

UCL PEARL
RIBA Stage 3 FEDRA Report
PRL-BUH-01-XX-RP-F-002

10 July 2019

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01 Fire

1. Introduction

1.1 Aim

This Stage 3 report outlines the key fire strategy requirements for the proposed University College London (UCL) PEARL development.

This Stage 3 report has been produced for consultation with the design team, and Client in order to set out key parameters for the design and operation of the PEARL facility in terms of fire safety. The primary focus for the fire strategy is to demonstrate how the functional life-safety requirements of the Building Regulations 2010 will be met. The information in the following text is related to the architectural drawings produced by Penoyre & Prasad.

1.2 Building Description

The development is a research facility that focuses on accessibility and mobility in life-size environments. It is to be located on the Londoneast-uk development site in Dagenham. The facility will consist of a large warehouse-like space with open plan flexible laboratory area, racked storage areas and a separate two-storey office area/ workspace (known as “The Groove”). A plant and storage area would also be provided to the East of the building. The total area of the development is approximately 4,670m².

1.3 Applicable Code Guidance

The principal guidance document that the fire strategy will adopt to demonstrate compliance with the functional requirements of Building Regulations 2010, will be BS 9999 ‘Code of practice for fire safety in the design, management and use of buildings’, BSI, 2017. This guidance allows for a more flexible approach to fire safety design taking into account the occupancy characteristics, fire loading, physical properties (i.e. size and height) and the additional fire safety features that will exist within a development. In these cases fire engineering designs, in accordance with BS 7974¹ will be used to justify deviations from the code guidance and demonstrate that an equivalent level of safety is provided to a fully code compliant solution.

The design should also take into account the UCL Fire Safety Requirements (issued on 08/07/2019) where appropriate and the requirements are more onerous than recommendations of BS9999:2017.

1.4 Design Basis

The report is based on, and should be read in conjunction with, the plans issued by Penoyre & Prasad on 21/06/2019, as illustrated in Table 1—1. Additional information or variations to the plans referenced may invalidate the conclusions and recommendations contained within the report.

Drawing Number	Description	Rev	Date
PRL-PPA-01-00-DR-A-3200	Ground Floor Plan	P08	08/07/2019
PRL-PPA-01-01-DR-A-3201	First Floor Plan	P08	08/07/2019
PRL-PPA-01-02-DR-A-3202	Second Floor Plan	P07	08/07/2019
PRL-PPA-01-RF-DR-A-3203	Roof Plan	P06	08/07/2019
PRL-PPA-01-SL-DR-A-3160	Proposed Site Plan	P04	21/06/2019
PRL-PPA-01-ZZ-DR-A-3300	Site Sections AA and BB	P03	21/06/2019
PRL-PPA-01-ZZ-DR-A-3310	GA Sections 01 and 02	P03	21/06/2019
PRL-PPA-01-ZZ-DR-A-3311	GA Sections 03 and 04	P03	21/06/2019
PRL-PPA-01-ZZ-DR-A-3400	West and North Elevations	P06	21/06/2019
PRL-PPA-01-ZZ-DR-A-3401	East and South Elevations	P05	21/06/2019

Note: Architectural drawings to be updated to align with this report

¹ BS 7974 (2001) Application of fire safety engineering principles to the design of buildings – Code of Practice

1.5 Fire Safety Management

A significant part of the fire safety regimes within any building is the standard and quality of fire safety management.

This report is not the fire safety management policy and procedures document required as part of the ‘responsible person’s’ statutory compliance with the Regulatory Reform (Fire Safety) Order 2005.

In determining our fire safety design measures, we have clarified our assumptions on the quality of fire safety management to be put in to place by the client to meet statutory requirements. The aspects of the fire strategy that require management consideration are highlighted in **red** within the report.

1.6 Regulatory Reform Order

Responsibility for complying with the Regulatory Reform (Fire Safety) Order rests with the ‘responsible person’. In a workplace, this is the employer and any other person who may have control of any part of the premises, e.g. the occupier or owner.

The fire safety strategy developed by the design team is not a risk assessment under the Order but will form part of the information used by the ‘responsible person’ in developing their risk assessments.

1.7 Key Fire Strategy Parameters

Item	Fire Strategy Output
Risk Profile	
Overall Building	A3
Means of Escape	
Evacuation	The building will follow a simultaneous evacuation strategy, with all occupants evacuating on alarm in any of the building areas.
Escape Widths and Travel Distances	Escape and travel distances are as per BS9999:2017.
Disabled People Evacuation	Disabled refuges provided externally on the external stair landings from First Floor workspace areas. Evacuation-standard lift is provided within the workspace area that is not protected by protected lobbies and does not have protected escape route to outside at Ground level. Management procedures will be developed to allow use of the lift for evacuation.
Active Fire Safety Systems	
Alarm and Detection	Throughout to L2 standard in accordance with BS 5839-1 ²
Suppression	No fire suppression is provided within the building.
Smoke Control	No smoke control is provided within the building.
Fire Curtains and Shutters	A 60 minute integrity and radiation fire and smoke rated curtain will be provided at the connection between the Vehicle Access Zones area and the Laboratory area or alternatively the large door will provide 60 minutes and be linked to the fire alarm.
Firefighting	
Perimeter Vehicle Access	The fire vehicle access is provided to the 15% of the building perimeter, as per BS9999:2017 requirements.
Structure and Compartmentation	
Structural Protection to Loadbearing Elements	The frame of the main enclosure fire protected where it forms part of a compartment wall, such as between the Plant areas and the rest of the building or where the fire resistance is required to the external wall to restrict the external fire spread of fire between the buildings. 60 minute structural fire protection to all load-bearing structural elements of the workspace area.
Compartmentation and Fire resistance	All of the areas of the building are part of the same compartment, with the exception of the Plant area which is separated from the rest of the building by 60 minutes fire resisting construction. There are other areas which are enclosed in fire resistant construction to deal with the fire load contained within the room itself. For example, this is the case for LV switch room (120 minutes), Lift shaft (30minutes), Riser shafts (30minutes), Storage areas (30 minutes), Cleaners’ store (30 minutes), Server room (30minutes), and Bin store (30minutes). Please refer to the architect’s fire strategy drawings for details.

²BS 5839-1:2013 Fire detection and fire alarm systems for buildings – Part1: Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises

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2. Means of Escape

2.1 Evacuation Strategy

The building will follow a simultaneous evacuation strategy, with all occupants evacuating on alarm in any of the building areas.

2.2 Risk Profile

The building does not precisely fit any of the building use groups discussed in BS9999 and the risk profile would need to be determined by carefully analysing the risks.

Based on the information that has been provided by UCL regarding the materials used for the construction of the experimental set ups, these will be largely limited to the plywood of various thicknesses, steel, concrete and stone. No use of expanded polystyrene, paper or similar is proposed. An example of the experimental set up as used in the current facility is given below. Therefore, the Laboratory area could be classified as having a fast growth rate (Category 3), as opposed to ultra-fast fire growth rate.



Figure 2—1 Example Experiment Set Up in the Current Facility. Mock-up Train Unit and Platform Edge Doors Made from Plywood (with Polycarbonate Glazing in the Platform Edge Doors, but Open Windows in the Train).

This, however, will be dependent on the tight control of the materials present in the Laboratory area to ensure that the materials present in the building remain limited to the plywood, steel and concrete throughout the life of the building and suitably demonstrated management procedures. The management procedures will also need to be in place to ensure that at no point are items such as acetones, paints, thinners, fuel etc. stored in bulk in the premises (small volumes for maintenance uses can be retained, provided these are located in separate fire resisting enclosures).

While materials present in the storage area would be similar to these in the Laboratory area, the fact that they would be stacked on top of each other in high rack storage could lead to rapid, uncontrolled spread of fire. As such, this would still need to be classified as area with ultra-fast fire growth rate (Category 4) requiring sprinklers to comply with recommendations of BS9999 guidance if designed as a high rack storage area.

Therefore, to reduce the classification to a fast fire growth rate (Category 3) and avoid providing sprinklers, the height of the rack storage would need to be limited. The BS9999 guidance does not define the height at which the storage would be considered to be high rack storage. However, there is a definition for “high piled storage” given in the International Building Code (IBC, model building code developed by the International Code Council) as approximately up to 3.6m high storage in racks.

It is therefore proposed to limit the top height of the combustible materials stored in racks to 3.6m as a reasonable assumption for the shelving not to be considered as “high rack”. The materials of limited combustibility (i.e. materials classified as A2-s3,d2 in accordance with BS EN 13501-1:2007+A1, when tested to BS EN ISO 1182 or BS EN ISO 1716 and BS EN 13823) or non-combustible materials (i.e. materials not capable of undergoing combustion under specified conditions) can be stored above the 3.6m limit in principle, as they would not represent additional fire load or fire risk. The combustible materials stored in 60 minutes fire resisting enclosures can also be stored above 3.6m limit as they would be fire separated from the rest of the fire load.

Suitable management procedures will be developed by UCL to ensure that the storage rules are enforced throughout the life of the building, with colour coding provided to separate combustible/non-combustible material storage zones, for example.

The polymer-based floor surfaces that will be stored between the experiments will either be stored in fire resistant containers or outside of the building when not used, as these could potentially result in rapid fire spread.

In terms of the occupancy, for the majority of time, such as day to day operation and preparation of the experimental set ups, the building would be used by occupants who will be very familiar with the building.

For the experiments, the building will also be used by the experiments participants who will be unfamiliar with the building. However, the experiments will require high staff presence (at least 1:10 for Health & Safety reasons) to manage the experiment proceedings and it is understood that staff will be trained to assist occupants with evacuation in the event of a fire. Additionally, the Laboratory area has a simple layout, with exits immediately visible to the occupants. Therefore, it is proposed to use “A” classification for the occupancy of the building, i.e. occupants that are both awake and familiar with the building.

Therefore, this would result in the proposed risk profile of A3. This category is acceptable within the scope of BS 9999 without requirement to provide sprinklers and they are not proposed.

As the workspace area is an ancillary area to the Laboratory, it is not proposed to design it as a separate area and it will also be designed using the same risk profile.

The proposed approach discussed above has been discussed and agreed in principle with UCL, Bureau Veritas and London Fire Brigade on 31/05/2019.

Following this meeting it was noted that above 3.6m high it is proposed to store items in fire resistant boxes. Additional detail surrounding this point is to be included within the next stage of design.

2.3 Experimental Set Ups

At this stage of the project, it is not possible to predict the exact nature and layout of the experiment set ups that would be provided in the facility. As such, separate fire risk assessments (FRA) would need to be conducted where an experiment is likely to affect the fire strategy (such as changes restricting means of escape, or increasing the assumed fire loading, or increasing the occupant loading beyond that assumed within the fire strategy). This FRA would then be used to determine the escape

provisions required and the impact of the proposed test of the fire safety in the building.

For example, it is understood that some of the proposed experiments would involve cold smoke, which would necessitate the disabling of fire and smoke detection within the building. This would require the development of robust management procedures to ensure that safe evacuation is possible, and that a fire can be identified during the early stages of fire development.

Within this report we have provided the key fire safety parameters which should be adhered to in terms of means of escape, fire safety systems and fire service access. These parameters can be used as the basis of these focused fire risk assessments.

2.4 Design Occupancy

At this stage, the building will be designed to allow for escape of the proposed occupancy of 1100 people (500 experiment participants +500 people viewing+100 staff) from the Laboratory area. This assumes that all of the exits from the Laboratory area are available to be used for evacuation and occupants are not prevented from using any of the exits by the experimental set up. This will need to be reviewed as part of fire risk assessment for each experimental set up.

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2.5 Number of Escape Routes

The minimum number of exits from a room, tier, or storey are as per the below table. Sufficient number of exits is provided from all areas of the building.

Table 2-1 Number of Escape Routes

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

Where there are more than 60 persons in any location the escape doors should be arranged open in the direction of escape and panic hardware may also be required on any escape routes fitted with a lock, latch or bolt fastenings. Electronically locked doors and security gates on escape routes should fail safe open on activation of the fire alarm and in the event of a loss of power. Any electronically locked doors on escape routes should be openable through use of Green Break Glass Units located adjacent to the door. All of the escape routes should be kept clear, free of obstacles and maintained available at all times.

2.6 Travel Distances

Based on an A3 risk profile, travel distances in the building are limited to 18m in a single direction of escape and 45m where alternatives are available when taking the fit out of the spaces into account.

Where provided, alternative escape routes should be sited 45 degrees or more apart such that a fire cannot render both routes unavailable at the same time.

2.6.1 Laboratory

The travel distances within the Laboratory area are within the limits described in the section above. The example travel distances are shown in Figure 2-2.

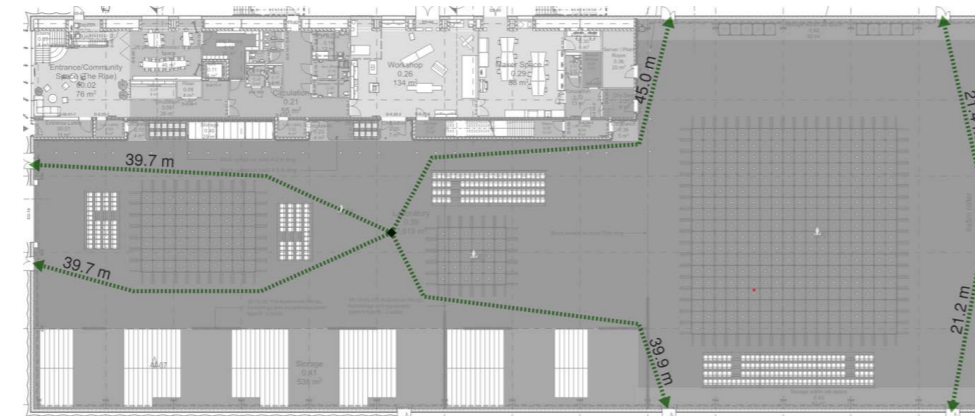


Figure 2-2 Travel Distances in the Laboratory Area

2.6.2 Office/Workspace (AKA "The Groove")

The workspace area is located over two levels. Travel distances in the workspace are within the recommendations noted in Section 2.6.

The occupants at Ground floor level can escape either directly to outside or to the Laboratory area, from where they can continue their escape via the Laboratory exits.

The occupants at First Floor level of the workspace can evacuate via the two external escape staircases (see section 2.8 for additional information on the design of external stairs) and an open accommodation stair leading to the Entrance/Community Space. The use of the open accommodation stair as a secondary escape route from the Seminar/Briefing room and the adjacent Break out Space is considered reasonable based on the route being a familiar route to the occupants and the travel distances to the final exit at Ground Floor level being within the recommendations of BS 9999 for travel in multiple directions of escape.

The single direction travel distance for wheelchair users or occupants with limited mobility from the First Floor balcony adjacent to the accommodation stair exceeds the single direction travel distance limit by 0.4m. This extension is considered reasonable in view of presence of the evacuation lift immediately adjacent to the escape route, as shown in Figure 2-4, and high level of management in the building.

The example travel distances are shown in Figure 2-3 and Figure 2-4.



Figure 2-3 Travel Distance in the workspace Area - Ground Floor

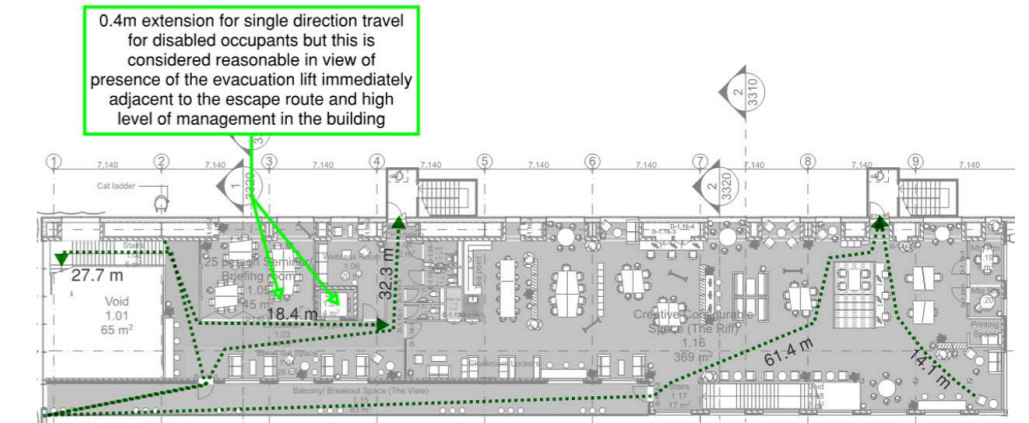


Figure 2-4 Travel Distance in the workspace Area - First Floor

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2.6.3 Storage

Travel distances from the storage area are within the recommendations of BS9999, as noted in Section 2.6 and shown in Figure 2—5.

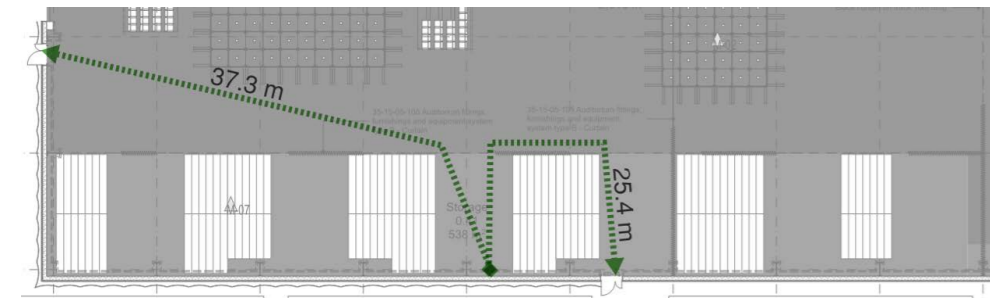


Figure 2—5 Travel Distance in the Storage Area

2.7 Escape Capacity

2.7.1 Code Guidance

Based on an A3 risk profile, escape capacity from the building should be assessed based on 4.6mm/person for exits 1050mm or larger. Where a door is less than 1050mm wide, including cases where the minimum width has been reduced by the provision of additional fire protection measures, the number of persons safely accommodated by that exit width should be calculated using the following equation:

$$n = 500/m$$

where:

n is the number of persons safely accommodated by the door width;

m is the minimum door width per person, 4.6mm/person

Escape routes should not reduce in effective width required along the route.

Day to day accessibility may have different requirements.

The escape capacity of the doors opening against the direction of escape will be limited to 60 occupants.

2.7.2 Laboratory

Six well-spaced 1250mm wide exits (clear width) are provided directly to outside from the laboratory area. After discounting one exit, this would provide escape capacity for 1358 occupants based on the escape width of 4.6mm/person, as discussed in Section 2.7.1. This is more than sufficient for the expected occupancy of the area.

It is noted the 4 of the exits are via spaces marked as Storage within lab space. As such, management procedures should be developed to ensure that the exits are not obstructed by stored items and are always available for escape.

2.7.3 Office/Workspace (AKA “The Groove”)

The escape from the Ground Floor workspace areas is available directly to outside via the following exits:

- 1050mm wide (clear width) door to outside from the Circulation area on the North elevation
- 2200mm wide (clear width) door to outside from Workshop on the North elevation
- 2200mm wide (clear width) door to outside from Maker Space area on the North elevation
- 850mm wide (clear width) door to outside from the Reception area on the North elevation
- 1050mm wide (clear width) door to outside opening against the direction of escape from the Entrance Lobby on the West elevation

After discounting the largest exit, this provides escape capacity for 1040 occupants.

Additional escape routes are also available into the Laboratory area, but these are not considered when assessing the escape capacity as Laboratory could represent high fire risk and it is preferred to direct occupants to the exits leading to outside.

The escape provisions from the First Floor area of the workspace are discussed in Section 2.8.

2.7.4 Storage

It is understood that the Storage area would not be separated from the Laboratory area and any occupants will be able to freely move between the spaces. Therefore, the Storage area would largely evacuate via the Laboratory area.

However, an additional 1050mm wide exit is provided from the Storage area that will provide additional escape route in the event of escape into the Laboratory area being obstructed. This will provide sufficient escape capacity for the minimal number of occupants expected in the Storage area.

2.8 External Stairs

The First Floor area of the workspace is served by two 1100mm wide external stairs with 1200mm exits leading into them. After discounting one of the stairs, this will provide escape capacity for 203 occupants based on 5.4mm/person escape width suitable for the stair serving a single floor in a building with an A3 risk profile. This exceeds the expected occupancy on this level.

The external staircases would require additional provisions to be suitable for evacuation, as follows:

- The doors leading into the external staircases will be fire resistant and provided with self-closers;
- Any part of the external walls within 1800mm of (an 9m vertically below) the flights and landings of the stairs will be fire resisting;
- Any part of the building elevation, including doors, within 1800mm of the escape route from the stair to a place of ultimate safety will be provided with fire resisting construction up to 1100mm above the route floor level.

As the external stairs are less than 6m in the vertical extent, no weather protection is required, with the exception of protection being provided to the top landings of the stairs where the disabled refuges are located.

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2.9 Plant Area

A Plant/MEWP storage area is provided to the East of the Laboratory area that will be fire separated from the rest of the building.

The MEWP storage area is a two storey space on Ground Floor with a mezzanine area at First Floor level. It is accessed directly from outside on the East elevation.

The Plant area is located on the Ground Floor level, with a Storage area above it accessed via protected stair. The Second Floor area consists of an open air plant and is also accessed via the stair serving the Storage area below. The stair will be separated from adjacent areas at Ground and First Floor levels as it is the only escape route serving the First Floor storage and Second Floor open plant area. These are shown in red in Figure 2—6.

The travel distances in all of the plant areas are within the recommendations of BS 9999. It should however be ensured that the travel distances from the Storage mezzanine area do not exceed 18m after fit out and when in use.

The Second Floor area is open plan area. Therefore, it is proposed to apply travel distance limit of 60m in a single direction, as recommended by Approved Document B for open air plant rooms. The travel distance is within the recommended limit.

The travel distances are shown in Figure 2—6.

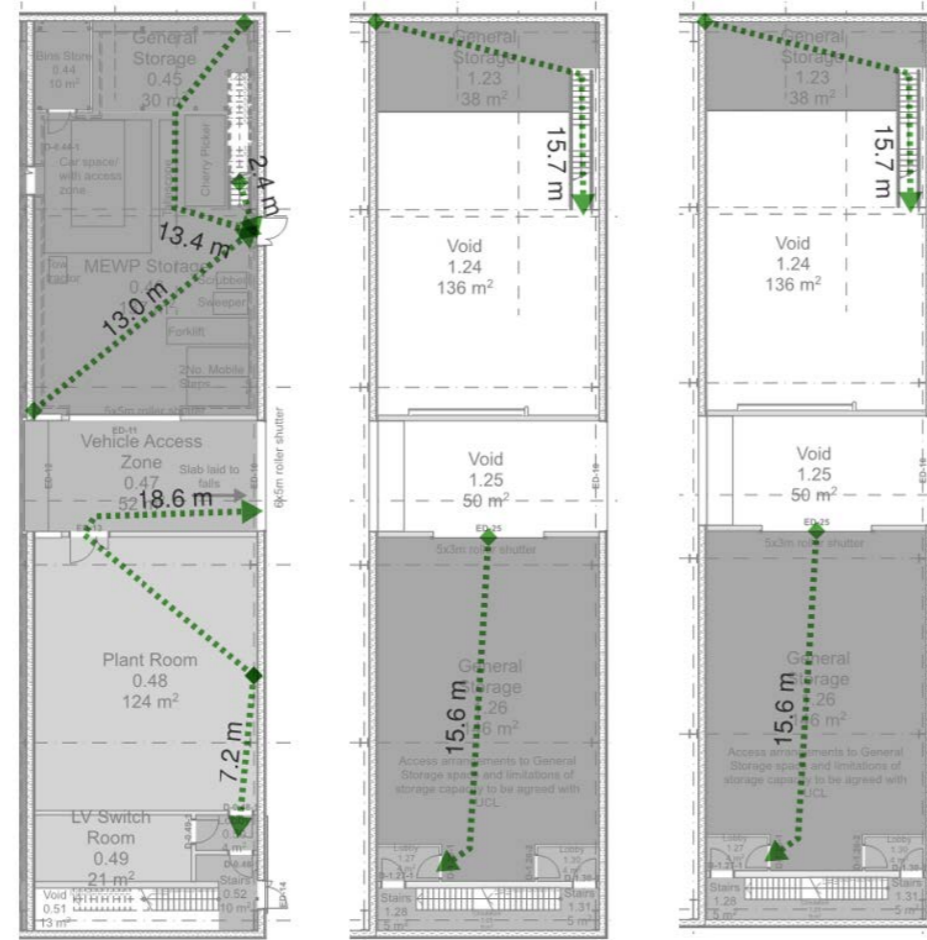


Figure 2—6 Travel Distances in the Plant Areas

2.10 Roof

The escape from the roof area is available via the Open Air Plant area and a CAT ladder located in the Northwest corner of the building. This is considered suitable, as the roof will only be accessed occasionally by trained personnel.

The travel distances are within the 60m recommendation for open air plant areas where the escape is available in more than one direction (as per Annex F of BS 9999).

2.11 Airplane Fuselage

It is currently proposed to provide an airplane fuselage to the South of the building. This would be used for experiments and would be accessed via the temporary access set ups from the Storage area.

The escape provisions from the fuselage in the event of a fire will be reviewed as part of fire risk assessment for each individual experiment proposed to be conducted with the use of the fuselage.

2.12 Inner Rooms

A room from which the only escape route is through another room is called an inner room.

These should be avoided if possible, however if present, one of the following should be provided:

- The enclosures (walls or partitions) of the inner room should be stopped at least 500mm below the ceiling; or
- A suitably sited vision panel not less than 0.1m² should be located in the door or walls of the inner room to enable the occupants of the inner room to see if a fire has started in the outer room; or
- The access room should be fitted with a suitable automatic fire detection and alarm system to warn the occupants of a fire in the access room, to a sound pressure level in accordance with the minimum recommended in BS 5839-1:2013, or gives an immediate visual alarm conforming to BS EN 54-23 in the inner room if ambient noise levels are so great as to make alarm inaudible.

The Prep Booth and Server/Plant Room and bin store areas in the Ground Floor workspace area, as well as the Bin Store room in the General Storage area at Ground Floor are currently designed as inner rooms. Therefore, they will be provided with suitable automatic fire detection and alarm system to warn the occupants of a fire in the relevant access room.

The proposed Bin Store arrangement, with access being provided via the General Storage area. While not considered to represent a special fire hazard area (i.e. it does not house oil-filled transformer or switch gear, boiler room, storage spaces for fuel or other highly flammable substances, or fixed internal combustion engine), it still represents a significant fire load. This is considered reasonable based on the low, transient occupancy of the Bin Store room (approximately a maximum of 2 occupants at a time), familiarity of the Bins Store occupants with the building layout, as well as proximity of the escape route into the Laboratory area to the exit from the Bin Store (approximately 3m), reducing the distance the occupants have to travel within the General Storage area.

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3. Means of Escape for Disabled Persons

3.1 Introduction

Where access is provided for disabled people, provisions for means of escape must be provided. In any escape, it is important to have choice; this is equally true for disabled people and there are a range of options available. The preferred option for evacuation is horizontally to outside the building, another fire compartment or by fire evacuation lift. If these are not available or not in operation, then it may be necessary to carry a person with mobility impairment down the escape stair.

The minimum recommendations contained within current design codes are the provision of refuges. Building Regulations, BS9999:2017 and recent changes to fire safety legislation (covered by the Regulatory Reform (Fire Safety) Order 2005) contain recommendations that evacuation of disabled persons be designed into the management plan of the building. In order for this to be achieved, it is necessary to understand the capabilities or limitations of the building. It is noted that it is the building owner/ tenant's responsibility and not that of the fire service to assist people from the building.

A management strategy will need to be developed by the occupier, (as employers of individuals in the building), which will include Personal Emergency Evacuation Plans (PEEPs) to enable a flexible response to different situations.

3.2 Refuges

A refuge is a location where people whose abilities or impairments might cause their evacuation to be delayed can, if necessary, await assistance from a member of staff with the next part of their movement to a place of ultimate safety. This movement may be vertical (up or down stairs or via lifts), horizontal or a combination.

A refuge should be a place of relative safety. It should be protected from a fire for a period of time sufficient to enable the evacuation sequence to be completed without placing the person(s) needing assistance, or those rendering that assistance, at unacceptable risk from a fire within the premises.

It is also essential that the location of refuges and of wheelchair spaces within refuges does not have an adverse effect on the means of escape provided within the building.

A refuge should be of sufficient size both to accommodate a wheelchair and to allow the user to manoeuvre into the wheelchair space without undue difficulty. To accommodate the wide variety of wheelchairs in use, including powered wheelchairs, the space provided for a wheelchair in a refuge should not be less than 900mm x 1400mm allowing for manoeuvring. To enable wheelchair users to manoeuvre themselves into the refuge, the door width should have a clear opening of not less than 850mm.

It is proposed to locate refuges externally on the top landings of the external stairs serving the First Floor workspace areas. This is considered reasonable based on the elevation being protected up to within 1800mm of the staircase, providing protection to the refuge. The refuges would also be located externally to the building and would not be affected by smoke. The top flight of the external stairs would also be provided with weather protection to ensure that occupants waiting at the refuge would not be subjected to adverse weather conditions.

Note, evacuation chairs have also been provided and are located internally on the escape route. Staff need to be suitably trained in the safe operation of the evacuation chairs and users who may need assistance should be identified as part of the PEEP process.

3.3 Communication Systems

Where people may have to wait at a refuge location, a fire protected two-way communication system to a control point will be provided in accordance with BS 5839 Part 9. This system will alert the building management/ control point to enable rapid and unambiguous identification of those locations where people requiring assistance with evacuation might be waiting and relay this information to the person operating the evacuation lift. This system may also be used to reassure those waiting that assistance is on its way.

3.4 Evacuation Lift

There is no firefighting lift proposed on the premises. However, there will be an evacuation lift provided within the workspace area to assist with evacuation of disabled persons unable to utilise the stairs for escape.

While the lift is not provided with a protected lobby at First Floor level and a protected escape route to outside at Ground Floor level, it is proposed to utilise this based on the management strategy being developed by UCL to ensure safe evacuation of disabled occupants via the lift in the event of a fire not directly affecting the lift escape. This was discussed and agreed with UCL fire officer and Bureau Veritas in principle.

The lift will need to be operated under the control of fire safety manager or delegated representative, or otherwise by someone trained and authorized to use the lift. The lift will need to be provided, constructed and operated in accordance with recommendations given in Annex G of BS9999:2017, including the provision of secondary power supply, with the exception of requirements to provide protected lobbies and protected escape route to the final exit, as discussed above.

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4. Active Fire Safety Systems

4.1 Fire Suppression

There is no requirement to provide sprinklers within the building and they will not be provided.

4.2 Automatic Fire Detection and Alarm

An automatic fire detection and alarm system should be provided in the building to at least an L2 standard designed in accordance with BS5839-1. The system will operate on single knock basis. Manual call points will also be provided in the Plant and Plant/MEWP Storage areas.

It is noted that cold smoke evacuation experiments are to be conducted in the area. These will necessitate the switching off of the detection and alarm system. As such, FRA would need to be conducted and management procedures would need to be developed and implemented based on the staff assistance with the escape of the occupants by the UCL to support this.

The exact design of the detection and alarm system and its type will be developed by specialist suppliers and MEP engineers.

4.3 Fire and Smoke Dampers

Ductwork which penetrates separate compartments either horizontally or vertically are to be provided with fusible link fire dampers (fire performance to be as per the compartment line crossed).

Where ductwork enters protected corridors leading from stairs to external, motorised fire/smoke dampers will be provided and activated by smoke detection.

The above should be designed in accordance with BS 9999 and BS EN12101-7³

4.4 Smoke Venting

There is no requirement to provide smoke venting in the UCL PEARL building for fire safety purposes.

However, it is understood that the cold smoke clearance system will be provided in the building to support the evacuation experiments. This will not form part of the fire strategy and will not be suitable to use in the fire situation.

³BS EN 12101-7:2011 Smoke and heat control systems – Part 7: Smoke duct sections

4.5 Emergency Lighting

Emergency lighting will be designed and installed in accordance with BS 5266 Part 1 and will be provided in the following locations:

- All escape routes (staircases, lobbies, and internal corridors).
- Windowless accommodation (i.e. plant rooms, store rooms etc).
- Open plan areas more than 60m².
- Externally over final exit doors.

Any areas of the building covered by a licence relating to the consumption of alcohol, will require an enhanced maintained installation. During special events where this may be the case there should be an independent Fire Risk Assessment performed and consideration should be given to emergency light provisions as well as all the other fire strategy related matters.

4.6 Escape Signage

All exits and routes to exits will be clearly marked with appropriate emergency escape signs so that the occupants can easily determine their most direct route to a place of safety in the event of an emergency. The system will be designed and installed in accordance with BS 5499: Part 1 and BS ISO 3864 Part 1. Signs will be located above:

- Final exits from the building;
- Storey exits;
- Changes in direction of the escape route;
- Doors from rooms where more than one exit is provided.

Signs are not proposed over the door from rooms where only one exit is provided.

4.7 Power Supply

Secondary and life-safety power supplies should be designed in accordance with BS 8519⁴. A secondary power supply will be provided to all life safety systems, such as an evacuation lift within the workspace area. The back-up power supply should be provided via diverse routes and the routes of supply fire separated from each other.

⁴BS 8519:2010 Selection and installation of fire-resistant power and control cable systems for life safety and fire-fighting applications – Code of practice

4.8 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 protection 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.

01 Fire

5. Internal Fire Spread

5.1 Structural Fire Protection

The structure of the main space is to be constructed as a portal frame, which only supports the roof used for the provision of plant. Therefore, there is generally no requirement to fire protect it. The frame however should be fire protected where it forms part of a compartment wall, such as between the Plant areas and the rest of the building. Additionally, it should be protected where the fire resistance is required to the external wall to restrict the external fire spread of fire between the buildings.

The recommendations in the SCI publication P313 for designing the foundations to resist overturning should be applied.

The structure of the internal workspace area should achieve 60 minutes fire resistance (R-Loadbearing). It is currently proposed to use CLT for the construction of the workspace area. This should be completed by the specialist CLT contractors. Alternatively, the CLT structure could be enclosed in fire resisting construction achieving the required fire resistance.

5.2 Compartmentation and Fire Separation

There is no compartmentation proposed internally to the building separating the Laboratory, Storage or workspace areas. However, the following would be enclosed in fire resisting construction:

- Storage areas within the workspace area – 30 minutes fire resisting construction (integrity and insulation) with FD30s doors
- Bin store within the MEWP storage area – 30 minutes fire resisting construction (integrity and insulation) with FD30s doors
- Server/Plant room within the workspace area – 30 minutes fire resisting construction (integrity and insulation) with FD30s doors
- The evacuation lift shaft enclosure – 30 minutes fire resisting construction (integrity and insulation) with FD30 doors

The Plant area will be separated from the rest of the building by 60 minutes fire resisting compartment wall (both integrity and insulation) with FD60S fire doors. Fire and smoke curtain will be provided across the entrance to Vehicle Access Zone achieving 60 minutes fire resistance for both integrity and radiance.

Note, an alternative solution which involves the large door achieving the fire performance required is being explored.

The following compartmentation would also need to be provided within the Plant area:

- Life safety plant rooms and risers - 120 minutes fire resisting construction (integrity and insulation) with FD60S doors
- Protected stair lobbies within the Plant area - 30 minutes fire resisting construction (integrity and insulation) with FD30S doors
- Protected stair within the Plant area - 30 minutes fire resisting construction (integrity and insulation) with FD30S doors

The fire resistant containers/stores for higher hazard materials will need to achieve 60 minutes fire resistance for both integrity and insulation.

The external walls, where protected to achieve the external fire spread requirements, will need to achieve at least 60 minutes fire resistance for integrity and 15 minutes fire resistance for insulation.

Where the external walls are required to be fire protected due to proximity to the external escape staircases, as discussed in Section 2.8, they would need to achieve 60 minutes fire resistance for integrity and 30 minutes fire resistance for insulation.

5.3 Internal Linings

The internal linings for all walls and ceiling surfaces will achieve the following:

Table 5—1 Internal Fire Spread (Linings)

Location	National Class	European Class
Circulation/escape routes including staircases	0	B-s3, d2
Rooms (excluding small rooms)	1	C-s3, d2
Rooms less than 30m ²	3	D-s3, d2

Note:

- 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,
- 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 5—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 m2 in bedrooms and 60 m2 elsewhere.

The following are excluded from the performance requirements of surface spread of flame:

- Doors and door frames;
- Window frames into which glazing is fitted;
- Architraves, cover moulds, picture rails and similar narrow small members; and,
- Fitted furniture, i.e. demountable sanitary “back panels”.

The provisions do not apply to the upper surfaces of staircases (i.e. treads and risers) because they are not significantly involved in a fire until it is well developed.

Where a room is an access room, although it provides circulation to other rooms it is in accordance with the recommendations for inner rooms and therefore the surface spread of flame used will be that applicable to the size of room.

5.4 Fire Stopping

Fire stopping should be provided on the line of compartment walls where gaps exist that could allow smoke and flames to breach the compartment wall. 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
- Fire stopped (which in the case of a flue or duct should allow thermal movement)

5.5 MEWP Storage

The MEWP storage and charging area is provide at Ground Floor level within the Plant area. This is considered reasonable as the area is fire separated from the main part of the building by 60 minutes fire resisting construction.

It will be ensured that MEWP units are stored within the storage area when not in use and are not left within the main Laboratory/Storage area. Management procedures should also be employed to ensure that the charging is conducted in line with manufacturer’s recommendations and the capabilities of the power network.

01 Fire

6. External Fire Spread

6.1 Building Separation and Maximum Unprotected Area

The risk of fire spread between buildings will need to be assessed and suitable measures taken to mitigate this. Where necessary, the use of alternative solutions and analysis tools can be investigated in order to limit the amount of fire resistant glazing and external façade required.

The assessment was carried out in accordance with BR187. Please note that the boundary distances were taken to site boundary and did not account for the plane fuselage to the South of the building, as it was considered to be a part of the building premises. Calculations are provided in Appendix A.

The amount of unprotected elevations for the Laboratory/Workspace/Storage area would need to be limited to the following:

- North elevation – 9% (131m²)
- South elevation – 10% (142m²)
- West elevation – 31% (179m²)

For the Plant area, the protection requirements are as follows:

- East elevation – no requirement to provide additional fire protection to the elevation as the unprotected elevation section is located more than 27m away from the site boundary
- South elevation – no requirement to provide additional fire protection as the elevation consists of a fire protected stairway.
- North elevation – the unprotected area should be limited to 17% (15m²)

Any fire protected elevation (or part of the elevation) should achieve a fire resistance period of 60 minutes (when exposed from both sides if separation distance is less than 1m). The insulation criterion can also be reduced to 15 minutes where the elevation is located at 1m away from the notional boundary. The doors within protected construction will need to be FD60 fire doors.

It is proposed to provide internal fire resisting plasterboard construction connected to the main building structure along the building walls to achieve the external fire spread requirements.

6.2 External Faces of the Building

6.2.1 Code Guidance

As the building does not house sleeping accommodation and is less than 18m high, there is no code restriction on fire performance of the insulation used in the external façade build up. It is however noted that in the updated UCL Fire Safety Requirements (issued on 11/04/2019), there is a requirement for all external cladding systems and all elements of the cladding system (including render materials, insulation materials and any rain-screen cladding, but not including elements such as gaskets, sealants and similar) to be non-combustible (or, as a minimum, materials of limited combustibility) and achieve European classification of Class A1 and A2 regardless of height and being non-sleeping accommodation.

The external wall surfaces should meet the provisions of Figure 47 of BS9999, as shown as follows:

Figure 19 Provisions for external surfaces of walls

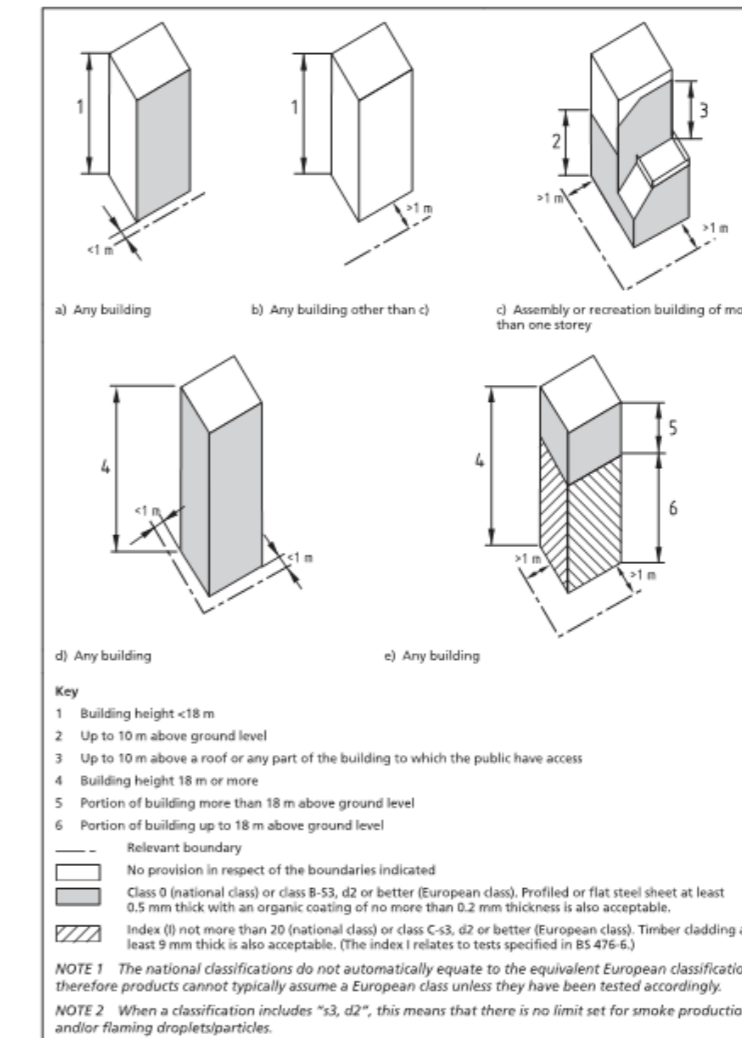


Figure 6—1 Figure 47 of BS 9999 – Provisions for external surfaces of walls

It is also recommended that any external storage should be located away from the building, i.e. approximately at least 5m-6m away as a rule of thumb.

01 Fire

6.2.2 Cavity Barriers

Cavity barriers should be provided to close the edge of cavities including around openings. Cavity barriers should also be provided:

- At the junction between an external cavity wall (except where the cavity wall conforms to Figure 36 of BS 9999) and every compartment floor and compartment wall, and
- At the junction between an internal cavity wall (except where the cavity wall conforms to Figure 36 of BS 9999) and every compartment floor, compartment wall, or other wall or door assembly which forms a fire resisting barrier. Provision of cavity barriers is shown in Figure 35 of BS 9999.

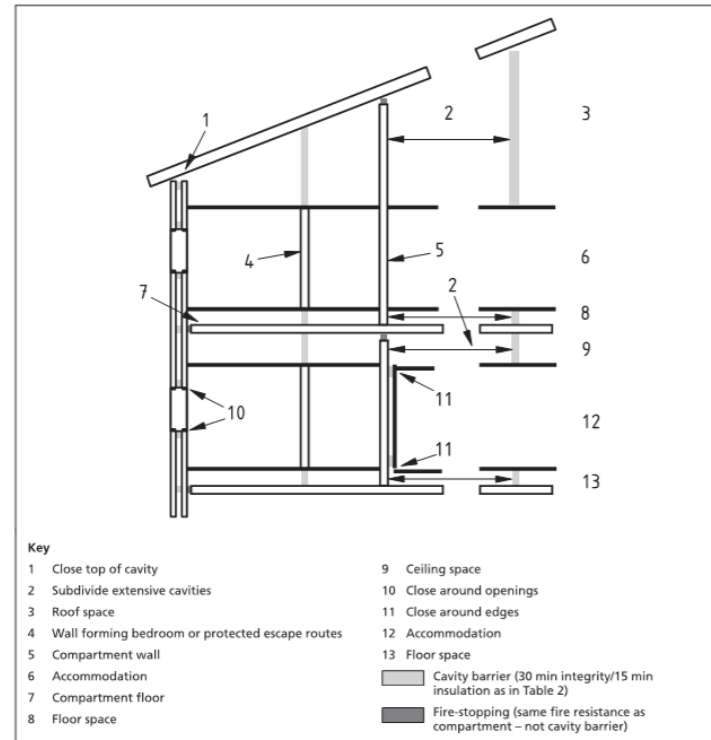


Figure 6—2 Figure 35 of BS 9999 – Provisions for cavity barriers

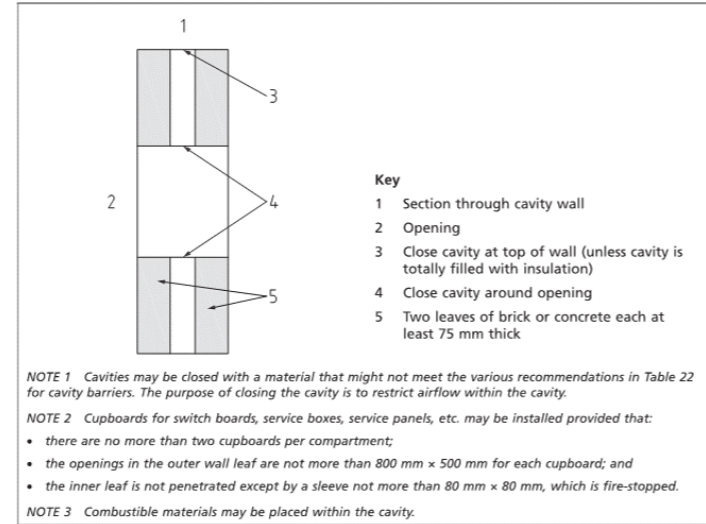


Figure 6—3 Figure 36 of BS 9999 – Cavity wall excluded from provisions for cavity barriers

6.2.3 Extensive Cavities

The maximum dimensions of cavities should be limited to 20m in any direction where the surface spread of flame classification of the exposed products is Class 0 or Class 1 (national class) or Class A1 or A2-s3, d2 or B-s3,d2 or Class C-s3, d2. If none of the above classifications can be confirmed the maximum dimension should not exceed 10m in any direction.

6.3 Roof Coverings

For restriction of fire spread over roofs the properties of a roof covering are in relevance if:

- If the roof is close enough to a boundary to be a risk of ignition from a fire in other buildings; and
- In 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 the figure below:

Table 6—1 Limitation on Roof Coverings

Designation of covering of roof or part of roof ¹	Distance of roof from any point on relevant boundary			
	Less than 6m	At least 6m	At least 12m	At least 20m
AA, AB or AC	Acceptable	Acceptable	Acceptable	Acceptable
BA, BB or BC	Not acceptable	Acceptable	Acceptable	Acceptable
CA, CB or CC	Not acceptable	Not acceptable	Not acceptable	Acceptable
AD, BD	Not acceptable	Not acceptable	Acceptable	Acceptable
DA, DB, DC	Not acceptable	Not acceptable	Not acceptable	Not acceptable

Note ¹: The performance of roof coverings is designated by reference to the test methods given in BS 476-3 (National Class) and BS EN 13501-5 (European Class)

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 inhibit effectively the rapid spread of fire over the roof coverings.

01 Fire

7. Access and Facilities for the Fire Service

7.1 Fire Service Access

There is no requirement to provide firefighting shafts in the building. The firefighting access could be provided from the perimeter of the building. This would require fire vehicle access to be provided to 15% of the building perimeter. Note, any perimeter wall (elevation) to which vehicle access has been provided should have a door which is at least 750mm wide.

The access is available to the parts of the western end of the South elevation and to the majority of the East elevation of the building. This is shown in Figure 7-1. This exceeds the 15% requirement (49.2m from a total perimeter of approximately 302m) and, therefore, the fire service access requirement is achieved. There is no code recommendation for dry fire mains.

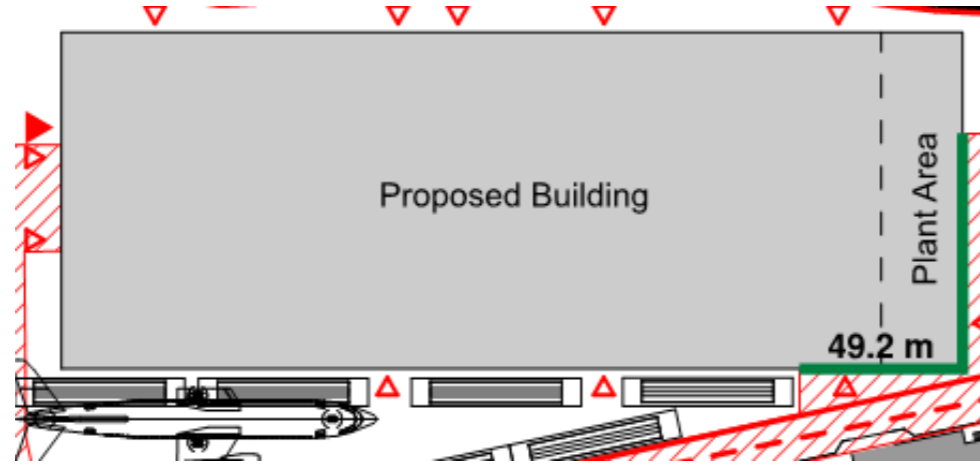


Figure 7-1 Portion of the External Elevation with Firefighting Access Available

7.2 Fire Vehicle Route Specification

The vehicle access route will be designed in line with the Table 7-1 below.

Table 7-1 Fire Service Access Route Specification

Appliance Type	Min. Width of Road between Kerbs (m)	Min. Width of Gateways (m)	Min. Turning Circle between Kerbs (m)	Min. Turning Circle between Walls (m)	Min. Clearance Height (m)	Min. Carrying Capacity (tonnes)
Pump	3.7	3.1	16.8	19.2	3.7	14.0

01 Fire

7.3 Fire Hydrants

For buildings not provided with fire mains or where the building is fitted with a wet fire main, hydrants should be provided within 90 m of an entry point to the building and not more than 90 m apart.

All hydrants should have signage in accordance with BS 3251 and should not be located within 6m of any building. A significant part of the fire safety regimes within any building is the standard and quality of fire safety management put in to place to ensure that the 'built provision' is maintained to appropriate standard and that people who occupy that building understand their roles and responsibilities as part of the fire safety plan.

This report is not the fire safety management policy and procedures document for the proposed works but the 'collective proposal' for passive and active measures, which support the responsible person's statutory compliance with the Regulatory Reform (Fire Safety) Order 2005. In determining these measures, we have made certain assumptions on the quality of fire safety management that will be put in place.

We have assumed that it is the intention to apply and maintain, as a minimum, the standards necessary to meet statutory requirements while seeking to achieve best management practice in accordance with Fire Safety Legislation and good practice standards. The responsible person's intention is, as far as is reasonably practicable, and in accordance with legal obligations and standards, to:

- Provide and maintain passive and active fire prevention, protection measures according to the purpose or use of the building.
- Provide comprehensible and relevant information to employees, students and others, through the provision and availability of emergency instructions or fire safety plans and the risks identified by relevant risk assessments.
- Provide a programme of Fire Safety Training.
- Carry out and keep under review a Fire Risk Assessment, which analyses building and process fire risks, the existing preventative and protective measures and identifies areas for improvement.
- Ensure suitable and sufficient evacuation procedures are in place in the premises.
- Ensure that persons appointed to positions of fire safety responsibility are competent to undertake those duties.

- Where appropriate, to prepare and keep under review risk assessments in relation to the use, storage, handling, disposal, transportation of substances and ensure that, so far as is reasonably practicable, the risks are reduced or controlled.

As part of the Fire Safety Management Plan, existing emergency evacuation procedures and plans will be reviewed to determine how they will apply to this building, and as required, and will consider:

- Effectiveness of the alarm;
- Awareness of team members to the situation;
- Handling of the public, or people who are less familiar with the building;
- Effectiveness of evacuation to cover all people;
- Procedures undertaken for checking the building or part of the building affected;
- Effectiveness of disability evacuation procedures;
- Speed of evacuation;
- Use of fire escape routes;
- Ease of access to assembly point; and,
- Procedures for briefing the Fire Brigade on arrival.

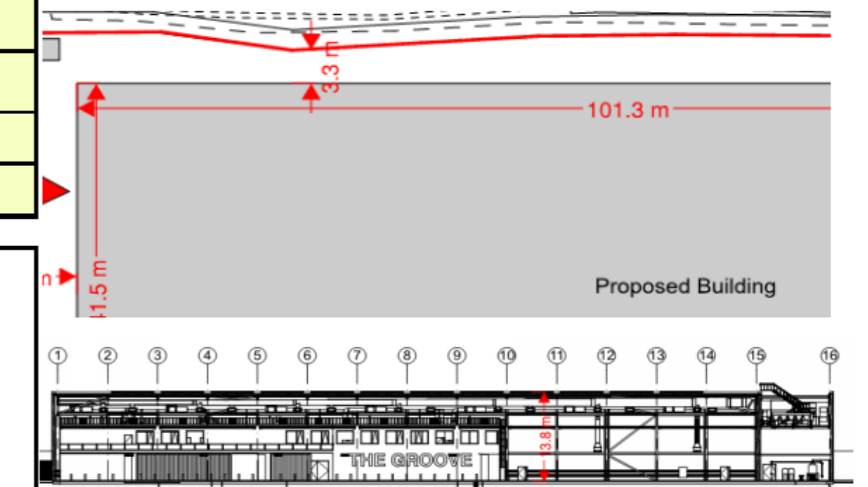
The passive and active measures proposed do not attach any additional or onerous fire safety management provisions on to the building in excess of those reasonably expected in this type of premises.

01 Fire

Appendix A External Fire Spread Calculations

BURO HAPPOLD ENGINEERING	Project	UCL PEARL	Sheet No	1
	Area of Project	External Fire Spread	Revision	B
	Elevation Description	North Elevation	Prepared by	AT
			Checked by	JLM

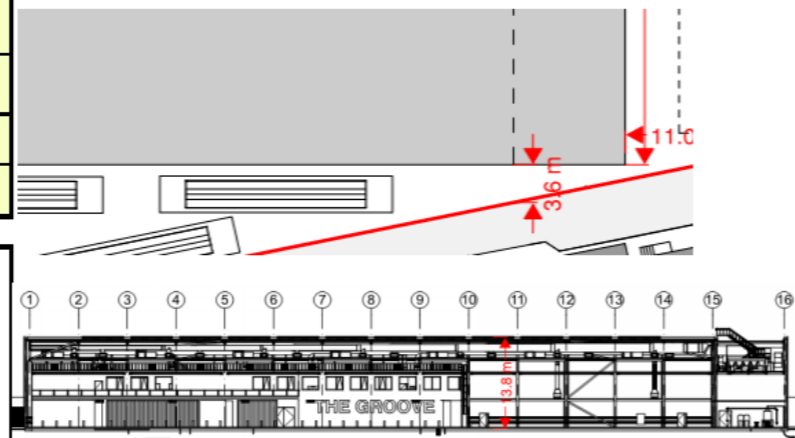
Design Assumptions		
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method		
2. If sprinklers are taken into account, unprotected area or boundary distance is doubled.		
<input type="checkbox"/> Calculate allowable boundary distance <input type="checkbox"/> Calculate allowable unprotected area		
Input		
Building purpose	1	
<i>for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1</i>		
<i>for Residential, Office or Assembly and recreational purposes enter 2</i>		
Is building sprinklered?	N	
<i>Enter Y if yes and N if No</i>		
Height of enclosing rectangle	13.8	(m)
Width of enclosing rectangle	101.3	(m)
Distance to the boundary	3.3	(m)
Allowable percentage and area of façade unprotected		
Tables Method	9%	131 (m ²)
Calculation Method	7%	100 (m ²)



01 Fire

Appendix A External Fire Spread Calculations

BUROHAPPOLD ENGINEERING	Project	UCL PEARL	Sheet No	1
	Area of Project	External Fire Spread	Revision	B
	Elevation Description	South Elevation	Prepared by	AT
			Checked by	JLM

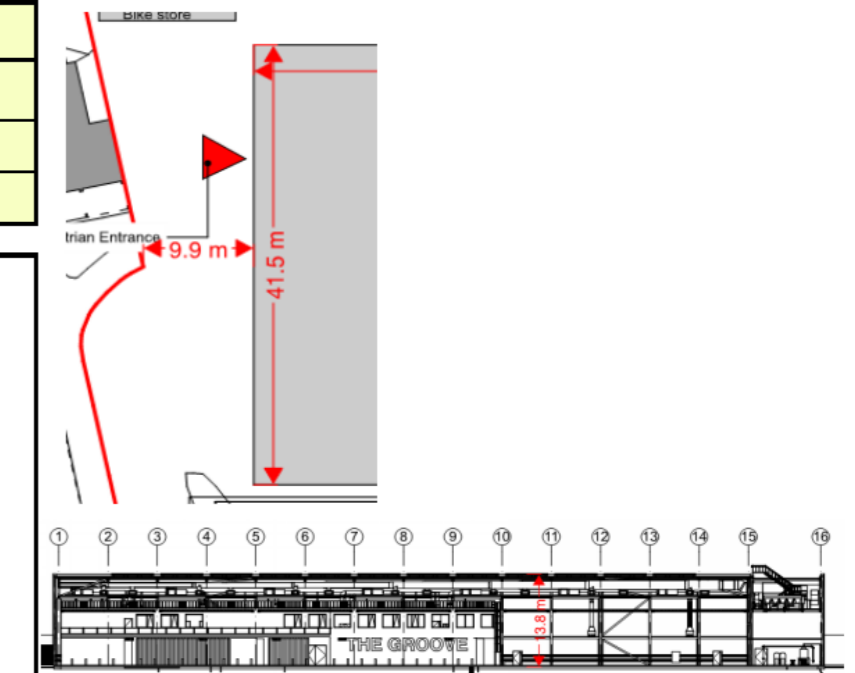


Design Assumptions		
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method		
2. If sprinklers are taken into account, unprotected area or boundary distance is doubled,		
<input type="radio"/> Calculate allowable boundary distance <input checked="" type="radio"/> Calculate allowable unprotected area		
Input		
Building purpose		
<i>for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1</i>	1	
<i>for Residential, Office or Assembly and recreational purposes enter 2</i>		
Is building sprinklered?	N	
<i>Enter Y if yes and N if No</i>		
Height of enclosing rectangle	13.8	(m)
Width of enclosing rectangle	101.3	(m)
Distance to the boundary	3.6	(m)
Allowable percentage and area of façade unprotected		
Tables Method	10%	142 (m ²)
Calculation Method	8%	109 (m ²)

01 Fire

Appendix A External Fire Spread Calculations

BUROHAPPOLD ENGINEERING	Project	UCL PEARL	Sheet No	1
	Area of Project	External Fire Spread	Revision	B
	Elevation Description	West Elevation	Prepared by	AT
			Checked by	JLM



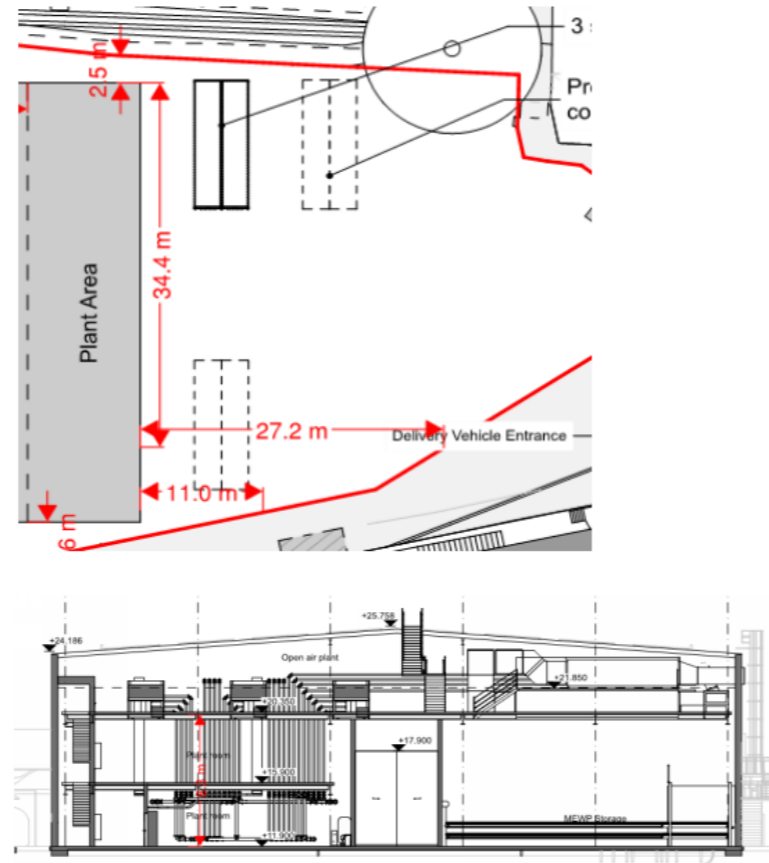
Design Assumptions		
1. In accordance to BR187 - 2014 using the Enclosing Rectangle Method		
2. If sprinklers are taken into account, unprotected area or boundary distance is doubled,		
<input type="radio"/> Calculate allowable boundary distance <input checked="" type="radio"/> Calculate allowable unprotected area		
Input		
Building purpose		
<i>for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1</i>	1	
<i>for Residential, Office or Assembly and recreational purposes enter 2</i>		
Is building sprinklered?	N	
<i>Enter Y if yes and N if No</i>		
Height of enclosing rectangle	13.8	(m)
Width of enclosing rectangle	41.5	(m)
Distance to the boundary	9.9	(m)
Allowable percentage and area of façade unprotected		
Tables Method	31%	179 (m ²)
Calculation Method	26%	150 (m ²)

01 Fire

Appendix A External Fire Spread Calculations

BUROHAPPOLD ENGINEERING	Project	UCL PEARL	Sheet No	1
	Area of Project	External Fire Spread	Revision	B
	Elevation Description	East Elevation	Prepared by	AT
			Checked by	JLM

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 doubled,	
<input type="radio"/> Calculate allowable boundary distance <input checked="" type="radio"/> Calculate allowable unprotected area	
Input	
Building purpose <i>for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1</i> <i>for Residential, Office or Assembly and recreational purposes enter 2</i>	1
Is building sprinklered? <i>Enter Y if yes and N if No</i>	N
Height of enclosing rectangle	8.3 (m)
Width of enclosing rectangle	35 (m)
Distance to the boundary	27.2 (m)
Allowable percentage and area of façade unprotected	
Tables Method	100% 291 (m ²)
Calculation Method	100% 291 (m ²)



01 Fire

Appendix A External Fire Spread Calculations

BUROHAPPOLD ENGINEERING	Project	UCL PEARL	Sheet No	1
	Area of Project	External Fire Spread	Revision	A
	Elevation Description	North Plant Elevation	Prepared by	AT
			Checked by	JLM

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 doubled,	
<input type="radio"/> Calculate allowable boundary distance <input checked="" type="radio"/> Calculate allowable unprotected area	
Input	
Building purpose <i>for Shop and commercial, Industrial, Storage or Other non-residential purposes enter 1</i> <i>for Residential, Office or Assembly and recreational purposes enter 2</i>	1
Is building sprinklered? <i>Enter Y if yes and N if No</i>	N
Height of enclosing rectangle	8.8 (m)
Width of enclosing rectangle	10.1 (m)
Distance to the boundary	2.5 (m)
Allowable percentage and area of façade unprotected	
Tables Method	17% 15 (m ²)
Calculation Method	11% 9 (m ²)

