Richmond and Wandsworth Councils

Elleray Hall Site, Teddington

Stage 4 Fire Strategy

REPORT REFERENCE: 20137-FS-01-A

LAWRENCE WEBSTER FORREST

Fire Engineering & Fire Risk Management Consultants

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Richmond and Wandsworth Councils

Elleray Hall Site, Teddington

Stage 4 Fire Strategy

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EXECUTIVE SUMMARY

Lawrence Webster Forrest (LWF) has been commissioned by Richmond and Wandsworth Councils to produce a Stage 4 Fire Strategy for the proposed redevelopment of the Elleray Hall Site, 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. Detailed design, to achieve compliance with the standards specified, 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	Yes	N/A
Internal Fire Spread - Linings	Yes	N/A
Internal Fire Spread – Structural Fire Protection	Yes	N/A
External Fire Spread	Yes	N/A
Fire Service Access & Firefighting Facilities	No	Extended hose distances. See Section 8.2.

Table 1 Compliance Overview

1 INTRODUCTION

1.1 General Description of the Development

The proposals involve the redevelopment of an existing site to create a two storey residential building comprising ground and first floor levels. The building will provide residential accommodation in the form of 16 flats with a mixture of 1 and 2 bed dwellings. Although the building is a single entity, it has been subdivided into 4 individual blocks, with each block serving 4 flats; 2 flats at ground floor level and 2 flats at first floor level per block. All 4 flats within each block will be accessed via shared common ways; the exception to this is the block containing Flats 1 – 4. Flats 1 and 2 are accessed directly from outside whilst Flats 3 and 4 are accessed via a common stair.

The general arrangement 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 redevelopment will be BS 9991:2015 Fire safety in the design, management and use of

residential buildings – Code of practice (BS 9991). Reference will also be made to Volume 1 of Approved Document B – 2019 Edition (ADB), including the May 2020 amendments, and other relevant British and European standards where appropriate.

The Building Regulations are fully functional. This means that the guidance given in the above referenced documents 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	Revision
Location Plan	EHT-01	-
Master Plan Proposed Site Layout and roof plan	EHT-02	-
Proposed Ground and First floor plans	ERH-01	-
Proposed Elevations and Sections	ERH-02	-
Asset Location search water Map	ALS/ALS Standard/2020_4251031	-

Table 2 Reference Drawings

2 MEANS OF ESCAPE

2.1 Evacuation Strategy

The flats will be designed for a stay put evacuation strategy. This means that in the event of a fire within one of the flats, only the occupants within the flat of fire origin will be expected to evacuate. All other residents within the building can remain within their flats, however, they are still able to evacuate at any time if they wish to do so.

2.2 Internal Flat Layout

Each of the flats has a protected entrance hallway, which provides direct access to all habitable rooms. The travel distance within the protected entrance hall is less than the 9 metre limit outlined within BS 9991 and is therefore deemed to comply.

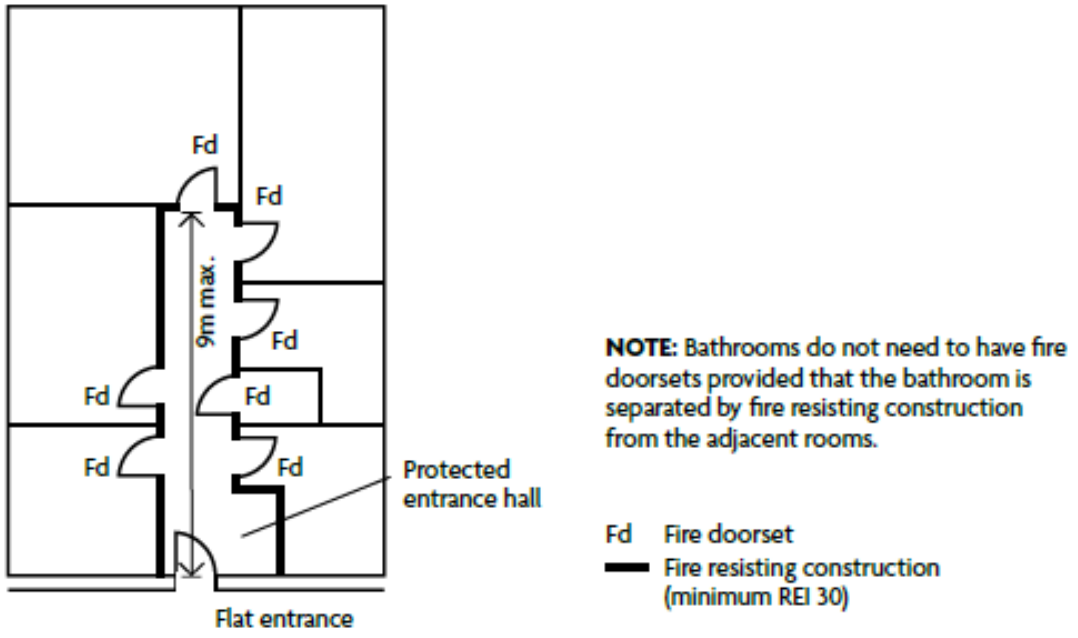


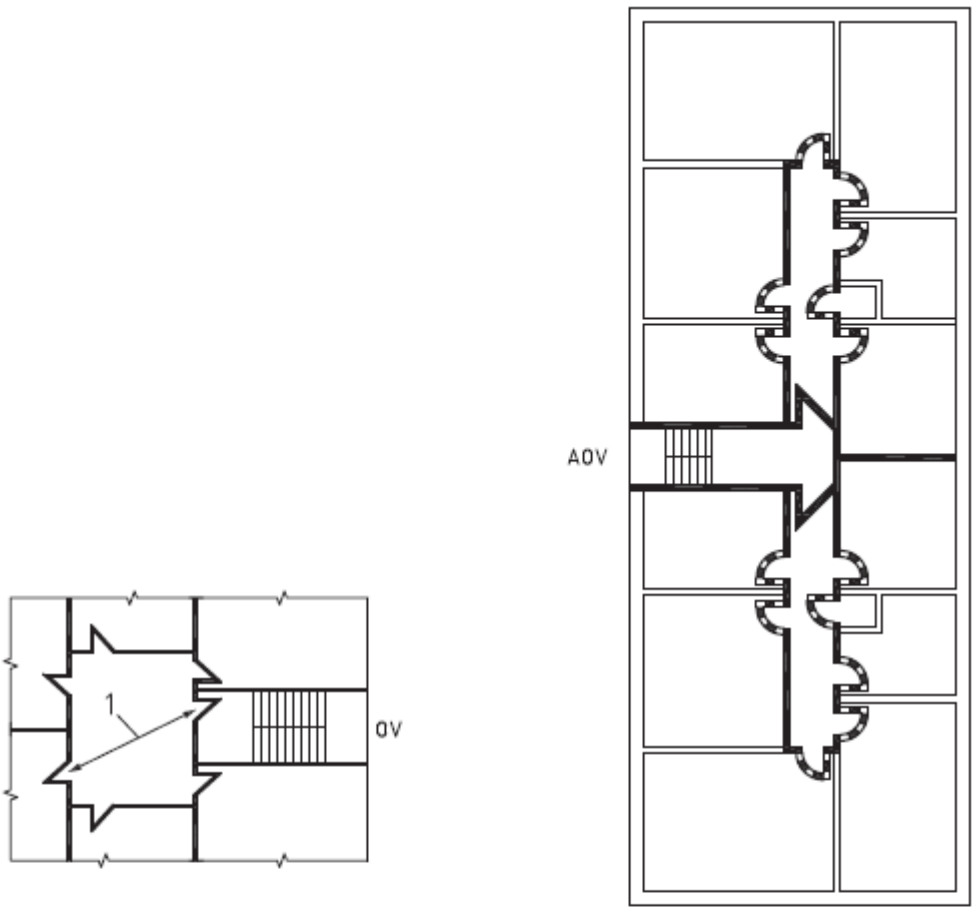
Figure 1 Protected Entrance Hall

2.3 Common Ways

The building can be classed as a small single stair building.

Where a building does not have a storey at a height greater than 11 metres, has no more than three storeys above ground storey and has a single stair, the following recommendations should be met. -

- Escape routes should be provided in accordance with Figure 2 below.
- The stair should connect to a covered car park at ground level or above, only if the car park is provided with permanent natural ventilation equivalent to 5% of the floor area of the car park, or is mechanically ventilated in accordance with BS 7346-7, and is separated by a protected, ventilated lobby.
- The stair should not serve ancillary accommodation unless the ancillary accommodation is separated from the stair by a protected lobby or corridor that is provided with permanent ventilation of not less than 0.4m^2 for the control of smoke or protected by a mechanical smoke ventilation system.
- Either:
    - a high level openable vent should be provided at each floor level within the staircase enclosure with a minimum free area of 1m^2; or
    - a single openable vent which can be remotely operated from fire and rescue service access level should be provided at the head of the stair; or
    - an automatic opening vent (AOV) should be provided at the head of the stair.



a) Small single stair building (see Notes)

b) Small building of not more than two dwellings per storey and protected internal entrance halls

Key

1 Maximum travel distance 4.5 m

AOV Automatic opening vent (1.0 m² minimum)

OV Openable vent for fire and rescue service use (1.0 m² minimum)

Fire-resisting construction

Self-closing FD 30S fire door (double swing)

Self-closing FD 30S fire door

FD 30 fire door

NOTE 1 If the lobby is provided with an AOV (1.5 m² minimum), the maximum travel distance may be increased to 7.5 m.

NOTE 2 The openable vents to the stairway may be replaced by a remotely openable vent over the stair.

NOTE 3 It is not permissible to double the 4.5 m travel distance using AWFSS.

Figure 2 Small Single Stair Premises

The plans show that the layout of each block is compliant with the requirements for a small single stair building. The common ways for each block serves no more than 2 dwellings per floor, therefore due to the provision of an automatic opening vent (AOV) at the head

of the stair and a protected entrance hall within each flat, the guidance permits the flats to open directly into the stair enclosure.

The stair serving the upper levels has a width of approximately 1000mm; BS 9991 states that a stair should have a minimum clear width of 750mm (measured between the walls and/or balustrades) unless it is a firefighting stair, where the width should be increased to 1100mm. As the building does not require a firefighting stair, the stair width is considered suitable.

2.4 Disabled Evacuation

Additional measures for the evacuation of mobility impaired people from flats are not generally considered. One reason for this is that once occupants have escaped from their flat and are in the protected staircase enclosure, they are in a relative place of safety. Currently it is not anticipated that any additional measures will be required to assist disabled persons residing within the building.

2.5 Emergency Lighting

Emergency lighting is required and will be installed in accordance with BS 5266:2016 and BS EN 1838:2013 throughout the common parts of 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.

2.6 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.

As the common ways of each block comprise only of a communal staircase, which is the only access to the flats, escape signage is not required.

3 AUTOMATIC FIRE DETECTION AND MEANS OF WARNING

A Grade D LD2 system, as described in BS 5839-6: 2019 will be fitted within all of the residential units. This system will provide smoke detection coverage to the circulation routes that form part of the means of escape within the flats and any areas of high fire risk; this should include suitable coverage within the open plan living accommodation. Any areas adjacent to cooking facilities should be provided with heat detection or suitably configured smoke detection, which prevents false alarms.

Under the new 2019 version of BS 5839-6, a Grade D system is split into two different variants; Grade D1 and Grade D2. A Grade D1 system is a system of one or more mains-powered detectors, each with a tamper-proof standby supply consisting of a battery or batteries; should the flats be rented, a Grade D1 system should be fitted. Should the flats be privately owned, a Grade D2 system should be fitted within the flat; this will comprise a system of one or more mains-powered detectors, each with an integral standby supply consisting of a user-replaceable battery or batteries.

A Category L5 system, as described in BS 5839-1: 2017, will be fitted within the common ways. This system will activate the automatic opening vent located at the head of the staircase enclosure. There should be no alarm sounders linked to this system.

4 AUTOMATIC FIRE SUPPRESSION

A life safety residential sprinkler system will be fitted throughout each of the flats, with the exception of Flats 1-4, in accordance with BS 9251:2014. The sprinkler system should be a Category 2 system and all parts of each flat should be sprinkler protected, with the exception of the following:

- bathrooms with a floor area of less than $5m^2$;
- cupboards and pantries with a floor area of less than $2m^2$ or where the least dimension does not exceed 1 metre;
- crawl spaces;
- ceiling voids;
- external balconies permanently open to the outside;
- uninhabited loft/roof voids.

As the sprinkler system forms part of the compensatory measures for the extended hose distances from the pumping appliance, the minimum design discharge density should be increased to 4.0 mm/min for a single head operation, or 2.8 mm/min through each sprinkler operating simultaneously, up to a maximum of two sprinkler heads in a single area of operation. The system should have a minimum supply duration of 30 minutes.

5 SMOKE CONTROL

In residential buildings designed with a stay put strategy, additional protection to the staircase should be provided in the form of a smoke control system. The smoke control system within residential buildings should be located such that it is maintainable from the common parts of the building.

An automatic opening vent (AOV), with a minimum geometric free area of $1m^2$, will be provided as high as practicable on the top storey of each stairway. The AOV should conform to BS EN 12101-2 and should be configured to operate on detection of smoke anywhere within the common ways.

6 INTERNAL FIRE SPREAD

6.1 Linings

In accordance with BS 9991, the internal linings for the proposed development should be as detailed below in Table 3.

Location	Classification
Small rooms with a floor area less than $4m^2$ in residential accommodation	D-s3, d2
Circulation spaces within a dwelling	C-s3,d2
Other circulation spaces including the common areas of blocks of flats	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 3 Classification of linings

It should be noted that parts of walls in rooms may be of lower performance than that stated in Table 3, 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 $20m^2$ in residential accommodation.

6.2 Structural Fire Protection

In accordance with the guidance given in BS 9991, all elements of structure will be provided with fire protection to achieve a minimum fire resistance of 30 minutes.

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 Table 4 of BS 9991, the fire rating of elements of structure for the proposed development 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	30	N/A	N/A	Exposed faces
Load-bearing wall element	30	N/A	N/A	Each side separately
Floors	30	30	30	From underside
External wall less than 1m away from the relevant boundary	30	30	30	Each side separately

External wall 1m or more away from the relevant boundary [2]	30	30	30	From inside the building
Compartment walls	30	30	30	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). See Section 7.2 of this strategy.

Table 4 Minimum fire resistance performance and method of exposure

6.3 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.

Each of the flats will be individual compartments separated from all other parts of the building with fire resisting compartment walls and floors.

Recommended compartmentation measures are summarised in Table 5 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**	
Floors[2]	30	30	30	From underside
Walls separating a flat from any other part of the building[3]	30	30	30	Each side separately
Protected Shaft[4]	30	30	30	Each side separately
Enclosing a protected entrance hallway within a flat	30	30	30	Each side separately

Part of building	Minimum provisions when tested to the relevant parts of BS 476 (minutes)			Method of Exposure
	Load-bearing capacity [1]	Integrity	Insulation	
Cavity Barriers	N/A	30	15	Each side separately

NOTES:

1. Applies to load-bearing elements only.
2. All floors to be constructed as compartment floors.
3. Any compartment wall should be continued up through the ceiling or roof cavity to maintain standard of fire resistance.
4. Protected shafts include stairs and service risers.

Table 5 Recommended Periods of Fire Resistance for Compartmentation Elements

All compartment walls and compartment floors should form a complete barrier to fire between the compartments they separate.

Timber beams, joists, purlins and rafters may be built into or carried through a masonry or concrete compartment wall if the openings for them are both of the following.

- As small as practicable.
- Fire-stopped.

If trussed rafters bridge the wall, failure of the truss due to a fire in one compartment should not cause failure of the truss in another compartment.

A compartment wall should achieve both of the following.

- Meet the underside of the roof covering or deck, with fire-stopping to maintain the continuity of fire resistance.
- Be continued across any eaves.

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 wall, should have a covering classified as $B_{ROOF}(t4)$, on a substrate or deck of a material rated class A2-s3, d2 or better.

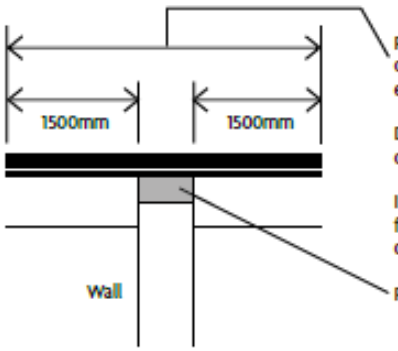
Materials achieving class B-s3, d2 or worse used as a substrate to the roof covering and any timber tiling battens, fully bedded in mortar or other suitable material for the width of the wall may extend over the compartment wall in residential buildings that are a maximum of 15 metres high.

Double-skinned insulated roof sheeting with a thermoplastic core should incorporate a band of material rated class A2-s3, d2 or better, a minimum of 300mm in width, centred over the wall.

As an alternative to the provisions outlined above, the compartment wall may extend through the roof for a minimum of either of the following:

- Where the height difference between the two roofs is less than 375mm, 375mm above the top surface of the adjoining roof covering.
- 200mm above the top surface of the adjoining roof covering where either of the following applies:
    - The height difference between the two roofs is 375mm or more.
    - The roof coverings either side of the wall are of a material classified as $B_{ROOF}(t4)$.

a. ANY BUILDING OR COMPARTMENT



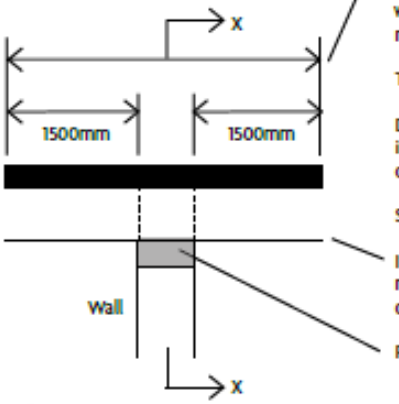
Roof covering over this distance to be designated B_{ROOF}(t4) rated on deck of material of class A2-s3, d2 or better. Roof covering and deck could be composite structure, e.g. profiled steel cladding.

Double-skinned insulated roof sheeting should incorporate a band of material rated class A2-s3, d2 or better, a minimum of 300mm in width, centred over the wall.

If roof support members pass through the wall, fire protection to these members for a distance of 1500mm on either side of the wall may be needed to delay distortion at the junction (see paragraph 5.9).

Fire-stopping to be carried up to underside of roof covering, e.g. roof tiles.

b. RESIDENTIAL (DWELLINGS) AND RESIDENTIAL (OTHER) A MAXIMUM OF 15M HIGH



Roof covering to be designated B_{ROOF}(t4) rated for at least this distance.

Boarding (used as a substrate) or timber tiling battens may be carried over the wall provided that they are fully bedded in mortar (or other no less suitable material) where over the wall.

Thermoplastic insulation materials should not be carried over the wall.

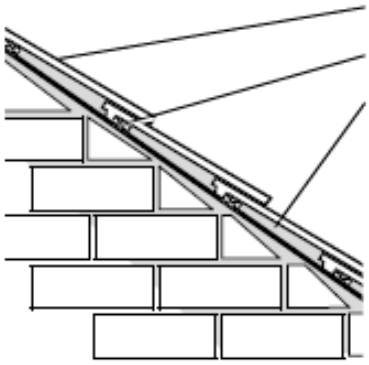
Double-skinned insulated roof sheeting with a thermoplastic core should incorporate a band of material of class A2-s3, d2 at least 300mm wide centred over the wall.

Sarking felt may also be carried over the wall.

If roof support members pass through the wall, fire protection to these members for a distance of 1500mm on either side of the wall may be needed to delay distortion at the junction

Fire-stopping to be carried up to underside of roof covering, boarding or slab.

Section X–X



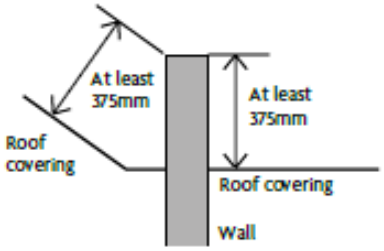
Roof covering to be designated B_{ROOF}(t4) rated for at least 1500mm either side of wall.

Roofing battens and sarking felt may be carried over the wall.

Fire-stopping to be carried up to underside of roof covering above and below sarking felt.

NOTES:
1. Fire-stopping should be carried over the full thickness of the wall.
2. Fire-stopping should be extended into any eaves.
3. The compartment wall does not necessarily need to be constructed of masonry.

c. ANY BUILDING OR COMPARTMENT



The wall should be extended up through the roof for a height of at least 375mm above the top surface of the adjoining roof covering.

Where there is a height difference of at least 375 mm between two roofs or where the roof coverings on either side of the wall are B_{ROOF}(t4) rated, the height of the upstand/parapet wall above the highest roof may be reduced to 200mm.

Figure 3 Junction of compartment wall with roof

6.4 Fire Doors

Fire doors have at least one of two functions:

- to protect escape routes from the effects of fire so that occupants can reach a final exit;
- to protect occupants, fire-fighters and the contents and/or structure of a building by limiting the spread of fire.

Doors installed on site should conform, in dimensions and workmanship, to the manufacturer's specification for the appropriate fire resistance test report/assessment. Doors should be hung to ensure a good fit to the frame when closed, and the junction between door assembly and surrounding structure should be adequately sealed.

Location of door	Minimum period of fire resistance	Comments
Flat entrance doors (separating a flat from a space in common use)	FD30S	Must be self-closing. Does not apply to the ground floor flats which have their own independent front doors accessed directly from outside.
Enclosing a protected shaft forming a stairway	FD30S	Must be self-closing.
Enclosing a protected shaft forming a service shaft	FD30	Self-closing devices are not required to cupboards and service ducts which are normally kept locked shut.
Internal flat doors forming part of a protected entrance hallway	FD30	No requirement for self-closing devices or intumescent strips and cold smoke seals.
Within a cavity barrier	FD30	Must be self-closing.

Table 6 Fire Door Provision

In accordance with BS 9991, all fire doors other than those to flats and lift entrance 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.

Security requirements should not override the need to provide adequate means of escape. All security locks and/or devices fitted to a dwelling entrance or other exit door should be openable from the inside by a single manual operation not requiring the use of a key.

Integrated elements such as locks, letter plates and security viewers should not reduce the fire resistance of the door.

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

- be fitted only with simple fastenings that can be operated from the escape side of the door without the use of a key;
- 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°.

6.5 Concealed Spaces

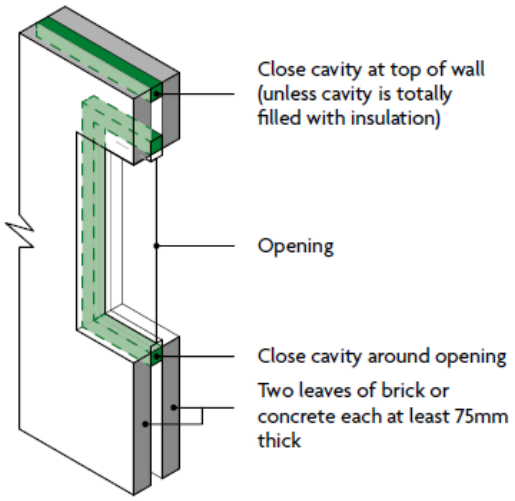
Concealed spaces and cavities in the building can allow the rapid unseen spread of fire and smoke to areas remote from the seat of an incident. To reduce the potential for fire spread, cavity barriers should be provided to divide cavities and to the close the edge of cavities.

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.

In accordance with BS 9991, cavity barriers should be provided in accordance with Figure 5 and includes, but is not limited to, the following:

- all junctions between an external cavity wall (except where the cavity wall is shown in Figure 4 below) 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 (except where the cavity wall is shown in Figure 4 below) and every compartment floor, compartment wall, or other wall or door assembly which forms a fire-resisting barrier;

It is important to continue any compartment wall up through a ceiling or roof cavity to maintain the standard of fire resistance, therefore compartment walls should be carried up full storey height to a compartment floor or to the roof as appropriate. It is therefore not appropriate to complete a line of compartmentation by fitting cavity barriers above the compartment wall.



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 4 Cavity walls excluded from provisions for cavity barriers

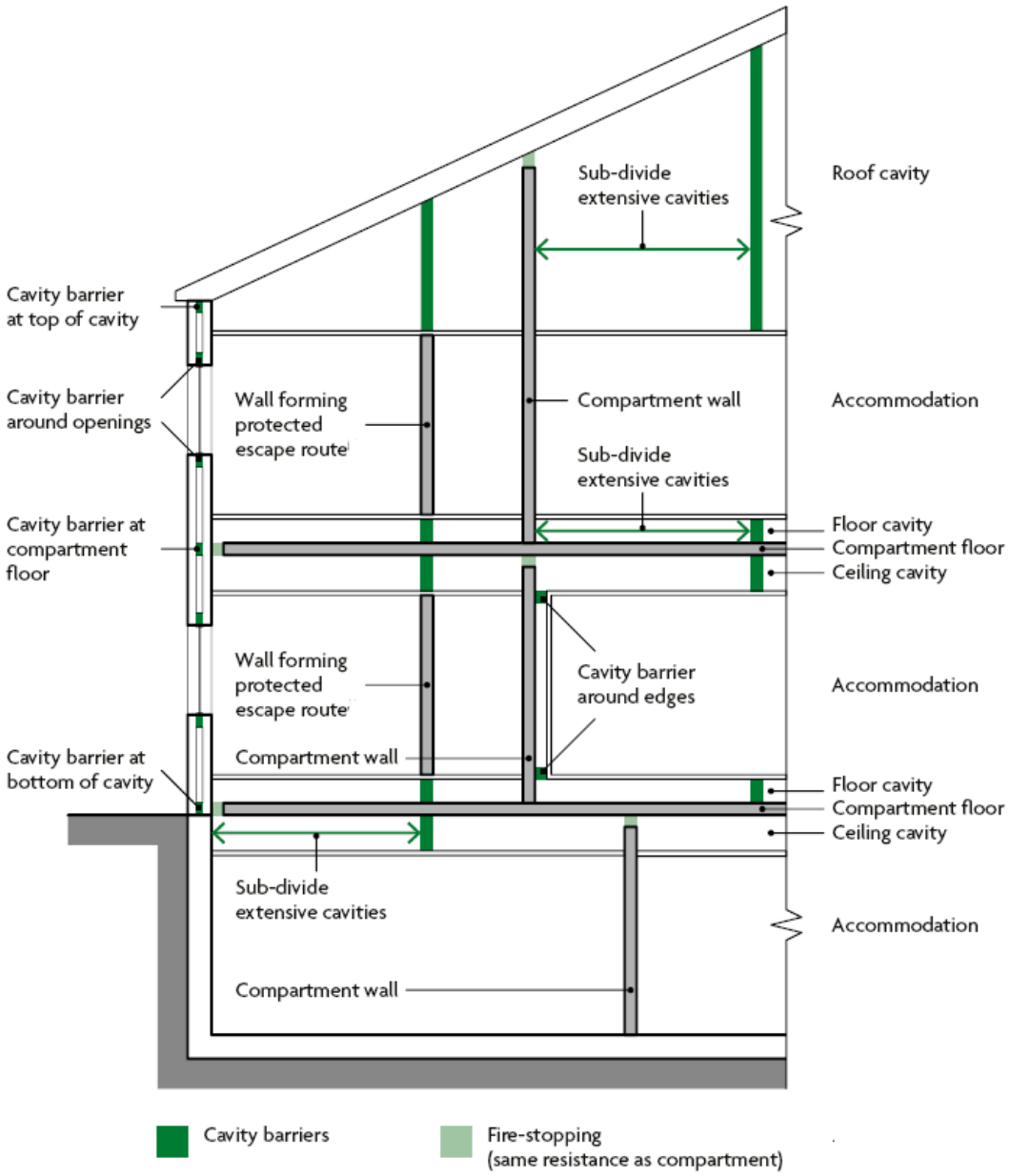


Figure 5 Provisions for Cavity Barriers

For a protected escape route, a cavity that exists above or below any fire-resisting construction because the construction is not carried to full storey height or, in the case of a top storey, to the underside of the roof covering, should be either:

- fitted with cavity barriers on the line of the enclosure(s) to the protected escape route; or

- for cavities above the fire-resisting construction, enclosed on the lower side by a fire-resisting ceiling having fire-resistance tested in accordance with the applicable parts of BS 476 for exposure above and below the ceiling and which extends throughout the building, compartment or separated part.

A cavity that exists above or below partitions between bedrooms because the enclosures are not carried to full storey height, or (in the case of the top storey) to the underside of the roof covering, should be either:

- fitted with cavity barriers on the line of the partitions; or
- for cavities above the partitions, enclosed on the lower side by a fire-resisting ceiling which extends throughout the building, compartment or separated part.

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 as outlined above.

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.

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.)

6.6 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.

6.7 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.

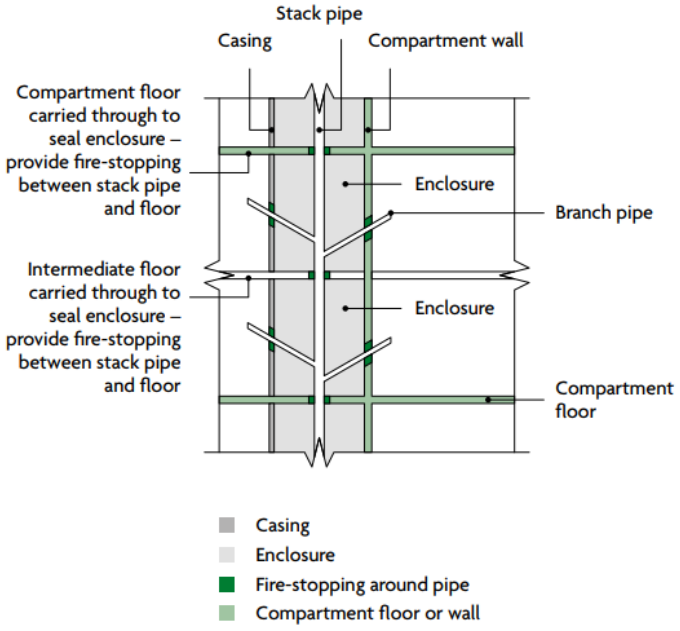
Situation	Pipe material and maximum nominal internal diameter (mm)		
	Non-combustible material (1)	**Lead, aluminium, aluminium alloy, PVC(2), fibre-cement**	**Any other material**
A. Structure (but not a wall separating buildings) enclosing a protected shaft that is not a stairway or a lift shaft.	160	110	40
B. Compartment wall or compartment floor between flats	160	160 (stack pipe)(3) 110 (branch pipe)(3)	40
C. Any other situation	160	40	40

Situation	Pipe material and maximum nominal internal diameter (mm)		
	Non-combustible material (1)	Lead, aluminium, aluminium alloy, PVC(2), fibre-cement	Any other material

NOTES:

1. A non-combustible material (such as cast iron 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.
3. These diameters are only in relation to pipes forming part of an above-ground drainage system and enclosed as shown in Figure 6. In other cases, the maximum diameters against situation C apply.

Table 7 Maximum nominal internal diameter of pipes passing through a compartment wall/floor



NOTES:

1. The enclosure should meet all of the following conditions.
   a. Be bounded by a compartment wall or floor, an outside wall, an intermediate floor or a casing (see specification at 2 below).
   b. Have internal surfaces (except framing members) of class B-s3, d2 or better.
   Note: when a classification includes 's3, d2', this means that there is no limit set for smoke production and/or flaming droplets/particles).
   c. Not have an access panel which opens into a circulation space or bedroom.
   d. Be used only for drainage or water supply or vent pipes for a drainage system.

2. The casing should meet all the following conditions.
   a. Be imperforate except for an opening for a pipe or an access panel.
   b Not be of sheet metal.
   c. Not have fire resistance less than E 30 (including any access panel).

3. The opening for a pipe, in either the element of structure or the casing, should be as small as possible and fire-stopped around the pipe.

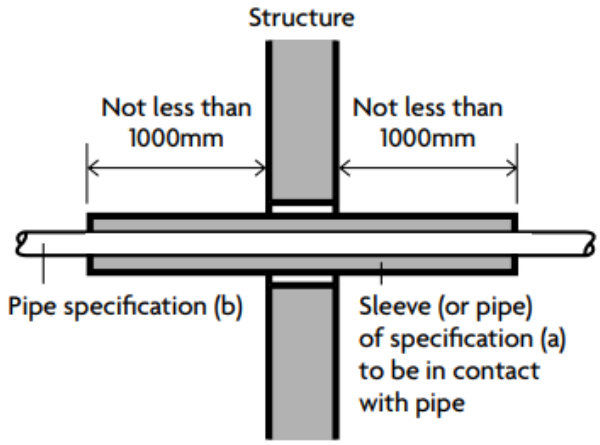
Figure 6 Enclosure for drainage or water supply pipes

Option 3

A pipe with a maximum nominal internal diameter of 160mm may be used with a sleeve made out of a non-combustible material, as shown below, if the pipe is made of one of the following:

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

A non-combustible material means any material (such as cast iron 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 7 for materials specification.
3. The sleeve should be class A1 rated.

Figure 7 Pipes penetrating structure

6.8 Mechanical systems for ducted heating, ventilation and air conditioning (HVAC)

6.8.1 HVAC systems within individual dwellings

Ducted HVAC systems should be arranged such that fire and smoke is not transferred from the room of fire origin in a manner that could inhibit the safe use of protected internal means of escape routes or allow the undue spread of fire.

The residential units should meet the following recommendations:

- Transfer grilles should not be fitted in any wall, ceiling, floor or door enclosing a protected internal hallway.

- Where practicable, ducts should be routed such that they do not pass through protected internal hallways.
- Where the duct does pass through a protected internal hallway, then:
    - the duct should be provided with ES rated fire and smoke dampers conforming to BS EN 1366-2 where penetrating the fire-resisting enclosure (such dampers should be accessible for maintenance); or
    - the duct should be of fire-resisting construction achieving 30 minutes integrity when tested from the inside; or
    - the ceiling zone containing the duct should be bounded by the protected enclosure and provided with an imperforate ceiling construction achieving 30 minutes fire resistance integrity and insulation when tested from above and have an upper surface of Class 1 surface spread of flame when tested in accordance with BS 476-7 or the European equivalent.
- Where an HVAC system re-circulates air and serves the protected internal hallway and other rooms, smoke detectors should be provided within the ductwork that switches the mode to shut down upon detection.
- HVAC ducted systems that link between dwellings or serve common areas should be in accordance with Section 6.8.2 below.

6.8.2 HVAC systems serving the whole building or interconnecting dwellings and other residential units

Mechanical HVAC systems serving the whole building should be designed to prevent the spread of fire and smoke from the room of fire origin throughout the building. In particular, measures should be taken to ensure that air movement in the system prevents incursion of fire and combustion products into protected escape routes and does not allow fire compartmentation to be breached.

The following measures should be implemented:

- Ventilation systems serving protected escape routes should not serve other areas and the normal airflow pattern should be directed away from the escape route.

- A separate ventilation system that does not allow for the re-circulation of air should be provided within the protected stairway;
- Ducts passing through the enclosure of a protected escape route should meet the relevant fire-resistance recommendations (protection using fire-resisting enclosures, or protection using fire-resisting ductwork) given in BS 9999.
- Where a ductwork system serves more than one part of a compartmented or fire-separated escape route, smoke detector operated fire dampers should be provided where the ductwork enters each fire-separated or smoke-separated section of the escape route. Where a fire damper is used to protect an escape route, it should be tested in accordance with BS EN 1366-2 and an ES classification equal to or greater than 30 minutes in accordance with BS EN 13501-3.
- Ducts passing through compartment walls and floors and other fire-separating elements should maintain the fire integrity using one of the following methods given in BS 9999:
    - using fire dampers;
    - using fire-resisting enclosures; or
    - using fire-resisting ductwork.
- Where ductwork serves more than one flat or maisonette, smoke detector operated fire and smoke dampers should be provided where the ductwork enters each dwelling. Such dampers should be tested in accordance with BS EN 1366-2 and an ES classification equal to or greater than 30 minutes in accordance with BS EN 13501-3.
- The fire resistance of ducts and dampers should be equal to the fire resistance required for the building element being penetrated. All ducts should be fire-stopped where they penetrate compartments and fire-resisting enclosure of escape routes.
- Systems which re-circulate air should be fitted with smoke detectors in the extract ductwork before the point of separation of the re-circulated air and the air to be discharged and before any filters or other air cleaning equipment. Detection should cause the system to immediately shut down or switch to extract the air to an external location.
- Systems should be provided with overriding fire-fighting controls in accordance with BS 9999.

- Air transfer grilles should not be positioned in enclosures to protected stairways, protected lobbies, protected corridors, fire-fighting stairways and lobbies, protected shafts and compartment walls or floors.
- Exhaust outlets should be positioned such that they:
    - do not discharge products of combustion close to final exits or other parts of escape routes;
    - are not close to any combustible or otherwise vulnerable element of the building construction;
    - do not enable re-entry of exhaust products back into the building or other ductwork.
- Ducts should be designed and constructed in accordance with BS 8313.

7 EXTERNAL FIRE SPREAD

7.1 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 8 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.
   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 8 Reaction to fire performance of external surface of walls

It should be noted that the term "relevant building", as outlined in the table above, is a new term, which has come into use following the review of the Building Regulations 2010. The Building (Amendment) Regulations 2018 defines a "relevant building" as a building with a storey (not including roof-top plant areas or any storey consisting exclusively of plant rooms) at least 18 metres above ground level and which -

- contains one or more dwellings;
- contains an institution; or
- contains a room for residential purposes (excluding any room in a hostel, hotel or boarding house).

Due to the limited height of the redevelopment, the building is not classed as a 'relevant building', therefore the requirements outlined in the table above for "any other building" should be used.

For all the elevations, the relevant boundary distance is over 1000mm, therefore, there are no provisions in relation to the external surfaces (i.e. outermost external material) of the walls. For all of the elevations, cavity barriers should be provided in accordance with Section 6.5 of this report.

Although not a mandatory requirement, in light of the current climate, it is strongly recommended that any materials used in the external wall construction are non-combustible.

7.2 Unprotected Areas

To prevent external fire spread from and to adjacent buildings, BS 9991 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. Some small unprotected openings can be excluded from the calculations, in line with the guidance in Figure 21 of BS 9991.

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, the solid portions of the elevation are suitably protected with fire resisting construction 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.

It should be noted that the calculations shown below have not taken the sprinkler protection into account, unless specifically stated, however, the guidance states that if a compartment is fitted throughout with a sprinkler system in accordance with BS 9251 or BS EN 12845, the boundary distance can be halved (to a minimum distance of 1 metre) or the amount of unprotected area can be doubled.

7.2.1 North Elevation

The minimum distance to the relevant boundary is approximately 2.4 metres. The relevant boundary has been taken as the centreline of Middle Lane.

Using a 3 metre wide x 3 metre high rectangle, a minimum boundary distance of 2.0 metres is required for 100% unprotected openings; as the relevant boundary distance exceeds this, the proposed glazed portion of this elevation does not require any fire resistance based on the current distance to the relevant boundary.

7.2.2 East Elevation

The minimum distance to the relevant boundary is approximately 3.5 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 2.0 metres is required for 100% unprotected openings; as the relevant boundary distance exceeds

this, the proposed glazed portion of this elevation does not require any fire resistance based on the current distance to the relevant boundary.

7.2.3 South Elevation

The minimum distance to the relevant boundary is approximately 5.5 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 2.0 metres is required for 100% unprotected openings; as the relevant boundary distance exceeds this, the proposed glazed portion of this elevation does not require any fire resistance based on the current distance to the relevant boundary.

7.2.4 West Elevation

The minimum distance to the relevant boundary is approximately 2.7 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 2.0 metres is required for 100% unprotected openings; as the relevant boundary distance exceeds this, the proposed glazed portion of this elevation does not require any fire resistance based on the current distance to the relevant boundary.

7.3 Roof Coverings

Roof coverings should comply with Table 8 of BS 9991. If any plastic roof lights are proposed they will need to meet the requirements of Table 9 of BS 9991.

Designation of covering of roof or part of roof [A)]	**Distance of roof from any point on relevant boundary**			
National Class	**Less than 6m**	**At least 6m**	**At least 12m**	**At least 20m**
AA, AB or AC	Acceptable	Acceptable	Acceptable	Acceptable
BA, BB or BC	Not acceptable	Acceptable	Acceptable	Acceptable
CA, CB or CC	Not acceptable	Acceptable[B), C)]	Acceptable[B)]	Acceptable
AD, BD (or CD[B)])	Not acceptable	Acceptable[C)]	Acceptable	Acceptable

Designation of covering of roof or part of roof [A]	Distance of roof from any point on relevant boundary			
DA, DB, DC (or DD[B])	Not acceptable	Not acceptable	Not acceptable	Acceptable[C]

NOTES:

A) The performance of roof coverings is designated by reference to the test methods given in BS 476-3 (or DD ENV 1187)
B) Not acceptable on buildings with a volume of more than 1500m^3.
C) Acceptable on buildings not listed in Footnote B, if part of the roof is no more than 3m^2 in area and is at least 1.5m from any similar part, with the roof between the parts covered with a material of limited combustibility.

Table 9 Limitations on Roof Coverings

8 FIRE SERVICE ACCESS & FIRE FIGHTING FACILITIES

8.1 Hydrant Provision

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.

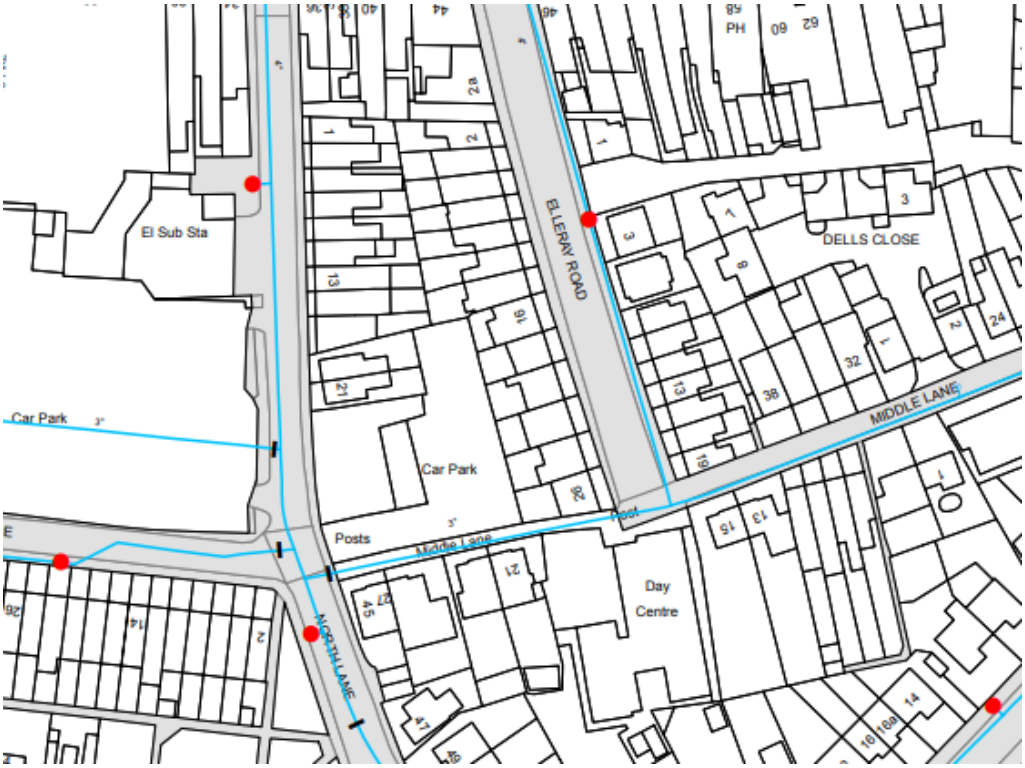


Figure 8 Location of fire hydrants

8.2 Vehicle Access

Due to the location of the site, vehicle access to the flats is only available to the front of the building. In the event of a fire in one of the flats, a fire appliance would have no choice but to park in front of Flat 1 and run hose from this point along the side of the building.

Figure 9 Site Plan

As a fire main is not provided within the building, access for a pumping appliance should normally be provided to within 45 metres of all points inside each of the flats, as measured along the route of the hose, however, as each flat, with the exception of Flats 1-4 (which can achieve the 45 metre hose distance), will be fitted throughout with a sprinkler system in accordance with BS 9251:2014, the distance between the pumping appliance and any point within each flat may be increased from 45 metres up to 75 metres. The hose distance between the pumping appliance, parked at the front of the building, to the furthest point of the first floor is approximately 53 metres; as this is below the 75 metre limit, the vehicle access is considered suitable.

Any roads or surfaces providing fire appliance access should comply with the widths and hard-standing requirements outlined 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 10 Vehicle Access Route Specification

9 FIRE SAFETY MANAGEMENT

Where fire safety systems are included within a dwelling, any lease agreements should ensure that it is clear who has the responsibility to maintain them and the permissions/right to do so should form part of the agreement.

Advice to occupiers of domestic residential buildings on precautions against fire that they may take can be found in BS 9991:2015, Annex F.

The occupier should be advised to ensure that the sprinkler system, fire alarm system and fire doors are maintained in a good state of repair, in accordance with relevant standards.

10 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 BS 9991. This level of safety, therefore, satisfies the functional requirements of the Building Regulations relating to fire safety.

11 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 10 Site Plan

Figure 11 Ground and First Floor Layouts

Figure 12 Proposed Elevations and Sections