ground level: class C-s3, d2(3) or better Up to 10m above a roof or any part of the building to which the public have access: class C-s3, d2(3) or better(4) From 10m in height and above: no minimum performance
Any other building	More than 18m	Class B-s3(2), d2 or better	From ground level to 18m: class C-s3, d2(3) or better From 18m in height and above: class B-s3(2), d2 or better
	18m or less	Class B-s3(2), d2 or better	No provisions

NOTES:

1. The restrictions for these buildings apply to all the materials used in the external wall and specified attachments.

2. Profiled or flat steel sheet at least 0.5mm thick with an organic coating of no more than 0.2mm thickness is also acceptable.

3. Timber cladding at least 9mm thick is also acceptable.

4. 10m is measured from the top surface of the roof.

Table 15 Reaction to fire performance of external surface of walls

External walls should meet the requirements outlined in Table 15 above, with cavity barriers provided in accordance with Section 4.5 of this report; it should be noted that in the case of an external wall

construction, which comprises an external cladding system with a masonry or concrete inner leaf (which is not subject to the provisions outlined in Table 13 of this report), the surfaces which face into the cavities should also meet the provisions of Table 15.

Due to the height and use of the building, the building is not classed as a 'relevant building', therefore the requirements outlined in the table above for "assembly and recreation" should be used.

As the boundary is more than 1000mm on all elevations, all external walls should achieve a rating of Class B-s3, d2 or better.

Should a cladding system be used, the external walls should either meet the requirements outlined in Table 15 above and paragraphs 12.6 - 12.9 of ADB or alternatively should meet the performance criteria given in the BRE Report "Fire performance of external thermal insulation for walls of multi storey buildings (BR 135) for cladding systems using full scale test data from BS 8414-1:2002 or BS 8414-2:2005".

5.2 Unprotected Areas

To prevent external fire spread from and to adjacent buildings, ADB requires limiting the extent of unprotected areas to the sides of a building which would not give adequate protection against the external spread of fire from one building to another. The amount of unprotected area allowed is dependent on the distance to site boundaries/ notional boundaries.

A prescriptive assessment has been undertaken in accordance with the "Enclosing Rectangles" approach as outlined in BR 187 report. The aim of this assessment is to ensure that the building is separated from the boundary by at last half the distance at which the total thermal radiation intensity received from all unprotected areas in the wall would be 12.6 kW/m². The assessment evaluates the need to provide fire rated construction within the external envelope to mitigate the risk of external fire spread. It has been assumed that other than any glazed areas and final exit doors, the solid portions of the elevation are suitably protected with fire resisting construction in accordance with the requirements outlined in Table 9 of this report and have no combustible material more than 1mm thick as its external surface.

It is always assumed that a fire will be confined to one compartment, therefore to calculate the allowable percentage of unprotected openings, the compartment providing the worst case scenario

is always assessed. As there are no compartment walls or floors within the building, each elevation is considered in its entirety.

5.2.1 Front Elevation (West Façade)

The minimum distance to the relevant boundary is approximately 10 metres. The relevant boundary has been taken to the centreline of North Lane.

Using a 15 metre wide x 6 metre high rectangle, a minimum boundary distance of 6.0 metres is required for 100% unprotected openings. This demonstrates that the proposed glazed portion of this elevation does not require any fire resistance based on the current distance to the relevant boundary.

5.2.2 Rear Elevation (East Façade)

The minimum distance to the relevant boundary is approximately 1.5 metres. The relevant boundary has been taken as the site boundary.

Using a 21 metre wide x 3 metre high rectangle, a minimum boundary distance of 4.0 metres is required for 100% unprotected openings; as the boundary distance is less than this, the percentage of unprotected area must be limited. A 1.5 metre boundary distance permits 30% of the "enclosing rectangle" to be unprotected; the area of the enclosing rectangle is 63m^2 therefore 30% of this area equates to 18.9m^2. From the drawings provided, the amount of unprotected area is approximately 22m^2. In order to comply with limitations of unprotected area, the amount of glazing should be reduced to less than 18.9m^2 or alternatively fire resistant glazing, which is fixed shut and achieves the same levels of fire resistance as the surrounding external wall should be provided to reduce the amount of unprotected area to 18.9m^2.

From the drawings provided, the easiest way to meet the unprotected area limitations would be to fire rate and fix shut the smaller window within the lounge and change the external kitchen door into a 60 minute self-closing fire door; this is shown in the diagram below and would reduce the unprotected area to less than 18.9m^2.

Figure 4 Rear Elevation - Unprotected Area Solution

An alternative option would be to provide a 60 minute compartment wall to separate the hall from the rest of the building; this would have to include a fire shutter to the servery located between the kitchen and the hall.

This will require further review by the design team.

5.2.3 **Side Elevation (North Façade)**

The minimum distance to the relevant boundary is approximately 1.5 metres. The relevant boundary has been taken as the site boundary.

Using a 3 metre wide x 3 metre high rectangle, a minimum boundary distance of 2 metres is required for 100% unprotected openings. This demonstrates that the proposed unprotected portion of this elevation does not require any fire resistance based on the current distance to the relevant boundary.

5.2.4 **Side Elevation (South Façade)**

The minimum distance to the relevant boundary is approximately 5.5 metres. The relevant boundary has been taken to the centreline of Middle Lane.

Using a 27 metre wide x 3 metre high rectangle, a minimum boundary distance of 4.5 metres is required for 100% unprotected openings. This demonstrates that the proposed glazed portion of this elevation does not require any fire resistance based on the current distance to the relevant boundary.

5.3 Roof Coverings

Roof coverings will need to comply with Table 16 below. If any plastic roof lights are proposed they will need to meet the requirements of Tables 14.2 and 14.3 of ADB.

Designation of covering of roof or part of roof	**Minimum distance from any point on relevant boundary**			
European Class	**Less than 6m**	**At least 6m**	**At least 12m**	**At least 20m**
B_{ROOF}(t4)	Acceptable	Acceptable	Acceptable	Acceptable
C_{ROOF}(t4)	Not acceptable	Acceptable	Acceptable	Acceptable
D_{ROOF}(t4)	Not acceptable	Acceptable(1)(2)	Acceptable(1)	Acceptable
E_{ROOF}(t4)	Not acceptable	Acceptable(1)(2)	Acceptable(1)	Acceptable(1)
F_{ROOF}(t4)	Not acceptable	Not acceptable	Not acceptable	Acceptable(1)(2)

NOTES:

(1) Not acceptable on any of the following buildings:
- Industrial, storage or other non-residential Purpose Group buildings of any size.
- Any other building with a cubic capacity of more than 1500m^3.

(2) Acceptable on buildings not listed in Note 1, if part of the roof is no more than 3m^2 in area and is at least 1500mm from any similar part, with the roof between the parts covered with a material rated class A2-s3, d2 or better.

Table 16 Limitations on Roof Coverings

6 FIRE SERVICE ACCESS AND FIRE FIGHTING FACILITIES

6.1 Hydrants

The provision of existing fire hydrants in the vicinity of the development has been confirmed by the design team. The existing hydrants are located in positions that are within 90 metres of an entry point to the building and not more than 90 metres apart. The location of the existing hydrants within the vicinity of the redevelopment can be seen on the diagram below.

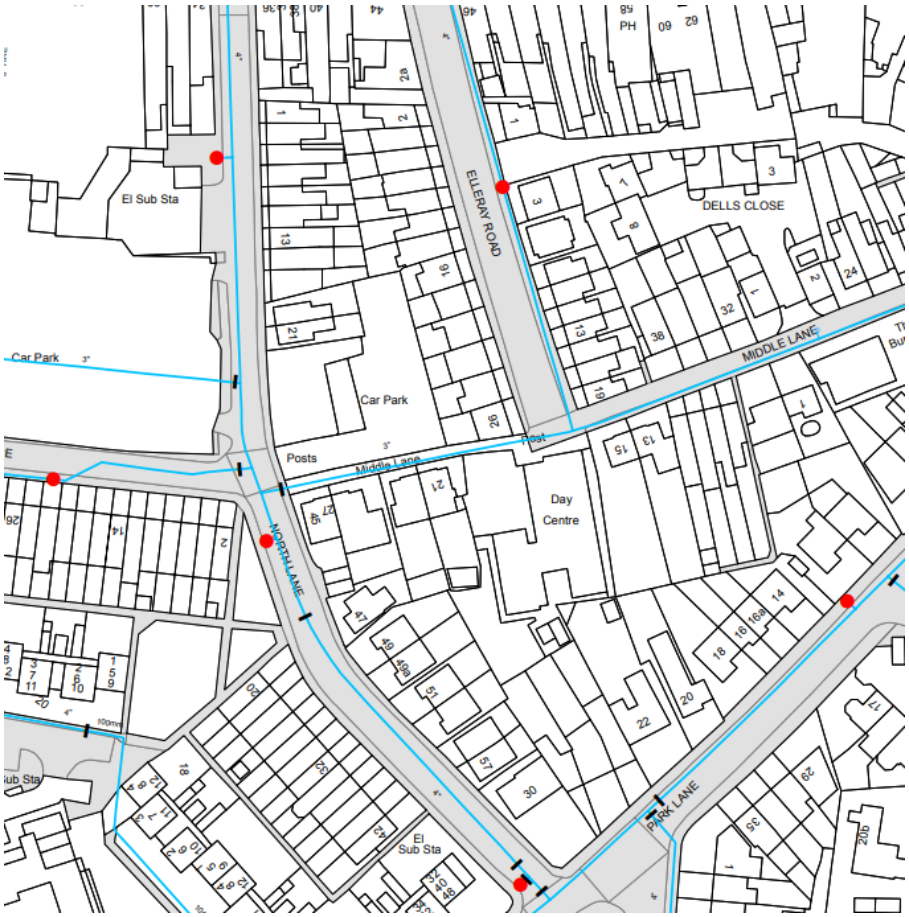


Figure 5 Location of fire hydrants

6.2 Vehicle Access

For buildings with a total floor area less than 2000m^2 and a top storey floor height less than 11 metres, ADB requires pumping appliance access to at least 15% of the perimeter of the building or within 45 metres of every point on the projected footprint of the building.

Currently it is possible to achieve both of the above requirements based on appliance access via North Lane.

All doors giving firefighter access into the building are considered suitable and meet the minimum required width of 750mm.

Any roads or surfaces providing fire appliance access should comply with the widths and hard-standing requirements outlined in ADB and as shown below. As North Lane is an existing road, it is assumed to comply with the requirements below.

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(3)
High Reach	3.7	3.1	26.0	29.0	4.0	17.0(4)

NOTES:

(1) Fire appliances are not standardised. The building control body may, in consultation with the local fire and rescue service, use other dimensions.

(2) The roadbase can be designed to 12.5 tonne capacity. Structures such as bridges should have the full 17-tonne capacity. The weight of high reach appliances is distributed over a number of axles, so infrequent use of a route designed to accommodate 12.5 tonnes should not cause damage.

(3) For buildings within London, as per LFB's Fire Safety Guidance Note 29 (GN29), this should be increased to 14 tonnes.

(4) For buildings within London, as per LFB's Fire Safety Guidance Note 29 (GN29), this should be increased to 23 tonnes.

Table 17 Vehicle Access Route Specification

7 PORTABLE FIRE FIGHTING EQUIPMENT

A detailed analysis of the risks within the building should be undertaken with portable fire-fighting equipment (PFFE) provided accordingly.

Portable fire extinguishers should be selected and installed in accordance with BS 5306-8:2012 and BS 5306-3:2017.

Normally, extinguishers should be located in conspicuous positions where they will be readily seen by persons following an escape route, i.e. room exits, corridors, stairways, lobbies and landings. Extinguishers should be sited in such a way that it is not necessary to travel more than 30 metres from the site of the fire to reach an extinguisher.

8 FIRE SAFETY MANAGEMENT

On occupation of the building a fire risk assessment will need to be carried out to comply with the Regulatory Reform Order (Fire Safety) 2005. That fire risk assessment will need to consider the level of management on site. There should be sufficient numbers of staff on duty at all times to manage the requirements of this fire strategy.

The management fire safety procedures should recognise that to compliment the passive and active fire safety measures, there must be a safe and effective procedure in the form of a fire evacuation plan.

When this plan is in place, it will be rehearsed in the form of staff training and fire/evacuation drills.

The emergency plan together with the notices and procedures detailed in this report will form the basis of the management commitment to effective fire safety procedures.

Records of all staff training should be maintained in a Fire Safety Logbook.

9 CONCLUSION

The proposals outlined in this document demonstrate a level of fire safety equal to or greater than the general standard implied by compliance with the recommendations in Approved Document B. This level of safety, therefore, satisfies the functional requirements of the Building Regulations relating to fire safety.

10 LIMITATIONS

The information limitations and assumptions used in the preparation of this report are described below.

Building Regulations

This report considers Building Regulations which deal with life safety only. Property protection, business continuity and insurance issues are not addressed in this report.

Other Limitations

Complying with the recommendations of this report will not guarantee that a fire will not occur. This report has been prepared for sole benefit, use and information of Richmond and Wandsworth Councils and other members of the design team and the liability of LWF, its directors and employees, in respect of the information contained in this report, will not extend to any third party.

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APPENDIX A - FLOOR PLANS

Figure 6 Site Plan

Figure 7 Ground and First Floor Layouts

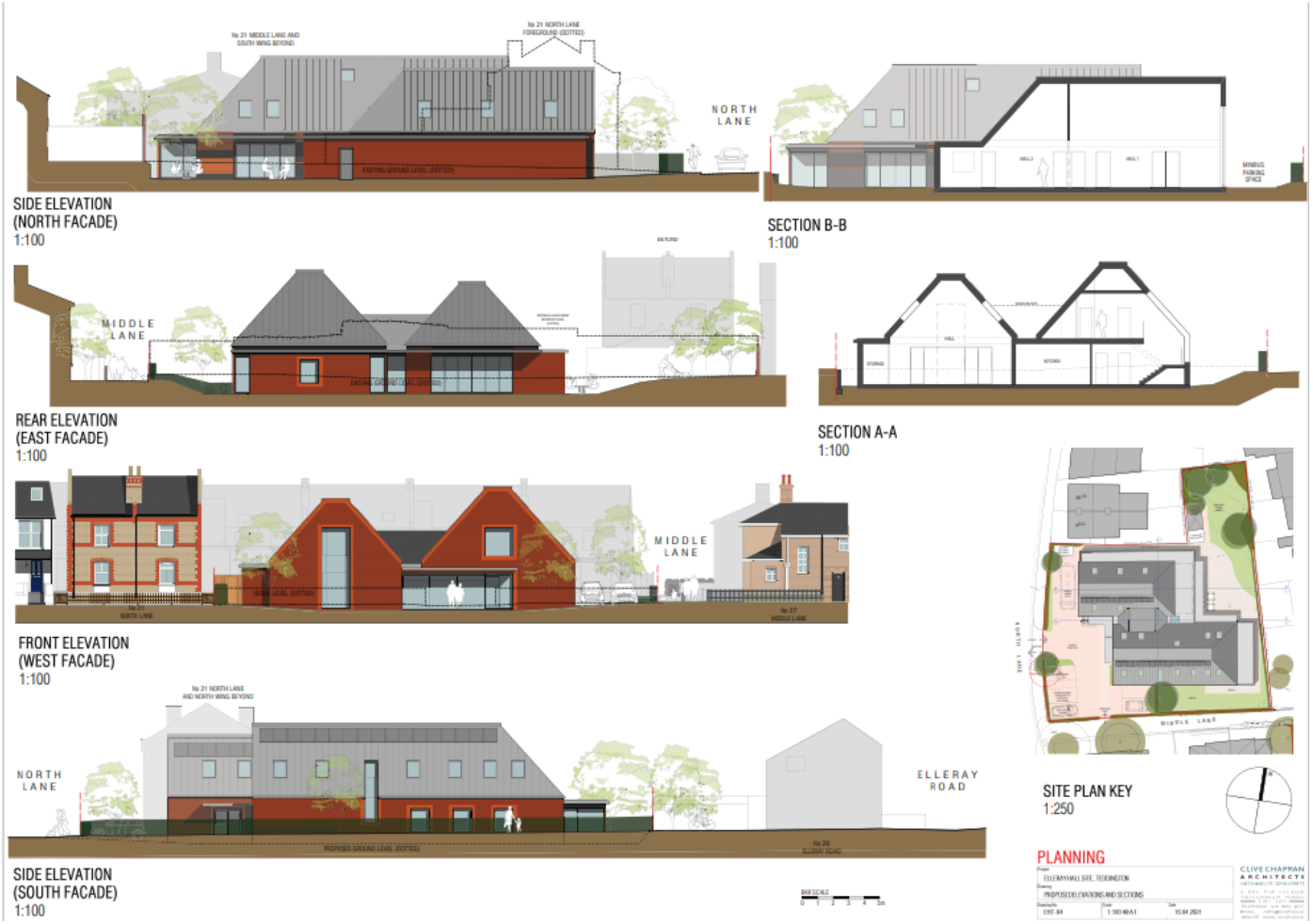

Figure 8 Proposed Elevation and Sections