BURO HAPPOLD

Free Wharf Phase 2 – Building G/G1

Stage 4a Fire Strategy Report

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Executive Summary

Buro Happold Fire Engineering has been appointed to develop a fire strategy for Phase 2 of the Free Wharf Development. This report has been produced to support the architectural design of Building G/G1 for RIBA Stage 4a and details the fire strategy for the building to meet the functional requirements of Part B of the Building Regulations 2010.

This report forms part of the Building Regulations submission and has been produced for the attention of the Design Team and Approving Bodies.

The fire strategy is primarily based on the recommendations contained within BS 9991 and BS 9999. Qualitative assessments have been made to non-standard areas of the design, such as final exit corridors and omission of sprinklers within the non-residential areas.

To ensure compliance with Part B of the Building Regulations 2010 the design team need to ensure the principles of the fire strategy are impeded in the design.

Blocks G and G1 are tower blocks with seven and six residential levels above ground respectively. The tower blocks share residential amenity spaces, such as terraces at level 6 and 1. Both towers are served by two protected cores each, with one of the cores in each designed as a firefighting core. The upper two levels in building G1 and top level in building G are served by the firefighting cores only. The shared ground floor contains office areas and resident's ancillary units, e.g. car park, cycle store.

This report states the fire safety strategy for the building and comprises of the following proposals.

Means of Escape

- The residential areas are designed based on a 'defend in place' or 'stay put' strategy
- The non-residential areas and residential ancillary accommodation will form separate evacuation zones and will be designed based on a simultaneous strategy
- Each block is provided with one protected escape stair and one firefighting core
- The means of escape provisions are in accordance with code guidance or a justification has been provided
- Refuge areas will be provided within the protected stair in the basement and in the office areas where step free escape is not provided

Internal Fire Spread (Linings)

- Surface spread of flame classifications will be in accordance with BS 9991

Internal Fire Spread (Structure)

- The building is provided with 60 minutes fire resistance to elements of structure (reduced from 90 minutes due to sprinkler protection within the residential and associated parts of the buildings)
- Non-residential areas located beneath the residential units are not proposed to be sprinkler protected. The structural fire resistance (and hence fire compartmentation) of the areas not provided with sprinkler protection is increased to 120 minutes
- Due to omission of sprinkler protection in the non-residential areas the structural fire resistance of all elements supporting the residential floors is uplifted to 120 minutes.
- Compartment floors are provided throughout the building. Full height service risers will be protected shafts
- Various fire hazard rooms, ancillary accommodation and storage spaces will be enclosed in fire resisting construction in line with code guidance

Active Systems

- A sprinkler protection system is provided throughout the residential areas, including the ancillary accommodation. The system will be designed to BS 9251
- An automatic fire detection and alarm system, designed and installed in accordance with BS 5839-1:2017, is provided in the building
    - LD1 system will be provided within the apartments
    - Smoke detection to operate the AOV is provided within the common corridors
    - L2 coverage will be provided within ancillary accommodation at ground floor level and the car park
    - M coverage is required as a minimum to non-residential areas, subject to fit-out design
- Basement car park will be provided with natural ventilation in the initial phase of works. During future phases of the development the basement becomes enclosed and mechanical ventilation system (impulse ventilation system) achieving 10 air changes per hour will be provided
- The natural ventilation in the ground floor car park is achieved by permanent openings having an area equivalent to 2.5% of the floor area
- Natural smoke ventilation to common corridors is achieved via a 1.5m^2 Automatic Opening Vent located in external walls
- Stairs serving the common areas of residential buildings will be provided with a 1m^2 geometric free area, automatically opening vent (AOV) at the head of the stair

External Fire Spread

- The main façade is a ceramic horizonal brick tiles mounted onto a steel substructure
- An external fire spread analysis has been carried out in accordance with BR187
- Facades above ground floor do not require fire resistance to reduce the likelihood of fire spread between buildings
- Depending on the use and design of the commercial unit parts of the North and West façade might require fire resistance to reduce the likelihood of fire spread between buildings. The protected construction required to achieve 120 minute integrity and 15 minute insulation fire resisting construction from the inside

Access and Facilities for the Fire Service

- Each block is provided with a firefighting core serving the block
- The parking positions of the fire tender are within sight of, and within 18 m of the entrance to the firefighting cores and in sight of the dry riser inlet
- Firefighting cores include a firefighting stair and firefighting lift
- Dry risers are provided within each of the firefighting stairs and within the protected stair serving the basement

Risk Items

- Final exits from the firefighting cores via not fire sterile entrance reception. This is considered reasonable based on the provision of alternative escape routes, separated from the firefighting cores with a fire resisting construction.

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In addition, the reception area will be provided with the residential sprinkler system which should limit the fire growth to limit the impact of any fire in this space

- Omission of the sprinkler system within the ground floor commercial unit(s). To mitigate the risk of fire spreading from areas not fitted with sprinklers to those provided with sprinkler protection it is proposed to increase the level of fire protection of the commercial units to the standard above the required for an equivalent non sprinklered commercial building with the same height as this overall building.
- Electric meters provided within utility cupboard. The utility cupboard will be enclosed within a fire resisting construction separating the utility cupboard from the rest of the apartment.

Next Steps

- To minimise approvals risk to the project, this report should be issued to Building Control and the Client for Approval prior to advancing to the next RIBA design stage.

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1 Introduction

1.1 Aim

This report details the Stage 4a fire strategy for Phase 2 Building G/G1 of the Free Wharf development. This report is intended for design team information and to form part of the Building Regulations submission. The primary focus of this strategy is to provide the key information to demonstrate how the functional life-safety requirements of the Building Regulations 2010 will be met.

It is the objective of this strategy to provide a risk proportionate approach that balances occupant needs with an uplift in fire precautions. The strategy is based upon information supplied and is determined on the basis of there being one fire seat in the building at any one time. Asset and property protection are not explicitly stated as design objectives and as such have not been considered within this fire strategy.

1.1 Design Framework

The residential blocks on Phase 2 are designed in accordance with BS 9991[1]. The non-residential areas at ground floor are considered separately to the residential blocks above and are designed in accordance with BS 9999[2]. Where aspects of the building design do not follow the recommendations of these codes, fire engineering designs have been used to justify deviations from the code guidance and demonstrate that an equivalent level of safety is provided to a fully code compliant solution. In these cases, the performance-based guidance in accordance with BS 7974[3] is utilised.

1.2 Development Description

Free Wharf is a mixed-use development located in Shoreham-by-Sea. The development comprises of ten residential tower blocks with a basement car park connecting all the blocks in the development, including blocks covered by this report. Ancillary accommodation and non-residential areas, such as offices, retail units, and restaurants, are located within the ground floor of the residential towers.

Phase 2 of the development, adjacent to Brighton Road, focuses on buildings G, G1 and H, as shown in Figure 1—1. This report focuses on the fire safety design for building G/G1 only. The recommendations for Building H are presented in a separate report.

Blocks G and G1 are tower blocks with seven and six residential levels above ground respectively. The tower blocks share residential amenity spaces, such as terraces at level 6 and 1. Both towers are served by two protected cores each, with one of the cores each designed as a firefighting core. The upper two levels in block G1 and top level in block G are served by the firefighting cores only. The shared ground floor contains office areas and residential ancillary space, e.g. car park, cycle store.

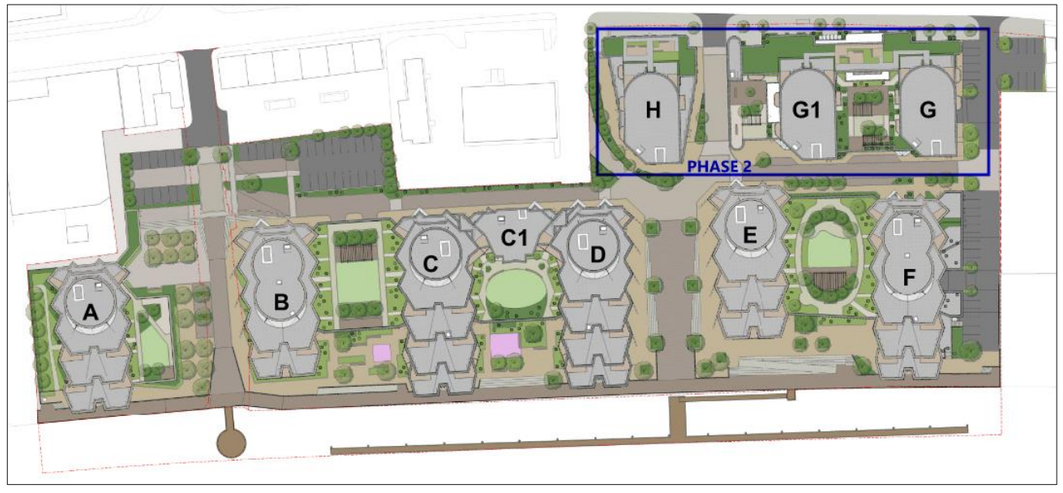

Figure 1—1 Development Layout

Table 1—1 Phase 2 Development Breakdown

Building Name	Approximate Block Height to Topmost Occupied Floor [m]	Description
G	20	Six residential levels above ground, ground floor shared with Building G1 used for amenity spaces and non-residential areas, basement car park
G1	22	Seven residential levels above ground, ground floor shared with Building G used for amenity spaces and non-residential areas, basement car park
H	20	Six residential levels above ground, ground floor used for amenity spaces and non-residential areas, basement car park

[1] BS 9991:2015, Code of practice for fire safety in the design, management and use of residential buildings
[2] BS 9999:2017, Code of practice for fire safety in the design, management and use of buildings
[3] BS 7974 (2001): Application of fore safety engineering principles to the design of buildings – Code of practice

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1.3 Documents Referenced

This report is based on a review of the proposed plans issued by CZWG Architects, as illustrated in Table 1—2. Additional information or variations to the plans referenced may invalidate the conclusions and recommendations contained within this report.

Table 1—2 Documents Referenced

Drawing No	Description	Rev	Date
2052-41-DR-0200	Building G & G1 Basement Level Fire Strategy Plan	T20	30/10/20
2052-41-DR-0201	Building G & G1 Ground Floor Fire Strategy Plan	T20	30/10/20
2052-41-DR-0202	Building G & G1 Level 01 Fire Strategy Plan	T20	30/10/20
2052-41-DR-0203	Building G & G1 Level 02 Fire Strategy Plan	T20	30/10/20
2052-41-DR-0204	Building G & G1 Level 03 Fire Strategy Plan	T20	30/10/20
2052-41-DR-0205	Building G & G1 Level 04 Fire Strategy Plan	T20	30/10/20
2052-41-DR-0206	Building G & G1 Level 05 Fire Strategy Plan	T20	30/10/20
2052-41-DR-0205	Building G & G1 Level 06 Fire Strategy Plan	T20	30/10/20
2052-41-DR-0205	Building G & G1 Level 07 Fire Strategy Plan	T20	30/10/20
2052-41-DR-0210	Building G & G1 North and South Fire Strategy Compartmentation Elevation	T20	30/10/20
2052-41-DR-0211	Building G & G1 East and West Fire Strategy Compartmentation Elevation	T20	30/10/20
2052-00-DR-0110	Site Wide Ground Floor GA Plan	T10	24/05/19

1.4 Approving Authorities

The following stake holders will need to approve the fire strategy principles for the buildings:

- Butler & Young Approved Inspectors.
- West Sussex Fire and Rescue Service.
- Southern Housing Group.

1.2 Design Alternatives

A number of alternative design approaches are presented within this report that are different to the solutions recommended in contemporary design codes. A summary of the areas where alternatives solutions are proposed is set out in Table 1—3 with references provided to the relevant report section(s).

Table 1—3 Design Challenges

Design challenge	Proposed Solution / Justification	Report ref
Omission of sprinklers system from the ground floor commercial unit.	The commercial unit will be provided with an enhanced level of fire protection.	5.1
The final exit route from the fire fighting cores pass through the reception area. The reception area is not proposed to be a fire sterile area.	Occupants are provided with alternative escape routes separated from the firefighting cores with fire resisting construction. The reception area will be covered by the residential sprinkler system which should limit the fire growth or extinguish the fire. In case of fire in this area the fire service may fight the fire from external, therefore they do not need to access the firefighting stair	2.2.5
Electricity meters provided within utility cupboards.	The design is considered reasonable based on provision of fire resisting construction separating the utility cupboard from the rest of the apartment. The utility cupboard with the meter will be enclosed within a 30 min fire resisting construction with FD30 doors.	4.2.1

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2 Means of Escape

2.1 Evacuation Strategy

2.1.1 Residential Areas

The residential areas will be designed based on a 'defend in place' or 'stay put' strategy. Only occupants from the dwelling of fire origin will evacuate and all other occupants will remain in place, unless directly affected by heat or smoke, or the fire and rescue service deem it necessary to evacuate other residents at a later stage.

2.1.2 Residential Ancillary Accommodation

All residential ancillary accommodation will form its own separate evacuation zone and will be designed based on a simultaneous strategy. Upon activation of the fire detection and alarm system all occupants of the ancillary accommodation will evacuate.

2.1.3 Non-residential Areas

The non-residential areas will form their own separate evacuation zone and will be designed based on a simultaneous strategy. Upon activation of the fire detection and alarm system all occupants of the non-residential areas will evacuate.

2.2 Residential Areas

2.2.1 Residential Apartments

All apartments within Building G/G1 are designed with the entrance at the same level as the apartment. The travel distances, measured from any point of the apartment to the apartment entrance door, should be limited to 9m. BS 9991 permits this to be increased to 20m based on the provision of an automatic water fire suppression system (AWFSS) designed to BS 9251[4] and an LD1 fire detection and fire alarm system designed to BS 5839-6[5].

All apartments are fitted with the residential sprinkler system and an LD1 fire detection and alarm system, therefore the travel distances within the apartments are designed not to exceed 20m.

The cooking appliances are located away from the apartment entrance door and the internal escape route. Figure 2—1 shows the travel distances within a typical apartment.

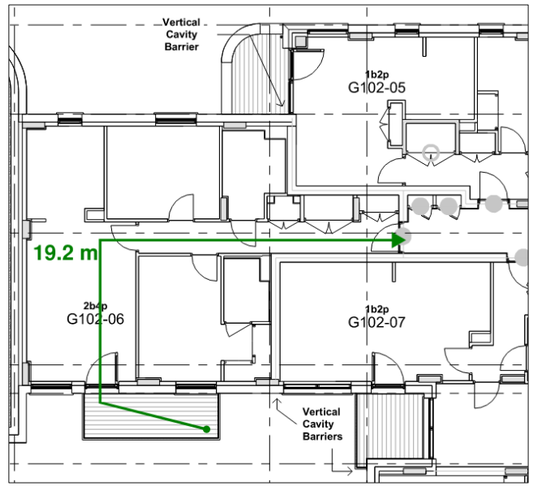

Figure 2—1 Travel Distances - Residential Apartment

2.2.2 Residential Ancillary Accommodation

Residential ancillary spaces have been provided within the building. These spaces are not open to the general public.

Travel distances within the ancillary accommodation are limited to 18m for single direction travel and 45m when more than one direction of travel is provided. This is achieved within the building. Travel distances within the resident's shared amenity at level 1 are shown in Figure 2—2.

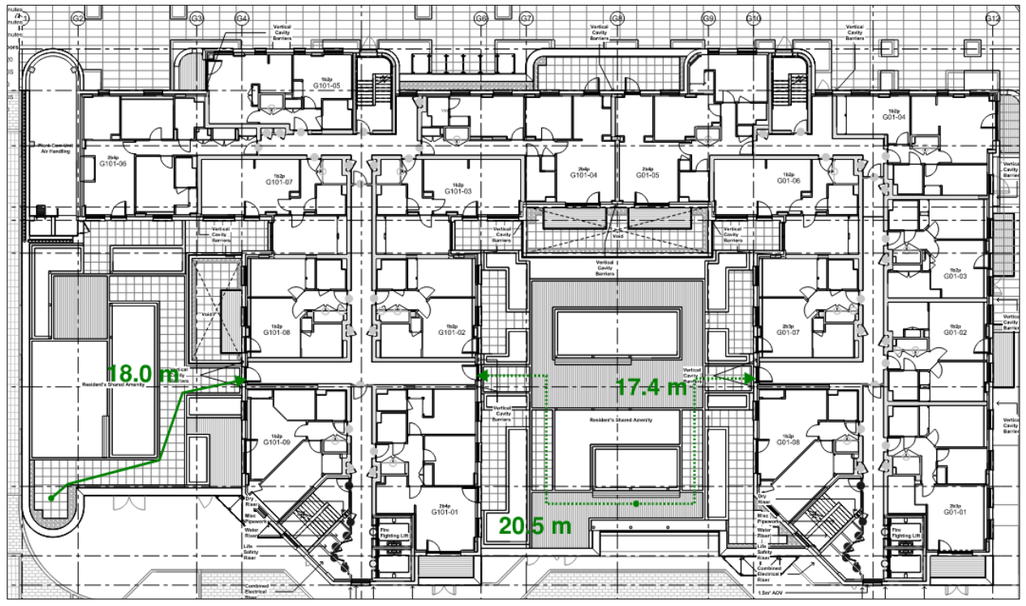

Figure 2—2 Travel Distances - Residential Amenity Spaces Level 1

[4] BS 9251 (2005): Code of practice for sprinkler systems for residential and domestic occupancies

[5] BS 5839-6 (2019): Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic premises

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Travel distances within the cycle store and covered car parks at the basement level and at the ground floor are designed to not exceed 18m in a single direction, and 45m when two directions of travel are available, see Figure 2—3.

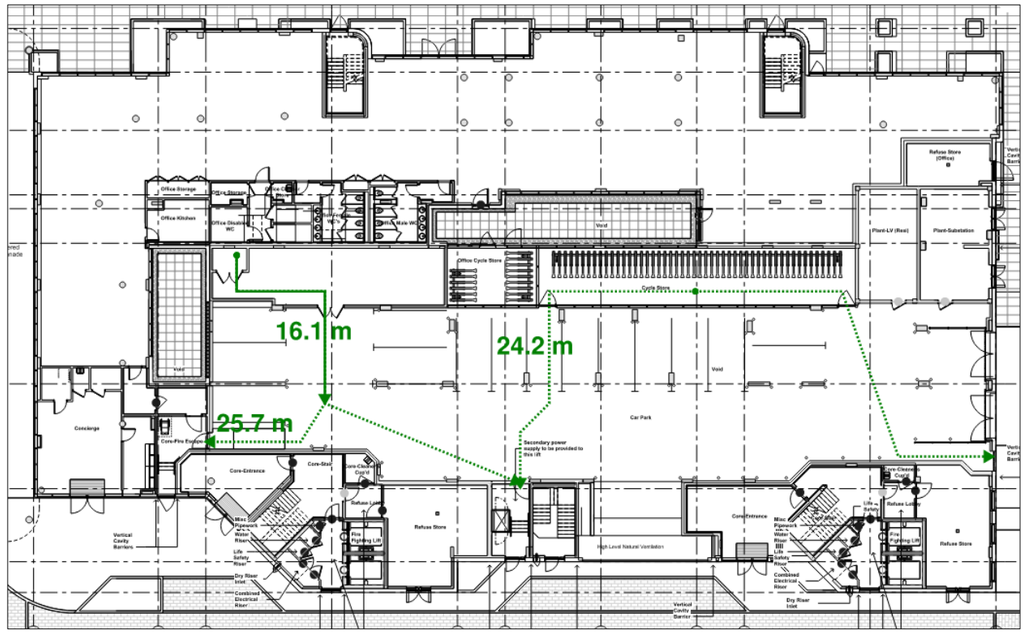

Figure 2—3 Travel Distances - Residential Amenity Spaces Ground Floor Car Park

Travel distances within plant rooms are limited to 9m for single direction travel and 18m when more than one direction of travel is provided. Outside of the room, the maximum travel distances are 18m in single direction and 45m with an alternative direction of escape. This is designed in accordance to the code recommendations.

Where occupant load is likely to exceed 60 people, the ancillary accommodation should be served by more than one exit and doors on escape routes should open in the direction of escape.

2.2.3 Residential Common Corridors

2.2.3.1 Common Corridors with Single Stair Access

Where there is access to a single stair from a common corridor, travel distances from the furthest apartment entrance door to the stair door should be limited to 7.5m. In accordance with BS 9991 this distance can be extended to 15m based on the provision of residential sprinklers within the apartments.

All apartments are to be provided with a sprinkler system designed to BS 9251, therefore, the maximum distance from the furthest apartment to the stair door is taken as 15m This is achieved within all floors served by a single stair, i.e. levels 6 and 7 in block G1 and level 6 in block G.

Where the floor is served by a single stair, smoke ventilation will be provided to the entire corridor via a 1.5m^2 automatic opening vent (AOV).

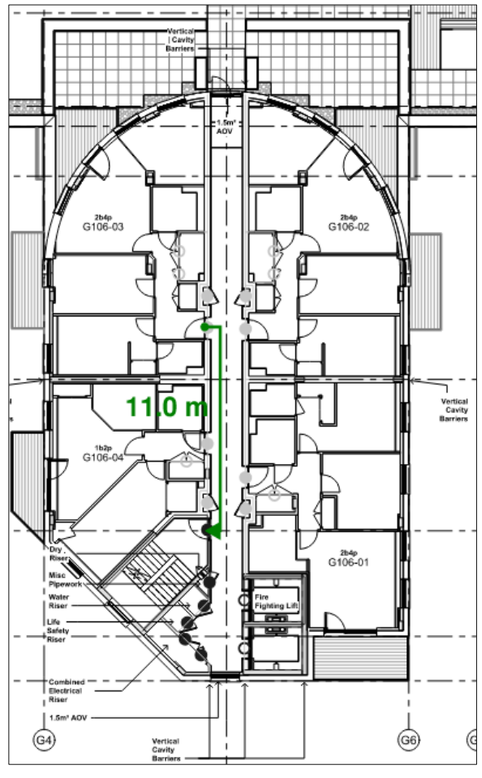

Figure 2—4 Travel Distance - Common Corridor Level 6 Building G1

2.2.3.2 Common Corridors with Access to Two Stairs

Where two stairs are accessed off the common corridor, the maximum travel distance from the furthest apartment entrance door to the stair door should be 30m. Travel distances within the common corridors served by two staircases are less than 30 m (see Figure 2—5).

The smoke ventilation within the common corridors with access to two stairs will be provided with a 1.5m^2 AOV at each end of the corridor

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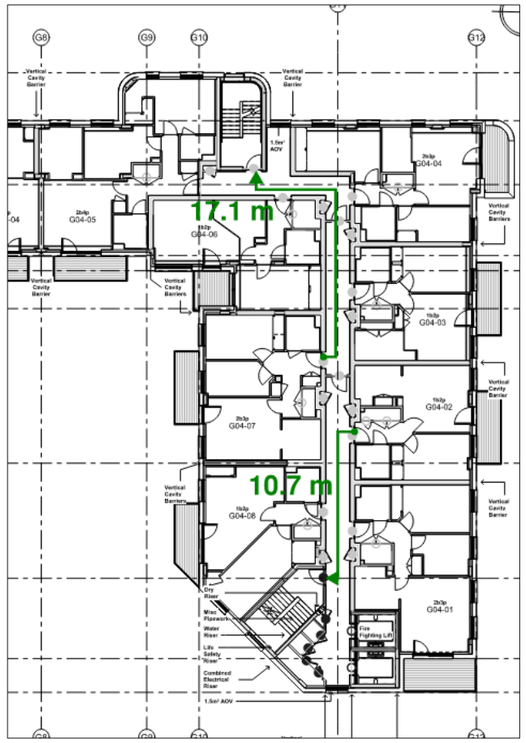

Figure 2—5 Travel Distances - Common Corridor Level 4 Building G

2.2.4 Vertical Escape

Building G and G1 act as individual residential buildings served by two cores each. The clear with of the common stairs is 1200mm which is above the limit of 750mm given by the code guidance. The firefighting stairs are 1200mm clear width, therefore above the minimum limit of 1100mm.

The exits on the escape route from the firefighting core should be as wide as the stair they are serving.

NOTE: Currently the doors between Core-Stair and Core-Entrance (in both G1 and G) have a clear width of 900mm. It is recommended for this door to be increased to at least 1200mm.

2.2.5 Final Exits

Based on the code recommendations, protected stairs should discharge directly to the outside, or into a protected, sterile, corridor leading to the final exit.

The final exits from two protected stairs serving floors above ground and from the stair serving the basement level are designed in accordance to the code guidance recommendations given above.

The final exit routes from the fire-fighting stairs, located in the South part of the building, pass through entrance/ reception areas that are not designed as a fire sterile space. This design is considered to be reasonable based on the following:

- In both blocks G and G1 occupants are provided with two protected stairs, one of which is designed with the final exit directly to the outside. Therefore, if one of the final exits is impassable, occupants can pass through the common corridor and evacuate via the other protected stair.
- The alternative routes are separated with cross-corridor fire doors, therefore, it is unlikely for both escape routes to be affected at the same time.
- The entrances/ reception areas will be covered by the residential sprinkler system which should limit the fire growth or extinguish the fire.
- If the fire is within the reception area the fire service may fight the fire from external air therefore, they do not need to access the fire fighting stair.

The final exit route at ground floor is separated from any accommodation by a protected lobby with 0.4m^2 permanent natural ventilation. This will be provided between the refuse store / cleaners cupboard access lobby and both firefighting cores serving blocks G and G1.

Ancillary accommodation such as electrical risers, major service distribution routes, and communications cupboards are considered to be high risk and should not open into the protected route at ground floor which leads to a final exit. The lift lobbies at ground floor provide access to the service risers which are provided with 120 minute fire resisting construction and FD60S doors to separate the lift lobbies and the fire-fighting stairs.

Where lobby provides access to the firefighting lift it will be provided with 1.5m^2 permanent ventilation. This is achieved at ground floor and floors above via 1.5m^2 AOVs located in external walls.

The firefighting lift continues to the basement level, however, the lift is not used at this level for firefighting operations and the lobby does not provide access to firefighting stairs. Therefore, the lift lobby at the basement level will be provided with 0.4 m^2 permanent mechanical ventilation only, see Figure 2—6

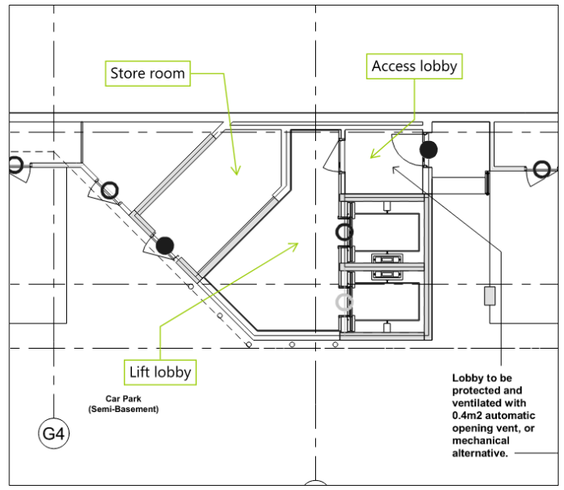

Figure 2—6 Basement Lift Lobby

2.3 Non-residential Areas

Non-residential areas are located underneath the residential blocks on the ground floor. Currently the commercial areas are design as shell and core. For the fit out design the recommendations given in the fire strategy should be followed or advice should be sought and the fire strategy amended to reflect the changes,

Means of escape from these areas will be designed in accordance with BS 9999 based on a A2 risk profile for the offices and A3 for the bike store, store rooms and plant rooms.

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2.3.1 Number of Escape Routes from Non-Residential Units

BS 9999 recommends at least two escape routes in case one is not accessible due to fire. The minimum number of exits, from a room, tier, or storey are as per Table 2—1. Where there are more than 60 people in any location there should be a minimum of two escape routes with doors hung to open in the direction of escape.

Table 2—1 Minimum Number of Escape Routes

Maximum Number of Persons	Minimum Number of Escape Routes/Exits
60	1
600	2
More than 600	3

2.3.2 Travel Distances

Travel distances within office areas are limited to 22m in a single direction and 55m in two directions. These limitations in travel distances shall be maintained after fit-out. The travel distances from the areas with risk profile A3 should not exceed the limits of 18m in a single direction and 45m in two directions.

2.3.3 Occupant Capacity

The capacity of office areas is determined based on the number and width of exits leading to external and the minimum exit width per person, which is 3.6mm/person for A2 risk profile.

The office is provided with three final exits, two 900mm wide exits and one 2300mm wide exit. In the calculations the largest exit is discounted in accordance with code guidance. Note, the minimum clear exit width is 800 mm, or 850 mm if unassisted wheelchair users are expected. Based on that the overall capacity of the office area is 277 persons.

Based on the floor space factor of 6 m^2/person and 520m^2 of office area, the occupant capacity of the office area is approximately 86 persons, which is less than the exit capacity.

2.4 Mobility Impaired Persons

No disabled refuges are required within the residential elements of this development. This is due to the 'defend-in-place' strategy where occupants are located within a place of relative safety (within their apartment), which is being provided with a high level of compartmentation (60 minutes) to protect them from a fire in an adjacent apartment.

A disabled refuge will be provided at basement level within the protected stair and within protected final exit corridor from the office areas where the access to the final exit is not step free.

The disabled refuges should have a clear area of 900mm × 1400mm and should not impede ambulant means of escape. The disable refuge points will be provided with a two-way communication system designed to BS 5839-9 and linked to the fire command centre (located in Building D) to allow occupants to call for assistance.

2.5 Doors on Escape Routes

The following applies to all doors on escape routes:

- They should have a clear width not less than 800mm (850mm where unassisted wheelchair access is necessary);
- They should be openable without the use of a key (excluding residential apartment doors);
- Where serving more than 60 occupants they should open in the direction of escape; and
- Panic hardware in accordance with BS EN 1125 should be fitted to all secured doors serving more than 60 occupants.

Vision panels will be provided in doors that subdivide a corridor. Other vision panels may be required as part of accessibility requirements. All fire-resisting doors shall be fitted with smoke seals (where specified) and the complete door assemblies will be able to demonstrate compliance with:

- BS 476-22[6] or BS EN 1634-1[7] (fire resistance); and,
- BS 476-31[8] or BS EN 1634-3[9] (smoke leakage), and

2.5.1 Hold Open Fire Doors

Where a fire door, such as cross corridor door, is held open, to ensure the doors are released and close effectively they will be provided with an automatic release mechanism that is part of the door or door closing devices that incorporates a hold open mechanism.

A door with a hold open device will close upon:

- detection of smoke by the fire alarm system;
- mechanical damage to cable;
- failure of the power supplies;
- activation of local manual over-rides (green break glass);
- activation of a manual call point.

To ensure that the device releases in the event of a fire the system will be designed to conform to the requirements of BS 5839-3[10].

2.5.2 Locking Mechanisms

Electronically locked doors and security gates on escape routes should failsafe unlocked on activation of the fire alarm and in the event of a loss of power. This is in accordance with BS EN 179[11] or BS EN 1125[12] as appropriate. Any electronically locked doors on escape routes should be openable through use of Green Break Glass Units located adjacent to the door.

The basement car park is proposed to connect all buildings in the development and be served by the same mechanical ventilation system. The fire detection and alarm system in the basement car park for these buildings should be linked. As

[6] BS 476-22 (1987), Fire tests on building materials and structures. Methods for determination of the fire resistance of non-loadbearing elements of construction (incorporating Corrigendum No.1)
[7] BS EN 1634-1 (2014), Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Fire resistance tests for door and shutter assemblies and openable windows (+A1:2018)(incorporating Corrigendum August 2018)
[8] BS 476-31-1 (1983), Fire tests on building materials and structures. Methods for measuring smoke penetration through doorsets and shutter assemblies. Method of measurement under ambient temperature conditions (incorporating amendment No.1 and corrigendum No.1)
[9] BS EN 1634-3 (2004), Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware. Smoke control tests for door and shutter assemblies (incorporating Corrigendum No.1)
[10] BS 5839-3 (1988), Fire detection and alarm systems for buildings. Specification for automatic release mechanisms for certain fire protection equipment
[11] BS EN 179 (2008), Building hardware – Emergency exit devices operated by a lever handle or push pad, for use on escape routes – Requirements and test methods
[12] BS EN 1125 (2008), Panic exit devices operated by a horizontal bar, for use on escape routes – Requirements and test methods

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such, on positive fire detection in the carpark, electronically locked doors and security gates on escape routes from the carpark in all connected buildings should unlock.

Holes and apertures for fire cables that provide electrical power to the door or frame mounted devices must be protected to maintain the fire integrity of the doors.

If there are to be internal doors on specific rooms that are fitted with an electronic latch operated by a swipe card reader on the un-secure side, then these doors will also have door latches operated by a handle on the secure side (so people inside the room will always be able to get out).

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3 Internal Fire Spread (Linings)

The internal linings for all walls and ceiling surfaces for building G/G1 will achieve the classifications given in Table 3—1 below.

Table 3—1 Internal Fire Spread (Linings) – Classifications

Location	National Class	European Class
Circulation/escape routes including staircases	0	B-s3, d2
Rooms (excluding small rooms) and circulation spaces within apartments	1	C-s3, d2
In the non-residential areas small rooms less than 30 m^2	3	D-s3, d2
In the Residential areas, small rooms less than 4 m^2	3	D-s3, d2

Notes:

- The National classifications do not automatically equate with the equivalent classifications in the European column, therefore, products cannot typically assume European class, unless they have been tested accordingly; and,
- When a classification includes "s3, d2", this means that there is no limit set for smoke production and/or flaming droplets/particles.

Parts of walls in a room may be of poorer performance than specified in Table 3—1 above, but not less than Class 3 or D-s3, d2. This variation is limited to a total area not exceeding one half of the room's floor area, subject to a maximum of 20 m^2 in bedrooms and 60 m^2 elsewhere.

Where furnishings, fabrics and decorative features are included in communal areas, they should comply with the following criteria:

- They should be non-combustible or should conform to the requirements for classification as type B in accordance with BS 5867-2 after being subjected to wetting or a cleansing procedure;
- They should not be provided within enclosed escape routes (other than foyers) unless they are made from non-combustible materials;
- Drapes should not be provided in front of exit doors or across escape routes; and,
- Textile floor coverings (including the underlay) should not ignite nor have effects of ignition on both the use surfaces and under surfaces not extending beyond a circle of radius 35 mm.

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4 Internal Fire Spread (Structure)

4.1 Structure

The fire resistance required to the structure of the building is based on its height measured from fire brigade access level to the topmost occupied storey.

Building G/G1 is greater than 18m in height and less than 30m, therefore, including the benefit from the sprinkler system designed in accordance with BS 9251, the required period of fire resistance to the building structure, based on BS9991 guidance, is **60 minutes** (Loadbearing).

To comply with BS 9991, the residential areas need to be fire separated from the commercial units. As the commercial spaces located beneath the residential units will not be sprinkler protected, the fire protection to these areas is uplifted to **120 minutes** (REI). As such, all elements of structure supporting the residential floors should meet this criterion, this includes structural elements in the basement and ground floor.

Elements of structure provided with this standard of protection include the following, but are not limited to:

- Member forming part of the structural frame of a building or any other beam/ column/ brace;
- Load bearing wall or load bearing part of a wall;
- Any floors;
- A compartment wall, including any structural frame members providing support or restraint to that wall;
- Structure supporting a fire resisting external wall that is required to be fire resisting to limit external fire spread.

This should be confirmed by the structural engineer.

As per BS 9991, the structure of a roof, and the structure that supports only a roof, does not require fire resistance.

All elements of structure forming the fire-fighting shafts should be afforded 120 minutes fire resistance (loadbearing).

4.2 Compartmentation

Table 4—1 summarises the requirements for compartmentation within Building G/G1, for additional details please consult CZWG Fire Strategy drawings.

Table 4—1 Summary of Compartmentation

Compartmentation	Required Fire Resistance [1] [minutes]	Fire door
Compartment floors in apartment block	60	-
Construction subdividing common corridors	30	FD30
Compartment floors separating non-residential and residential areas	120	-
Compartment walls separating apartments from other apartments	60	-
Compartment walls separating apartments from common corridors	60	FD 30S
Compartment walls and floor separating non-residential and residential areas	120	-
Protected shaft	60	FD30S
Firefighting stair	120	FD60S
Firefighting lift	120	FD60
Enclosure to storage/refuse rooms	60	FD60S
Small stores	30	FD30
Enclosure to life safety plant rooms	120	FD120S
Enclosure to plant rooms	60	FD60S
Energy supplier substation	240 [2]	FD240S [2]

Note 1: Loadbearing (R), integrity (E) and insulation (I), unless otherwise stated
Note 2: This should be confirmed with the utility provider as they may have their own, more onerous fire rating requirements

4.2.1 Electric Meters within Apartments

The code guidance recommends for the electric meters to be located in a separate, non-fire resisting cupboard, designed to fit only the meter and associated equipment. However, the electric meters within apartments will be fitted in the utility cupboards together with MVHR system and direct electric boiler.

The proposal to mitigate for this combination is to enclose the utility cupboard with the meters within a 30 min fire resisting construction with FD30 doors. In addition, as the construction is provided to separate a fire hazard area and not as part of the protection of means of escape, the use of PVC ducting for the MHVR system is acceptable and will be fitted with fire collars where the ducts pass through the fire resisting walls.

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4.3 Service Risers and Service Penetrations

Any services which pass through fire resisting construction will be protected from promoting fire spread. This will be achieved by the provision of a proprietary sealing system, which has been shown by test to maintain the fire resisting construction it penetrates, or, where the pipe is non-combustible, fire stopping around the pipe, keeping the opening as small as possible.

All service risers will either be designed as protected shafts or fire stopped at floor level.

Where they are constructed as protected shafts, where a service penetrates the enclosing walls of those shafts they will be adequately fire stopped with a proprietary sealing product achieving the required fire resistance.

Any penetrations through the 120 min compartment floor which separates residential and non-residential areas will be fully fire sealed at that interface slab level.

Note: services must not pass through a fire fighting shaft unless they serve them.

4.4 Fire Stopping

Fire stopping should be provided on the line of compartment walls and floors where gaps exist that could allow smoke and flames to breach the compartment wall or floor. Joints between elements that serve as a barrier to the passage of fire should be fire stopped and all openings for pipes, ducts, conduits or cables to pass through any part of an element that serves as a barrier to the passage of fire should be:

- Kept as few as possible;
- Kept as small as practicable; and
- Fire stopped (which in the case of a flue or duct should allow thermal movement)

4.5 Cavity Barriers

Concealed spaces or cavities within the construction of a building provide a means for flames and smoke to spread, often unseen. Where cavities occur within a wall, floor, roof space, or ceiling, they will be sub-divided with a cavity barrier with a fire resistance of not less than 30/15 minutes (integrity/insulation).

Cavity barriers will be installed so that the maximum distance between them does not exceed 20m, where materials in the cavity have a Class 1 spread of flame, reducing to 10m where the materials have a lower spread of flame value.

All concealed spaces and cavities will be subdivided with cavity barriers in accordance with the following:

- In a protected escape route, above and below any fire resisting construction which is not carried full height or to the underside of the roof covering.
- Above the door assembly, subdividing a corridor (where the construction is not carried full height).

To subdivide any cavity between a roof/floor soffit and ceiling such that that the maximum cavity dimension does not exceed 20m.Please refer to section 6.5 for cavity barrier provisions in the external walls.

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5 Active Fire Safety Systems

5.1 Sprinklers

In accordance with the updated code guidance, coming in effect on 26th of November 2020, all residential buildings above 11m high should be sprinkler protected (including all residential and non-residential areas). The 2020 guidance will be in effect for projects that submit a Building Regulations application after that date, or/and if works on site begin after 29th January 2021.

It has been confirmed by the Client that the works on site will not begin before 29th January 2021. Therefore, for the design of Phase 2 buildings the updated code guidance should be followed, and sprinkler protection should be provided throughout the building.

Based on the above, a sprinkler protection system will be provided throughout the residential areas of the building, including the ancillary accommodation. However, the provision of commercial sprinkler system in the commercial areas is omitted.

To mitigate the risk of fire spreading from areas not provided with sprinkler protection to the sprinklered areas, the fire separation between the non-residential and residential areas will be uplifted. According to the code guidance the construction separating the occupancies require fire resistance period equal to that of the elements of structure, i.e. 60 minutes. This will be uplifted to 120 minute fire resisting construction.

This has been discussed with the Approved Inspector and has been agreed in principle. Further discussion with Approved Inspectors and the Fire Brigade is required.

5.1.1 Residential Areas

All apartments are sprinkler protected in all parts of the dwelling, with the permitted exception of:

- Bathrooms with a floor area of less than 5m^2;
- Cupboards and pantries with a floor area of less than 2m^2 and where the least dimension does not exceed 1m and the walls and ceilings are covered with non-combustible or limited-combustible materials. This will apply to the utility cupboard within apartments.

The category 2 residential sprinkler system will be provided within the residential units in accordance with BS 9251. However, to enable use of the system for engineered solutions, the reliability of the water and electrical supply needs to be reviewed within the context that the safety features rely on the sprinklers to operate effectively. Therefore, an enhanced system will be provided with dual pumps with dual power supplies. The enhancements to this system will be as follows:

- Back-up power;
- 60 minute supply; and,
- Dual pumps.

5.1.2 Ancillary Accommodation

The residential sprinkler system provided within the residential units will be extended to cover:

- Refuse stores;
- Store/amenity rooms;
- Entrance reception;
- Plant rooms; and
- Cycle store.

No sprinkler coverage is necessary to the common corridors or the risers in accordance with BS 9251.

5.1.3 Car Park

Ground floor car park will be provided with natural smoke ventilation system. Basement car park will be provided with natural ventilation in the initial phase of works. During future phases of the development the basement becomes enclosed and mechanical ventilation system (impulse ventilation system) will be provided.

Therefore, based on the above smoke ventilation provisions, both car parks do not require sprinkler protection system.

The car park ventilation systems are described in Section 5.4.5

5.2 Automatic Fire Detection and Alarm Systems

5.2.1 Residential Apartments

All apartments will be provided with linked fire detection and alarm in each habitable room to an LD1 standard. Fire detection and alarms will be linked within the apartments only and will not be linked to any landlords or off-site monitoring system.

A category LD1 system is defined in BS 5839-6[13], as a system installed throughout the dwelling, incorporating detectors in all circulation spaces that form part of the escape routes from the dwelling, and in all rooms and areas in which fire might start, other than toilets, bathrooms and shower rooms (including utility cupboards).

Where an LD1 system is provided it will consist of linked alarms in each habitable room. To minimise the potential for false alarms and ensure a fire is quickly detected the proposed approach to detection is:

- Kitchen – heat detector;
- Lounge – multi criteria heat and optical smoke alarm; and
- Bedrooms – optical smoke alarm.

Detectors should be located and sited in circulation areas (i.e. hallways/corridors) so that no point within the hallway or corridor is more than 7.5 m from the nearest detector.

Smoke detectors should be sited in all habitable rooms such that no point is further than 7.5 m from the nearest smoke detector or, in rooms protected by heat detectors, no further than 5.3 m from the nearest heat detector.

Mounting of smoke and heat detectors will follow the recommendations of BS 5839-6.

Lifts will return to ground level on actuation of detection in the common areas.

5.2.2 Common Corridors

Smoke detectors within the common corridors will be installed in accordance with BS 5839-1 to an L5 level of coverage. These will be used to activate the AOV's.

[13] BS 5839-6:2013, Fire detection and fire alarm systems for buildings – Code of practice for the design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic premises.

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5.2.3 Ancillary Accommodation

Residential amenity spaces at ground floor will be provided with automatic detection and alarm to L2 coverage in accordance with BS 5839-1.

The standard of coverage provided within the basement carpark is 'M' during the initial phase of works. When the mechanical smoke ventilation is provided during the future phases of development the coverage should be upgraded to an L2 standard. This should be designed in accordance BS 5839-1.

5.2.4 Non-residential Areas

Manual coverage is required as a minimum for the office areas and cycle store. This should be reviewed during the fit-out design.

5.3 Visual Warnings

Where occupants have access to the terraces, such as residential amenity spaces at level 1, a sounder and flashing beacon will be provided as a visual warning. In non-residential areas, visual warning devices will be provided in noisy areas, e.g. plant rooms.

5.4 Smoke Control

5.4.1 Residential Stairs

All stairs serving the common areas of residential buildings will be provided with a 1m² geometric free area, automatically opening vent (AOV) at the head of the stair.

5.4.2 Basement Stairs and Lifts

The basement stair is separate from the residential stairs and it serves the basement level only. The stair discharges directly to the external at ground floor and is accessed from the car park via a protected, ventilated (permanent 0.4m² to external) lobby.

Lift lobbies in the basements are accessed via protected lobbies with 0.4m² permanent ventilation to external.

5.4.3 Common Corridors

Natural smoke ventilation to common corridors is achieved via a 1.5m² Automatic Opening Vent located in external walls. Only the AOV leading from the protected corridor where smoke has been detected should open. The AOVs at the head of the escape stairs need to open upon smoke detection within any of the corridors/lobbies directly adjacent to the stair enclosure.

The vents should conform to BS EN 12101-2[14], including a suitable fail-safe means for opening the vents in this manner in the event of mains power failure.

5.4.4 Ancillary Accommodation

All stores, refuse rooms and ancillary accommodation that communicate with an escape route are provided with a fire resistant, ventilated (0.4 m² permanent ventilation) lobby between the room and the escape route.

5.4.5 Car Park

During initial phase of works the basement car park will be open on two sides, and therefore, natural ventilation will be provided. For future phases of the development, when the basement becomes enclosed, mechanical ventilation system (mechanical cross ventilation using jet impulse fans), designed in accordance with BS 7346-7:2013[15], will be provided.

The ground floor car park will be provided with a natural ventilation system designed in accordance with BS 7346-7:2013. The natural ventilation will be achieved by permanent openings having an area equivalent to 2.5% of floor area. The openings are distributed such that half of the area is equally provided between two opposing sides.

5.4.6 Basement Rooms

The ancillary accommodation and plant rooms, which only have access from the basement without exhaust to the outside, will be ventilated via the car park mechanical ventilation system. Therefore, the CFD of the mechanical car park ventilation system should demonstrate that ventilation of these rooms can be achieved (10 ACH of car park area + biggest room vented from carpark).

This approach will need to be discussed and agreed with the Approved Inspectors and the Fire Brigade.

5.5 Fire and Smoke Dampers

Automatically actuated fire and smoke dampers triggered by smoke detectors should be provided to ductwork passing or serving:

- Protected lobbies to escape stair;
- Protected escape routes to outside from escape stairs; and
- Two separate evacuation zones.

All other ductwork passing through fire resisting construction should be provided with fusible link fire dampers. Smoke control dampers will be provided to smoke extract systems to control extract from individual zones as necessary.

Services not associated with the fire-fighting shaft should not pass through the fire-fighting shaft.

Sufficient care and attention should be provided when selecting and detailing the installation of dampers to ensure that the correct damper type is used for that particular penetration detail (e.g. ensuring they are suitable for a drylined wall or a masonry/RC wall, or floor slab) and that it can be installed as per manufacturers details (e.g. ensuring there is enough space around dampers for fire stopping and fixing to manufacturers details etc.). The installation details for each specific damper should be clearly communicated to the installation team. If there is any doubt during design/detailing that the damper cannot meet the installation requirements of the manufacturers then they should be consulted to determine what needs to be done to ensure the damper operates as intended and tested, well before it is installed on site. This is to avoid any issues with installation and retrofitting on site which could result in installations that are not compliant with the tested configuration for that particular damper. Care and attention also need to be given as to how all dampers will be tested and inspected so access is also a key consideration during detailing/selection. Dampers should be maintained in line with the manufacturer's recommendations.

5.6 Emergency Lighting

Emergency lighting should be designed in accordance with BS 5266-1:2016[16].

[14] BS EN 12101-2:2017, Smoke and heat control systems. Natural smoke and heat exhaust ventilators.
[15] BS 7346-7:2013, Component for smoke and heat control systems. Code of practice on functional recommendations and calculation methods for smoke and heat control systems for covered car parks

[16] BS 5266-1:2016 Emergency lighting – Part 1: Code of practice for the emergency lighting of premises

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Emergency lighting should be provided in:

- Ancillary accommodation accessed by residents;
- All common escape routes; and
- Common stairs.

5.7 Secondary Power Supplies

A secondary power supply will be provided to all life safety systems where necessary, and where applicable in accordance with BS 8519[17].

5.8 Emergency Escape Signage

To ensure safe and quick evacuation fire safety signage should be provided. Escape routes should be marked with appropriate exit signage designed in accordance with appropriate standards at the time of design/construction and if updated it should comply with Health and Safety (Safety signs and signals) Regulations 1996 and EC Directive 92/58/ECC.

Exit signs will comply with BS 5499-1 and ISO 3864-1[18] and should be reviewed as part of the RRO Fire Risk Assessments throughout the lifetime of the building.

5.9 Arc-fault Protection

Where PV panels are to be installed, care should be taken that they are installed correctly and in accordance with the manufacturer's recommendations. During the early stages of this technology there were a number of instances where poorly fitted panels led to a risk of fire and undue spread. It is therefore recommended that arc-fault protected is provided to these panels in order to mitigate the risk of ignition and therefore reduce the associated fire risk.

It is recommended that these panels also be fitted with a shutdown mechanism such that the fire brigade can shut down the panels to ensure no further power is generated. It is recommended that this be linked to the fire alarm system such that this shuts down automatically in the event of a genuine fire alarm activation. This will help to ensure firefighter safety by removing power/electricity for potential fire loads.

[17] BS 8519 (2020), Selection and installation of fire-resistant power and control cable systems for life safety, fire-fighting and other critical application – code of practice

[18] BS ISO 3864-1 (2011), Graphical symbols – Safety colours and safety signs. Design principles for safety signs and safety markings.

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6 External Fire Spread

6.1 Method

The following describes the method used for assessing the external fire spread between buildings.

Fire spread from building to building by radiation is dependent on:

- The distance between, and orientation of, the building of origin and the neighbouring structure;
- The extent of the building surface capable of transmitting heat i.e. the area of non-fire resisting façade; and,
- The intensity of the source of radiation i.e. the building usage.

This calculation is undertaken using the BR 187 Enclosing Rectangle Method. The intensity of the radiation used in the calculation is categorised as follows:

- Purpose Category 1 – a standard fire load with a radiation intensity of 168 kW/m^2 (this is usually used for shops, commercial units and storage units);
- Purpose Category 2 – a reduced fire load with a radiation intensity of 84 kW/m^2 (this is usually used for offices, or assembly and recreational purposes).

The boundary at which the radiation intensity is assessed is known as the relevant boundary.

Details of the calculations are included in Appendix A.

6.2 Building Separation

The relevant boundaries for the building are taken either as the site boundaries or the centreline of the road, as shown in Figure 6—1 .

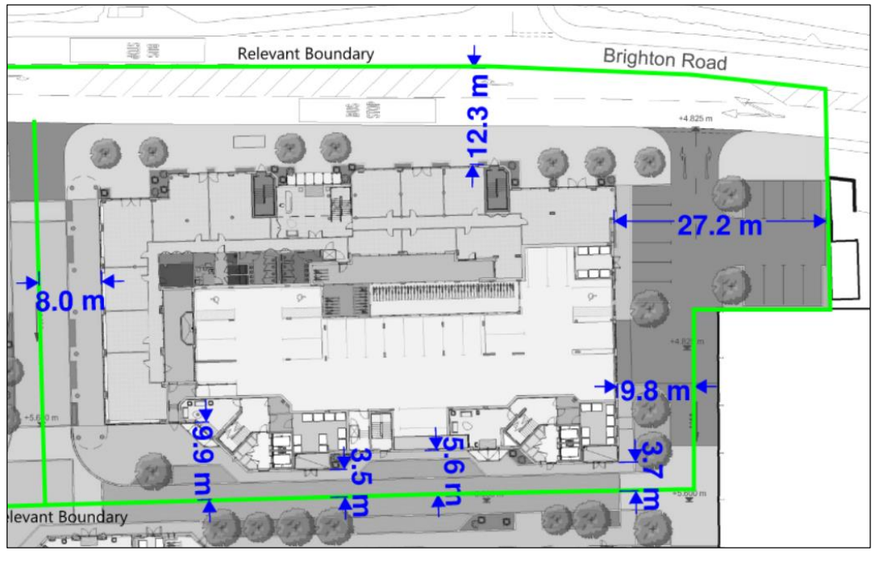

Figure 6—1 Relevant Boundaries

The South and West boundary distances have been measured to the middle of the access roads between the development buildings.

The North boundary has been taken as a middle of Brighton Road.

The East boundary has been measured to the middle of the road between building G/G1 and the existing building. Where the existing building is not located adjacent to the site boundary the distance has been taken to the site boundary.

6.3 Assessment

In the following sections the outcome of the enclosing rectangle assessment has been presented in tables.

In the assessment the allowable unprotected area is checked for the most critical compartments, based on a rectangle size or distance to the boundary,

6.3.1 Apartments

Based on the provision of compartment floors and compartment walls between apartments, the enclosing rectangle is taken around the unprotected areas of one apartment only (the largest). The finished floor to underside of slab is taken as 3.1m for the purposes of the calculation. These calculations take into account that the apartments will be sprinkler protected to BS 9251 and therefore boundary distances can be doubled as per BR 187.

Table 6—1 External Fire Spread Assessment - Apartments

Height of Enclosing Rectangle[1] [m]	Width of Enclosing Rectangle [m]	Area of Enclosing Rectangle [m^2]	Actual Boundary Distance [m]	Allowable Unprotected Area [%]
North Elevation				
3.1	13.4	34	13.4	100
East Elevation				
3.1	11	34	9.8	100
South Elevation				
3.1	4.8	15	5.7	100
West Elevation				
3.1	9.3	29	7.9	100

Therefore, using the enclosing rectangle method, it has been determined that it is possible to maintain the external walls to the apartment as a 100% unprotected area.

6.3.2 Amenity Spaces and Non-Residential Units

For the purposes of the calculation, the finished floor to underside of slab has been taken as 5.0m at ground floor and 3.1m for floors above

Table 6—2 External Fire Spread Assessment – Amenity Spaces and Non-residential Units

Height of Enclosing Rectangle [m]	Width of Enclosing Rectangle [m]	Area of Enclosing Rectangle [m^2]	Actual Boundary Distance [m]	Allowable Unprotected Area [%]
North Elevation – Ground Floor Commercial Unit				
5.0	66.5	333	12.3	100 (office/restaurant) 95 (retail)

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Height of Enclosing Rectangle [m]	Width of Enclosing Rectangle [m]	Area of Enclosing Rectangle [m^2]	Actual Boundary Distance [m]	Allowable Unprotected Area [%]
North Elevation – First Floor AHU Plant Room [1]				
3.1	4.4	14	13.8	100
East Elevation – Ground Floor Car Park				
5..0	15.3	77	9.8	100
South Elevation – Ground Floor Car Park Ventilation Slot				
2.3	6.0	13	7.2	100
South Elevation – Basement Car Park Ventilation Slot				
1.3	9.6	12	5.6	100
South Elevation – Ground Floor Refuse Store [2]				
5.0	7.1	36	7.1	100
West Elevation – Ground Floor Commercial Unit				
5.0	29.1	146	8.0	100 (office/restaurant) 62 (retail)
West Elevation – First Floor AHU Plant Room [1]				
3.1	14	43	3.9	100

Note 1: Due to low risk of fire in the air handling units the Purpose Category 2 has been used when assessing the external fire spread for the air handling unit at the first floor

Note 2: Provision of residential sprinkler system within the two refuse stores accessed from the fire-fighting core is assumed

When using the BR 187 method for the **North and West** façade, the **commercial unit** is considered to be one unit used as an **office/restaurant** or retail. Based on that it has been determined that it is possible to maintain **100%** of unprotected area to the commercial unit when it is used as an office space. If the space is used as a **retail** the **North and West** elevation can remain **95%** and **62%** unprotected respectively. The protected construction required to achieve 120 minute integrity and 15 minute insulation fire resisting construction from the inside.

If the **commercial unit** is to be used for **retail** purposes and **100% of the elevation is to remain unprotected** the unit has to be **divided into separate retail units** with 120 min fire resisting construction between the units. For the external wall to be 100% unprotected the width of the retail unit at the North façade should not exceed 45m and 14m at the West façade,

Using the enclosing rectangle method, it has been determined that the rest of the elevations can be maintained as 100% unprotected.

6.4 External Wall Systems

The main façade is a horizonal brick tiles mounted onto a steel substructure.

6.4.1 External Wall Definition

The external wall definition is taken from The Building (Amendment) Regulations 2018 (2018 No. 1230).

- anything located within any space forming part of the wall;
- any decoration or other finish applied to any external (but not internal) surface forming part of the wall;
- any windows and doors in the wall; and,
- any part of a roof pitched at an angle of more than 70 degrees to the horizontal if that part of the roof adjoins a space within the building to which persons have access, but not access only for the purpose of carrying out repairs or maintenance

6.4.2 Construction of External Walls

External walls should be constructed using materials that do not support fire spread. Flame spread over or within an external wall construction should be controlled to avoid creating a route for rapid fire spread, bypassing compartment floors or walls.

In buildings with a storey 18m or more above ground level all materials which become part of an external wall should achieve European Class A2-s1,d0 or Class A1 when classified in accordance with BS EN 13501[19]. This does not apply to the following:

- cavity trays when used between two leaves of masonry;
- any part of the room if that part is connected to an external wall;
- door frames and doors;
- electrical installations;
- insulation and water proofing materials used below ground level;
- intumescent and fire stopping materials where the inclusion of materials is necessary to meet the requirements of Part B of Schedule 1;
- membranes;
- seals, gaskets, fixings, sealants and backer rods;
- thermal break materials where the inclusion of the materials is necessary to meet the thermal bridging requirements of Part L of Schedule 1; and
- window frames and glass.

If any of the following are attached to an external wall, they should also achieve European Class A2-s1,d0 or Class A1 with a storey 18m or more above ground level:

- any balconies;
- devices for reducing heat gain within a building by deflecting sunlight; and,
- solar panels.

Membranes used as part of the external wall construction should achieve a minimum classification of European Class B-s3 d0 in buildings with a storey 18m or more above ground level.

[19] BS EN 13501-1:2018 Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests.

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6.5 Cavity Barriers

The main objectives for the cavity barriers within the external wall are to ensure that they are provided:

- To meet the limits for cavity void dimensions;
- On the line of every compartment wall;
- On the line of every compartment floor;
- Within the void of a cladding system (i.e. between the back of the outer cladding and the insulation or sheathing board to the inner wall system) running past the line of compartmentation (i.e. wall or floor), which includes staircases, firefighting shafts, lift shafts, service risers, etc.;
- At the junction between external walls containing a cavity and every internal fire-resisting element whether it be a wall, floor, or door;
- At any edges of openings through the external wall (which includes and door, window, and other similar penetration openings); and,
- So that so that the maximum distance between them does not exceed
    - 20m, where materials in the cavity have a Class 1 (EN Class C-s3, d2) or better spread of flame,
    - 10m where the materials have a lower than Class 1 spread of flame value, except where a closer spacing is required to meet other relevant criteria.

The locations for cavity barriers with cavity formed by the rainscreen cladding system and the SFS backing wall or reinforced concrete panels are as follows:

Open State:

- At the head of windows, doors, etc. (Note: if these can be close state that is preferred).
- Horizontally at all compartment floors.
- Horizontally within the cavity in front of a protected escape staircase, or protected shaft service riser abutting the external wall every 20m measured vertically from the lowest cavity level of the cavity.

Close State:

- At the sides and sills of windows, doors, etc.
- Vertically at compartment walls – i.e. party walls, protected shafts (i.e. staircases, service risers, lifts).
- Around all edges of service penetrations (i.e. louvres, vent grilles etc).
- Vertically to ensure that the horizontal width of any cavity does not exceed 20m.

Note: where a cavity barrier is installed around a window or door, the cavity barrier may need to be positioned slightly away from the sides/ head/ sill due to the positioning of cladding support rails at these interfaces.

In all cases the cavity barriers around windows, etc, must be continuous.

Cavity barriers shall achieve a minimum of 30 minutes in terms of integrity and 15 minutes in terms of insulation (EI 30/15) when:

- tested from the underside for horizontal cavity barriers, and
- tested from both sides for vertical cavity barriers.

All proprietary materials to be used as a cavity barrier shall hold relevant and current fire resistance test evidence, field of application or extended field of application reports relevant to their intended use.

For additional detail on locations of cavity barriers and fire stops please consult CZWG fire strategy drawings and details.

Figure 6—2 presents Figure 24 of BS 9991 indicating provision of cavity barriers.

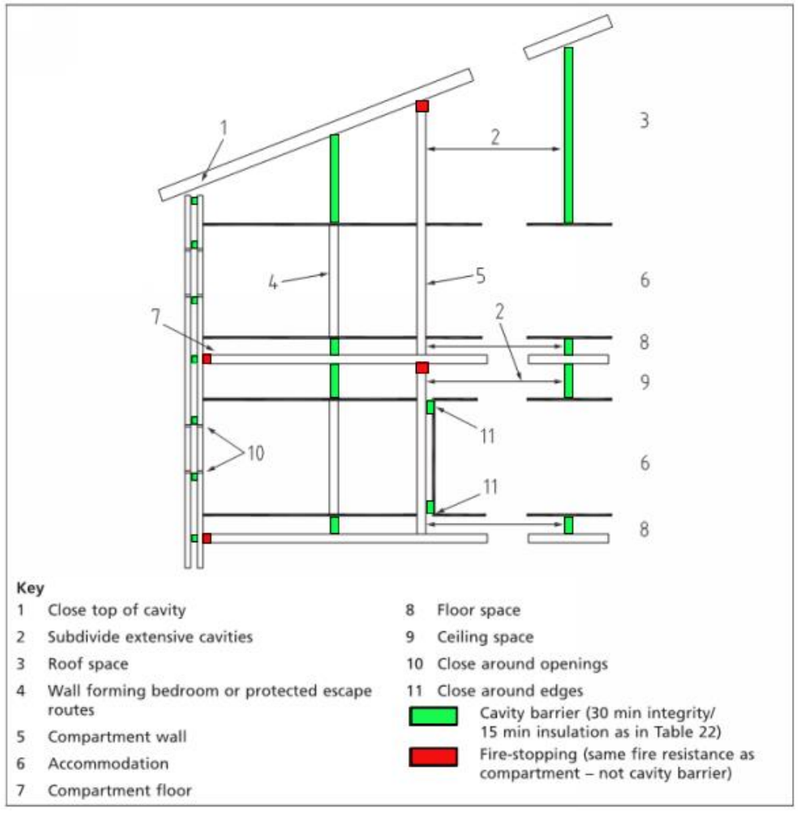

Figure 6—2 Figure 24 of BS 9991:2015 – Provisions for Cavity Barriers

6.6 Roof Coverings

To restrict the spread of fire over roofs, the properties of a roof covering are relevant if:

- the roof is close enough to a boundary to be a risk of ignition from a fire in other buildings; or
- It is within the vicinity of a compartment wall, to avoid fire spread between compartments via a roof covering.

The separation distances for roof coverings are given in Table 6—3.

The smallest distance from roof to a relevant boundary is approximately 5.5m, therefore the roof covering should achieve class AA, AB or AC ($B_{ROOF}(t4)$).

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Table 6—3 Separation Distances for Roof Coverings

Designation of covering of roof or part of roof [1]		Distance of roof from any point on relevant boundary			
National Class	**European Class**	**Less than 6m**	**At least 6m**	**At least 12m**	**At least 20m**
AA, AB or AC	B_{ROOF}(t4)	Acceptable	Acceptable	Acceptable	Acceptable
BA, BB or BC	C_{ROOF}(t4)	Not acceptable	Acceptable	Acceptable	Acceptable
CA, CB or CC	D_{ROOF}(t4)	Not acceptable	Not acceptable	Not acceptable	Acceptable
AD, BD	E_{ROOF}(t4)	Not acceptable	Not acceptable	Acceptable	Acceptable
DA, DB, DC	F_{ROOF}(t4)	Not acceptable	Not acceptable	Not acceptable	Not acceptable

Note 1: The performance of roof coverings is designated by reference to the test and classification standards given in BS 476-3 (or DD ENV 1187) (national class) and BS EN 13501-5 (European class).

A compartment wall should be taken up to meet the underside of the roof covering or deck, with fire-stopping where necessary at the wall-roof junction to maintain continuity of fire resistance. The compartment wall should also be continued across any eaves cavities. The recommendations of Figure 30 of BS 9999:2017 should be followed.

Where PV panels are to be provided, care should be taken when installing significant numbers of panels, such that these do not attribute to undue fire spread. As a minimum, the performance of the PV panels should achieve the same classification as the roof coverings applicable to that area to effectively inhibit the rapid spread of fire over the roof coverings. It is recommended for an isolation switch to be provided for fire service use, if these are provided.

Green roofs at the residential amenity spaces will be designed in accordance with DCLG guidance note, *Fire Performance of Green Roofs and Walls*, 2013.

7 Fire Brigade Access and Facilities

7.1 Fire Service Access

Fire Brigade access has been provided to within 18m of each dry fire main inlet connection point, see Figure 7—1.

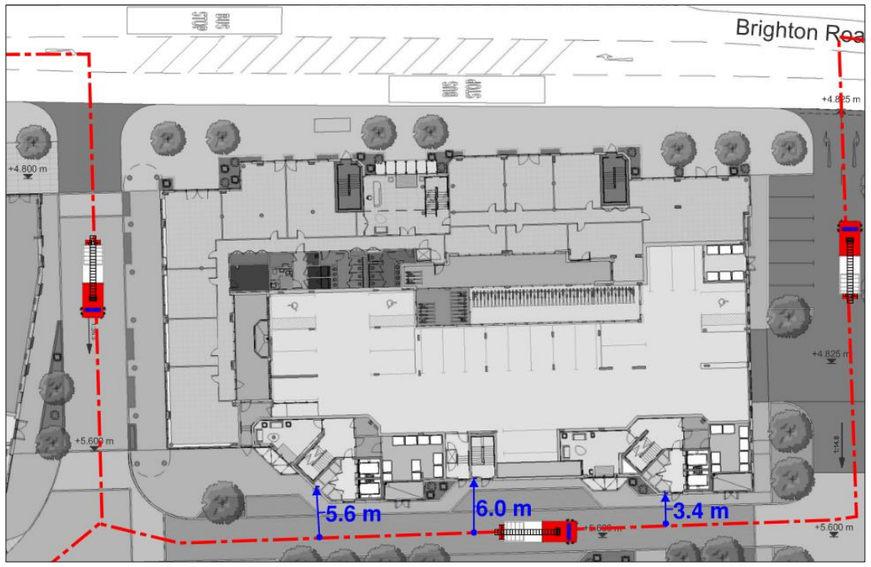

Figure 7—1 Fire-fighting Access

The access routes conform to the dimensions in Table 7—1. Dead-ends are avoided in this design.

Table 7—1 Typical Vehicle Access Route Dimensions

Appliance Type	Min. with 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 [t]
Pump	3.7	3.1	16.8	19.2	3.7	12.5

Note: the roadway carrying capacity may be exceeded by the local fire service appliances and the requirements for their equipment should be confirmed.

7.2 Fire-fighting Facilities

7.2.1 Residential Areas

Both tower blocks have a height of more than 18 when measured from fire-fighting access level to the top occupied floor. Therefore, both blocks are provided with firefighting shafts which comprise a fire-fighting stair, fire-fighting lift and a fire main (designed as dry main for buildings below 50m in height).

Staircase

Fire-fighting stair cores will be provided with a 1m^2 geometric free area AOV at the head of the stair. The staircase has a width not less than 1100mm.

Fire Fighting Lobby

The common protected corridors, which access the apartments, form the firefighting lobbies. The lobbies are provided with natural smoke ventilation via openable windows, as per the provisions for means of escape.

Fire Mains

Dry risers are to be designed in accordance with BS 9990[20]. Dry riser outlets will be provided within the fire-fighting stair enclosures at the full storey landings. The distance from the fire-fighting lift to the fire-fighting stair is designed to be less than 7.5m. Fire-fighting lifts will be designed in accordance with BS EN 81-72[21].

Fire Resistance

Both fire-fighting shafts are enclosed in 120 minutes fire resisting construction.

Access

Access for fire fighters to the residential levels is via an entrance reception. This area is not designed to be fire sterile; however, as presented in Section 2.2.5 this design is considered reasonable based on provision of sprinkler protection within the reception area and provision of fire separated alternative routes from the building for evacuating occupants. If the fire is located within the entrance reception fire-fighters are expected to fight the fire from the outside and will not require access to the fire-fighting core.

7.2.2 Basement

Fire-fighting access to the basement level is via a protected stair serving this level only. The protected stair is provided with a dry main and is separated at the basement level with a protected ventilated lobby between the stair and the car park.

7.2.3 Ground Floor

The office areas and ground floor car park are designed to be accessed within 45m hose laying distance from an appliance parking position, measured on a route suitable for laying hose.

[20] BS 9990:2015, Code of practice for non-automatic fire fighting systems in buildings.

[21] BS EN 81-72:2015, Safety rules for the construction and installation of lifts – particular applications for passenger and goods passenger lifts. Firefighters lifts.

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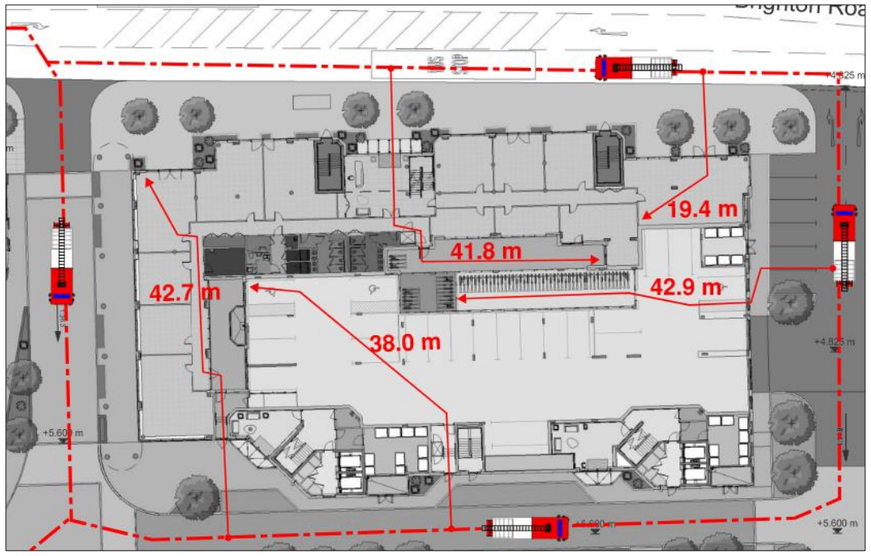

Figure 7—2 Ground Floor Hose Coverage from Fire Brigade Parking Position

7.3 Fire Hydrants

Fire hydrants should be located within 90m of dry fire main inlets, and not more than 90m apart. The location of the fire hydrants is to by confirmed

7.4 Hose Coverage

All parts of the floorplate within areas that are sprinkler protected in accordance with BS 9251 (i.e. residential apartments and ancillary accommodation) are no more than 60 m from the fire main outlets in the fire-fighting stairs, as measured on a route suitable for laying hose. This limit is reduced to 45m for areas without sprinkler protection, i.e. car parks and offices. as presented in Figure 7—2. Figure 7—3 illustrates the hose coverage within residential units.

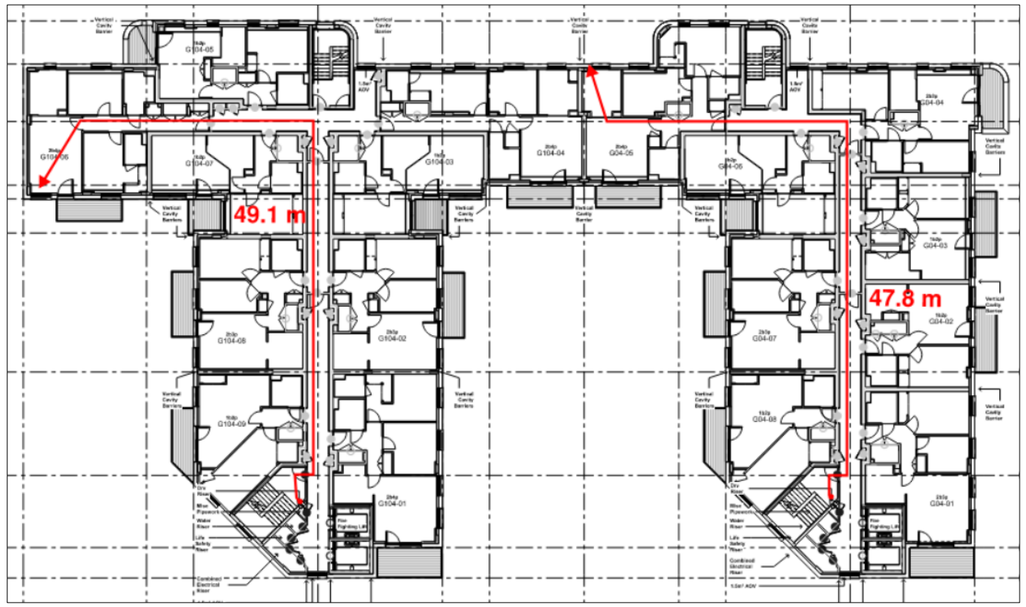

Figure 7—3 Hose Coverage Residential Areas – Level 4

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Appendix A External Fire Spread Assessment

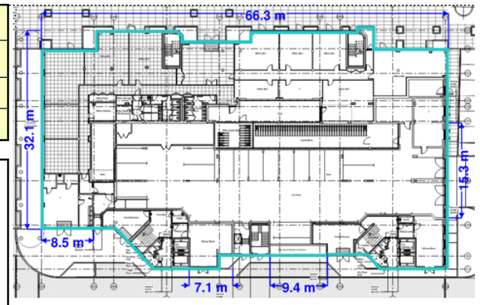
BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	NORTH FAÇADE Ground Floor – Office	Prepared by	AW
			Checked by	SJM

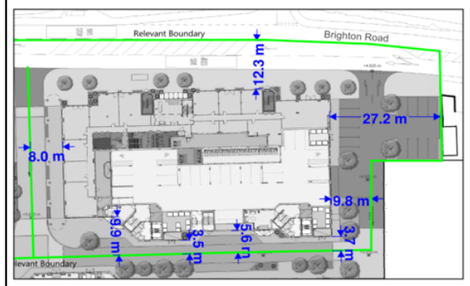
Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	2	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	5	(m)
Width of enclosing rectangle	66.3	(m)
Distance to the boundary	12.3	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	332	(m^2)
Calculation Method	100%	332	(m^2)





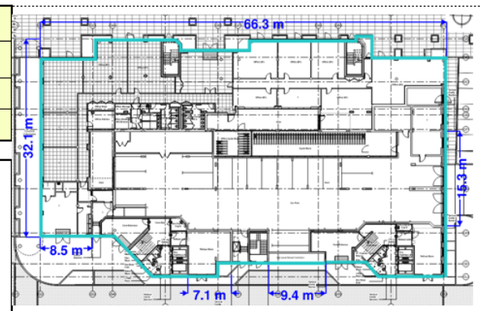
BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	NORTH FAÇADE Ground Floor – Retail	Prepared by	AW
			Checked by	SJM

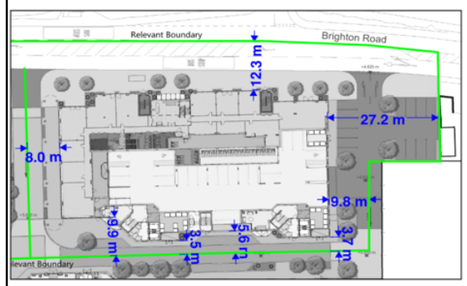
Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	5	(m)
Width of enclosing rectangle	66.3	(m)
Distance to the boundary	12.3	(m)

Allowable percentage and area of façade unprotected			
Tables Method	95%	313	(m^2)
Calculation Method	83%	274	(m^2)





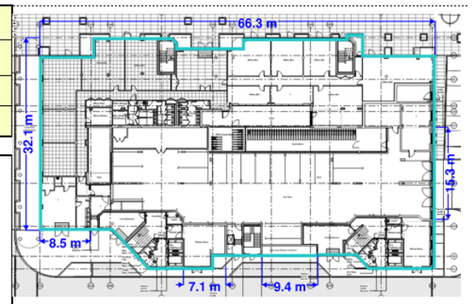
BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	NORTH FAÇADE Ground Floor – Retail Maximum Width of the Compartment	Prepared by	AW
			Checked by	SJM

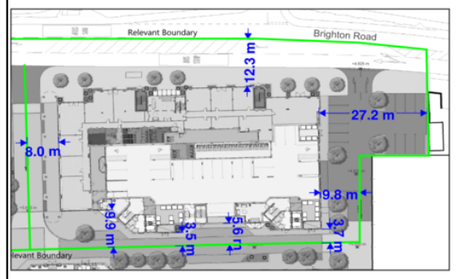
Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	5	(m)
Width of enclosing rectangle	45	(m)
Distance to the boundary	12.3	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	225	(m^2)
Calculation Method	94%	212	(m^2)





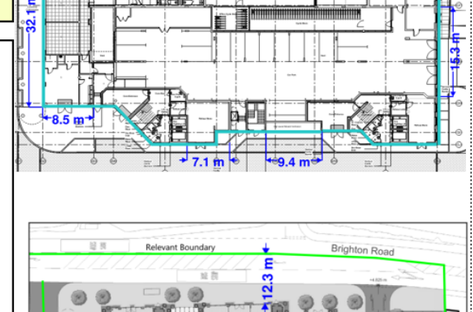
BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	EAST FAÇADE Ground Floor – Car park	Prepared by	AW
			Checked by	SJM

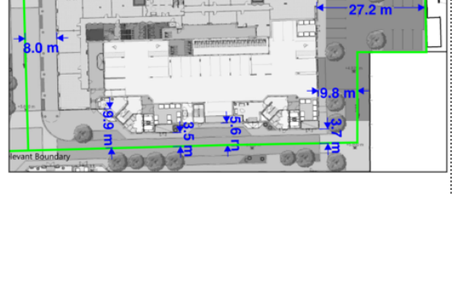
Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	5	(m)
Width of enclosing rectangle	15.3	(m)
Distance to the boundary	9.8	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	77	(m^2)
Calculation Method	100%	77	(m^2)





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Project	0047496 Free Wharf Phase 2	Sheet No	1
Area of Project	Building G/G1	Revision	A
Elevation Description	SOUTH FAÇADE Ground Floor – Car park	Prepared by	AW
		Checked by	SJM

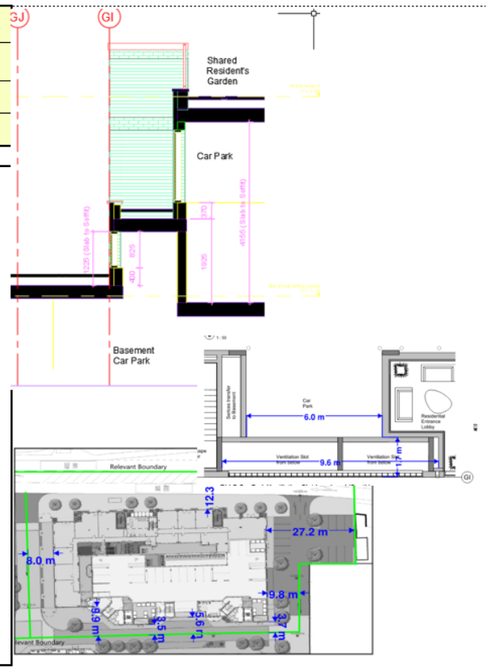
Design Assumptions

1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

○ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	2.23	(m)
Width of enclosing rectangle	6	(m)
Distance to the boundary	7.2	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	13	(m^2)
Calculation Method	100%	13	(m^2)



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Project	0047496 Free Wharf Phase 2	Sheet No	1
Area of Project	Building G/G1	Revision	A
Elevation Description	SOUTH FAÇADE Ground Floor – Refuse Store 1	Prepared by	AW
		Checked by	SJM

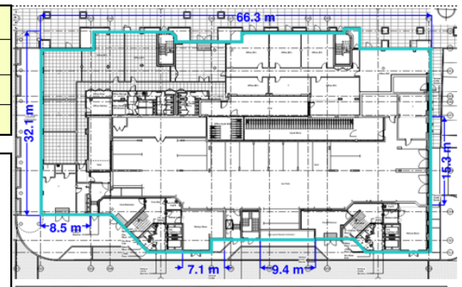
Design Assumptions

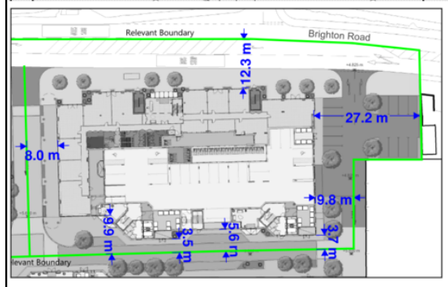
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

○ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	Y	
Height of enclosing rectangle	5	(m)
Width of enclosing rectangle	7.1	(m)
Distance to the boundary	3.5	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	36	(m^2)
Calculation Method	100%	36	(m^2)





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Project	0047496 Free Wharf Phase 2	Sheet No	1
Area of Project	Building G/G1	Revision	A
Elevation Description	SOUTH FAÇADE Ground Floor – Basement Car park Ventilation	Prepared by	AW
		Checked by	SJM

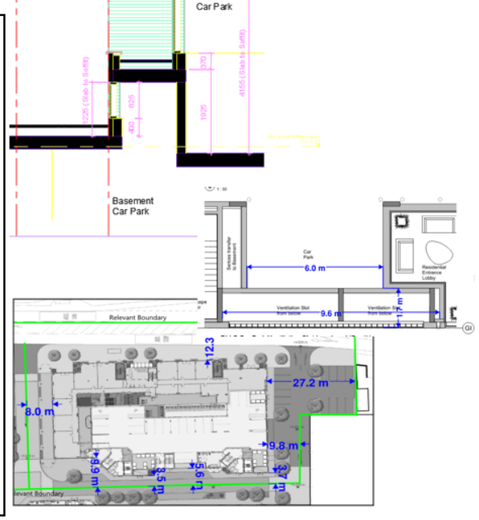
Design Assumptions

1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

○ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	1.3	(m)
Width of enclosing rectangle	9.6	(m)
Distance to the boundary	5.6	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	12	(m^2)
Calculation Method	100%	12	(m^2)



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Project	0047496 Free Wharf Phase 2	Sheet No	1
Area of Project	Building G/G1	Revision	A
Elevation Description	SOUTH FAÇADE Ground Floor – Reception	Prepared by	AW
		Checked by	SJM

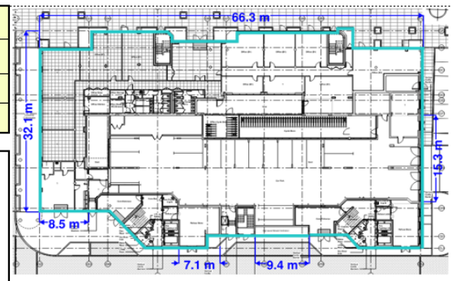
Design Assumptions

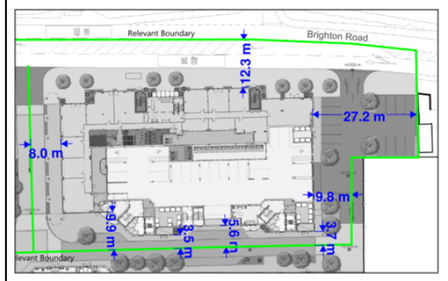
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

○ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	5	(m)
Width of enclosing rectangle	8.5	(m)
Distance to the boundary	9.9	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	43	(m^2)
Calculation Method	100%	43	(m^2)





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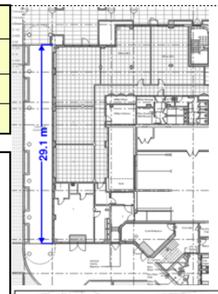
BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	WEST FAÇADE Ground Floor – Office	Prepared by	AW
			Checked by	SJM

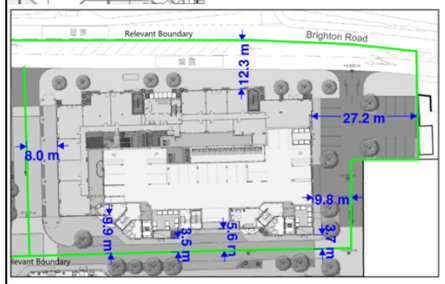
Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	2	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	5	(m)
Width of enclosing rectangle	29.1	(m)
Distance to the boundary	8	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	146	(m^2)
Calculation Method	100%	146	(m^2)





BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	WEST FAÇADE Ground Floor – Retail	Prepared by	AW
			Checked by	SJM

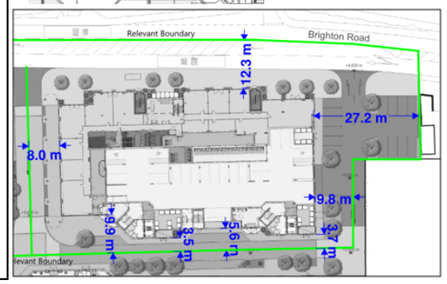
Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	5	(m)
Width of enclosing rectangle	29.1	(m)
Distance to the boundary	8	(m)

Allowable percentage and area of façade unprotected			
Tables Method	62%	90	(m^2)
Calculation Method	61%	89	(m^2)





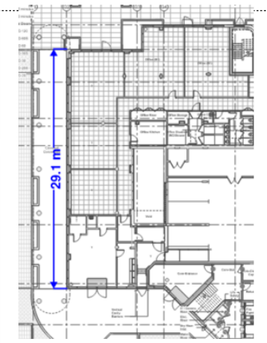
BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	WEST FAÇADE Ground Floor – Retail Maximum Width of the Compartment	Prepared by	AW
			Checked by	SJM

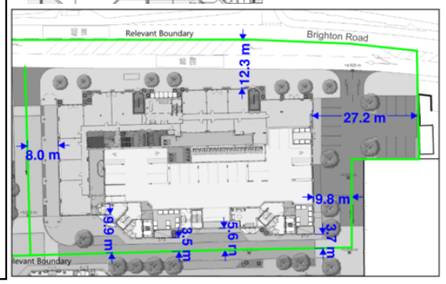
Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	5	(m)
Width of enclosing rectangle	14	(m)
Distance to the boundary	8	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	70	(m^2)
Calculation Method	98%	69	(m^2)





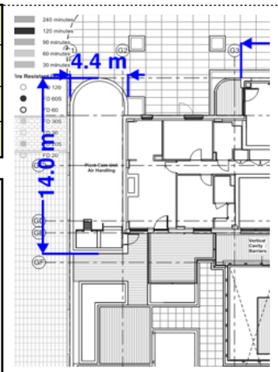
BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	NORTH FAÇADE Level 1 Air Handling Unit	Prepared by	AW
			Checked by	SJM

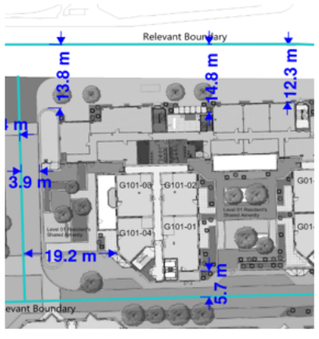
Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	2	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	4.4	(m)
Distance to the boundary	13.8	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	14	(m^2)
Calculation Method	100%	14	(m^2)





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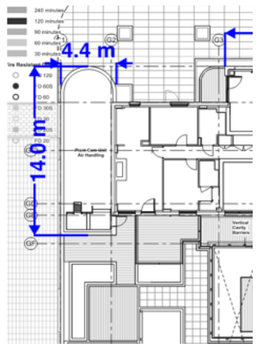
BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	WEST FAÇADE	Prepared by	AW
		Level 1 Air Handling Unit	Checked by	SJM



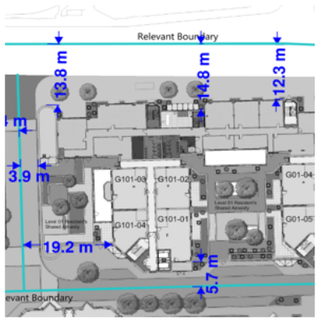
Design Assumptions

1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

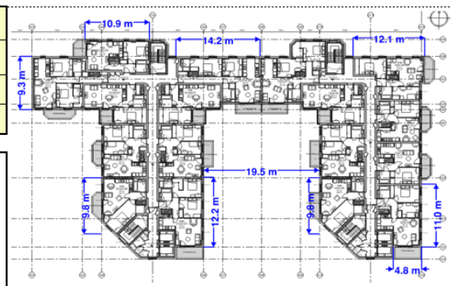
◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	2	
Is building sprinklered? *Enter Y if yes and N if No*	N	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	14	(m)
Distance to the boundary	3.9	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	43	(m^2)
Calculation Method	100%	43	(m^2)



BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	NORTH FAÇADE	Prepared by	AW
		Levels 1-5 – Apartments	Checked by	SJM



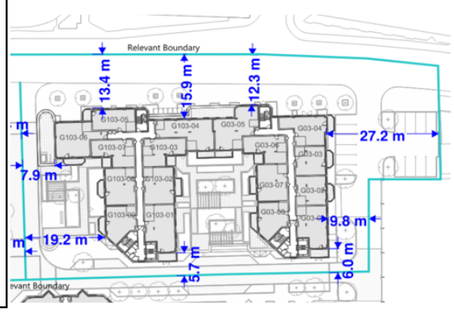
Design Assumptions

1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

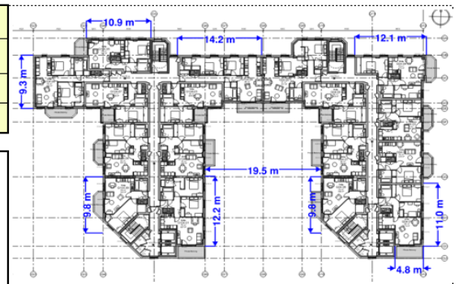
◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	Y	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	10.9	(m)
Distance to the boundary	13.4	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	34	(m^2)
Calculation Method	100%	34	(m^2)



BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	EAST FAÇADE	Prepared by	AW
		Levels 1-5 – Apartments	Checked by	SJM



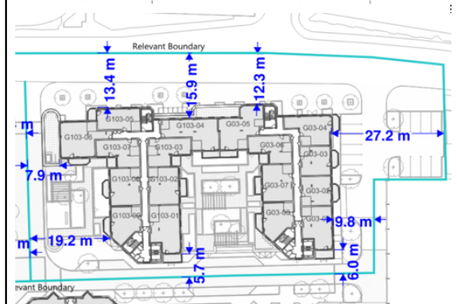
Design Assumptions

1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	Y	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	11	(m)
Distance to the boundary	9.8	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	34	(m^2)
Calculation Method	100%	34	(m^2)



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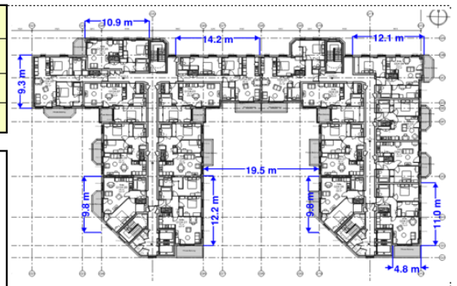
BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	SOUTH FAÇADE Levels 1-7 – Apartments	Prepared by	AW
			Checked by	SJM

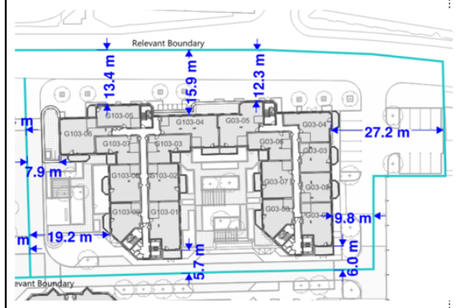


Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

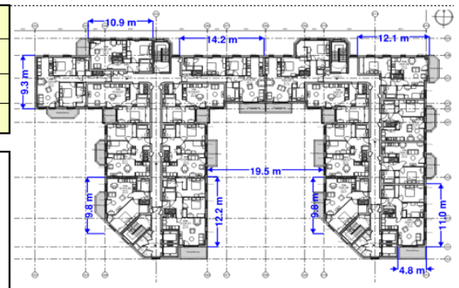
○ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	Y	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	4.8	(m)
Distance to the boundary	5.7	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	15	(m^2)
Calculation Method	100%	15	(m^2)



BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	WEST FAÇADE Levels 1-5 – Apartments	Prepared by	AW
			Checked by	SJM

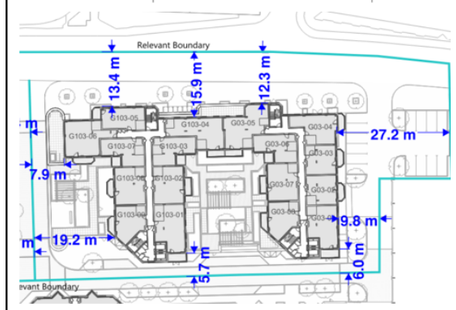


Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

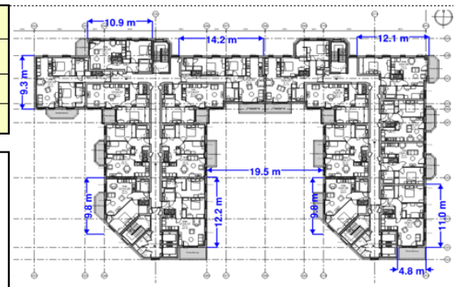
○ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	Y	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	9.3	(m)
Distance to the boundary	7.9	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	29	(m^2)
Calculation Method	100%	29	(m^2)



BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	INTERNAL FACADES Level 6 – Apartments	Prepared by	AW
			Checked by	SJM



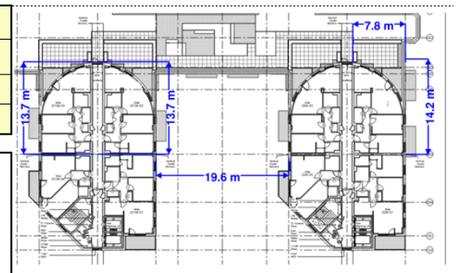
Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

○ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	Y	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	12.2	(m)
Distance to the boundary	9.75	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	38	(m^2)
Calculation Method	100%	38	(m^2)

BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	NORTH FAÇADE Levels 6-7 – Apartments	Prepared by	AW
			Checked by	SJM

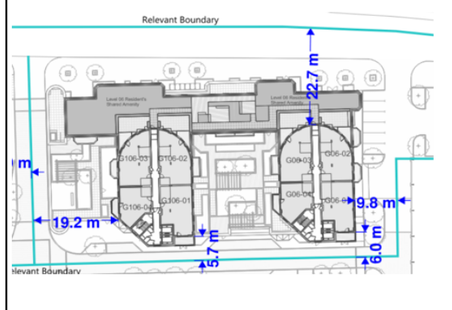


Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

○ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	Y	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	7.8	(m)
Distance to the boundary	22.7	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	24	(m^2)
Calculation Method	100%	24	(m^2)



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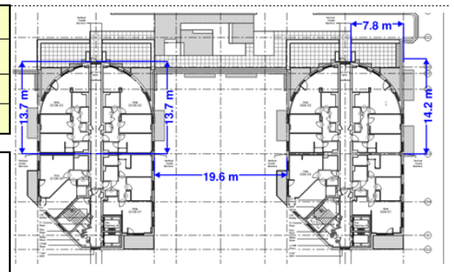
BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	EAST FAÇADE Levels 6 – Apartments	Prepared by	AW
			Checked by	SJM

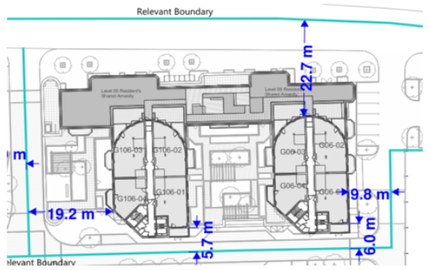


Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

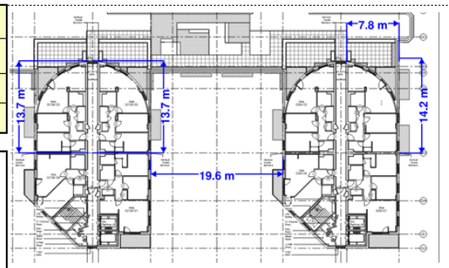
◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	Y	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	14.2	(m)
Distance to the boundary	9.8	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	44	(m^2)
Calculation Method	100%	44	(m^2)



BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	WEST FAÇADE Levels 6–7 – Apartments	Prepared by	AW
			Checked by	SJM

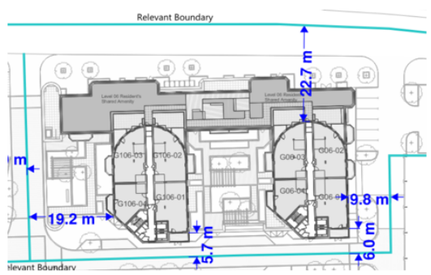


Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

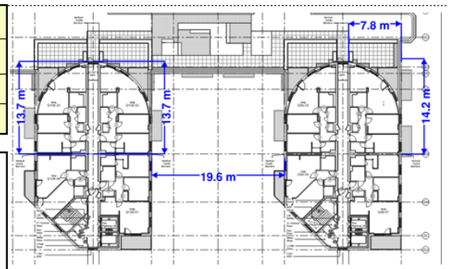
◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	Y	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	13.7	(m)
Distance to the boundary	19.2	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	42	(m^2)
Calculation Method	100%	42	(m^2)



BUROHAPPOLD ENGINEERING				
	Project	0047496 Free Wharf Phase 2	Sheet No	1
	Area of Project	Building G/G1	Revision	A
	Elevation Description	INTERNAL FAÇADE Levels 6 – Apartments	Prepared by	AW
			Checked by	SJM



Design Assumptions
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method
2. If sprinklers are taken into account, unprotected area or boundary distance is

◇ Calculate allowable boundary distance
◉ Calculate allowable unprotected area

Input		
Building purpose *for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1* *for Residential, Office or Assembly and recreational purposes enter 2*	1	
Is building sprinklered? *Enter Y if yes and N if No*	Y	
Height of enclosing rectangle	3.1	(m)
Width of enclosing rectangle	13.7	(m)
Distance to the boundary	9.8	(m)

Allowable percentage and area of façade unprotected			
Tables Method	100%	42	(m^2)
Calculation Method	100%	42	(m^2)

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