4orm Architects Ltd

Grove Lodge

Fire Strategy Report

REPORT REFERENCE: 17150-FS-01-B

LAWRENCE WEBSTER FORREST

Fire Engineering & Fire Risk Management Consultants

LWF

Lawrence Webster Forrest

4orm Architects Ltd

Grove Lodge

London

Fire Strategy Report

Prepared By:
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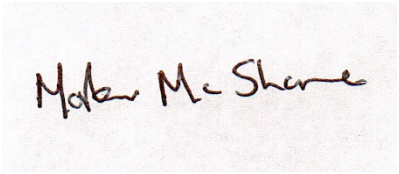
Fire Engineer



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EXECUTIVE SUMMARY

Lawrence Webster Forrest have been commissioned by 4orm Architects to prepare a fire safety strategy for the proposed alteration of Grove Lodge located at Hampstead, London NW3 6RS, making recommendations with regards to fire safety precautions.

An assessment has been carried out for the proposed design. The majority of the design could be compliant with the code recommendation, except two items (unenclosed stair at ground level and plant room which presents an inner room accessing via a kitchenette). These two items of non-compliance have been identified within the report 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.

1 INTRODUCTION

Lawrence Webster Forrest Ltd has been appointed to provide a fire safety report and advice regarding fire safety requirements for the proposed development at Grove Lodge in Hampstead London.

1.1 General Description of the Development

The proposal involves a major reconstruction and extensions to a Grade 11 listed building in Grove Lodge Hampstead, London, NW3 6RS. The key changes are adding a basement floor and revising floor layout arrangement. There is no change in terms of building façade or the distance to the site boundary.

The proposed dwelling comprises:

- A basement consisting of one bedroom, exercise room, a home office, a TV room, a play room, a kitchen room as well as a plant room and a utility space.
- A ground floor consisting of reception room, a library room, a sitting room, a kitchen, dining room and a garage.
- A first floor consisting of three bedrooms and an ante-room.
- A second floor consisting of three bedrooms.

Each floor of the dwelling house has a floor area more than 200m^2 and the second floor of the building is more than 4.5m but less than 7.5m above ground floor.

Two escape staircases are provided for the Grove Lodge. One of which serves basement, ground and first floors, and the other serves ground, first and second floors. The two stairs are only connected at ground and first floor level through habitable rooms.

The plans below in Figures 1-1 to 4-1 indicate the proposed layout of the building.

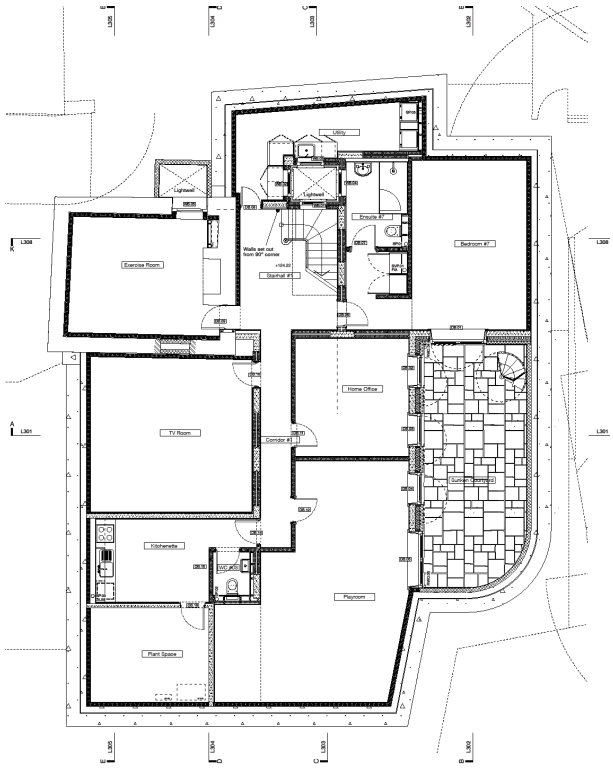


Figure 1-1 Proposed Basement Floor Layout at Grove Lodge

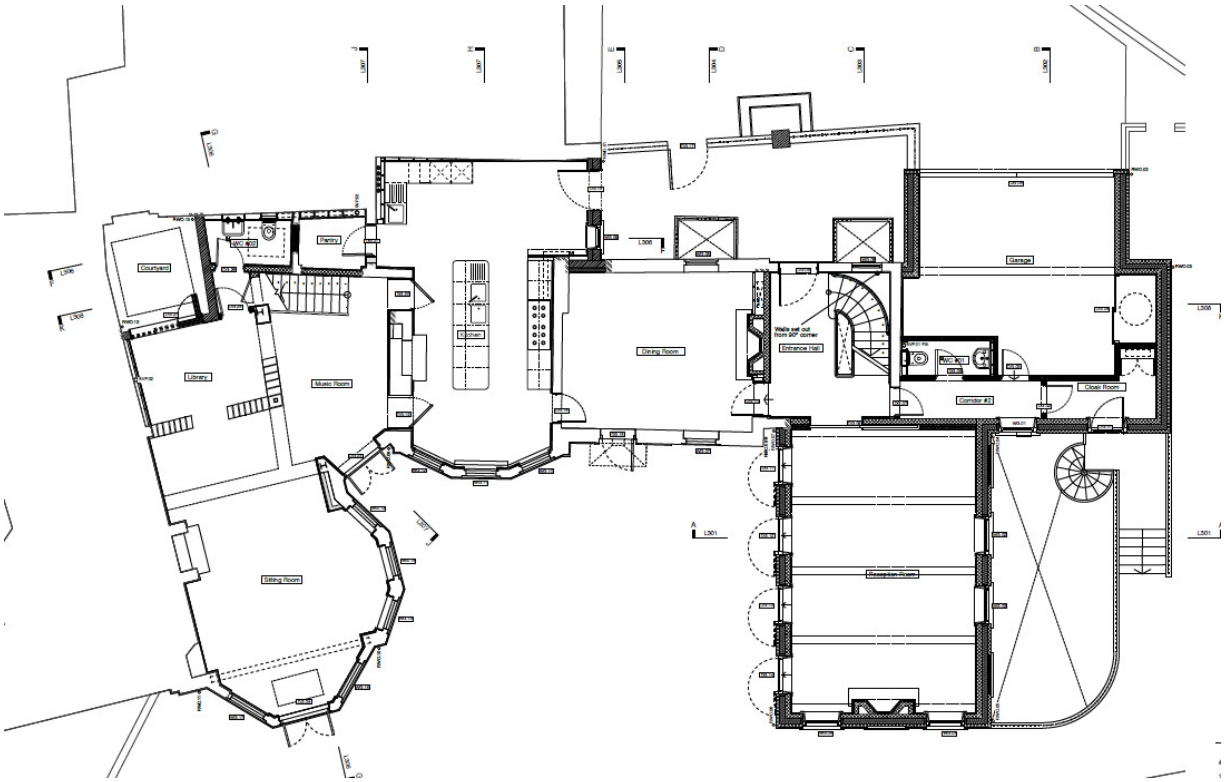


Figure 2-1 Proposed Ground Floor Layout at Grove Lodge

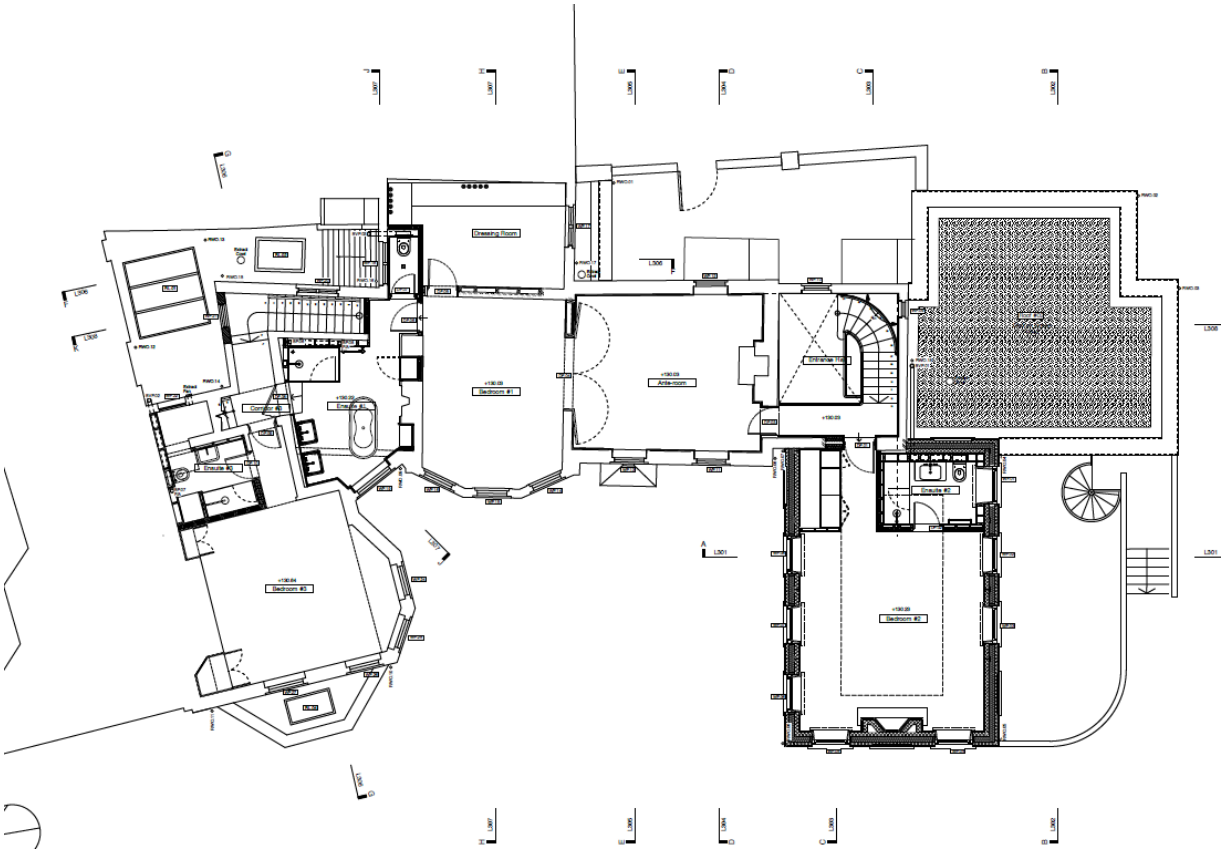


Figure 3-1 Proposed First Floor Layout at Grove Lodge

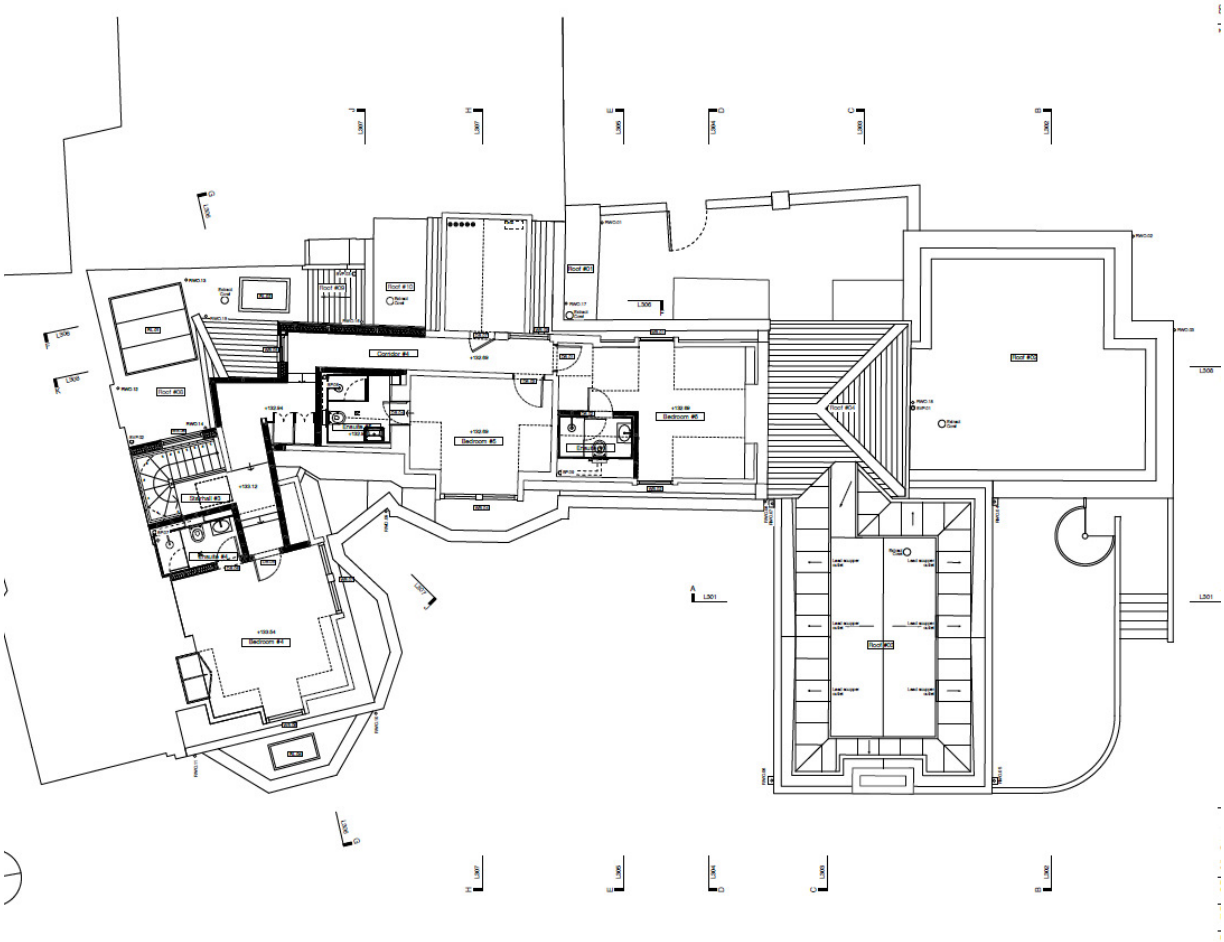


Figure 4-1 Proposed Second Floor Layout at Grove Lodge

1.2 Purpose of the Report

The report describes the key fire safety considerations following the review of the proposed layout in relation to fire safety precautions, as well as to the client's wish to leave the stair serving second floor unenclosed at ground level. It serves as a record of the coordination with the design team to date.

The fire safety proposals given within this document are based on meeting an adequate level of life safety, as required by the Building Regulations 2010. The guidance within Approved Document B Fire Safety Volume 1 - Dwellinghouses (2006 edition incorporating 2010 and 2013 amendments)(ADB Volume 1) has been referred to as a basic guidance document.
Where a compliant design could not be achieved, it was applied on a comparative basis to achieve an equal or better level of safety, in order to meet the functional requirements of Building Regulations.

The report will be submitted to the Approving Authorities in order to gain regulatory approval for compliance with Part B of the Building Regulations 2010.

Based on the recommendations provided within this report, it is believed that the Premises will be provided with an adequate level of fire safety. 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.

1.3 Principle Guidance Documents

As aforementioned, the principal guidance document considered for the development of the fire strategy for this development will be Approved Document B (Fire safety) – Volume 1: Dwelling houses (2006 edition incorporating 2010 and 2013 amendments).

Since each floor of the dwelling house has a floor area more than 200m^2 and Grove Lodge, is therefore, treated as a large house within the guidance of ADB Volume 1. In accordance with Table D1 of ADB Volume 1, the premises will be Purpose Group 1(b), a dwelling house, which contains a habitable storey with a floor level which is more than 4.5m above ground level.

Reference will also be made to relevant British and European standards where appropriate, in particular BS 9991 – Fire safety in the design, management and use of residential buildings – Code of practice.

The Building Regulations are fully functional. This means that the guidance given in ADB Volume 1 is not mandatory. Nevertheless, it is intended that due notice will be taken of the guidance of Approved Document B 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 is based on the drawings supplied by 4orms as listed below in Table 1-1.

Description	Drawing Number	Revision	Prepared By
Basement	4075-L-102	-	4orm Architects
Ground	4075-L-103	-	4orm Architects
First floor	4075-L-104	-	4orm Architects
Second floor	4075-L-105	-	4orm Architects

Table 1-1: Reference Drawings

2 MEANS OF ESCAPE

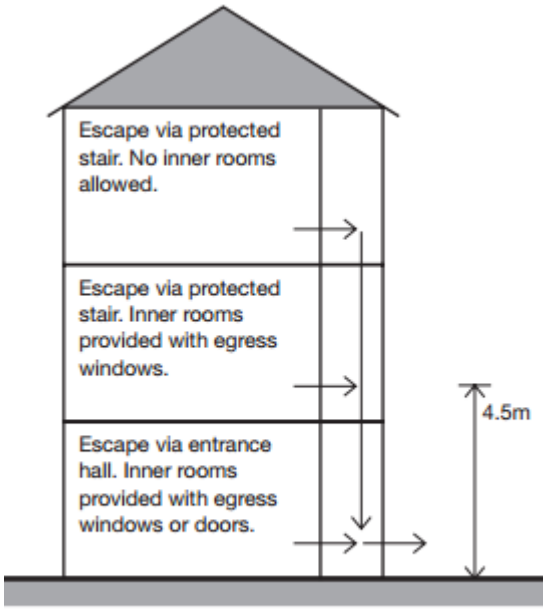
The means of escape for dwellings predominantly involves ensuring sufficient doors and windows are available at lower levels and sufficient protected stairs are available at levels above 4.5m. Unlike commercial properties or residential flats there are no specific travel distances recommended other than the need to provide reasonable travel distances.

2.1 Vertical Escape

Two escape staircases are provided for Grove Lodge. One of which serves basement, ground and first floors, and the other serves ground, first and second floors. The two stairs are only connected at ground and first floor level through habitable rooms.

The second floor is over 4.5m above ground level and is served by a single escape stair. In accordance with Clause 2.6 of ADB Volume 1, either a protected stairway shall be provided or the top floor to be separated and given its own alternative escape route.

It is impossible to extend the main escape stair serving second floor as an alternative escape route without extending the current roof, hence a single escape stair is proposed to minimise the change needed for the existing listed building. ADB Volume 1 recommends the single stairway to be protected at all levels with a minimum 30 minutes fire resistant construction and no inner rooms would be allowed for this level, as demonstrated in Figure 5-1. The level of smoke detection would be a minimum of a Grade A LD2 standard.



c. Dwellinghouse with one floor above 4.5m (see paragraph 2.6)

Figure 5-1 Diagram 1 of ADB Vol 1- Dwelling with a Floor Over 4.5m

It is the Client's aspiration for the stair leading from ground to second floor not to be enclosed at ground floor level. Rooms at upper floor levels will be separated from the stair enclosure by 30 minutes fire resisting construction.

LWF have considered the particular layout of Grove Lodge and proposed the following fire-engineered solution (see also Figure 6-1) which could meet the functional requirement of Building Regulation 2010:

BS9991:2015 permits an open plan arrangement at lower ground floors, provided that an automatic water suppression system is fitted throughout the building, and a fire-resisting partition is provided to separate the ground and upper floors.

- As a compensatory measure, a water mist system will be provided for Grove Lodge at ground floor level covering the Music, Library, Sitting rooms and kitchen space, and an Automatic Opening Vent (AOV) will be provided at the top of the stair. The water mist system should be a life safety system designed and installed in accordance with BS 8458:2015.

The water mist suppression system will control the fire size of any potential fire at ground floor and enable smoke venting to keep the stair clear of smoke for all occupants of the entire building during the evacuation. Natural ventilation via an Automatic Openable Vent (AOV) at the top of the stair will be provided to prevent the smoke layer from filling the stair. The size and extent of natural smoke ventilation openings would need to be justified by CFD modelling (which may be provided by the supplier).

- All doors to each of the stairs at basement, first and second floors will be 30 minute fire resisting doors. The fire doors leading to a protected stair in a single family dwelling permitted to be FD20 doors (ADB Volume 1). Therefore, this is an enhancement to the fire protection measures.

- In addition, an enhanced fire detection and alarm system will be provided which would reduce the time needed for occupants initiating the evacuation and into a place of relative safety. A minimum level of LD2 fire detection and alarm system is allowed in accordance with ADB Volume 1. Instead, a LD1 type detection system is proposed to be installed throughout the dwelling, design to BS 5839-6. This will involve smoke detectors in all rooms and heat detection in kitchen.

- The final exit doors leading from the Sitting and Music rooms will be provided with automatic release. This would further reduce the overall evacuation time required since it would avoid the need for occupants to search for keys; in particular those doors are generally closed during normal situation.

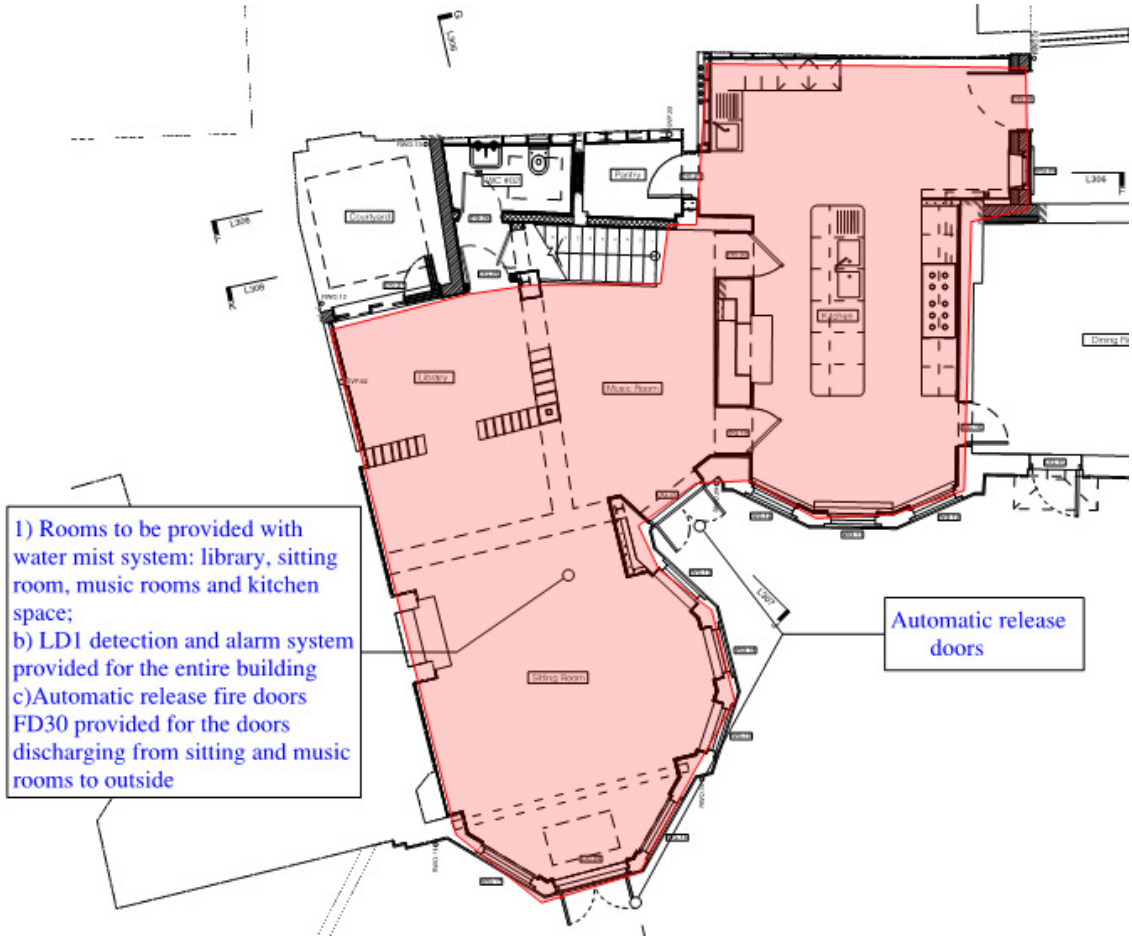


Figure 6-1 Stair Protection by Suppression System at Ground Level

2.2 Horizontal Escape

The horizontal escape is considered reasonable based on the following:

- The amount of occupancy in daily use is expected to be low for a dwelling house. Each level is provided with at least one storey exit via an escape stair. In addition, escape routes are also available via windows from bedrooms first floor level. The number of escape routes provided at each level is considered sufficient to accommodate the few people in the house.
- The travel distances to the protected stairways are relatively short, with the maximum distance being approximately 10m from basement plant space. This permits occupants escaping into a place of relative safety in a very short time (less than a minute).

Note that where windows are needed for escape they should have an unobstructed openable area of 0.33m^2 and be at least 450mm high and 450 wide. The bottom of the openable

window should be no more than 1100mm above the floor. The window should allow the person to escape to a place free from danger; this can be rear garden, provided the garden is deeper than the height of the dwelling.

It is recognised that the escape route from the plant space to the protected stairway at basement would need to be via a risk area (the kitchenette) (see Figure 7-1). This is not a typical arrangement. Nevertheless, upon reviewing the layout, the hot surface of the kitchenette is quite a distance away from the fire exit (over 2.5m) which would present little, if any, radiation impact on the escaping occupants. This is comparable to an open-plan kitchen arrangement for a residential flat. In addition, the plant space will only be infrequently accessed by maintenance engineers or persons responsible for the adjustment to the controls. In the unlikely event of a fire in the kitchenette area, the vision panel provided on the access door to plant room would allow the occupants within the plant room to be fully aware of the status within the kitchenette and to make an appropriate judgement for their escape directions. The enhanced LD1 detection and alarm system will also reduce the time for them to initiate an evacuation if needed. The above arrangement would significantly mitigate the fire risks of occupants escaping from plant space via the kitchenette area to the protected corridor and stair. This is considered suitable. However, this arrangement deviates from the code recommendation, and early consultation with the Approving Authorities is recommended. Until then, this arrangement would still present a design and approval risk.

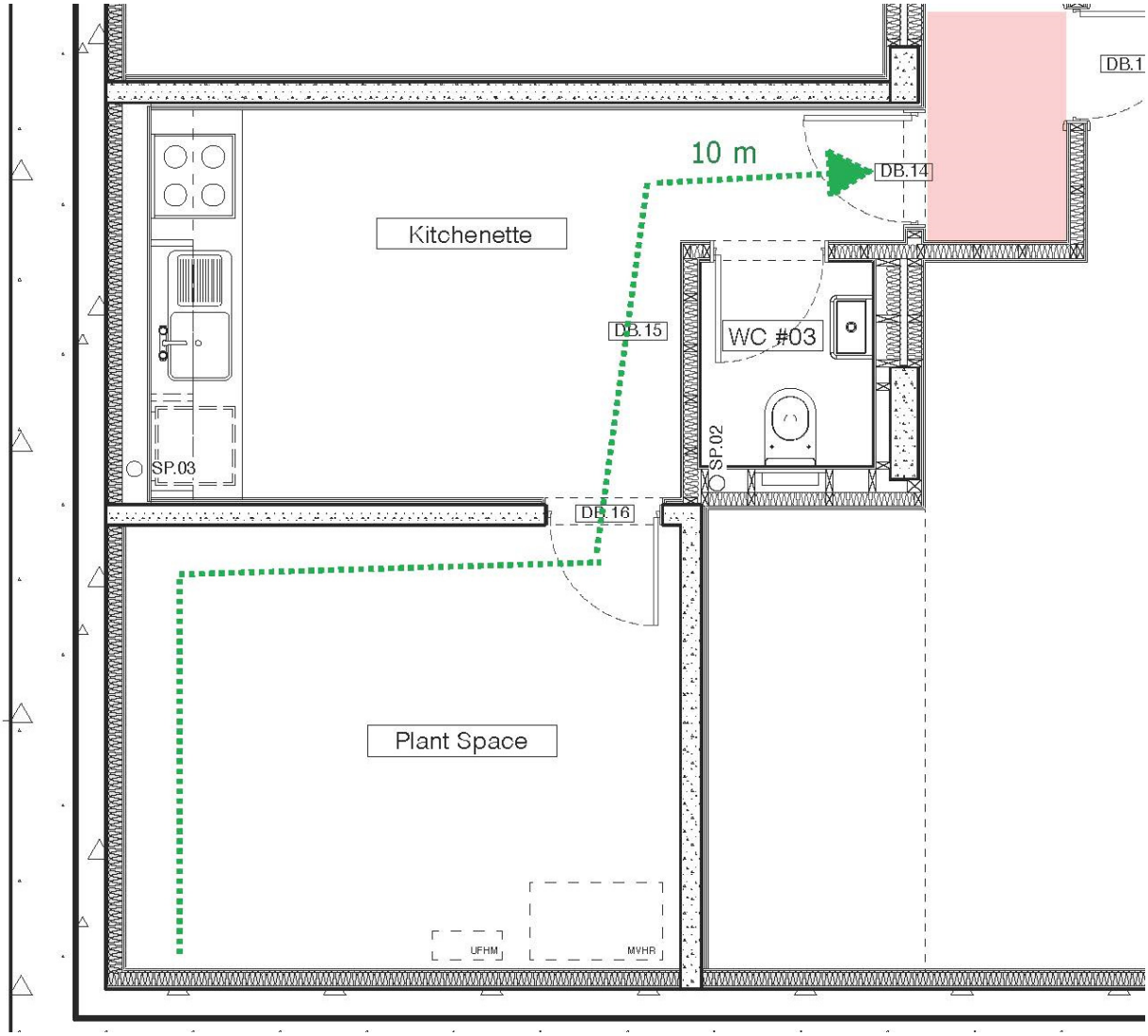


Figure 7-1 Plant Space Escaping via Kitchenette at Basement Level

2.3 Exit Widths

Within the guidance for dwelling there is no minimum exit width stated. The width of individual circulation routes will provide sufficient escape capacity for a dwelling house.

2.4 Disabled Evacuation

ADB Volume 1 suggest that needs of disabled person within the dwellings are assessed on a case by case basis. We are not aware of any other reason at this development, where extra measure may be required to assist disabled persons.

Should a temporary disabled person be present within the house, it is assumed that he/she will always be assisted by the family member/members living within the house.

3 AUTOMATIC FIRE DETECTION AND MEANS OF WARNING

A large dwelling house of three or more storeys (excluding basement storeys) should be fitted with a Grade A category LD2 system as described in BS 5839-6:2013, with detectors sited in accordance with the recommendations of BS 5839-1:2017 for a category L2 system.

An LD1 type detection system should be installed in accordance with BS 5839-6, to a Grade A standard which is an enhancement to the normal standards. This implies that smoke alarms should be provided throughout the dwelling with heat alarms within the kitchens. The smoke and heat alarms should be mains-operated and conform to BS 5446 Part 1 and Part 2. They should have a stand-by power supply such as a battery or capacitor. To ensure that occupants will be alerted by the alarm, it must be ascertained that the sounder(s) achieve the required 75db (A) at the bed head.

4 INTERNAL FIRE SPREAD

4.1 Ceiling and Wall Linings

Ceiling and wall linings provide a means for the spread of fire throughout a building. Internal linings will need to achieve the classification to surface spread of flame required to the particular area in line with Table 1, Section 3.1 of ADB Volume 1.

- Class 3 (National – BS 476: Part 7) or Class C-s3, d2 (European – BS EN 13501-1: 2002) for small rooms less than 4m^2 area or domestic garages of area not more than 40m^2.
- Class 1 (National – BS 476: Part 7) or Class C-s3, d2 (European – BS EN 13501-1: 2002) for all rooms greater than 4m^2 area and circulation space within dwellinghouses.

Note the National classification corresponds to materials tested to the relevant parts of BS 476 and the European classification is as per BS EN 13501-1 for materials tested to the relevant parts of BS EN 1364, 1365, 1366 or 1634.

4.2 Structural Fire Protection

The structural fire resistance for the proposed development should be provided in accordance with the guidance given in Table A2 of ADB Volume 1. The key requirements are as shown in Table 2-1 below, all load bearing elements of structure for the ground and above ground building should be provided with fire protection to achieve a minimum of 60 minutes fire

resistance. This requirement also applies to any element of structure that supports or provides stability to another.

The following elements can be excluded from the above fire resistance requirements:

- Any structure that only supports a roof, except where the roof performs the function of a floor or where the roof structure is essential for the stability of an external wall that requires fire resistance;
- The lowest floor of the building;
- A platform floor; and
- Any gallery, stage grid, lighting bridge or similar structure.

Floor Levels	Building Height, meters (approximately)	Fire Resistance Period, minutes
Ground and above	above 5m	60min
Basement including floor over	n/a	60min

Table 2-1: Recommended Fire Resistance Period of Elements of Structure

4.3 Compartmentation

The main requirement for the provision for compartmentation is to protect the means of escape and restrict the spread of fire from its room of origin. This is a detached house and no compartmentation is required, apart from the need to separate the garage from the dwelling and to separate the escape stairs and/or corridors from the adjacent rooms.

The walls and floors separating the garage shall be fire compartment walls and floors, achieving at least 30 minutes fire resistance in terms of integrity, insulation and load bearing capacities (REI), exposed from the garage side. A self-closing fire door to achieve 30 minutes fire resistance shall be provided within the wall separating the living area and the garage.

In case of fuel spills within the garage, the floor should be designed to fall away from the door to outside or the door opening should be positioned at least 100mm above garage floor level.

All escape stairs where enclosures are provided shall be provided with a minimum of 30 minutes fire resistance, in terms of integrity, insulation and load bearing capacities (REI), exposed from each side separately.

4.4 Fire Doors

Fire doors tested in accordance with BS 476-22, BS EN1634, or equivalent should be provided as shown in Table 3-1 below.

Note that the proposed doors have been increased from the FD20 recommendation within ADB Volume 1 to FD30 in terms of integrity, in support of the overall strategy.

In addition, the doors discharging from the Sitting and Music rooms to outside at ground floor will be automatic release doors as aforementioned to enhance the level of fire safety.

Position of door	Fire resistance in terms of integrity (BS 476-22)	Fire resistance in terms of integrity (European Standard)
Doors opening onto the protected stair from 2nd to 1st floor	FD30	E30
Bedrooms along 1st floor corridor	FD30	E30
Door separating ground floor from Garage	FD30s	E30Sa
Door into basement plant room	FD30	E30

Table 3-1: Fire Resistance for Doors

4.5 Concealed Spaces

Concealed spaces and cavities in the building can allow the rapid unseen spread of fire and smoke to areas remote from the seat of an incident.

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 ADB, cavity barriers should be provided as follows:

- All junctions between an external cavity wall and every compartment floor and compartment wall;
- All junctions between an internal cavity wall and every compartment floor, compartment wall, or other wall or door assembly which forms a fire-resisting barrier;
- For a protected escape route, i.e. protected corridor, a cavity that exists above or below any fire resisting construction should either be fitted with cavity barriers on the line of the enclosures to the protected escape route or for the cavities above the fire resisting construction, enclosed on the lower side by a fire resisting ceiling which extends throughout the building, compartment or separated part;
- Where the dimension of uninterrupted ceiling void is greater than 20m. The maximum dimensions of cavities should be less than 20m in any direction.

4.6 Fire Stopping

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

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

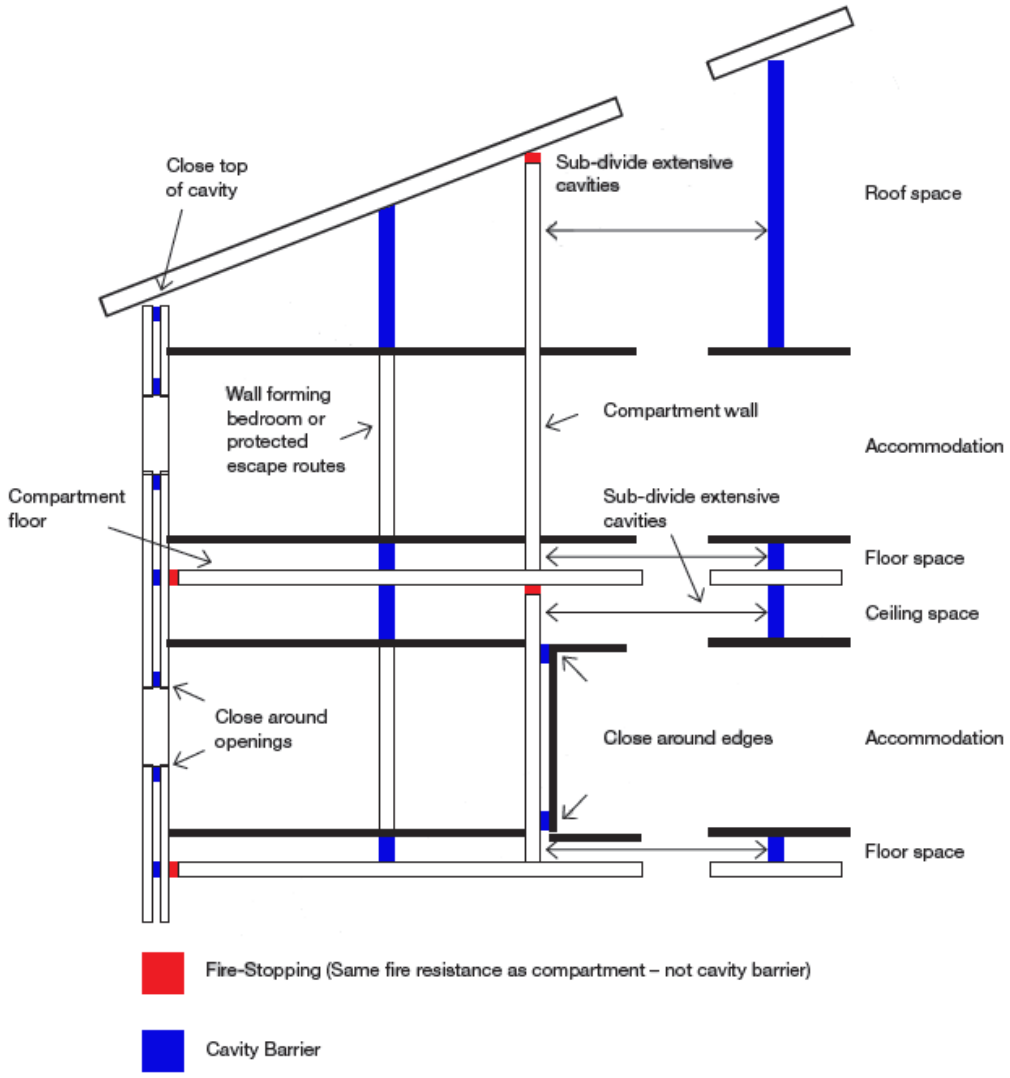


Figure 8-1: Provisions for Cavity Barriers

5 External Fire Spread

The building is existing and the external space separation boundaries are unaffected by the proposals.

6 Fire Service Access and Fire Fighting Facilities

Fire service access is as existing and is unaffected by the proposals.

In review of the building site map, the fire service vehicle access is available to within 45m of all parts of the footprint of the building. Since the house is adjacent to a main road, it is likely that the access road could also comply with the requirements for a pump appliance as

shown in Table 8 of AB D Volume 1, and also shown in Table 4-1 below. The proposed alternation will not present a worse case for the existing fire fighting arrangement.

Appliance type	Min. width of road between kerbs (m)	Min. width of gateways (m)	Min. turning circle between kerbs (m)	Min. turning circle between walls (m)	Min. clearance height (m)	Min. carrying capacity (tonnes)
Pump	3.7	3.1	16.8	19.2	3.7	12.5

Table 4-1 Fire Fighting Vehicle Access Requirements

7 Fire Protection Systems

7.1 Automatic Suppression System

The proposed water mist system will need to meet the requirements of BS 8458:2015 for a life safety system. It is recommended that a mains fed system with salamander pumps provided to ensure correct pressure is maintained.

7.2 Smoke Control

An Automatically Opening Vent (AOV) should be provided at the top of the stair at second floor level and be at least 1m^2 in aerodynamic free area. This should be located at high level within the stair. This vent will allow some clearance of smoke that may have entered the stair.

7.3 Secondary Power Supplies

A standby power supply is required for all life safety systems. It shall be provided as either a backup battery or mains power supply. Further details on the power supply are available in Clause 37.2.3 of BS 9999: 2017.

8 Conclusion

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

9 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 the sole benefit, use and information of 4orm Architects and other members of the design team and the liability of LWF, its directors and employees, in respect of the information contained in the report, will not extend to any third party.

10 REFERENCES

1. Building Regulations 2010 Part B "Fire Safety" Approved Document B (2006 Edition) incorporating 2007, 2010 and further 2013 amendments
2. BS 5839 Part 6, Fire detection and fire alarm systems for buildings. Code of practice for the design, installation and maintenance of fire detection and fire alarm systems in dwellings
3. BS 476 Fire Test on Building materials and Structures
4. BS 9991:2015 Fire safety in the design, management and use of residential buildings- Code of Practice
5. BS 8458:2015 Fixed fire protection systems - residential and domestic water mist systems – Code of practice for design and installation
6. BS 9999:2017 Fire safety in the design, management and use of buildings – Code of practice