Sainsbury Welcome Centre
5th Quad Support Building
Fire Statement

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Executive Summary

This fire statement has been produced by Arup to support the planning application for the 5th Quad building, which is a new support building within the courtyard behind the existing Sainsbury Welcome Centre (SWC) in central London.

A separate Fire Strategy has been developed at RIBA Stage 3 (as per the report issued on 30/07/2021) to explain the fire safety features provided for compliance with the life safety requirements of Part B of the Building Regulations 2010 (as amended).

The project seeks to use a mass timber structure (due to weight and sustainability considerations). Current statutory and prescriptive guidance in England does not consider what material the elements of structure are made from and do not provide guidance where they are combustible. To design the mass timber safely, and address the additional fire hazard it introduces, a holistic performance-based approach is required, based on the BS 7974 framework and fire engineering principles. Arup's in-house risk-based methodology for mass timber fire safety design is therefore applied, supplemented where appropriate by the statutory guidance in Approved Document B Volume 1 2019 (including 2020 amendments): Buildings other than dwellings (ADB) and the documents referenced therein.

This Fire Statement has been produced to describe how the fire strategy design of the building meets Policy D12 (Fire Safety) of the London Plan 2021, and other relevant aspects, specifically Policy D5 (Inclusive Design).

1 Introduction

1.1 Fire safety objectives

The 5th Quad Support Building will meet the functional requirements of Part B of the Building Regulations 2010 (as amended). Additional client goals such as property protection and business continuity, as set out in the University College London (ULC) Employer's Requirements and Fire Safety Standards, are also being considered in developing the design.

The project seeks to use a mass timber structure (due to weight and sustainability considerations). Current prescriptive guidance in the UK (such as ADB) does not provide guidance for larger structures made from timber. To address the additional fire hazard a timber structure introduces, a holistic performance-based approach is required, based on the BS 7974 framework and fire engineering principles. Arup's in-house risk-based methodology for mass timber fire safety design is therefore adopted, supplemented where appropriate by the statutory guidance in ADB and the documents referenced therein.

The impact of the proposed extension on compliance and safety of the existing SWC building and surrounding buildings is also being assessed and addressed as part of the 5th Quad fire strategy. This includes means of escape from the adjacent Astor College buildings via the SWC courtyard.

1.2 Assumptions

UCL has specific goals beyond life safety and legislative compliance. These will be discussed and agreed with the client as the design progresses, including application of the UCL Fire Standards.

UCL will lead on insurer consultation, which should commence as soon as possible to seek feedback on the proposals for mass timber construction. Separately consultation with suppliers for all products that will need to interfacew ith CLT should commence earlier than usual due to limited availabilty of products thant are tested with CLT at this time.

1.3 Description of the building

The project comprises the construction of a new support building within the courtyard behind the existing Sainsbury Welcome Centre (SWC), which as six above-ground floors and two basements (2B+G+5).

This new 5th Quad will have five floors (L01-L05) and is to be raised on a steel frame structure so that its lowest level aligns with level one of the main building.

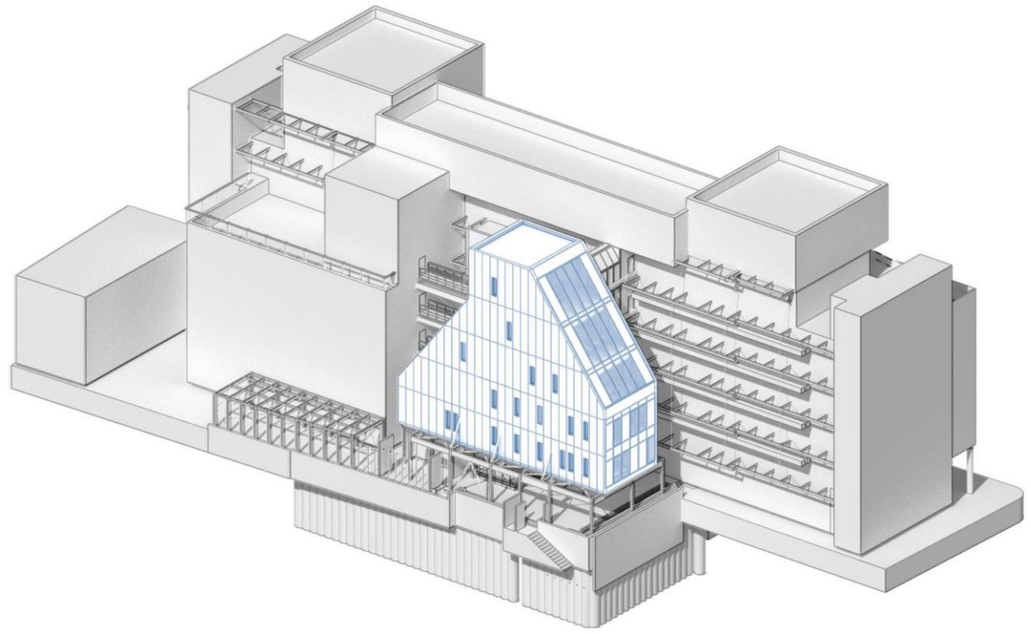
The 5th Quad will be connected back to the main building via link bridges to the north and east. The plot is flanked by neighbouring properties to the east and south.

The extension has approx. 905 m^2 total gross internal area (GIA). The largest floors L01 and L02 are approx. 200 m^2 each. The smallest floor L05 is approx. The height of the topmost floor L05 above ground level is the same as in the existing building at 26.375 m.

The structural design includes cross-laminated timber (CLT) slabs spanning onto steel frame.

From a fire strategy perspective, for application of ADB guidance the extension will be 'office', as per the base-build fire strategy for the main SWC building.

Figure 1: Isometric showing the proposed location and general massing of the new 5th Quad extension



1.4 Plans referenced

The plans listed Table 1.are directly referenced in this fire statement. Excerpts from these plans are used to illustrate the means of escape and firefighting access. The wider package of architectural drawings included within the planning submission has been referenced in developing the fire strategy.

Table 1- Drawings referenced

Drawing title	Reference
General arrangement plan – Level one	780-IRAL-DR-20-0001
General arrangement plan – Level two	780-IRAL-DR-20-0002
General arrangement plan – Level 00	IRAL-SK-1000

2 Fire Safety Provisions

2.1 B.1 – Building Construction

B.1. The building's construction: methods, products and materials used, including manufacturers' details.

2.1.1 Structural methods and materials

The superstructure for the 5Th Quad is proposed to be a hybrid of CLT floor panels and steel frame (columns and beams).

Current English statutory guidance does not consider what material the elements of structure are made from and does not provide guidance where they are combustible. To design the mass timber safely, a holistic performance-based approach is required, supported by robust data / evidence.

Arup apply a risk-based fire safety design methodology for mass timber projects. This is grounded in latest knowledge of mass timber behaviour in fire, based on the experience of timber experts globally, and the outcomes of small and large-scale tests, many of which Arup has been heavily involved with. The risk-based methodology considers the fire safety strategy holistically, providing design options based on factors such as the building occupancy type, height and whether suppression is provided.

The process set out in BS 7974 is being followed and will be progressed at the next design stage, including a qualitative design review (QDR) process involving Building Control, London Fire Brigade (LFB) and all relevant stakeholders.

Based Arup's risk-based methodology for the building risk profile, the fire strategy is being developed to incorporate the following:

- **Exposed mass timber** – Up to 100% of one surface in each compartment can be supported as being exposed mass timber (i.e. all ceilings of the CLT floor slabs). Additional exposed surfaces (e.g. the top side of the CLT slabs) are not permitted. Where mass timber is exposed, fire resistance will achieved through charring of the CLT, and demonstrated by suitable test evidence.
- **Encapsulating the underside of the level one CLT slab –** The level one slab will be exposed to air underneath as the 5th Quad extension is raised up above the courtyard. The soffit will therefore be encapsulated both for weather protection purposes and to achieve the required fire resistance.
- **Addressing burndown** – The top of the CLT panels will be encapsulated in a non-combustible boarding, to address the risk of burndown in the CLT panels from fire above.
- **Perimeter fire-stopping** – The sides of the CLT panels will be encapsulated in a non-combustible boarding, to provide a more robust substrate for perimeter fire-stopping.
- **Mass timber adhesive type** – If CLT is to be exposed (as above), it must be of non-delaminating type (i.e. no glue-line integrity failure).
- **External wall construction** – Will be constructed from A2-s1,d0 or better performing materials, i.e. CLT not permitted in the external walls, due to the congested site and non-standard firefighting access using the existing firefighting shafts.
- **Link bridges providing means of escape and firefighting access** – Will be constructed from non-combustible materials, with firefighting access provided from the two existing SWC firefighting shafts (as described later in this Fire Statement).
- **Sprinklers –** The existing BS EN 12845 system will be extended into the 5th Quad.
- **Evacuation strategy –** The 5th Quad will operate under simultaneous evacuation with the remainder of the existing SWC building.

2.1.2 Structural fire resistance

The 5th Quad will be provided with a minimum of 60 minutes loadbearing fire resistance (R) to elements of structure, in accordance with Table D1 of ADB.

The link bridges will also be provided with a minimum of 60 minutes fire resistance (R).

Further fire engineering analysis will be undertaken at the next design stage to establish the appropriate fire resistance period considering the additional fire load presented in the exposed CLT soffit option. It may be possible that the elements of structure in the 5th Quad (including CLT panels and steel frame) would need to be enhanced to achieve 90 minutes fire resistance. This has been allowed for in the structural design and in sizing the CLT panels at this stage.

2.1.3 Compartmentation

The 5th Quad will form a separate fire compartment from the existing building. This will be achieved through compartment walls achieving 60 minutes integrity (E) and insulation (I) fire resistance at all link bridges.

To reduce the risk of fire spread between floors, floor-to-floor compartmentation will be provided between all levels achieving REI 60.

Floor-to-floor compartmentation requires all penetrations, vertical shafts (e.g. service risers) and perimeter areas where the floor slabs meet the façade to be appropriately fire-stopped. Shafts will be constructed from A2-s1, d0 or better performing materials (not CLT).

Compartment walls will be provided at level one and two to sub-divide these larger floor-plates into two compartments, which is needed to support the external fire spread assessment. These will achieve 60 minutes REI. Fire-separation walls will also be provided around the fab lab area of level one, achieving 30 minutes REI. See Figure 2 and Figure 3.

Interfaces between fire compartment walls and exposed CLT will need to be suitably detailed and supported by test evidence. This may include robust mechanical fixing between the two and return of

compartment wall boarding at the interface, so that CLT charring cannot penetrate along the junction and thereby jeopardise the studwork supporting the compartment wall and the wall fire performance. Engagement with supply chain will take place early in the next design stage to progress these details.

All fire doors in fire-separating walls will achieve the same fire resistance as the walls within which they sit, apart from vertical shafts (e.g. service risers) for which the fire doors may have half the fire resistance of the shaft rating (in line with prescriptive guidance).

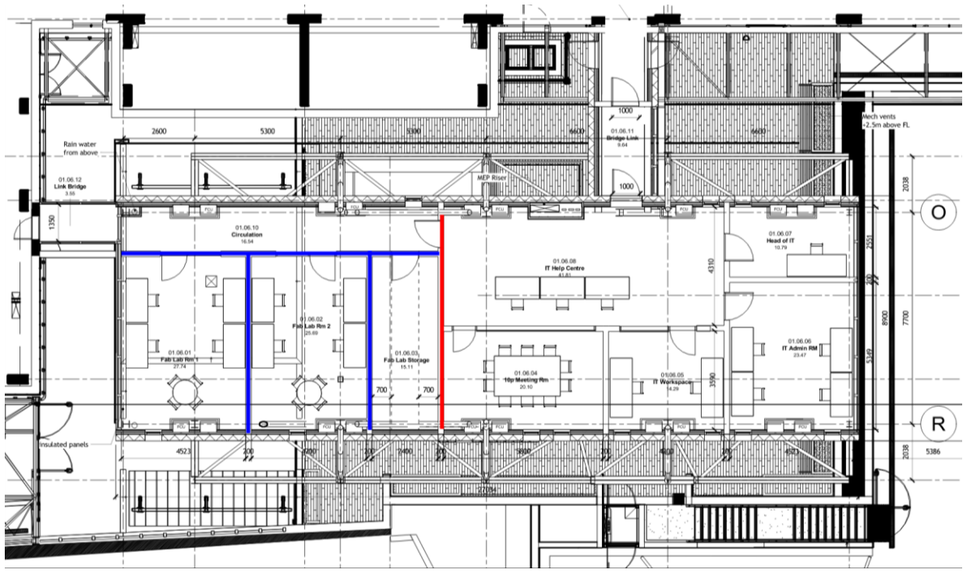


Figure 2 - Proposed fire compartmentation at level one (REI 60 red, EI 30 blue)

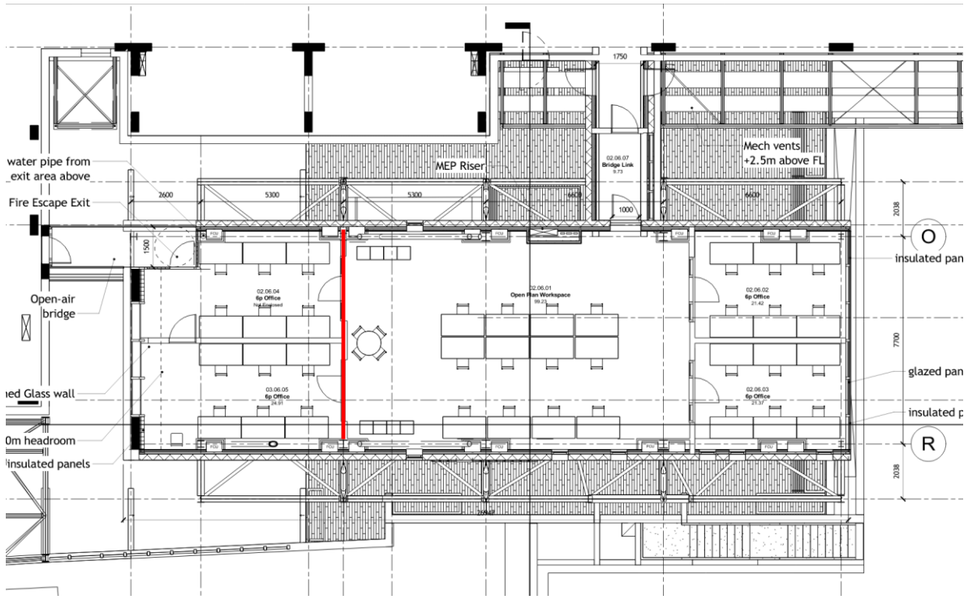


Figure 3 - Proposed fire compartmentation at level two (REI 60 red, EI 30 blue)

2.1.4 Internal Fire Spread

Ceiling and wall linings provide a ready means for the spread of fire throughout a building. Linings used in the development will be in accordance with the guidance given in the Table 10 of ADB.

2.1.5 External Fire Spread

An evaluation of the risk of fire spread to and from neighbouring buildings using the Enclosing Rectangle methodology has been undertaken, following the principles and acceptance criteria of BR 187 (External fire spread: Building separation and boundary distances, BRE 2014).

To suitably assess and mitigate the proposed exposed CLT ceilings for the 5th Quad, a simple but conservative assessment has been undertaken. The radiation intensity adopted for the unprotected façade areas (i.e. windows, vents) in the analysis was that recommended by BR 187 for more severe fire loads such as those found in retail (168 kW/m^2) which is double that typically recommended for office occupancy (84 kW/m^2), likely reflective of the occupancy and contents of the 5th Quad.

The assessment shows that a considerable amount of the façade on each elevation will need to achieve fire resistance. This construction will achieve at least 60 minutes integrity (E) and 15 minutes insulation (I) fire resistance, in accordance with prescriptive guidance for protected areas of external walls.

The complete assessment including details and results is described in the RIBA Stage 3 Fire Strategy report (issued on 30.07.2021). Further radiation analysis will also be undertaken as part of substantiating the mass timber design at the next design stage.

2.1.6 Construction of external walls

All primary materials in external walls will achieve either European Class A2-s1, d0 or Class A1 when classified in accordance with BS EN 13501-1:2007+A1:2009, with exceptions only in line with Regulation 7 exceptions, e.g. membranes and gaskets.

BS EN 13501-1 allows for materials to be classified based upon appropriate fire testing. Alternatively, a number of materials and products can be classified as Class A1 without need for testing. These products are listed in the Commission Decision 96/603/EC, as amended by 2000/605/EC and 2003/424/EC.

2.2 B.2 Means of Escape

B.2. The means of escape for all building users: suitably designed stair cores, escape for building users who are disabled or require level access, and associated evacuation strategy approach

2.2.1 Evacuation strategy

A simultaneous evacuation strategy will be adopted where the entire building is to evacuate immediately on activation of the alarm and automatic detection system. Automatic detection will be provided throughout to enable early warning and will be provided with a two stage alarm to enable building management to investigate the source of an detector activation to allow early intervention and avoid unnecessary evacuation and associated disruption.

2.2.2 Building occupancy load

A conservative figure of 100 occupants has been advised by SWC (on 23.09.2020) of which 30 will be new persons for the overall SWC building.

2.2.3 Travel distances

The building has been designed so that travel distances follow the recommendations provided within Table 2.1 of ADB.

Travel distances are within the limits of ADB. Bridge links provide two directions of escape from levels one, two, three and four. Level five has only one bridge link, but this provides an escape route that is within the maximum compliant distance permitted for single direction of escape before a choice of route is offered.

2.2.4 Means of escape

The main SWC building includes two firefighting stairs, and one means of escape stair which will be used by occupants escaping from the 5th Quad (see Figure 4).

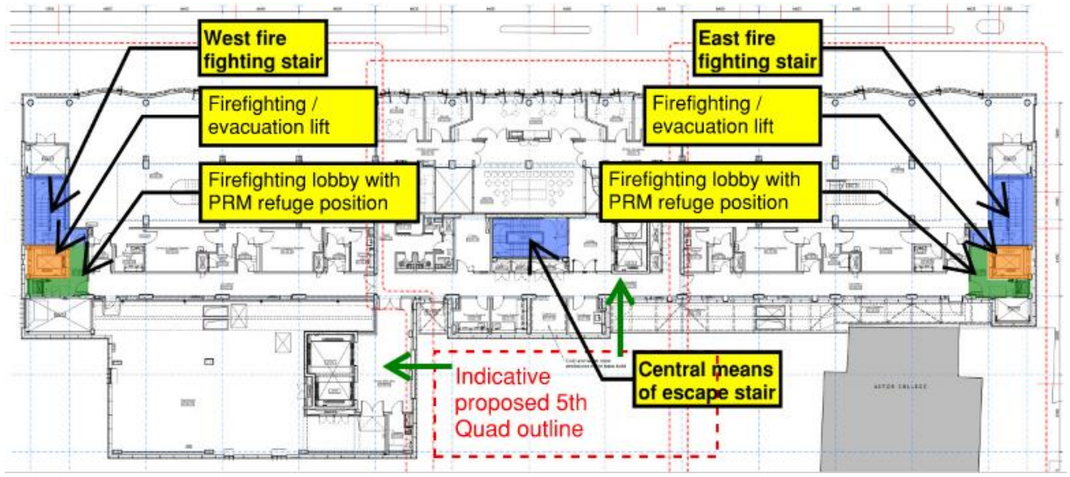


Figure 4 – Protected stairs in existing building and indicative location of 5th Quad with link bridges

Means of escape for the 5th Quad will be provided via two link bridges into the existing building. At level five only one link bridge is provided.

The north-south enclosed bridge links are provided at levels one to five and east/west bridge links are provided at levels one to four. The east-west bridge links are enclosed at level one and open air at levels two, three and four. The east-west bridge links at levels two and three are sheltered by the bridges above.

The two firefighting stairs (West and East cores) and the protected stair (Central core) discharge either directly to outside or via protected routes, summarised as follows:

- **West stair**; discharges to outside at Ground level;
- **East stair**; discharges to outside at Ground level;
- **Central stair**; discharges into the central circulation corridor – to ensure safe egress to outside, the base-build strategy has provided protected lobbies to separate the final exit route from adjoining accommodation

2.2.5 Evacuation of Persons with Reduced Mobility (PRMs)

The two firefighting lifts located in the existing building will be used for the evacuation of disabled people until fire brigade arrival, at which point a management strategy must be in place to continue the evacuation should anyone still require assistance.

Flat or ramped access from the 5th Quad to the existing building will be provided to enable wheelchair users to reach a final exit or a refuge.

Protected refuges are provided within or immediately adjacent to every protected escape stair within the existing building (i.e. in a protected lobby, protected corridor, a compartment, or within the stair itself). Each refuge space has an area accessible to a wheelchair of minimum dimensions 900 mm by 1400 mm, in which a wheelchair user can await assistance. The wheelchair spaces have been positioned so as to not obstruct the flow of other people escaping.

Each refuge is understood to have been provided with an emergency voice communication system complying with BS 5839-9. All call points are linked back to the central panel. This will be confirmed at the next design stage.

2.2.6 Emergency lighting and signage

Emergency lighting will be provided throughout the 5th Quad in accordance with BS 5266-1:2016. Escape signage will be provided in accordance with BS 5499-1:2002.

2.2.7 Escape signage

Escape signage will be provided in accordance with BS 5499-1:2002 - *Graphical symbols and signs. Safety signs, including fire safety signs. Specification for geometric shapes, colours, and layout.*

2.3 B.3 Fire Safety Systems

B.3. Features which reduce the risk to life: fire alarm systems, passive and active fire safety measures and associated management and maintenance plans.

2.3.1 Alarm and detection

A category L2/P2 detection and alarm system will be provided throughout, designed, and installed in accordance with BS 5839-1, forming an extension to the system provided in the SWC building.

The system will incorporate a voice alarm in accordance with BS 5839-8, as provided in the existing SWC building. Flashing warning beacons are also to be installed within areas with high noise levels.

The system will operate two stage alarm (double knock), whereby operation of one detector will send an alert to the fire alarm panel, prompting the building management to investigate.

2.3.2 Automatic sprinkler systems

The existing sprinkler system will be extended to provided coverage throughout the 5th Quad. in line with BS EN 12845:2015+A1:2019 and applicable Annex F provisions for enhanced reliability (formerly referred to as “life safety” requirements).

Based on as built information provided by UCL, the building has been provided with an OH3 full capacity BS EN 12845 wet sprinkler system. This will be suitable to extend to feed the extension, but a hydraulic check will need to be carried out to confirm the existing pumps can account for the additional friction losses. The existing system was mainly provided for property protection purposes, as per the existing fire strategy. Based on the information provided, it can meet “life safety” requirements but the controls and interfaces will need to be checked to confirm full life safety compliance.

Pre-action dry-pipe sprinklers will also be installed to underside of L01 in open air space under proposed 5th Quad (similar to the service area and loading bay in the existing building).

2.3.3 Backup power supply

Secondary power supplies will be provided to all life safety systems in the 5th Quad, including (but not limited to) the following:

- Automatic fire detection and alarm system;
- Emergency lighting.

Secondary power supplies will be in accordance with BS 8519:2010.

2.4 B.4 Fire-Fighting Facilities

B.4. Access for fire service personnel and equipment: how this will be achieved in an evacuation situation, water supplies, provision and positioning of equipment, firefighting lifts, stairs and lobbies, any fire suppression and smoke ventilation systems proposed, and the ongoing maintenance and monitoring of these.

No new staircases or lifts are included in the proposal for the 5th Quad. The existing two firefighting shafts in the main building provide access for firefighting purposes.

Both firefighting shafts serve all levels of the existing building and contain a:

- Firefighting stair;
- Firefighting lift;
- Firefighting lobby (ventilated); and
- Dry fire main.

2.4.1 Water supply for the firefighting operations

Hose coverage guidance in ADB recommends that all areas of all floor plates are reachable within 60 m of the fire main landing valves, measured over routes suitable for laying hose.

Hose run routes and distances have been considered from the existing firefighting cores and dry riser outlets to the proposed 5th Quad.

- The hose routes at levels one, three and five are within compliant distances recommended by ADB (60 m).
- The hose runs at level two and four are within 60 m if routes are measured through lab rooms, but longer than 60 m if routes are taken that avoid the lab rooms, and instead use circulation corridors only.

Three possible solutions have been considered at this stage:

- Routing the hose via the normal circulation routes, offering a slightly longer, but clearer route. Suggestion is that existing dry riser could be extended horizontally to provide new outlet at end of firefighting lobby to limit the distance the hose has to travel.
- Routing the hose via the labs, offering a shorter, but potentially more complex route for firefighters and possibly resulting in more impact to property.
- Options have also been considered for introducing a new independent dry riser (e.g. within the central core or externally to the building adjacent one of the new link bridges). This appears to have significant technical complications.

Consultation is be held with LFB (via Building Control) at the next design stage to discuss the above and establish their preferred method.

2.5 B.5 Fire Vehicle Access

B.5. How provision will be made within the curtilage of the site to enable fire appliances to gain access to the building.

Access to the 5th Quad building will be as per the access to the existing SWC building, as set out in the base-build fire strategy as follows (see Figure 5):

- Via Cleveland Street at ground level to the west firefighting shaft.
- Via Charlotte Street at ground level to the east firefighting shaft.
- Via Howland Street at ground level to the main entrance / exit (and central core).

Personnel access to the 5th Quad building could also be available via the external courtyard.

Access for fire appliances is available provided within 18 m of each fire main inlet connection point, as the fire service vehicles will be able to approach the two firefighting shafts from Cleveland Street and Charlotte Street.

2.5.1 Hydrants

Existing hydrants are provided within 90 m of the existing dry riser inlet points and entrance to the building.

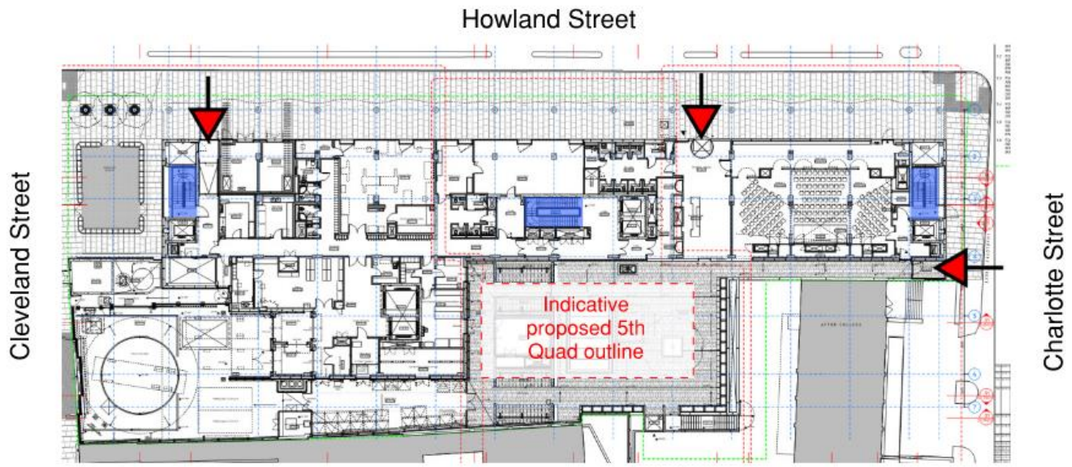


Figure 5 – Existing fire service access into the building (plus 5th Quad shown indicatively)

2.6 B.6 Future Building Changes

B.6. Ensuring that any potential future modifications to the building will take into account and not compromise the base build fire safety/protection measures

Any changes to the building design or use type will need to be assessed with regards to the proposed fire strategy to ensure the strategy satisfies the functional life safety requirements of the Building Regulations 2010 (as amended). The responsible person as defined in the RR(FS)O will be responsible for ensuring that this assessment is undertaken.

The fire safety management plan will need to ensure that any potential future modifications to the building will consider and not compromise the base build fire safety/protection measures.

3 Competency statement

This report has been prepared by Eoin O'Loughlin CEng and approved by Judith Schulz CEng.