



Fire strategy report

Victoria Mill, Manchester

6 December 2022

Medlock FRB Ltd

10779-OF

Revision History

Version	Date	Author	Comments
01	15/11/2022	Shauna Jameson	For initial issue
02	06/12/2022	Shauna Jameson	Updated post architect comments

Document reference

10779-OF

Prepared by	Shauna Jameson shaunajameson@bbseven.com	Pentagon Centre 26-38 Washington Street Glasgow G3 8AZ
Reviewed by	Dominic Way domway@bbseven.com	Pentagon Centre 26-38 Washington Street Glasgow G3 8AZ
Prepared for	Medlock FRB Limited	Greengate Street Oldham OL4 1DG

This document is the copyright of BB7 and has been prepared by BB7 for the sole use of the below named Client. The content of the document applies only to the named development and must not be used in support of any other development. No third party may rely upon this document without the prior and express written agreement of BB7 and it may only be distributed to third parties with the permission of BB7 and must be distributed in full and without amendment to content or presentation. BB7 accept no liability for any information contained in this document until payment has been received in full.

This document relates only to statutory requirements for Building Regulations compliance which focuses on life safety only. Additional fire safety measures may be necessary for insurance and other purposes and if you require these to be considered you must inform us. Where no reference is made within this report to a certain element, all detailed aspects of the design and construction will, unless explicitly stated otherwise in this report, be in accordance with the recommendations of the selected design guidance identified in the legislation section of this report and the appropriate British Standards.

The validity of this document is dependent upon the recommendations being implemented in full and as described. This document relates to a development that is subject to review from Approval Authorities. It should be ensured that the contents of the document are agreed with all the relevant approval bodies prior to implementation.

This document is based on our Client's or our Client's Representative's description of their requirements and is subject to assumptions that BB7 can reasonably be expected to make in accordance with our professional principles and experience. BB7 accept no liability for the accuracy of the information provided by our Client or any third parties and any information provided by to us and referred to herein has not been verified by BB7, unless otherwise expressly stated in the document.

BB7 shall not be held responsible or liable for the designs produced by any other consultants, sub-consultants or sub-contractors, including any original designs produced by others which we may adapt, modify or develop in the carrying out of the Services. The document is based on the drawings referenced. Any subsequent changes to the design which are not agreed with BB7 will invalidate the document.

BB7 is a trading name of BB7 Consulting Limited. BB7 Consulting Limited is a private limited company incorporated in [England and Wales] with registered number 13111820 and with its registered address at The Old Surgery, The Historic Dockyard, Chatham, Kent, ME4 4TZ, UK VAT reg No: 322570036

Contents

Summary	5
1. Introduction	6
2. Building description	7
2.1 2.1 Overview	7
2.2 2.2 Building height	7
2.3 2.3 Vertical circulation	7
2.4 Occupancy	8
3. M&E information	9
3.1 Fire detection and alarm	9
3.2 Cause & effect	10
3.3 Smoke ventilation	11
3.4 Dampers and ducts	13
3.5 Automatic suppression	14
3.6 Emergency lighting provisions	14
3.7 Signage	14
4. Means of escape - Residential	15
4.1 Flats	15
4.2 Common areas	18
4.3 Storage areas	20
4.4 Escape widths and final exits	21
4.5 External escape routes	23
4.6 Mobility impaired persons	23
5. Means of escape – Ground floor & basement	24
5.1 Occupancy	24
5.2 Escape principles	24
5.3 Number of exits and escape widths	25
5.4 Travel distances	26
5.5 Inner rooms	27
5.6 Protected corridor	28
5.8 External escape routes	29
5.9 External walls adjacent to escape stairs	29
5.10 Mobility impaired persons	29
6. Internal fire spread (linings)	30
6.1 Wall and ceiling linings	30

7. Internal fire spread (structure)	31
7.1 Loadbearing elements of structure	31
7.2 Compartmentation	31
7.3 Protected shafts	32
7.4 Concealed spaces (cavities) and fire stopping	33
8. External fire spread	34
8.1 Space separation analysis	34
8.2 Ground floor	35
8.3 External wall construction	35
9. Fire and Rescue Service access facilities	36
9.1 Access	36
9.2 Facilities	37
9.3 Ground floor & basement	40
9.4 Hydrants	42
10. Management	43
11. Statutory Guidance	44
11.1 Building Regulations 2010	44
11.2 Property protection	44
11.3 The Regulatory Reform (Fire Safety) Order 2005	44
11.4 Regulation 38	44
Firefighting shafts	46
Firefighting stairs	48
Firefighting lobby	48
Limitations	49
Existing structure	49
Assessment and results	50
Report conclusion	50
BB7 comments	50

Summary

This report outlines the fire strategy for the Victoria Mill refurbishment which converts an existing office building to residential flats. It is a multi-stair building, 19.3m to the top finished floor, consisting of single storey flats. There is also office accommodation at ground floor and a basement containing plant accommodation.

The purpose of this fire strategy is to assess the means of escape, internal fire spread, external fire spread, and Fire & Rescue Service (FRS) access and facilities provided.

Subject to implementation of the recommendations made within this report, the buildings are considered to meet the functional requirements of the Building Regulations. The guidance in BS 9991:2015 – *Fire safety in the design, management and use of residential buildings* – code of practice has been followed in order to do so.

In summary:

- Category LD1 fire detection and alarm systems in accordance with BS 5839-6 should be provided in all flats. The common areas require Category L5 detection to operate the ventilation system and the rooms accessed from the common area should be provided with Category L3 detection and alarm in accordance with BS 5839-1.
- The flats and rooms accessed from the common area are to be provided with a Category 2 sprinkler suppression system in accordance with BS 9251. Rooms accessed from the common area are to be lobbied and in addition the refuse lobby be provided with a 0.2m² vent.
- The layout of Flat 117 is considered to be acceptable and adequate means of escape is provided, but this requires approval with the Authority Having Jurisdiction (AHJ).
- The bin stores and rooms accessed from the common area require approval with the AHJ, however, adequate provisions are considered to be made to mitigate the risk and achieve the guidance.
- The separation of the stair void (formally Staircase A) requires approval with the AHJ.
- The loadbearing elements of structure in all blocks will be a minimum of 60 minutes fire resisting construction. (On the provision of minor upgrades to the sprinkler systems). However, the ground level does not have sprinkler provision and, as such, the floor between ground and first as well as the discharge corridor from Stair B should have 90 minutes fire resistance. Stair B should also be enclosed in 90 minutes fire resistance at ground floor level. Similarly, the floor between ground and basement will be a 90 minutes fire resisting compartment floor.
- Staircase C is provided as a firefighting shaft as the building is greater than 18m. It is noted that a firefighting lift will be provided. The spiral stair is considered to be the most appropriate firefighting shaft, however, this requires approval with the AHJ.
- Ventilation at the basement floor should be reviewed to ensure openings are available to achieve 1/40th of the floor area.
- The risk of external fire spread is low based on the façade being inherently fire resisting and the provision of sprinklers. As such, there is no requirement for additional fire resistance to the façade or glazing.
- Suitable Fire Service access and facilities are considered to be provided. The vehicle access to Staircase B should be confirmed with the FRS.

1. Introduction

The purpose of this report is to provide a fire strategy that outlines how the proposed residential refurbishment at Victoria Mill, Manchester, will comply with the fire safety requirements of the Building Regulations 2010.

It will be necessary, therefore, for it to meet the requirements of Schedule 1 of the Regulations and this report follows the guidance on how to satisfy the functional requirements provided in BS 9991:2015 – Fire safety in the design, management and use of residential buildings – code of practice. Any deviations from the guidance in BS 9991:2015 will be detailed within this report and any alternative means of meeting the functional requirements justified.

Office accommodation is not covered under the guidance in BS 9991, therefore, the ground floor and basement has been considered in accordance with guidance in Approved Document B – Vol 2 (2019 incorporating 2020 amendments).

The report should be read in conjunction with the architectural drawings provided by Allison Pike, Architects & Designers.

Where not explicitly addressed within this report, it is assumed that in all other aspects, the building will be designed in accordance with the relevant guidance in BS 9991:2015 or the supporting British Standards referenced therein.

This document will be provided as part of the planning application and accompanies the planning drawings. This report can also form part of the formal Building Regulations submission report, providing there are no changes to the design. It will also be used by the ‘responsible person’ whilst undertaking any risk assessments of the building, which is required under the Regulatory Reform (Fire Safety) Order 2005.

The report deals only with the statutory requirements, so property protection is not, therefore, explicitly addressed, unless otherwise stated. As such, it is recommended that the building insurers are consulted at an early stage to ensure that any additional needs are satisfied.

It is important that the building management have a clear understanding of the fire strategy adopted, and of the operation and maintenance of the fire safety systems and equipment within the building, designed to protect lives and property.

Any recommendations made within this report are subject to issue to and approval by the Statutory Authorities.

2. Building description

2.1 Overview

The Victoria Mill project is a conversion of a former office building into residential accommodation. The building consists of seven levels (Basement, Ground & 5 floors). The building is Grade II* Listed.

There are flats (open plan / protected entrance hall) from first to 5th and there are also storage areas on each floor, along with a bin store.

The ground floor includes existing NHS office accommodation along with a Doctor Surgery, clinic areas, etc. The drawings provided of the ground floor are indicative as an accurate survey of the existing accommodation has not been completed.

At basement level, it is proposed to alter the existing layout to incorporate a water tank room and UPS.

The conversion and change of use of the building is, therefore, required to meet the functional requirements of the Building Regulations. However, it is noted that with existing and listed buildings, this is not always reasonably practicable.

2.2 Building height

The building has five storeys above ground and the height of the topmost finished floor is approximately 19.3m above ground level.

2.3 Vertical circulation

The following figure shows the location of the escape stairs.

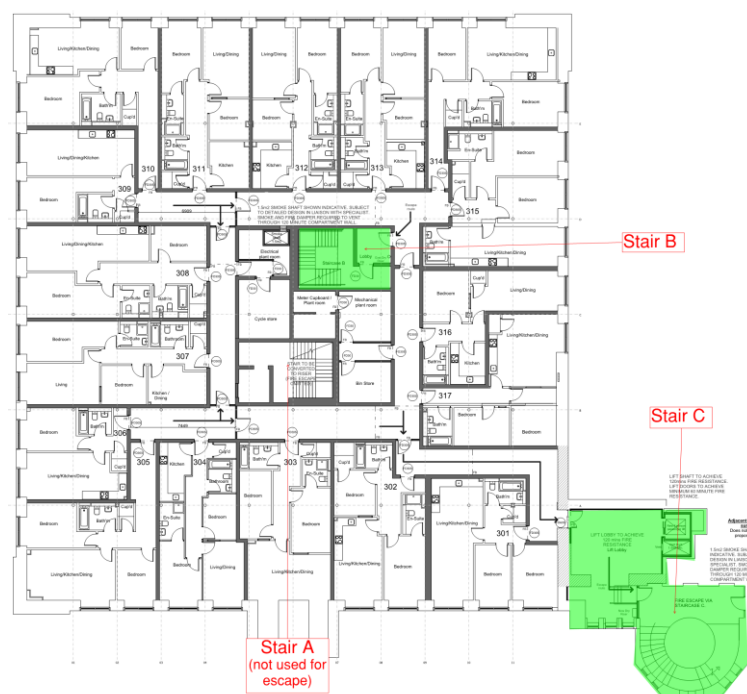


Figure 1. Stair location

It is noted that there is a third stair, Stair A, shown on the plans, however, this is to be converted into a riser and will not provide an escape route.

2.4 Occupancy

For residential accommodation, a 'stay-in-place' evacuation strategy is adopted in the event of a fire, such that only the apartment of fire origin would evacuate. Therefore, the occupancy load per floor level is insignificant when considering escape widths.

3. M&E information

3.1 Fire detection and alarm

3.1.1 Flats

Each flat will be provided with a standalone fire detection and alarm system with no interconnection between flats or the storage areas. Upon activation of a detector head in a flat, only the flat in which the detector has activated will be required to evacuate. This 'stay-in-place' strategy is based on the 60 minutes of fire resistance provided between each apartment.

To allow for the layout of the flats, a Grade D, category L1 automatic fire detection (AFD) and alarm system to BS 5839-6 would be required for the flats.

A Grade D system is one comprising of mains powered smoke alarms with a battery back-up.

A smoke detector will be provided in the living space, remote from the cooking area and a heat detector can be provided adjacent to the cooking area to make up any coverage issues. It is recommended that a 'silence / hush' button is provided to mitigate unwanted alarms. This should be provided at a reachable height and should silence the alarm for 6-8 minutes maximum.

3.1.2 Common areas

The protected stairs are provided with lobby protection between the common corridor serving the flats.

Ventilation is required in the common area as per Section 3.2 and 4.2 of this report therefore detection is required to a Grade L5 standard in accordance with BS 5839-1.

It should be noted that this detection is solely for the purposes of operating automatic vents within the staircase and ventilation system within the corridor; hence sounders or manual call points should not be provided within these areas.

The smoke detection will be required to satisfy the individual ventilation system requirements and, as such, should be designed and installed by a specialist sub-contractor. The detector only needs to be provided in the section of corridor containing the ventilation (this does not need to extend to unventilated sections of the corridor).

The plant, cycle, bin rooms accessed from the common areas should be provided with detection due to the inner inner room nature of the units. An L1 detection and alarm system in accordance with BS 5839-1, with coverage for all rooms accessed from the corridor, as shown in Figure 2 below.

Sounders should be provided in any access rooms but not in the common corridors themselves, to limit the possibility that these might be heard through the walls in the separating the flats. The system can also be standalone from the residential areas within the building, however it is proposed that it be activated on the sprinkler flow switch, as this is indicative of a real fire. Therefore, in the event of a fire within the apartment, there will effectively be the equivalent of a heat detector to signal for the ancillary units to evacuate.

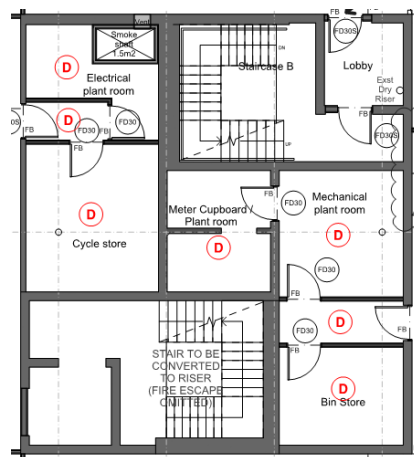


Figure 2. Indicative example of detection

Detection in the above should be linked to the fire alarm panel.

The fire alarm panels from the corridor and rooms accessed from the corridor should be located within the ground floor lift lobby to the main entrance to core C. Ideally, the fire alarm panel should be visible from outside of the building (e.g., via vision panels within the entrance door) to enable the Fire Service to identify and access it easily when attending site. Any panels linked to flow switches on sprinklers or vents should also be provided in this location.

The system may benefit from the panel functionality of a pager/mobile integrations, so that remote management can be made aware of activation should they desire. (Not a requirement).

It has been confirmed by the client that notices will be displayed through the site advising residents of what to do in the event of the fire alarm. Furthermore, the caretaker / key holder will carry out an initial investigation of any fire alarm activations in the rooms accessed from the corridor.

3.1.3 Ground floor & basement

As a minimum, a Category M manual fire detection and alarm system would be required in the office accommodation. It has not been confirmed what level of coverage the existing office accommodation has, however, it is presumed that automatic detection will be included.

In the basement, an automatic fire detection and alarm system should be provided as a fire could break out in the unoccupied part of the premises.

It is recommended that a Category L3 detection and alarm system should be provided in accordance with BS 5839-1.

L3 systems are designed to warn of fire at an early enough stage to enable all occupants, other than possibly those in the room where the fire started, to escape safely before the escape routes become impassable because of fire, smoke or toxic gases.

There is sometimes a preference that management are alerted via a pager or similar when there is an activation of the fire detection and alarm system; it would be prudent to allow an option for a link on the panel to facilitate this.

3.2 Cause & effect

Full Cause-and-Effect details for the fire alarm system should be developed by the system designer and in consultation with the building operator and the Statutory Authorities.

Although there should be no interconnection between the flats, office and basement, it may be beneficial to have an alert on the fire panels in the respective areas.

3.3 Smoke ventilation

In accordance with Figure 7 of BS 9991, the common escape routes between the flats and the protected stairs should be provided with smoke ventilation. It is only the section of corridor directly outside the stair that requires ventilation.

3.3.1 Common areas

In accordance with Figure 7 of BS 9991:2015 ventilation should be provided on each protected section of the corridor on every level.

Staircase B does not have direct access to an external wall for ventilation. As such a natural smoke shaft has been incorporated to protect stair B from fire and smoke.

Furthermore, due to Victoria Mill being a listed building the windows in staircase C are unable to be made into openable vents. Thus, a natural smoke shaft has been incorporated into the design to provide the appropriate ventilation to the firefighting lobby and staircase C, which, according to BRE research, is more effective at protecting the stair.

The following figure provides the location of the natural smoke shafts.

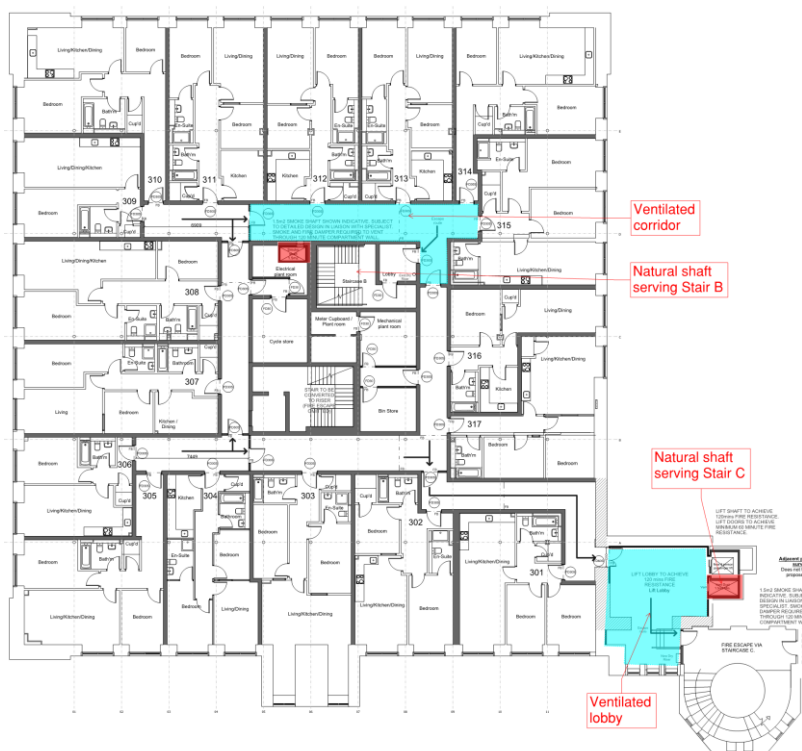


Figure 3. Smoke shaft locations

In accordance with section 14.2.3.2 of BS 9991:2015 smoke shafts serving storeys above ground level should meet the following recommendations:

- a. The smoke shaft should be fully open to the external air at the top and closed at the base.
- b. The opening at the top of the smoke shaft should be located at least 0.5 m above any surrounding structures that fall within a 2m radius on a horizontal plane so that it is not subject to adverse wind effects (i.e. it should always have negative wind pressure coefficients).
- c. The shaft should extend a minimum length of 2.5 m above the ceiling of the highest storey which is served by the shaft (see note below).

- d. The cross-sectional area (free area) of the smoke shaft should be at least 1.5 m², with a minimum dimension of 0.85 m in any direction.
- e. The vent, the opening at the head of the shaft and all internal locations (such as safety grilles) within the shaft should have a free area of at least 1.0 m².
- f. The top of the vent should be located as close to the ceiling as is practicable and should be at least as high as the top of the door connecting to the stairwell.
- g. The lobby or corridor vents, in the closed position, should have a minimum fire and smoke resistance performance of 30 min and integrity (leakage) no greater than 360 m³/h/m² when tested in accordance with BS EN 1366-2.
- h. The smoke shaft should be constructed either of non-combustible materials conforming to BS 476-4 or of any material which, when tested in accordance with BS 476-11, does not flame or cause any rise in the temperature on either the centre of the specimen or the furnace thermocouples. The smoke shaft should run vertically from top to bottom with no more than 4m of the shaft at an inclined angle (max 30°).
- i. No services other than those relating to the smoke shaft should be contained within the smoke shaft.
- j. The smoke shaft should be located at the remote end of the corridor away from the staircase. (Neither are adjacent to the stair and it is considered that they are a remote as practically possible in the respective lobbies and corridors in which they are provided).

Particular notice should be paid to b and c of this list to ensure that the shaft extends adequately above the building.

All remaining AOV's will remain closed, unless over-ridden by the Fire Service during firefighting operations.

A specialist sub-contractor / the M&E consultant should provide a detailed design of these elements.

Also, the lobby serving the bin store on each floor is required to be provided with 0.2m² permanent ventilation. This should go directly to fresh air via fire resisting construction where it passes through compartmentation. It is proposed to duct the ventilation through openings which have been previously made in the building's floors.

The duct will run the height of the building and discharge to fresh air at roof level, which is considered to be acceptable. The duct will require fire and smoke dampers where it passes through compartment floors.

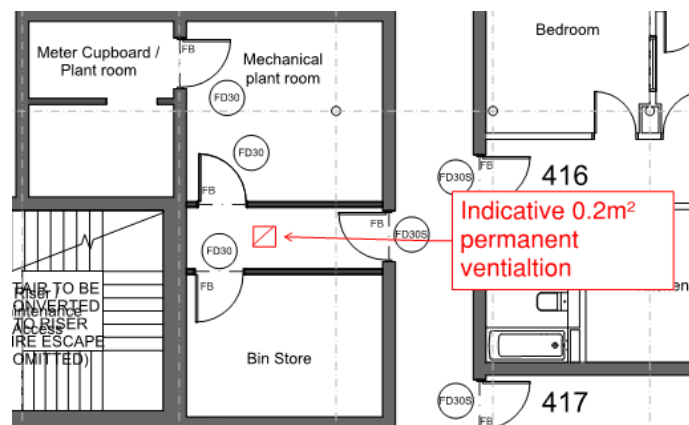


Figure 4. Bin store ventilation (indicative)

3.3.2 Stairs

A vent to the outside with a minimum free area of 1m^2 should be provided at the head of the escape stairs, these will be remotely operatable at the buildings access level for the use of Fire and Rescue Service personnel.

The vent in the stair should open automatically on detection within any of the common corridors serving the stair.

3.4 Dampers and ducts

3.4.1 Flats

The flats are ventilated on a day to day basis by ductwork which serves all of the flats. Dampers should be provided to duct work where the duct work enters the flat on the compartment line.

These dampers should be activated on fire and smoke detection. The detection needs to be located so that smoke cannot spread from one apartment to another without being detected and operating the fire and smoke dampers.

A detector in the apartment of fire origin would achieve this, but as access for maintenance may be difficult in this scenario, it is proposed that detection be provided within the duct work.

3.4.2 Main ventilation

Where the ventilation system runs through the floors, it can either be provided with a fire and smoke damper:

- On the floor slab, or
- It can be provided in a fire rated riser (60 min) and the damper be provided where it enters or leaves the riser.

3.4.3 Bin Store

The bin store lobby will be provided with 0.2m^2 permanent ventilation. A damper activated by smoke should be provided. The vents can remain open or closed; but on detection the vent on the floor of activation within the lobby should open and all other floors should close (in a similar fashion to the smoke shafts).

3.4.4 Construction

Fire dampers are ES Rated both in the existing units and new units.

3.5 Automatic suppression

It is proposed to provide suppression to the flats and rooms accessed from the common area within the building.

Residential sprinkler systems should be designed in accordance with BS 9251-2014 *Fire sprinkler systems for residential and domestic occupancies – Code of practice* and BS DD 252 *Components for residential sprinkler systems – Specification and test methods for residential sprinklers*.

In accordance with Table 2 in BS 9991:2015; a Category 2 system should be provided, using the density of 4 mm/min for single head operation, or 2.8 mm/min through each sprinkler operating simultaneously up to a maximum of two sprinklers in a single area of operation.

The water duration of the supply should be a minimum of 60 min, because of the reduction in fire resistance as detailed in Section 6.1.

The design of the system should be carried out by a specialist sub-contractor. The system should be provided throughout, including the rooms accessed from the common areas of the residential floors, which will be part of the same BS 9251-2014 system. Sprinklers do not need to be provided in the common areas such as stairs, stair lobbies, corridors or landings as these are managed areas (by the caretaker) which should be fire sterile.

The sprinkler coverage does not extend to the ground or basement floors.

3.6 Emergency lighting provisions

All escape routes should have adequate artificial lighting. If the mains electricity power supply fails, escape lighting should illuminate the route (including external escape routes).

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

Escape lighting should conform to BS 5266-1.

3.7 Signage

All exits and exit routes will be clearly marked with appropriate escape signs so that the occupants can easily determine their most direct route to a place of safety in the event of an emergency.

The emergency exit signage to be installed will comply with the recommendations of BS 5499: Part 1 and the Health and Safety (Safety Sign and Signals Regulations 1996).

4. Means of escape - Residential

4.1 Flats

The flats at Victoria Mill are of an 'open-plan' nature as they are not provided with protected entrance halls.

Although, the hallway is not enclosed in fire resisting construction, the walls will inherently provide a degree of protection and reduce the amount of smoke spread. Furthermore, the cooking facilities are considered to be remote from the escape route. The sprinkler system will also provide coverage to the entrance halls of the flats.

The sprinkler provision will also limit the size and spread of a fire in the kitchen area and, therefore, the risk of the open plan kitchen areas is considered to be negligible with the provision of an LD1 detection and alarm system.

In flats where the kitchen is located behind a wall close to the escape routes such as in flat 204 for example, BB7 deem the risk to be mitigated. This is due to the combination of the partitioning, sprinklers, and distance of which the cooking appliances are from the kitchen door, thus preventing radiation from a fire within the kitchen negatively impacting upon the escape route.



Figure 5. Flat 204 example

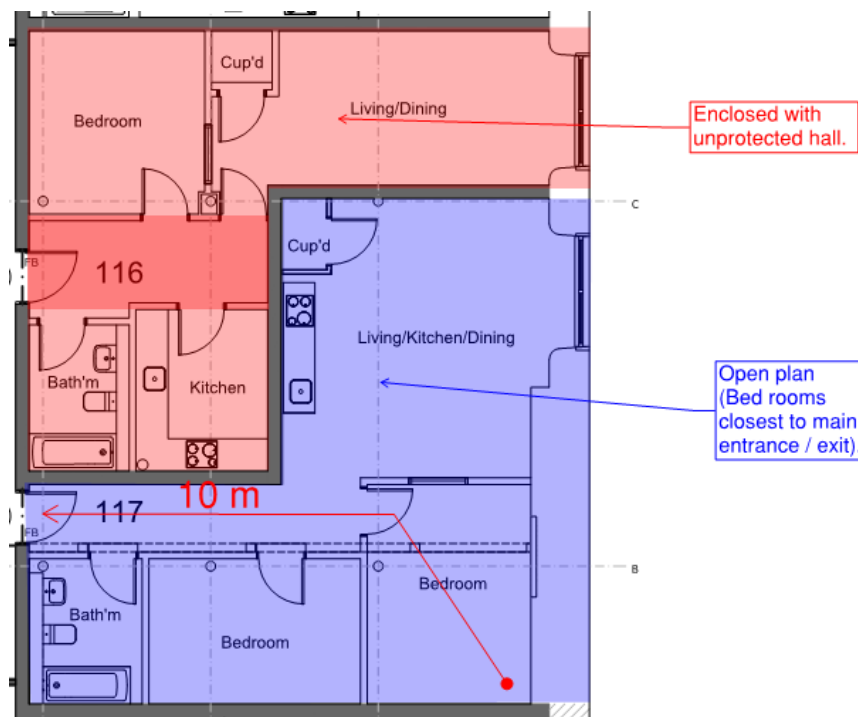


Figure 6. Open plan and non-protected halls

Flat type 117 is the only open plan flat without an enclosed hallway in the development, shown above, and the guidance on open plan flats as detailed in Section 9.7 of BS 9991: 2015 has been followed, which states:

- They should be fitted throughout with a Grade D LD1 fire alarm and detection system in accordance with BS 5839-6:2019, as well as an AWFSS (automatic water fire suppression system).
- The size of the open plan flat should not exceed 16m x 12m.
- Open-plan flats should be situated on single level only.
- The ceilings within the open plan flat should have a minimum height of 2.25m.
- The kitchen should be enclosed in open plan flats having an area exceeding 8m x 4m. Cooking appliances in open-plan flats having an area smaller than 8m x 4m should not be adjacent to the entrance of the flat.

The area of Flat 117 is marginally greater than the recommended 8m x 4m (approx. 9.5m x 10m (95m²)). However, the area is considerably less than that permitted if the kitchen was enclosed (i.e. 16 x 12 = 192m²).

More importantly the travel distance is much less than that considered under the NHBC Foundation review of open plan flat layouts (Figure 7).

It can be seen from Figure 6 that the travel distance is 10m within the apartment from the sleeping risk area.

In Figure 7, an adjusted plan showing that, in principle, the travel distance could be up to 28m (from the furthest point in the enclosed kitchen). In Figure 8, the NHBC layout with an open plan kitchen is 9m. However, in the NHBC case, the occupant would need to escape through the living space, whereas in apartment 117, the escape is passed the living space for a distance

of circa 1m. The rest is within a corridor, which whilst not protected, is considered less of a risk.

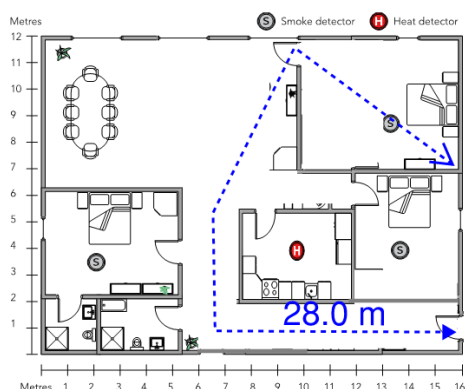


Figure 7. NHBC foundation open plan (amended)

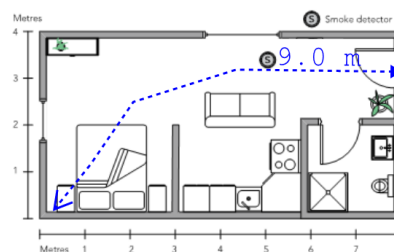


Figure 8. NHBC open plan kitchen

Additionally, statistics show that doors between the kitchen / living area and the hall are held open 80% during the day and 60% at night which effectively renders them useless. As such, the provision of AFD and sprinklers is considered to reduce the risk more than if the kitchen was enclosed.

On this basis, adequate means of escape is considered to be provided but this will be subject to approval from the AHJ.

The Building Control officer has expressed concern that the layout of the kitchen could be changed in the future. BB7 do not see this as any greater risk than people leaving a kitchen/hall door open or removing the door in a code compliant apartment.

However, to address this concern, it is recommended that the flat ownership / tenancy agreement should also ensure that building control approval is sought before any buyer can alter the apartment layouts (e.g. relocate kitchens, specifically ovens and hobs).

4.2 Common areas

The building is provided with two dedicated means of escape stairs and there are more than three storeys above ground. As such, the sections of corridor directly adjacent to stairs are required to be provided with ventilation. Based on the provision of sprinkler protection in the flats, the permitted travel distances are 15m where there is only one direction of travel and 60m where there is more than one direction of travel in accordance with Figure 7 of BS 9991:2015, as replicated in Figure 9 below.

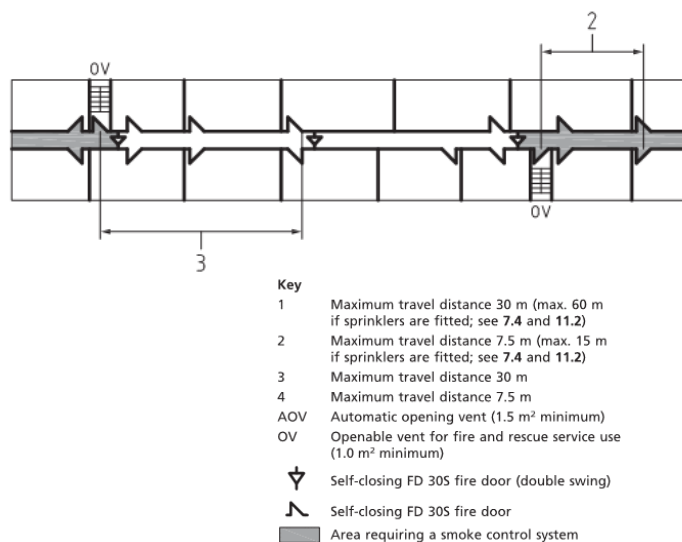


Figure 9. Common areas in a multi stair building

As per Section 3.2 of this report, natural ventilation shafts are being installed to provide natural ventilation to both staircases. It is noted that the ventilation is provided in the corridor rather than the lobby in front of the stair. However, this is considered to be a benefit as it provides additional separation. The ventilated areas are shown in the Figure 10 below.

It can be seen in Figure 10 that the travel distance within the common areas is within the permitted 60m limit.

The arrangement at Victoria Mill differs from the that of Figure 9, however, the following demonstrates it meets the principles of the guidance and it is at least equivalent:

- The lobbies adjacent to each stair are ventilated and separated from the rest of the corridor with 60 minutes fire resistance.
- The travel distances in two directions are within the 60m criteria for sprinklered apartments, and only just over 30m.
- There is a cross corridor door separating the two stairs, so that the travel distances are limited in an unventilated corridor.
- The dead ends are less than 15m (approximately 7.5m) until two directions of escape are possible
- Where two directions of escape are possible, a door is provided at the dead-end point, so occupants at that point can escape away from signs of smoke or fire.

Extra protection by the inherent layout has resulted in each stair having a sterile lobby with no flats opening onto it. This means that there are always three doors between a potential fire in an apartment and the stair. This is all illustrated within the following two figures.

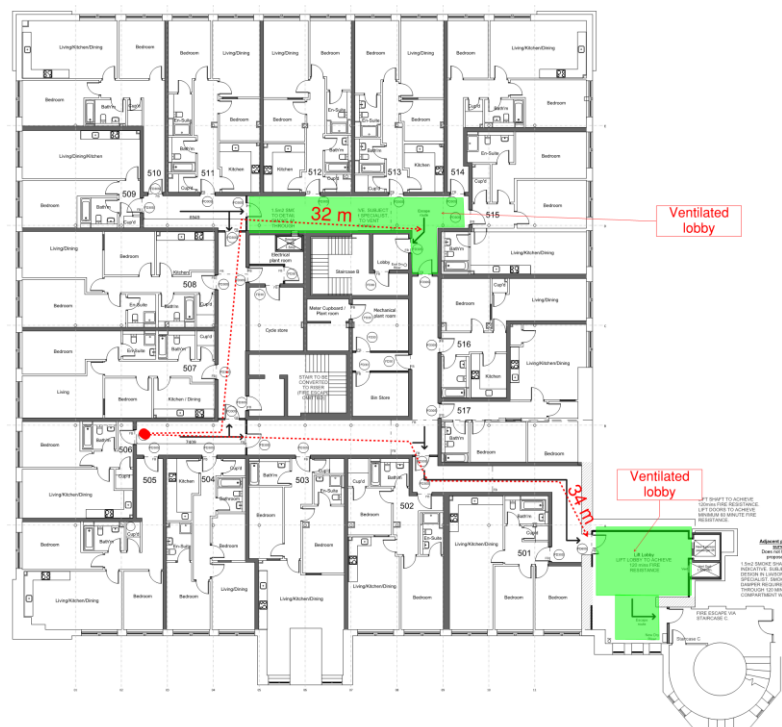


Figure 10. Travel distance and ventilation in the common areas

Due to the layout of the corridor, there are also 'dead ends' created. The cross-corridor doors are provided as highlighted in the following figure to reduce the risk from the dead ends and prevent smoke spread between the means of escape routes.

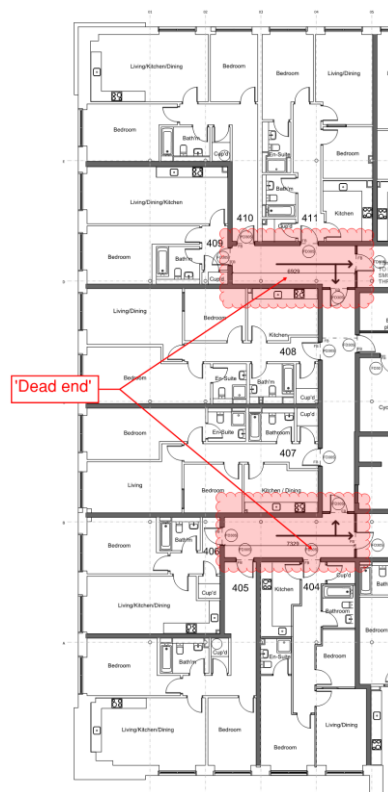


Figure 11. Dead end separation

4.3 Storage areas

BS 9991: 2015 states that Ancillary accommodation (the plant, cycle and bin store rooms) generally presents a greater fire hazard than the dwellings themselves because the accommodation might only be visited occasionally and is thus not under regular surveillance.

Ancillary accommodation should meet the following recommendations.

- a. In multi-stair buildings:
 - i. ancillary accommodation should be separated from any stair by a protected lobby or protected corridor at the storey in which the accommodation is situated;
 - ii. ancillary accommodation should be separated from any common corridors by a protected lobby where the escape route is in a single direction (Which there is not in this building).
- b. Ancillary accommodation should be separated from other parts of the building in accordance with Table 15 and, where necessary, have ventilated lobbies in accordance with Clause 13 and 14.1.6.
- c. Emergency escape lighting should be provided.
- d. All ancillary accommodation, with the exception of communal lounges, common amenity areas and transformer, switchgear and battery rooms for low voltage or extra low voltage equipment, should be treated as places of special fire hazard (see Clause 38).

The location of the rooms accessed from the common area are considered to exceed the expectation of the guidance. Additionally, the bin stores are entered via a protected lobby which has 0.2m² permanent ventilation. All are covered by an L3 alarm system (this should be

the minimum decibels to avoid confusion with the residents. The sound in lobby, should not permeate into the corridor), there should be an acoustically robust door, and they also have sprinkler protection.

Thus, BB7 deem these measures will mitigate the risk which the rooms had the potential to cause.

It has been confirmed by the client that notices will be displayed throughout the site advising residents of what to do in the event of the fire alarm. Furthermore, the caretaker / key holder will investigate any activations in the rooms accessed from the common area. These rooms should be checked on a weekly basis and a pager could be available for management to review alarms / call the FRS.

The rooms will be managed and accessed by the caretaker / key holder only.

This is subject to approval with the AHJ.

4.4 Escape widths and final exits

Section 28 of BS 9991 recommends that the width of each common stair should be not less than 750mm, while a firefighting stair should be not less than 1100mm.

Staircase B is 1400mm and Staircase C (firefighting stair) have both been measured from the plans as 1900mm (clear widths) thus, sufficient escape capacity is provided.

At Victoria Mill neither of the two escape stairs discharge directly to the outside, thus, the corridors extending to the outside from the stairs require the same level of protection as the stair and the same width to avoid the escape route narrowing. This is shown in Figures 12 and 13 below with the blue lines representing 90 minutes fire resistance (REI) duration due to the ground floor having no sprinkler protection.

4.4.1 Staircase B

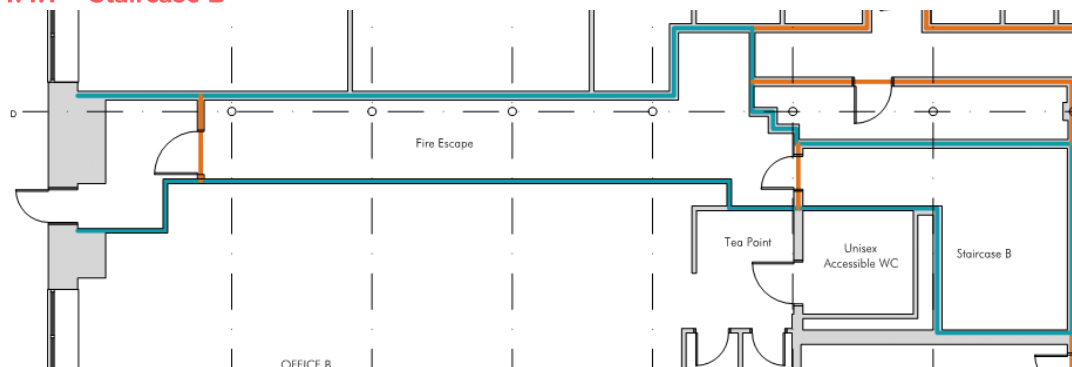


Figure 12. Staircase B protected escape route

It is noted that the existing building is connected to the NHS accommodation at ground floor, however, the residential stair does not share the escape route with any other accommodation and the route is separated by 90 minutes fire resistance, as shown. No doors from the NHS open into the escape routes used by the residential or provide a route between the two. Nor should areas not under the management of the building open into the residential space.

4.4.2 Staircase C

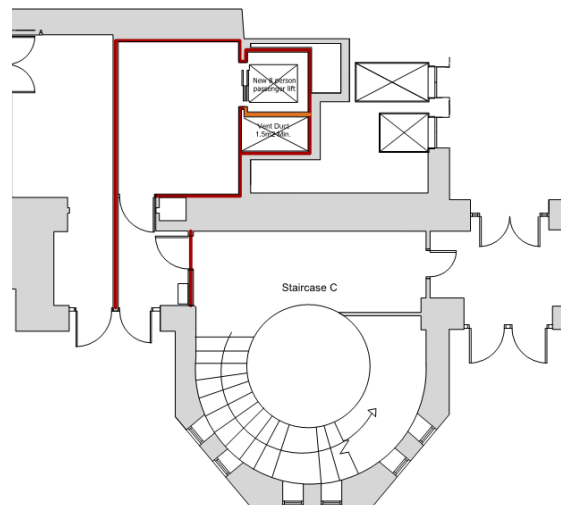


Figure 13. Staircase C protected escape route

It is understood that there is ventilation (natural at ground floor and mechanical on the upper floors) provided to the common areas serving the adjacent residential accommodation which is considered to provide adequate protection between Staircase C. (This is the areas entered via the door on the right hand side of staircase C).

In accordance with Section 30 of BS 9991, where there is more than one common stair from an upper storey, at least one such stair serving the upper storeys should terminate at ground level. Any other stair may connect with the basement storey, provided that it is separated from the basement level by a protected lobby. It has been confirmed by the client that the basement at Victoria Mill is completely separate from the residential development and the existing entrance to the basement from staircase C will be blocked up and separated with fire resisting construction.

It is noted that there are post boxes located in the lobby serving stair C, however, this is considered to be reasonable based on the provision of a 60 minutes fire resisting enclosure, (RE) a sloping top to prevent storage, and appropriate management by the caretaker.

It is noted that large parcels have been historically left beside post boxes if they are too big, therefore, procedures should be implemented to keep this area as fire sterile as possible. It has also been confirmed that when mail that does not fit into the post boxes, the postman will buzz the relevant apartment, if no one answers then they put a note in the apartment mail box and take the mail back with them.

4.4.3 Stair void

The existing building has a third staircase, however, it is not to be used for escape purposes in the proposed redevelopment.

The stair void (formally stair A) is to be used as a riser for some services in the building but predominantly it is void. As such it is proposed that the following measures are incorporated to ensure adequate means of escape from the riser:

- The stair void will be fully separated with fire resisting construction (see Table 6.1) from the upper levels. The only access to the void is via a door on the fifth floor and a door at ground, whilst this might result in long travel distances within the stair, the following means it is considered acceptable:
 - The space has the protection of a stair, which has no travel distance limitations.

- It will be used infrequently and by trained personnel who are awake and have been familiarised with the building.
- Any risers within the void space will be contained in separate shafts with fire resisting construction.
- It will not be used for storage. The caretaker/building management should manage this.
- A door is provided at the base of the stair void so that when people exit, they have two routes for escape (see Figure 14 below).
- Any detection covering the corridor should also be linked to sounders within this area.
- Any detection in the adjoining NHS site will activate the sounder in the riser as they potentially share an escape route.

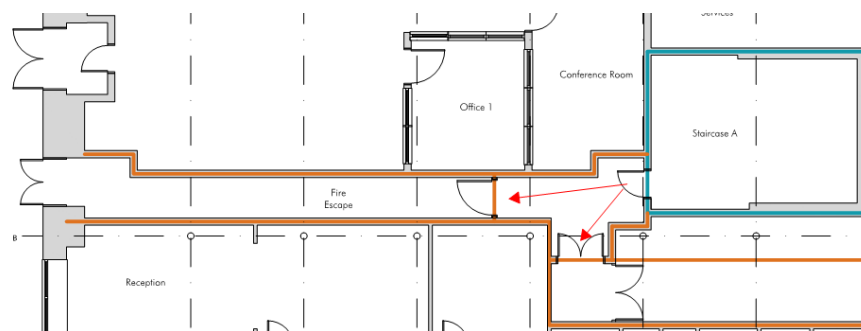


Figure 14. Ground floor alternative escape

This arrangement is subject to approval with the AHJ.

4.5 External escape routes

Any part of the external wall adjacent to an escape route (i.e., in Figure 12 where Staircase B discharges) should be clear of any risk from fire or smoke.

The distance between any opening in the external enclosure to the building and any opening in the enclosure to the stairway should be not less than 1.8m.

This is achieved on staircase C, by the nature of the brick construction, as seen in Figure 13 above.

This is usually only applied to the stair and not to the final escape routes from the stair, however, this interpretation is to be agreed with the AHJ.

As a further justification: the building is listed and existing, it is not considered reasonably practicable to provide fire resistance to either side of the stair discharge route from Stair B. The glazing is at 180° from the escape route and people can quickly disperse in any direction as there are two stairs within the building.

4.6 Mobility impaired persons

Disabled refuges are not required within residential accommodation on the basis of the high levels of compartmentation and 'stay-in-place' evacuation strategy. They are also not practical due to the lack of management.

However, due to the provision of sprinklers, two directions of escape and subdivision of corridors, this building is considered safer than a code compliant building without these benefits.

5. Means of escape – Ground floor & basement

The ground floor is occupied by existing NHS office accommodation. The drawings provided by the architect are noted to be indicative as an accurate survey has not been undertaken, however, the following is considered to demonstrate that adequate escape is provided.

Office accommodation is not covered under the guidance in BS 9991, therefore, the ground floor and basement has been considered in accordance with guidance in Approved Document B – Vol 2 (2019 incorporating 2020 amendments).

5.1 Occupancy

The design occupancy of the office has been based on the $6\text{m}^2/\text{person}$ floor space factor, as per Table D1 of ADB.

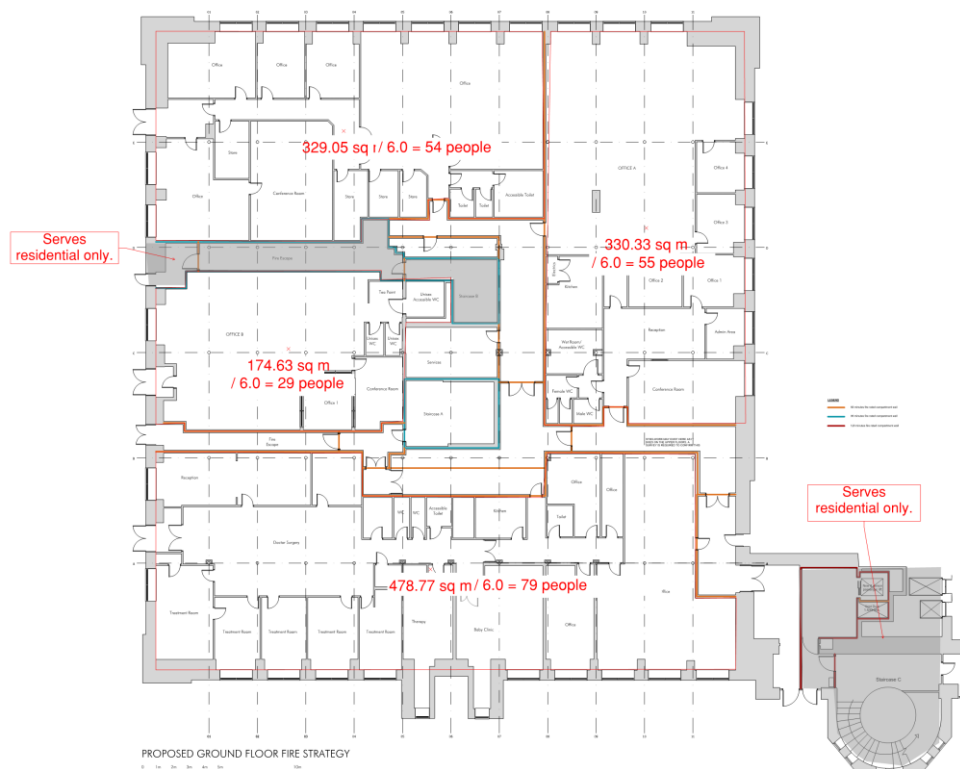


Figure 15. Office occupancy

In the basement, the occupancy is expected to be transient with no permanently occupied areas, due to the nature of the proposed spaces (e.g. plant, void, server etc).

5.2 Escape principles

There is no shared access/escape between the residential element and the offices on the ground floor. The office accommodation should operate a simultaneous evacuation strategy where, in the event of the activation of the fire detection and alarm system, all occupants will evacuate.

In the event of a fire alarm on the ground floor, this should not result in an alarm / evacuation of the flats on the upper floors. This is acceptable based on the compartmentation provided between the different uses.

Detection and alarm in the basement should result in simultaneous evacuation of the basement only, again there should be no alarm in the adjacent office or flats on the upper floors.

In the event that the FRS considers it necessary, they may instruct occupants of flats in the first floor to evacuate and, in the unlikely event that the fire does spread, they may conduct a full building evacuation.

5.3 Number of exits and escape widths

In accordance with Table 2.2 of ADB, the following number of escape routes are required.

Table 5.1 **Number of escape routes**

Maximum number of people	Minimum number of escape routes
60	1
600	2
More than 600	3

The ground floor consists of 5 office areas, 2 of which have escape direct to outside and 3 which rely on escape via a central corridor to a final exit, shown in the following figure.

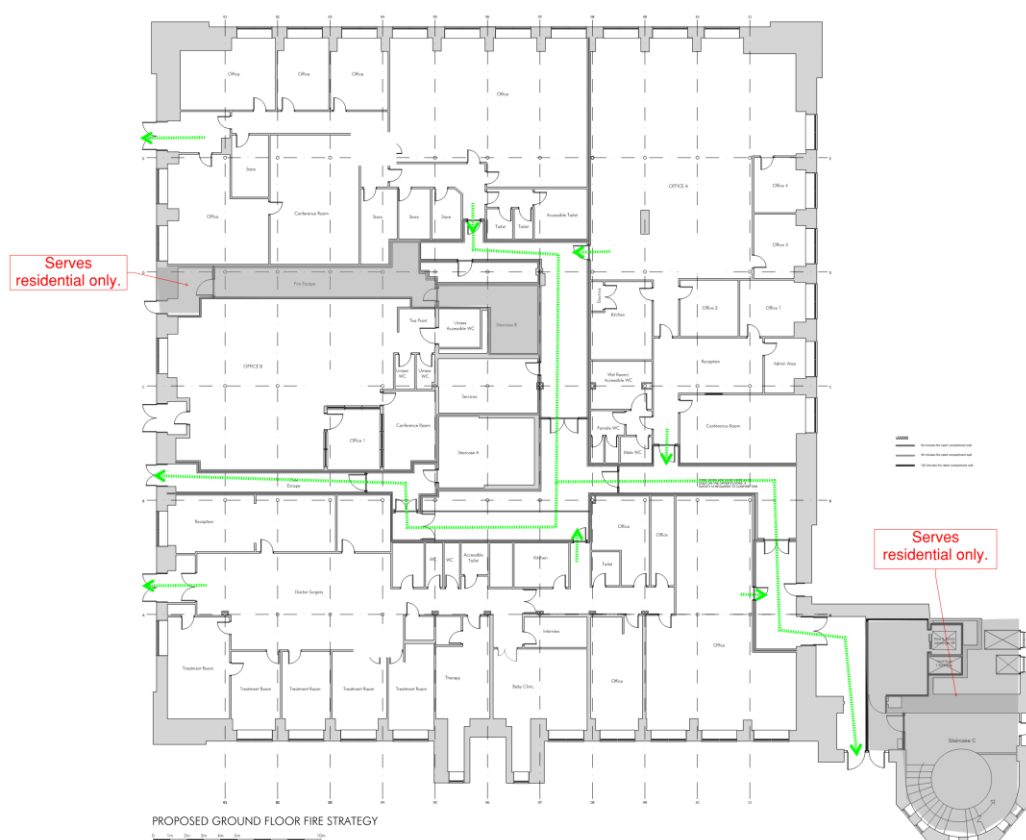


Figure 16. Ground floor escape routes

The basement is expected to have a limited and transient occupancy (i.e. no permanent occupants) and, therefore, likely to be less than 60 people.

In accordance with Table 2.3 of ADB, the following escape route widths are required.

Table 5.2 Width of escape routes

Maximum number of people	Minimum width of escape routes
60	750mm
110	850mm
220	1,050mm
More than 220	5mm per person

The exits on the ground and basement floors are all greater than 750mm and, therefore, adequate escape routes are provided.

5.4 Travel distances

In accordance with Table 2.1 of ADB travel distances within the office should be within the following limits.

- 18m in a single direction; and
- 45m where there is more than one direction.

As shown in the following figure, the distances are within the permitted limits.

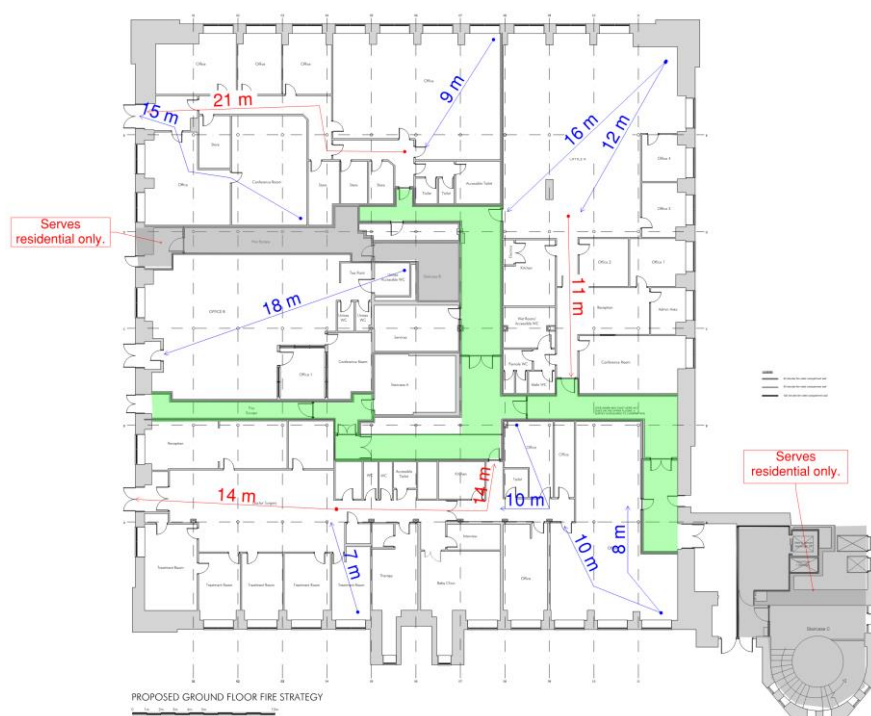


Figure 17. Ground floor travel distances

Distances have been measured to the protected central corridor (highlighted green) which is considered to be a place of relative safety from which occupants can safely travel to a final exit.

Similarly, in the basement, for plant accommodation the travel distances are limited to:

- 9m in a single direction; and
- 35m where there is more than one direction.

The travel distances are shown in the following figure. It is noted that the 'void' has a travel distance of 13m and, as such, should be provided with another escape route.

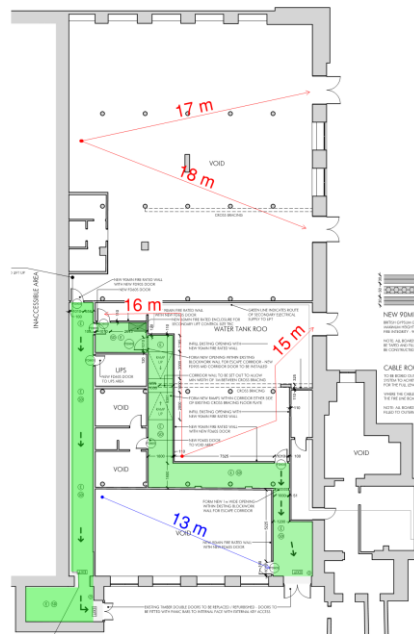


Figure 18. Basement travel distances

5.5 Inner rooms

Inner rooms should be in accordance with Clause 2.11 of ADB which is satisfied if the following is achieved:

- The occupancy is less than 60 people
- The inner room is entered directly from the access room (but not via a corridor).
- The escape route from the inner room does not pass through more than one access room.
- The travel distance from any point in the inner room to the exits from the access room does not exceed the travel distance limits outlined in Section 5.4.
- The access room meets both of the following conditions.
 - It is not a place of special fire hazard.
 - It is in the control of the same occupier.
- One of the following arrangements is made.
 - The enclosures (walls or partitions) of the inner room stop a minimum of 500mm below the ceiling.
 - The door or walls of the inner room contain a vision panel (minimum 0.1m²), so people can see if a fire starts in the access room.
 - The access room is fitted with an automatic fire detection and alarm system to warn occupants of the inner room if a fire starts in the access room.

Any inner room arrangements, e.g., the internal meeting rooms / offices, will comply with the above recommendations with automatic detection in the access rooms, as shown in the following figure.

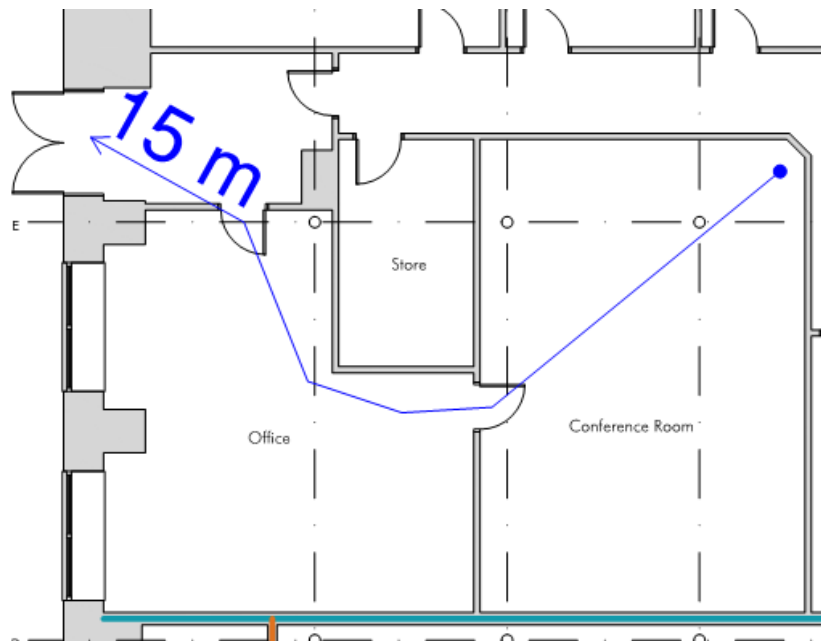


Figure 19. Inner conference room

5.6 Protected corridor

As highlighted in Figures 17 and 18, the central corridor at ground floor / basement is protected. As such, it will be enclosed in 60 minutes fire resisting construction and doors opening into it should be FD30S.

Cross corridor doors within the protected corridor are also required in order to separate exits and as the corridor is greater than 12m long. The doors should be FD30 with a self-closing device. The following figure highlights where these have been provided and the orange lines show 60 minute fire resisting walls.

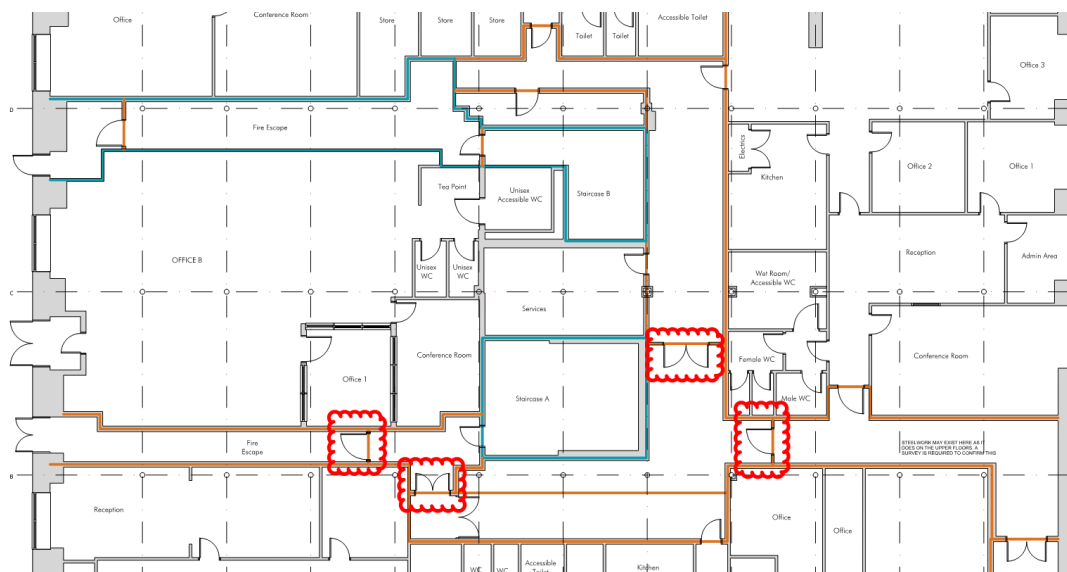


Figure 20. Protected corridor

5.7 Final exits

All final exits lead directly to outside and are sited so all occupants can move freely away from the building.

The width of final exits is not less than the minimum width required for the escape route(s) they serve.

5.8 External escape routes

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

- Within 1,800mm of the escape route.
- Up to 1,100mm above the surface of the escape route.

5.9 External walls adjacent to escape stairs

Where the wall of an escape stair projects beyond, is recessed from or creates an internal corner with the external wall of the building, at least 30mins fire rated construction should be provided for a horizontal distance of at least 1,800mm and for the full vertical height.

Refer to Diagram 3.3 of ADB.

5.10 Mobility impaired persons

On the ground floor, management procedures should be implemented to account for occupants who would need assistance in the event of a fire. As escape is direct to outside, this is not considered to require refuge areas.

Similarly at basement, procedures should be considered. The occupancy is considered to be transient and anyone entering the basement would not do so without permitted access.

6. Internal fire spread (linings)

6.1 Wall and ceiling linings

All wall and ceiling linings will comply with the relevant guidance, as per clause 20.1 of BS 9991 with the required classifications shown in Table 5.1 below.

Table 6.1 Classification of linings

Location	Classification
Small rooms of maximum internal floor area of not more than 4m ²	D-s3, d2
Other rooms Circulation spaces within a dwelling	C-s3, d2
Other circulation spaces including the common area	B-s3, d2
Small rooms not exceeding 30m ² (office and basement)	D-s3, d2

The European classifications are described in BS EN 13501-1:2007, *Fire classification of construction products and building elements*, Part 1: *Classification using data from reaction to fire tests*.

7. Internal fire spread (structure)

7.1 Loadbearing elements of structure

Loadbearing elements of structure include the structural frame, floors, and loadbearing walls.

Originally the fire resistance period of the building should have been 90 minutes but since the building is provided with sprinkler protection and the height of the topmost storey is 19.3m, in accordance with BS 9991, all loadbearing elements of structure can be reduced to a minimum of 60 minutes fire resistant construction. (The sprinkler system should be upgraded to category 2, to allow for this).

However, the ground floor of the building is not fitted with sprinklers which as a result means the floor slab separating the ground and first floor as well as any risers / stair void should achieve 90 minutes fire resistance. Also, staircase B between ground and first floor level should have 90 minutes fire resistance.

If one element of structure supports or stabilises another, as a minimum the supporting element should have the same fire resistance as the other element. Therefore, any elements of the existing basement / NHS supporting the upper levels should achieve the same fire resistance as the other element.

7.2 Compartmentation

The spread of fire within buildings can be restricted by sub-dividing into compartments separated from one another by walls and / or floors of fire resisting construction.

The following table is reliant on the sprinklers being provided on the upper floors to a Category 2 standard with an increased supply duration of 60 minutes.

Table 6.1: Compartmentation requirements

Area / element of structure	Minimum fire resistance period (minutes)	Fire door	Type of exposure
Elements of structure	60	N/A	Exposed face
Compartment floors (between ground and first)	90	N/A	From underside
Compartment floors (upper floors)	60	N/A	From underside
Compartment walls (between flats)	60	N/A	Each side separately
Walls between flats and the common area	60	FD30S	Each side separately
Rooms accessed from common area/refuse stores	60	FD30S	Each side separately
Protected stair Staircase B*	60	FD30S	Each side separately
Stair void Stair A*	60	FD30	Each side separately

Area / element of structure	Minimum fire resistance period (minutes)	Fire door	Type of exposure
Lobby to Staircase B / Stair discharge route**	90	FD30S	Each side separately
Firefighting shaft Staircase C	120	FD60S	Each side separately
Firefighting lobby / firefighting shaft discharge route	120	FD60S	Each side separately
Firefighting Lift	60 (between shaft and lobby)	FD30**	Each side separately
Protected shafts / risers	60	FD30S	Each side separately

* Between ground and first floor level staircase B / stair void should have a 90-minute fire resistance duration due to the ground floor not being sprinklered.

** Smoke seals are not required to lift car doors.

For further guidance, firefighting shafts should be constructed in accordance with Figure 20 and 21 of BS 9999:2017.

7.2.1 Ground floor & basement

In accordance with Table 8.1 of ADB, there are no limits on compartment size for office accommodation. As such, the ground floors is not required to be divided with compartment walls.

However, as detailed above, a 90 minute fire resisting compartment floor is required between ground and first floor.

Although compartment walls are not required, 60 minute fire resisting walls should be provided to the central protected corridor to provide a place of relative safety for occupants evacuating along with separating the different occupancies.

In accordance with Section 8.11c, the floor of the ground storey should also be a compartment floor, if the building has one or more basements. This should also be 90 minutes fire resisting.

The basement area is considered to be 'storage and other non-residential in accordance with Table 8.1 of ADB, as such, for a building greater than 18m, the maximum floor area would be limited to 4000m². The area of the basement is less than the permitted limit and, therefore, is not required to be divided with compartment walls.

See Appendix 2 for further detail on the existing structure at ground floor.

7.3 Protected shafts

Any stairs, ventilation shafts and service risers (containing pipes, ducts or chutes), which pass through a compartment floor need to be constructed as protected shafts and provided with a minimum of 60 minutes fire resistance. The doors to the shafts should be provided with half the period of fire resistance to the shafts which they serve (i.e. FD30).

Risers passing through compartment floors should be protected as a complete shaft or at each floor level with the appropriate fire stopping to avoid fire spread. This includes the stair that has been converted to a riser as mentioned in section 4.4.

Note: Where shafts pass between ground and first floor, there should be fire stopping at the base providing at least 90 minutes fire resistance.

7.4 Concealed spaces (cavities) and fire stopping

Suitable provisions should be made to prevent the unseen spread of fire and smoke through cavities or concealed spaces by the use of cavity barriers. The provision of any such barrier should meet the general recommendations of Section 19 of BS 9991.

Openings in any fire-separating element (e.g. compartment wall, cavity barrier, protected corridor, etc.) should be protected with appropriate fire stopping or sealing to ensure that the fire resistance of the elements is not compromised. The provision of any such protection should meet the general recommendations of Section 21 of BS 9991.

The existing upper floor is made up of Caberfloor with 25mm of EPS below it. Wooden thresholds have been provided below the fire doors within the corridors, to break up the existing combustible material in the floor and break the cavity within the floor. These are at least 38mm thick, at 100mm and they are 50mm in height.

8. External fire spread

8.1 Space separation analysis

Under the guidance of BS 9991:2015, the external walls of the building must adequately resist the spread of fire from one building to another. This is achieved by ensuring the development has sufficient spatial separation from adjacent buildings.

The risk of external fire spread has been assessed using the BRE 'Enclosing Rectangle' method from the BRE report No. 187: 2014.

Based on the provision of compartment walls and floors between each apartment, it is proposed to assess the unprotected area based on the assumption that only a single apartment is emitting thermal radiation. The largest (worst case) flat will be assessed and if it is determined that the separation distances are adequate, it will be assumed that the remaining flats also have adequate separation distances.

The distance has been measured to the site notional boundary (red dotted line) on each elevation, as shown in the following figure.

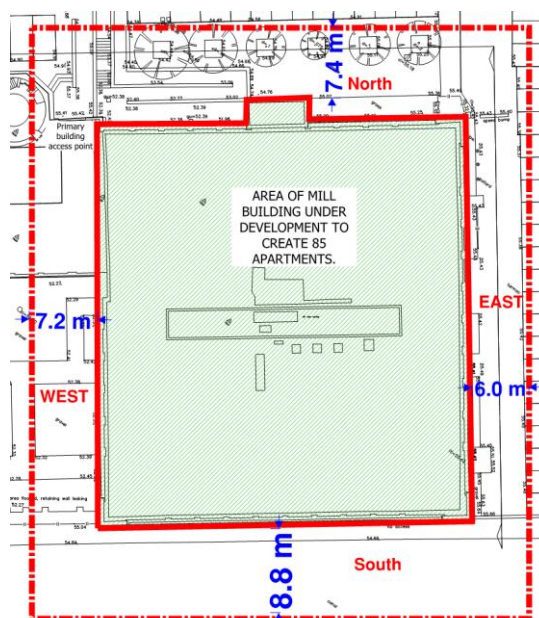


Figure 21. Site plan

The notional boundary applied to Victoria Mill in Figure 20 is based on ensuring the adjacent section of the building (separated by courtyard) as well as the nearby parking facilities are a safe distance from the building in the event of a fire in any of the building's compartments.

In accordance with section 18.4 of BS 9991:2015, if a building is fitted throughout with sprinklers, the boundary distance can be halved, to a minimum of 1m. As detailed in Table 7.1, the required distances from Table B of BR 187 have been halved.

The building is brick and therefore the non-glazed areas are likely to provide adequate protection. These have not been included within the calculations and it is presumed they are 100% unprotected.

Table 8.1 External fire spread assessment

Elevation	Unprotected area (Height x width)	Enclosing rectangle (Height x width)	Unprotected	Required distance*	Distance provided	Acceptable (Yes / No)
North	3.86m x 16.2m	6m x 18m	100%	3.25m	7.4m	Yes
East	3.86m x 19.0m	6m x 21.0m	100%	3.5m	6m	Yes
South	3.86m x 24.9m	6m x 27m	100%	3.75m	8.8m	Yes
West	3.86m x 24m	6m x 24m	100%	3.75m	7.2	Yes

*Required distance has been halved due to the provision of sprinklers throughout.

Based on the required boundary distance being less than the distance provided to the notional boundary there is considered to be little risk of external fire spread and no requirement for additional fire resistance or fire rated glazing to the façade.

8.2 Ground floor

As the ground floor is existing, no change of use occurs, or alterations to the external façade are being proposed, there is no requirement under the Building Regulations to re-assess the potential for external fire spread to adjacent buildings.

8.3 External wall construction

In accordance with section 18.2 of BS9991:2015 a building with a storey height greater than 18m above ground level, any cladding material, insulation product, filler material etc, used in the external wall construction should be of limited combustibility.

Nonetheless, BB7 would recommend that external walls (especially insulation and cladding) are European Class A1 or A2. Additionally, it is recommended that ACM is not used on the façade unless it is of limit combustibility. Any materials which could increase the chance of fire spread should be considered carefully and omitted from the design where they are considered to result in undue risk of disproportionate fire spread.

Whilst this is over and above the guidance we consider that it is of benefit to the safety of the occupants and the reputation of the construction company/client.

Cavity barriers in any external wall cavity are required in accordance with Section 9 of ADB. It is important to note that cavity barriers should be provided at compartment floors, compartment walls (including between flats) and around windows, doors and other openings.

It is noted that the façade is existing, and the vast majority of it is brick and a third party report suggests that there are no cavities. Works are also in place to ensure that the external walls meet a reasonable standard which would not allow fire spread across them.

9. Fire and Rescue Service access facilities

9.1 Access

Fire and Rescue Service (FRS) appliances should be able to park within 18m of and have line of sight to the dry fire main inlet valve for each stair. As shown in the Figures 16 and 17, sufficient access is provided at Victoria Mill.

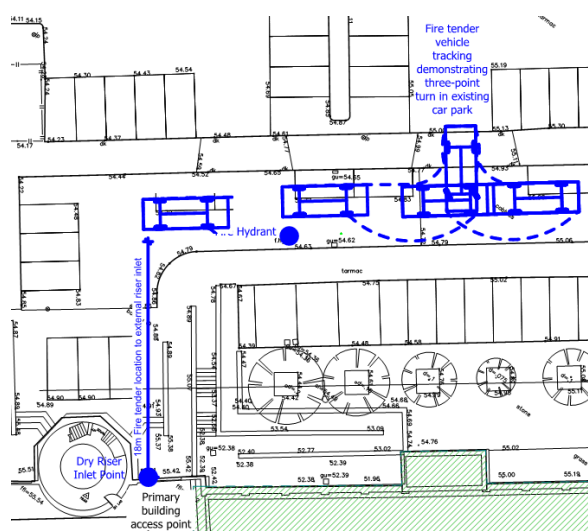


Figure 22. Vehicle access at Victoria Mill to Staircase C

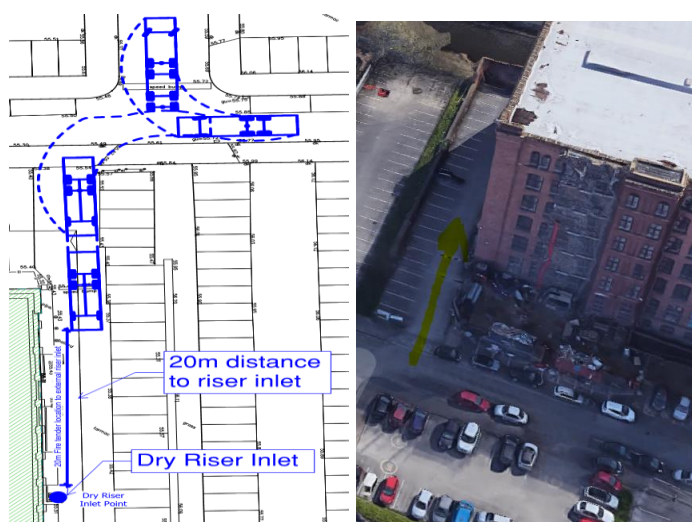


Figure 23. Vehicle access at Victoria Mill to Staircase B

For access to Staircase B, the Fire Service are required to reverse down the side of the building, as shown above.

It is noted that the distance is marginally greater than the permitted 18m from the appliance parking location to the dry riser inlet, however, this is considered to be an onerous assessment as it is likely they could reverse slightly further and hose lengths are greater than 18m.

On this basis, adequate provisions are considered to be made, however this will be subject to approval with the FRS and AHJ.

Access routes for a pump appliance are required to meet the specifications given in the following table.

Table 8.1: Fire service appliance access route requirements

Appliance type	Minimum road width between kerbs (m)	Minimum gateway width (m)	Minimum turning circle between kerbs (m)	Minimum turning circle between walls (m)	Minimum clearance height (m)	Minimum carrying capacity (tonnes)
Pumping	3.7	3.1	16.8	19.2	3.7	12.5

Notes:

1. Fire appliances are not standardised. Some fire services have appliances of greater weight or different size. In consultation with the FRS, the Building Control Body may adopt other dimensions in such circumstances.

2. Because the weight of high reach appliances is distributed over a number of axles, it is considered that their infrequent use of a carriageway or route designed to 12.5 tonnes should not cause damage. It would therefore be reasonable to design the road base to 12.5 tonnes, although structures such as bridges should have the full 17 tonnes capacity.

FRS vehicles should not have to reverse more than 20m from the end of an access road, as shown below.

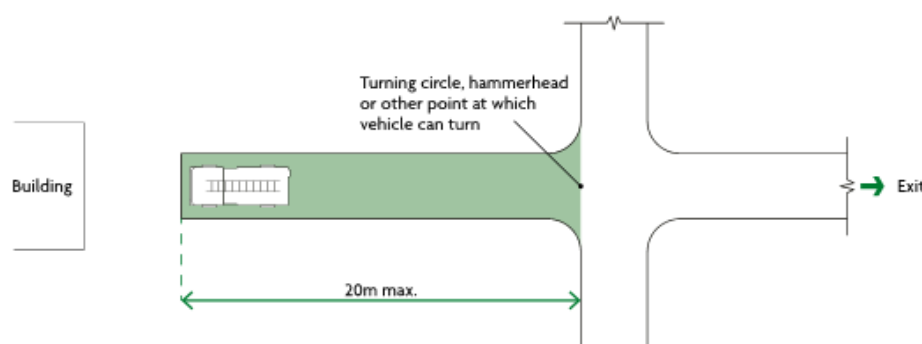


Figure 24. Vehicle turning facilities

Source: ADB

9.2 Facilities

9.2.1 Dry fire mains

The building is provided with dry rising fire mains to allow the FRS to connect a hose from the appliance and run water through the building without having to lay hose throughout.

Dry riser outlets are provided on all floors, including ground as the fire service often set up at least one floor below the fire floor.

Where there is sprinkler protection, the maximum distance from a fire main outlet to the most remote point on every storey should be no more than 60m.

It is essential that a dry riser is maintained within staircase B, this is because the maximum hose lay distance when using a riser from the lobby at staircase C is inadequate as the distance is greater than 60m.

Whilst the existing location of the dry riser outlet is within a stair lobby, due to the additional inherent door, the door to the corridor on the connect floor does not need to be opened.

Figure 19 shows that a single riser outlet located in the firefighting lobby is insufficient and having a second riser installed within the lobby to staircase B would ensure compliance.

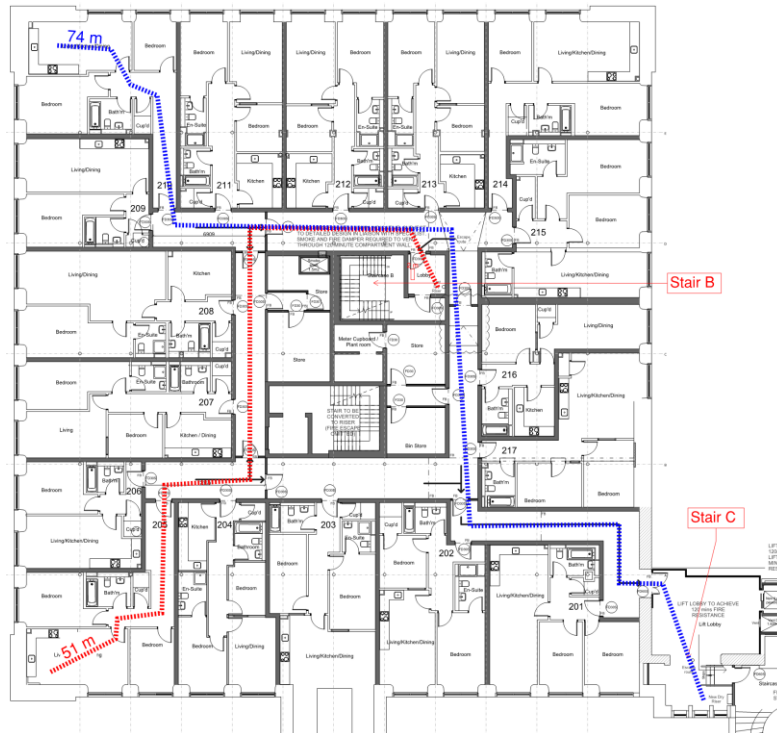


Figure 25. Hose lay distance from both stairs

9.2.2 Staircase C

As the building is greater than 18m in height, Staircase C acts as a firefighting shaft and is provided with the following:

- A stair greater than 1100mm (1500mm provided).
- A ventilated firefighting lobby.
- A dry rising main provided within the stair.
- A firefighting lift.

For the full measures see Section 6 of BS 9991 (Clauses 19-27).

Entrance lobbies into the building, which are included within the firefighting shaft or form part of the escape route should be maintained as sterile areas, (no/low fire load).

The existing lift is being upgraded to a firefighting lift. This will be enclosed in 60 minutes fire resistance and accessed via the firefighting lobby.

Firefighters lift installations should conform to BS EN 81-20 and BS EN 81-72 and additional guidance is provided in Section 20.4 of BS 9991. (See note below on Dual Power).

It should also be noted that staircase C is a shared stair with the adjacent part of Victoria Mill, which is also of residential use, the fire protection within staircase C in both sides of the building has been demonstrated in the following figures. Based on the provision of separation via lobby and ventilation, the layout is considered to be acceptable.

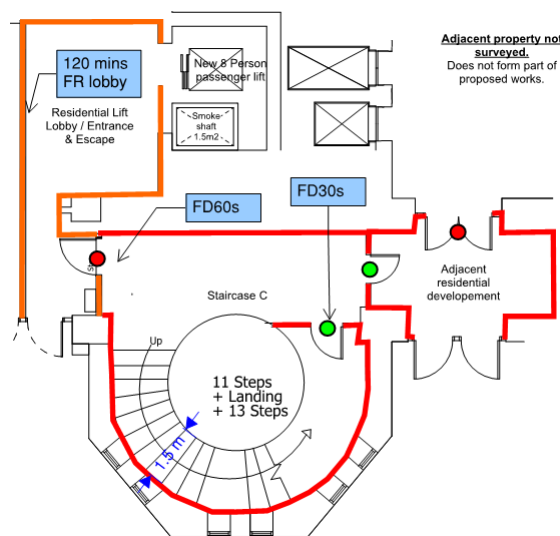


Figure 26. Stair C fire protection ground floor

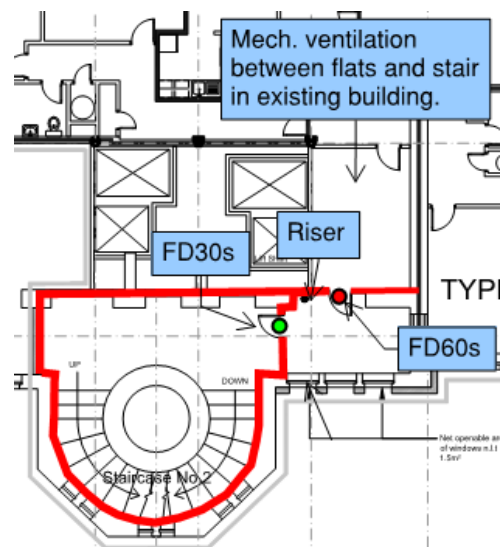


Figure 27. Stair C fire protection - adjacent side (existing building)

It is noted that BS 9999 (2015) does not permit the use of spiral stairs as firefighting shafts, however, the width of the stair is greater than the minimum requirement and the stair has a large radius with treads that do not vary in size. As such, it does not narrow as much as a spiral stair might normally and therefore it would not be challenging to use this for access.

Furthermore, the stair is existing and considered to be the most appropriate in comparison to Staircase B. Nonetheless, it remains subject to the approval of the AHJ.

9.2.3 Power Supplies

A firefighting lift and all other fire safety systems require an independent secondary power supply.

In accordance with the guidance in Section 15 of BS 9991, 'where practicable' power supplies should be provided via two separate intakes into the building from the same external substation or via a single intake and standby generator.

As such it is proposed to use an uninterruptable power supply (UPS). The output of each power supply should be sufficient to satisfy the maximum demands of the system.

If the primary power source fails, then the power supply should be automatically switched over to a secondary power source. Failure of or damage to one of the power sources should not cause the failure of the other power source or the failure of the supply of power to the system.

9.2.4 Staircase B

Staircase B is not a firefighting shaft, however, will require 60 minutes fire resistance construction, 30-minute fire doors with smoke seals installed at every level (except between ground and first floor level where 90 minutes fire resistance duration should be achieved), and have a 1m² ventilator at the head of the stair remotely operable at fire service access level.

Natural ventilation is provided to the common area serving the stair.

9.3 Ground floor & basement

9.3.1 Access

The ground floor and basement can both be accessed directly from outside, due to the sloping site. This is based on the information from the plans and google maps, where available.

The following figure highlights the access at the front of the building (source: google maps). There is also access to the offices on the East elevation via the car park, as shown in Figure 22.



Figure 28. Ground & basement access

On the ground floor, the hose laying distances are considered to be within 45m, as shown in the following figure.

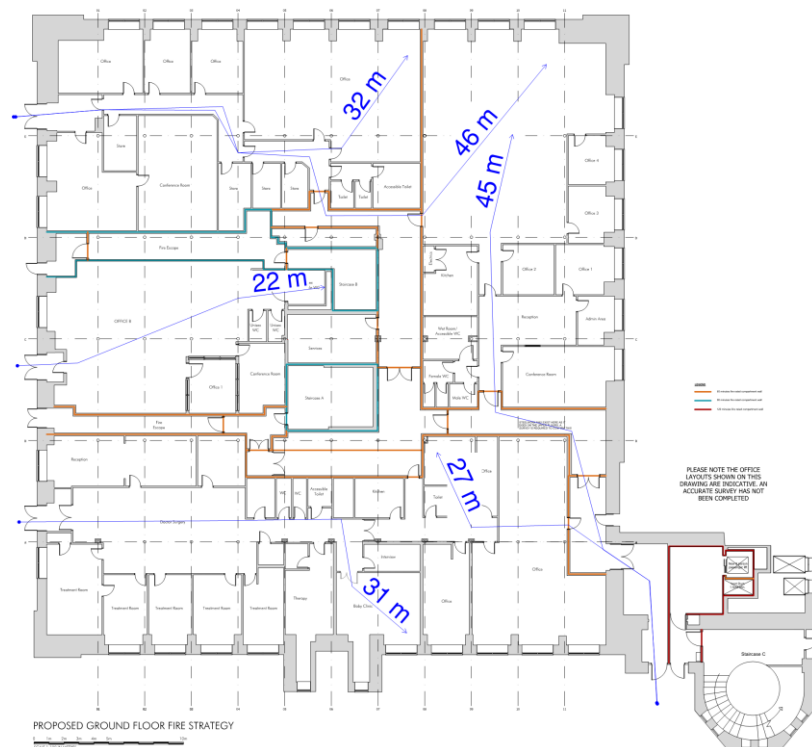


Figure 29. Ground floor hose distances

Similarly, in the basement the hose laying distances are considered to be within 45m, as shown in the following figure. It is presumed that the FRS can reverse as per Figure 22 and then run hose around the building to reach the doors at the back. This should be discussed and approved with the FRS to ensure access is achievable.

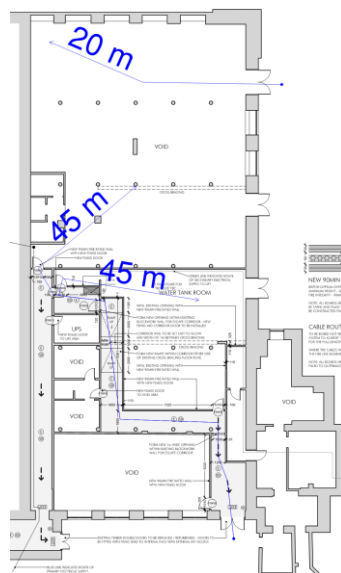


Figure 30. Basement hose distances

9.3.2 Facilities

No additional facilities are required at ground floor for the FRS.

The basement is provided with multiple doors direct to outside/open air and provided they equate to 1/40 of the floor area, adequate natural ventilation will be provided to the ground floor in accordance with Section 18.6 of ADB.

On the basis the floor area = 807m² (approx.), the required area = 20.2m². This should be checked by the relevant members of the design team. BB7 consider that this can be achieved by windows and doors at basement if they open to fresh air.

9.4 Hydrants

As per the Fire Service access drawing, a hydrant is provided at the front of a development, as shown in the following figures.

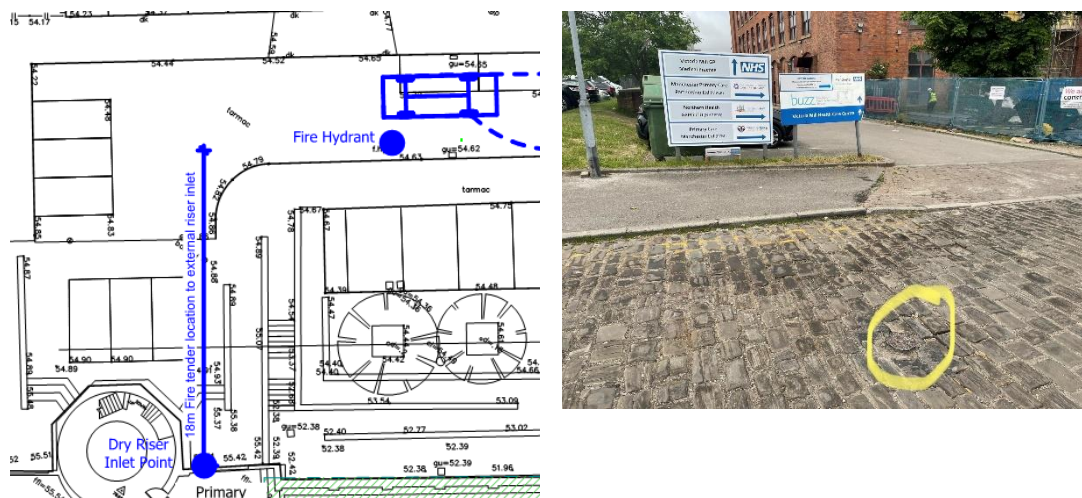


Figure 31. Hydrant provision

Hydrants should be constructed in accordance with BS 750: 2006. A hydrant should be clearly indicated by plates in accordance with BS 3251: 1976. They will achieve the following:

- For buildings provided with dry fire mains, hydrants should be provided within 90 m of dry fire main inlets.
- Water mains and hydrants should be capable of delivering a sufficient flow of water to enable effective fire-fighting to be undertaken.

10. Management

The building is not intended to be provided with a level of management (i.e. no concierge).

However, due cognisance should be given to the following elements when considering the RRO.

The management / owners of the building have a duty to:

- maintain all means of escape from fire;
- secure the means of escape from fire;
- secure all firefighting equipment; and
- secure all means of giving warning of fire to the occupants.

This can be adopted in a fire management plan for the building and, if so, should include:

- Fire safety management structure
- Actions to be taken in a fire emergency, including:
- Evacuation Protocols reflecting the fire alarm system cause and effect schedule
- Evacuation of people with physical, sensory and cognitive disabilities
- Housekeeping
- Maintenance of active and passive fire protection measures, e.g., fire alarm system, fire doors, compartmentation, etc.
- Staff training
- Continuing control and audit procedures
- Security
- Maintenance of FRS access and facilities

The Building Control officer has expressed concern that the layout of the kitchen could be changed in the future. BB7 do not see this as any greater risk than people leaving a kitchen/hall door open, or even taking it off in a code compliant apartment.

However, to address this concern, it is recommended that the flat ownership / tenancy agreement should also ensure that building control approval is sought before any buyer can alter the apartment layouts (e.g. relocate kitchens, specifically ovens and hobs).

Comprehensive procedures should be developed by the building management / owner, which includes evacuation protocols, to ensure that the safety of all occupants is not compromised.

11. Statutory Guidance

11.1 Building Regulations 2010

The building will be subject to the requirements of the Building Regulations 2010. It will be necessary, therefore, for it to meet the requirements of Schedule 1 of the Regulations relating to:

- B1 – Means of Warning and Escape
- B2 – Internal Fire Spread (Linings)
- B3 – Internal Fire Spread (Structure)
- B4 – External Fire Spread
- B5 – Access and Facilities for the Fire Service

Guidance on how these functional requirements can be found in Approved Document B - Fire Safety (the 'ADB'). However, whilst ADB provides guidance for some of the more common building arrangements, there is no obligation to adopt any particular solution contained in the document, as alternative solutions are acceptable, provided that an equivalent level of fire safety to that provided by the standard solutions can be demonstrated.

It is proposed, therefore, to use BS 9991: 2015 *Fire safety in the design, management and use of residential building – Code of practice* as the primary guidance document for the residential areas and ADB for the non-residential areas. Any deviations from this guidance will be justified using a fire engineered approach.

11.2 Property protection

The report deals only with the statutory requirements so property protection is not, therefore, explicitly addressed, unless otherwise stated. As such, it is recommended that the building insurers are consulted at an early stage to ensure that any additional needs are satisfied.

11.3 The Regulatory Reform (Fire Safety) Order 2005

The building is subject to The Regulatory Reform (Fire Safety) Order (RRO) 2005. This legislation is based on risk appropriate compliance and requires regular fire risk assessment to be carried out by the building management / owners / occupiers. The Fire Service will conduct inspections of premises to enforce the Regulations. Whilst guidance documents have been produced by the government to assist in the preparation of the risk assessment, it should be noted that these documents are not intended to be used to design the building.

The fire strategy detailed in this report does not, therefore, explicitly address the management requirements of the RRO. It will be necessary for effective fire safety management regimes to be developed and implemented by the building occupier and a risk assessment of the premises should be conducted (and updated on an on-going basis).

11.4 Regulation 38

Regulation 38 of the Building Regulations (2010) requires that 'the person carrying out the work shall give fire safety information to the responsible person (owner / occupier) not later than the date of completion of the work, or the date of occupation...whichever is earlier'. Therefore, the fire strategy documents will be given to the responsible person as the most accurate record of the fire safety features of the building and will enable them to carry out a valid fire risk assessment.

The building design may change during the different stages of the development which may lead to a change in the fire safety design and, if not recorded accurately in the fire strategy report, it may invalidate the fire risk assessment. Therefore, the fire strategy document handed to the responsible person should be the 'as built' fire strategy for that building.

11.5 Regulation 7

Regulation 7 of the Building Regulations (2010) requires that 'all building work should be carried out in a workmanlike manner, with adequate and proper materials that are appropriate for the circumstance in which they are used, are adequately mixed and prepared, and are applied, used or fixed so as to perform the functions for which that are designed'.

Therefore, any building work should be carried out as above and as per the guidance in the Approved Document supporting Regulation 7.

Appendix 1. Fire Service requirements

BS 9991 (2015) refers to the additional provisions in BS 9999 (2017) for further guidance regarding the Fire Service access and facilities. The following sections provided general information, however and pulls out the more salient points for the design teams attention, where not explicitly addressed within this report, it is assumed that in all other aspects, the building will be designed in accordance with the relevant guidance.

Firefighting shafts

Firefighting shafts should serve every storey which they pass through. It is also preferable to have the firefighting shaft sited on an external wall to provide easy access for fire service personnel. Where this is not possible it should be ensured the route from the fire service entrance to the firefighting shaft is as short as possible and via a protected corridor not exceeding 18m and via a firefighting lobby from the accommodation.

Fire resistance

Firefighting shafts should be constructed in accordance with Section 20.2 of BS 9999 and the following figures.

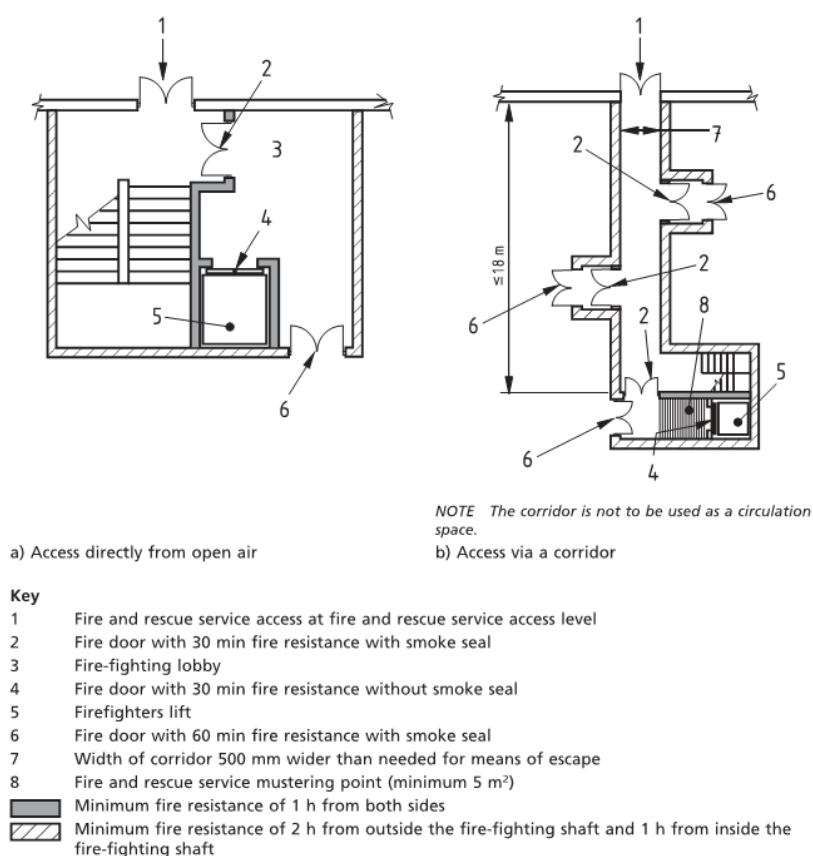


Figure 32. Typical fire-fighting shaft layout at fire and rescue service access level – Fire and rescue service access at lowest storey (Figure 20 of BS 9999)

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

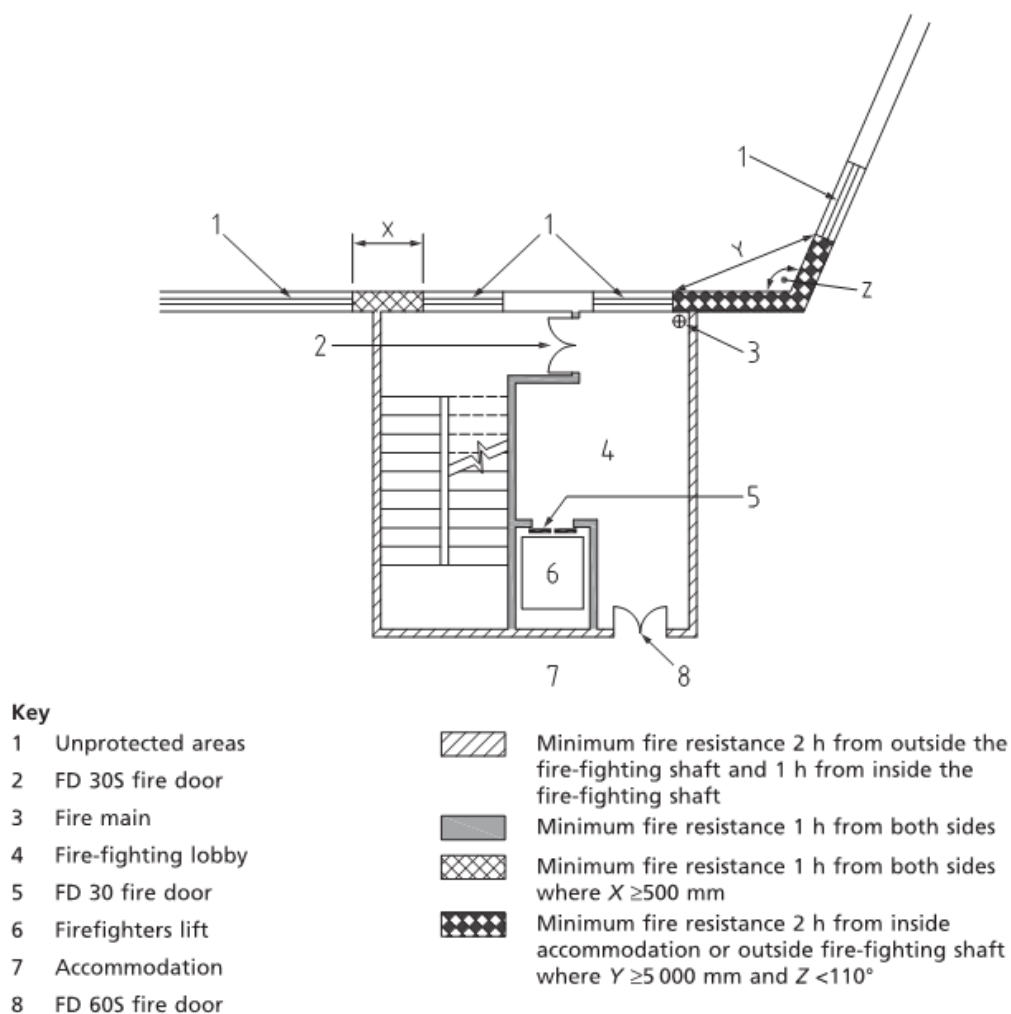


Figure 33. Protection of the firefighting shaft from external fire. (Figure 23 of BS 9999)

Flooring and floor coverings within the fire-fighting shaft

All floorings and floor coverings should be chosen so as to minimize slipperiness when wet, and resilient floor surfaces should be maintained in accordance with BS 6263-2, with only emulsion polish (i.e. not wax polish) being used.

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

Textile floor coverings should:

- a. when tested, together with any underlay, in accordance with BS 4790, using the test procedure reflecting the method used for securing the floor covering to the floor, either:
 - i. not ignite; or
 - ii. have effects of ignition on both the use- and under-surfaces not extending beyond a circle of radius 35 mm centred on the central point of application of the nut;
- b. be firmly secured to the floor, with any adhesive used being non-water soluble; and

- c. be interrupted at all doors to and within the fire-fighting shaft along the line of the threshold of the doorway with a metal or other non-combustible strip not less than 50 mm wide.

Stair door height

Full height (floor to ceiling) doors are not recommended for the door between the stair and lobby. This is because of the adverse effect the increased door height can have on the ability of the smoke ventilation system to keep the stair smoke-free.

Where such doors are proposed, evidence [e.g. computational fluid, dynamics (CFD) analysis], should be provided of satisfactory smoke control performance unless a pressurization system is used.

Firefighting stairs

Firefighting stairs should be sufficiently wide to be easily used by firefighting personnel carrying firefighting equipment. Firefighting stair enclosures should be provided with facilities for smoke ventilation to ensure that they remain relatively smoke-free. Clear signage should be provided on the landing in the stair to identify the storey level.

Firefighting stairs should be designed in accordance with BS 5395-1, with a width between the walls or balustrades of not less than 1.1m. This width should be maintained clear for a vertical distance of 2.0m, measured from the pitch line or landing floor level, with the following exceptions:

- a. Stringers, each intruding into the stair not more than 30 mm; and
- b. Handrails, each intruding into the stair not more than 100 mm.

Firefighting lobby

A fire-fighting lobby serves the firefighters lift and an approach stair. A lobby should be of sufficient size and design to enable the fire and rescue service to carry out the following tasks without undue congestion, but not so large as to encourage any form of storage or unauthorized use.

Fire-fighting lobbies should have a clear floor area of not less than 5m², all principal dimensions should be not less than 1.5m and should not exceed 8m in lobbies serving up to four lifts, or 2m per lift in lobbies serving more than four lifts (Although this does not usually apply to residential).

Appendix 2. Ground and basement compartmentation

The floors between the ground and basement and the ground and first floors are required to be compartment floors.

The ground floor is a separate demise to the residential element of the building and does not have sprinkler protection as existing. Therefore, the required minimum fire resistance period is 90 minutes.

As a result, the floor slab separating the ground and first floor as well as any risers / stair void should achieve 90 minutes fire resistance. Also, staircase B between ground and first floor level should have 90 minutes fire resistance and the ground and basement floor.

As the design has progressed, due to the existing and listed nature of the Victoria Mill building, difficulties have arisen when trying to achieve the above and, therefore, additional investigation has been sought to determine if the existing structure can achieve the required fire resistance.

Limitations

Medlock FRB Limited have appointed BRE Global to carry out an expert assessment of the anticipated fire resistance of the existing structure within the Victoria Mill development.

BB7 have reviewed the BRE report [*Victoria Mill report P123447TL 05.07.2022*] to consider their recommendations.

By reviewing the BRE report, BB7 are not approving or accepting any responsibility for the findings and conclusions.

It is understood that the report is based on:

- A review of documentation provided by the client
- Historical evidence
- Heat transfer analysis of the jack arch floors

It is not detailed if a survey of the existing structure has been conducted. BRE are best placed to understand if they are able to provide this from a desktop.

Existing structure

As per the report, the existing structure between ground and first floor is a 'jack arch floor system' with masonry arches supported on cast iron beams. The beams are in turn supported on either cast iron columns or directly on loadbearing masonry walls.

The Client (Medlock FRB Limited) have detailed that the supporting steelwork (cast iron beams and columns) will be protected with an intumescent coating to achieve the 90 minutes fire resistance.

The question is, therefore, whether the performance of the masonry / concrete jack arch spanning between the cast iron beams is adequate.

Jack arch floor systems

The BRE report details that the jack arch floor system is an example of a typical 19th century "fire proof" flooring system.

For many years it was believed to be 'fire proof', but the bottom flange of the iron joists remained exposed to heat and eventually it was realised that this was a fatal flaw. In order to

mitigate, the columns had to be protected by other means and often meaning they were fire resisting for insulation but not loadbearing capacity.

Assessment and results

The report considers numerical analysis to calculate the heat transfer to the specified construction when exposed to a standard fire.

The material properties are based on concrete and clay bricks with the thermal properties derived from Eurocode 6 and the validation of the heat transfer model is based on historical fire resistance test evidence on masonry walls.

The report compares the time-temperature history on the unexposed face of the tested masonry walls with the numerical results and it can be seen that the numerical model is able to predict a reasonable approximation of the historical standard fire resistance results.

The heat transfer analysis also shows that at 90 minutes standard fire exposure 14% of the arch cross section becomes ineffective due to the material degradation at elevated temperatures. Approximately 36% of the section will have reduced mechanical properties while the rest (50%) will retain ambient temperature.

The key finding being that the masonry arch would be expected to achieve a fire resistance with respect to loadbearing capacity, integrity and insulation performance criteria of 90 minutes (REI).

Report conclusion

The report concludes that the jack arch floor system can provide a fire resistance of 90 minutes (REI) where all supporting cast iron beams and columns are protected to the required level using an approved form of protection, based on the information provided by Medlock, historical fire data and the advanced numerical analysis.

BB7 comments

The purpose of this appendix is to detail the findings of the BRE report.

BB7 are not able to 'sign off' or 'approve' the assessment that has been carried out and that remains the remit of the approval authorities.

The results in the report are considered reasonable, however, we would caveat that they are based on assumptions and require the client to install additional fire resistance protection to the supporting beams and columns. This will need to be done to a tested detail and in accordance with the manufacturer's specification.

BB7 cannot determine acceptability of any system which deviates from tested systems. This can only be confirmed as acceptable by the manufacturers.

Furthermore, a survey of the existing condition of the structure / compartmentation should also be conducted to check for damage / anything that might jeopardise the integrity.

Imagination powered by borderless thinking

LONDON AND THE SOUTH EAST

The Old Surgery
The Historic Dockyard
Chatham
Kent
ME4 4TZ

NORTH WEST

2 Castle Street
Castlefield
Manchester
M3 4LZ

IRELAND

Mountpleasant Business
Centre
Ranelagh
Dublin
D06 N925

NORTH EAST

Carrwood Park
Selby Road
Leeds
LS15 4LG

NORTHERN IRELAND

Nextspace
Antrim Enterprise Park
58 Greystone Road
Antrim
BT41 1JZ

SCOTLAND

Pentagon Centre
26-38 Washington Street
Glasgow
G3 8AZ

CENTRAL AND EAST

Castle Hill House
Huntingdon
Cambridgeshire
PE29 3TE