HOARE LEA (H.)

Design Note

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Qualitative Design Review – Common corridor travel distances

1. Introduction

Hoare Lea have been appointed to provide fire strategy advice for the redevelopment of two listed buildings at Hayes Park, located at Hayes End Road in London. The two buildings proposed for redevelopment are namely, Hayes Park Central and Hayes Park South. The proposed development will see the conversion of both Grade II* listed office buildings to sole residential use, thereby constituting a material change of use as defined by the Building Regulations (as amended) 2010 [1].

Both buildings have a height of approximately 7.7m over three storeys (Ground, First and Second floors) with a partial Basement level existing at Hayes Park Central. Each building will benefit two escape stairs with one evacuation lift per stair proposed to facilitate the evacuation of mobility impaired occupants and address the recommendations of Policy D5 (Inclusive Design) of The London Plan (March 2021) [2]. Each building provides alternative means of escape apart from the Second floor of Hayes Park South which only has access to a single stair on each side of the building. Due to the proposed arrangement of this floor, each stair becomes separately accessed cores (e.g., a single stair condition) whilst also accommodating two common corridors with extended single direction travel distances.

A fire safety statement has been prepared by Hoare Lea to accompany the planning application for the development (DOC-1922747-05-NW-20230613-Planning statement-Rev02). The intention of this document is to address The London Plan; Policy D5 (Inclusive Design) and D12 (Fire Safety). The application was submitted in June 2023. In August 2023 comment from the GLA was received stating that further detail should be submitted on the fire engineered arrangements which are proposed to mitigate the extended travel distances in order to comply with Policy D12. This is considered to exclusively refer to the Second floor common corridors of Hayes Park South.

Following on from receipt of this comment, a qualitative design review (QDR) has been undertaken to ensure that the GLA comment is fully addressed. The QDR is a qualitative process that draws upon the experience and knowledge of the fire safety engineer and a team of others involved in the design,

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construction and operation of the building. The QDR should be used to identify the inputs to the quantitative analysis and acceptance criteria.

Approved Document B Volume 1: 2019 (with 2022 amendments) (ADB) [3] will be used for the design of this scheme. In satisfying the recommendations of ADB, the single direction travel distance within a residential common corridor should be limited to 7.5m in a single direction of travel. Hoare Lea have also adopted the recommendations outlined in "Guidance on Smoke Control to Common Escape Routes in Apartment Buildings (Flats and Maisonettes)" produced by Smoke Control Association (SCA) Revision 3 [4]. Herein referred to as the SCA Guide.

The SCA Guide recommends that, where travel distances from the furthest apartment entrance door to the staircase door does not exceed 15m, and the building is provided with a residential-type sprinkler system meeting the enhanced design guidance in BS 9251: 2021 [5], then irrespective of building height it is considered appropriate for the smoke ventilation system to meet the same performance criteria as a system provided for a building where the travel distance from the apartment of fire origin to the door to the staircase does not exceed 7.5m. In principle, by maintaining travel distances below 15m and providing a residential-type sprinkler system, travel distance is as comparatively effective as the 7.5m maxima (with focus on smoke ingress into the stair) as per the guidance of ADB. It is, therefore, considered reasonable to adopt this approach for the common corridor travel distances within the scheme.

The Second floor common corridors of Hayes Park South are proposed to have extended travel distances up to approximately 29m (note this distance may change slightly as the design develops but will not exceed 30m). It is proposed to justify this extended travel distance by providing a compensatory a residential-type sprinkler system meeting the enhanced design guidance in BS 9251 throughout the building and a double reversible mechanical extract system consisting of two mechanical extract shafts. As the building measures approximately 7.7m in height, which is below the 11m automatic sprinkler system threshold of ADB, this acts as a significant enhancement over the minimum requirement of code guidance. Furthermore, enhanced smoke ventilation systems are proposed within the Second floor common corridors. These ventilation systems will be justified using a fire engineered assessment supported by Computational Fluid Dynamics (CFD) modelling.

It is noted that extended travel distances within residential buildings based on provision of an enhanced smoke ventilation system is a well understood and long standing fire engineered design. The proposed enhanced smoke ventilation mitigation measures have been subject to independent research carried out by the system manufacturers and extensive fire and smoke modelling carried out by fire engineers within the industry. As such the hazards of the proposed design and the benefits and limitations of the proposed mitigation methods are well understood.

However, it is recognised that guidance in BS 7974:2019 (Application of fire safety engineering principles to the design of buildings - Code of Practice) [4] recommends that before attempting to carry out a detailed quantified analysis, the fire hazards should be identified, the problem simplified, and the required extent of quantification established. As the justification for extended travel distances is well understood and to avoid the need to reassess if the design changes in the early stages this process is usually carried out as the design develops. This process will include production of a Computational Fluid Dynamics (CFD) analysis of the proposed design. Before this model is created a scoping document will be produced. This document defines the fire hazards associated with the proposed design, establishes the performance criteria of the system, and provides the proposed design solutions to mitigate the extended travel distance. The CFD analysis will consider the internal layouts of apartments and will consider the worst case fire scenarios both in terms of smoke spread into the stair and longest travel distance to the stair. This process traditionally acts as the QDR for the extended travel distance design.

2. Planning Application.

2.1 Proposed development

The planning description for the proposed development is as follows:

"Change of use of the existing buildings to provide new homes (Use Class C3), together with internal and external works to the buildings, landscaping, car and cycle parking, and other associated works."

Specifically, the proposed development will comprise:

- The change of use of the buildings from office (Use Class E) to residential use (Use Class C3).
- 124 new homes, including 25 x Studios, 40 x 1-bed, 41 x 2-bed, 17 x 3-bed and 1 x 4-bed homes.
- A high proportion of open space across the site totalling 2.48 hectares (24,800 sqm), including the provision of a new playground, a new square, and extensive communal grassed areas surrounding the buildings.
- The provision of a variety of communal spaces within the buildings, including courtyards and flexible spaces on all levels:
  - 416 sqm internal communal amenity (lobbies, communal space, and storage)
  - 691 sqm external communal amenity
  - 1,153 sqm private external amenity

The proposed development will seek to promote sustainable modes of transport and will provide the following:

- 175 cycle parking spaces allocated as follows:
  - 175 cycle parking spaces allocated to the new homes.
  - 8 cycle parking spaces allocated to visitors to the site.
- 124 vehicle parking spaces allocated as follows:
  - 124 (111 standard and 13 accessible) vehicle parking spaces allocated to the new homes.
  - No visitor spaces are provided.

The application site plan is shown in Figure 1.

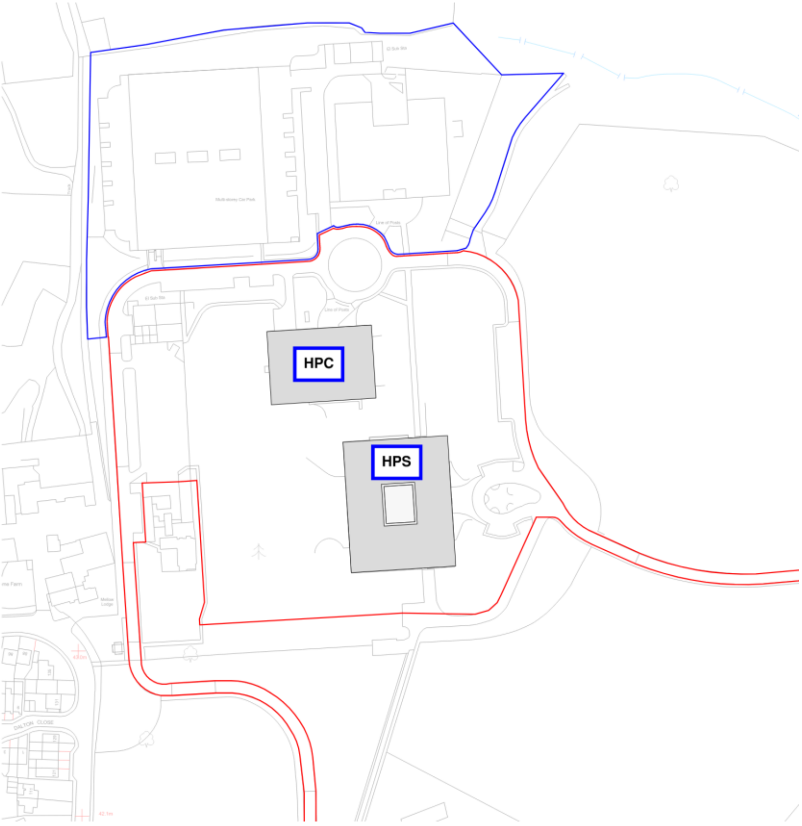

Figure 1: Application site plan, Hayes Park Central (HPC) is the smaller building to the north of the plan, Hayes Park South (HPS) is the larger building to the south.

3. The QDR Process.

The recommended structure for a QDR in accordance with the BS 7974 framework is as follows:

1. Review of architectural design and selection of materials
2. Establish functional objectives for fire safety
3. Identify hazards and possible consequences
4. Establish trial fire safety engineered designs
5. Set acceptance criteria
6. Identify method of analysis
7. Establish fire scenarios for analysis

BS 7974 recommends that for large and complex projects the QDR should be carried out by a study team involving the fire safety engineer, members of the design team and the building operational management. It is further recommended that additional members may also include the relevant building control body, relevant fire authority and insurers. A building control body has not yet been engaged on the design.

4. Architectural design.

Both buildings have a height of approximately 7.7m over three storeys (Ground, First and Second floors) with a partial Basement level existing at Hayes Park Central. They are both existing buildings and understood to be constructed with typical building materials such as masonry, steel, and concrete elements. To limit the spread of fire within the buildings, all wall and ceiling linings will satisfy the appropriate classification stated within Table 4.1 of ADB.

The RIBA Stage 2 fire safety strategy will include a space separation analysis to establish the necessary boundary distance around each building and whether any fire protection to the external façade is required. At this stage, no significant risk of spread of fire between buildings has currently been identified; however, detailed analysis will be provided during the RIBA Stage 2 design stage and the appropriate fire resisting construction will be provided.

As neither building on the Hayes Park development has a storey that exceeds 11m in height, the external walls of both buildings are to satisfy the performance criteria described in report BR 135 or the external wall surface should be in accordance with Table 10.1 of ADB for surface spread of flame classification. Cavity barriers are to be provided in any external wall cavity as required in accordance with Section 8 of the ADB.

5. Functional objectives for fire safety.

The functional objectives for the design of the Hayes Park development are outlined in Table 1.

Table 1: Functional objectives for QDR assessment.

Functional objective.	Criteria to achieve
Life Safety	– This objective will be met by fulfilling the functional requirements of the Building Regulations.
Management of building once operational	– This objective will be met by fulfilling the requirements of the Fire Safety Order [6] and undertaking a Fire Risk Assessment (FRA) and management strategy prior to occupation.
London Plan recommendations	– This objective will be met by fulfilling the requirements of The London Plan; Policy D5 (Inclusive Design) and D12 (Fire Safety).
Property protection	– Not specifically addressed but indirectly benefits from life safety provisions.
Business continuity	– Not specifically addressed but indirectly benefits from life safety provisions.

6. Hazards and Possible consequences.

Potential fire hazards and possible consequences have been assessed for the Hayes Park South development specifically in relation to the extended corridor travel distances and single stair condition of the Second floor, as outlined in Table 2.

Table 2: Hazards associated with the Hayes Park development and possible consequences.

Item	Hazard	Possible consequences
1.	Apartment layout	– Apartment layouts will affect an occupant’s ability to evacuate the building successfully. Open plan layouts may lead to more

Item	Hazard	Possible consequences
		smoke spread into the common corridor when occupants evacuate the apartment. The apartment layouts are proposed to be a mix of open plan and protected entrance hall design.
2.	Extended common corridor travel distance	– The occupants will have longer to travel until they can reach the relative safety of the protected stair core. This could mean occupants have a longer time exposed to the heat and smoke from a fire.
3.	Residential building with a single stair condition	– The stair will provide the main means of escape route from the upper levels of the building. A single escape stair condition does not provide any redundancy should the stair become blocked by fire or smoke.

7. Trial design.

In accordance with BS 7974, a trial design is defined as "group of fire safety measures which, in the context of the building parameters, might meet the specified functional objectives".

In accordance with BS 7974, it is considered necessary to amend the architectural design or provide additional fire safety measures to achieve the functional objectives as defined as part of the QDR process. Multiple trial designs can be identified to provide acceptable solutions to the building design. As this QDR is focusing on the Second floor extended travel distances only of the Hayes Park South common corridors a single trial design has been undertaken. In developing trial designs, the focus has not been solely on additional fire protection systems but a review of the potential for reducing or eliminating some of the identified hazards by amending the construction or layout of the building has been considered.

The trial design presented analyses different iterations of the extended corridor design with diverse degrees of fire safety measures incorporated to assess which design is the most appropriate for the development based on the hazards identified in Section 6 which will be incorporated into the building design. The trial design starts at the minimum level of fire safety design and increases fire safety provisions as part of the design.

Table 3: Trial design – Extended Common corridor design.

Iterations of trial design	Fire safety provisions	Qualitative assessment
1	No fire safety provisions. The common corridor is a route from the apartment to the stair no fire resistance is provided between apartments and common corridor.	It is considered that an unprotected common corridor will provide a route from the apartment to the stair for a person to evacuate during a fire. In addition, any other occupants of the building should either evacuate safely or be able to remain in place without being affected by the combustion products of a fire. If the corridor is unprotected, it is assumed that the fire could spread into the common corridor in the event of a fire. This trial design iteration is not considered suitable as it does not comply with the recommendations of statutory guidance. This design is not considered to provide an adequate level of safety as

Iterations of trial design	Fire safety provisions	Qualitative assessment
	Corridor is up to 30m in a single direction of travel.	a common corridor could be very quickly overcome, rendering means of escape provisions unusable in the event of a fire.
2	Each apartment and the common corridor is constructed out of 60-minute fire resistance.	It is considered that designing the common corridor out of fire resisting construction (60 minutes) will provide an adequate level of separation between the common corridors and adjacent apartments. As outlined in ADB, walls separating a dwelling and accommodation that does not form part of the dwelling by construction offering not less than 60-minute fire resistance. It is considered that the enclosure around each apartment would prevent a fire spreading into the common corridor (or other apartments) from an apartment on fire, based on a typical fire duration within a residential apartment burning for less than 60 minutes based on the typical fire load. This trial design iteration is not considered reasonable as, although the protection of the common corridor is considered to prevent fire spread into the common corridor from adjacent accommodation, the common corridor would likely become compromised by smoke. This is due to the heat and smoke which would enter the corridor while occupants are evacuating the apartment on fire into the corridor through the open apartment door. Furthermore, as smoke is likely to enter the corridor, the stair could be rendered smoke logged which would compromise evacuation from other apartments if necessary.
3	Each apartment will be provided with sprinkler protection designed and installed in accordance with BS 9251.	It is considered that sprinkler protecting the apartments will provide a significant uplift to the fire safety of occupants. Sprinkles significantly reduce the heat and smoke produced within a fire scenario and would work with the fire resistance to reduce the likelihood of fire spread into the residential common corridor. As above this trial design iteration is not considered reasonable as, although the sprinklers will significantly reduce the fire and smoke, the common corridor may still become compromised by smoke. This is due to the heat and smoke which would enter the corridor while occupants are evacuating the apartment on fire into the corridor through the open apartment door.
3	Mechanical smoke extract system within the common corridor. Simple system without fire resisting equipment, fire resisting shafts or backup power supplies	It is considered that a mechanical smoke extract system may provide the common corridor with smoke clearance could be used to protect the single means of escape stair from the ingress of heat and smoke. Based on the guidance outlined in BS 9991 for single stair building, common corridor design. Ingress of heat and smoke into the common corridor is considered to be unavoidable and through providing a mechanical extract system it

Iterations of trial design	Fire safety provisions	Qualitative assessment
		is considered that heat and smoke may be removed from the common corridor. However, due to the extended travel distance in the common corridor an enhanced ventilation system may be required to fully clear the corridor. This system will work in conjunction of an AOV at the head of stair which will provide suitable make-up air for the extract system to operate. This trial design iteration is not considered reasonable as the smoke extract may move hot smoke up the building and cause the fans to fail or lead to fire spread throughout the building.
4	Mechanical smoke extract system within the common corridor. Provided with fire resisting ductwork and fire resisting fan sets, backup power supplies are not provided.	As above it is considered that a mechanical smoke extract system may provide the common corridor with smoke clearance. The fire resisting fans and ductwork will ensure the system remains operational as it extracts the hot smoke. However, due to the extended travel distance in the common corridor an enhanced ventilation system may be required to fully clear the corridor. This trial design iteration is not considered reasonable as the smoke extract system would fail to operate if the mains power supply to the building fails.
5	Mechanical smoke extract system within the common corridor. Provided with fire resisting ductwork and fire resisting fan sets and backup power supplies.	As above it is considered that a mechanical smoke extract system may provide the common corridor with smoke clearance. The backup power supplies will ensure the system remains operational should the mains power supply fail. This trial design iteration is not considered reasonable as due to the extended travel distance in the common corridor an enhanced ventilation system may be required to fully clear the corridor.
6	Double-Reversible-Mechanical-Extract (DRME) system within the common corridor. Provided with fire resisting ductwork and fire resisting fan sets and backup power supplies.	A DRME system can provide both inlet or extract to either end of the corridor, and allows superior smoke clearance capability when compared to a single extract system which relies on inlet air replacement through the AOV at the head of the stair. It is considered that a DRME system within the common corridor would provide suitable means of ventilating the common corridor and protecting the stair from ingress of smoke. In an extended corridor a DRME system is considered to provide significant benefit over a single mechanical extract system. The mechanical extract system is considered reasonable as a concept which will be demonstrated by Computational Fluid Dynamics (CFD) modelling carried out as the design develops this modelling will feed into the specialist design on the required

Iterations of trial design	Fire safety provisions	Qualitative assessment
		extract rate for the system. Note that CFD modelling is not proposed to be carried out till later in the design as the architectural design is developed further and the corridor arrangements are set. This trial design iteration is not considered reasonable as the smoke extract system would not be able to operate as intended without automatic detection within the common corridor.
7	Category L5 detection system in the common corridor in accordance with BS 5839-1:2017 [7].	It is considered that the provision of automatic detection within the common corridor will activate the mechanical smoke extract system in a timely manner (i.e. when smoke enters the common corridor when an occupant is evacuating from the apartment on fire). As such, the smoke extract will activate at the required time to remove fire and smoke within the common corridor and protect the stair from the ingress of smoke. This trial design iteration is considered to be reasonable as it removes smoke from the common corridors and protects the stair from smoke ingress.

Trial design – Proposed fire safety features for extended travel distance common corridor design

- Construct each apartment and the common corridor out of 60-minute fire resisting construction with FD30s doors opening into the common corridor;
- Residential sprinkler protection designed in accordance with BS 9251;
- Double-Reversible-Mechanical-Extract (DRME) system within the common corridor. Provided with fire resisting ductwork and fire resisting fan sets and backup power supplies; and
- Category L5 detection in the common corridor in accordance with BS 5839-1.

8. Acceptance criteria.

8.1 Life safety

The acceptance criteria have been defined as to provide a level of fire safety design that exceeds the minimum recommendations of guidance i.e. better than code. This is considered to be satisfied by satisfying the functional requirements of Part B of Schedule 1 of Building Regulations.

8.1.1 CFD analysis

Where CFD analysis is required as a method of analysis, the tenability criteria outlined within this section have been utilised to determine the suitability of the systems proposed. A full CFD assessment into the extended travel distance within the residential common corridor will be carried out as the design develops.

Where the performance of a fire engineered system is being assessed deterministically, it is necessary to establish acceptance criteria, in this case the measurement for acceptance is defined by the tenability criteria. The tenability for a means of escape assessment and fire-fighting access assessment differ and are outlined below.

It is proposed to undertake the analysis of the common corridor smoke ventilation systems in accordance with the recommendations outlined in the SCA Guide.

8.1.1.1 Means of escape tenability criteria

To demonstrate that conditions are acceptable for occupants evacuating, the tenability criteria examined are related to the limits at which the average human being is affected by the products of combustion. These criteria are visibility, smoke temperature, thermal radiation (radiative heat flux), and Fractional Effective Dose (FED) within the smoke ventilated common corridor.

Visibility

During the period where the apartment door is open in the model. , BRE Report 213179:2015 [8] found that it was difficult under most smoke control scenarios to keep the corridor clear of smoke. As such, visibility in the corridor is not assessed during this period.

It is noted that; CIBSE Guide E:2010 [9] recommends that for small enclosures, visibility distance should not decrease below 5m, and for large enclosures, 10m. However, BS 7974-6: 2019 [10] infers that people move as if in total darkness at a visibility distance of 5m in irritant smoke conditions. Therefore, to enable some form of comparison to be undertaken, a conservative 10m visibility distance will be adopted to represent "smoke," based on the guidance given in CIBSE Guide E for large enclosures.

It is commonly accepted, although there is no scientific verification of these values, that a smoke control system should return visibility to 10m after approximately two minutes (120 seconds) of the apartment door closing. While it is subject to the engineer's judgement, as recommended in the SCA Guide, a ventilation system which achieves this clearance time is considered to meet the guidance of the Building Regulations.

The visibility factor applied within FDS will be the default value of 3.0.

Smoke temperature

Temperature will be assessed in accordance with the guidance of BS 7974-6 Annex I and Table I.4. On this basis, it is proposed to set the tenability limit at different tolerance times and the associated water saturation and temperature intensity of smoke which is summarised below in Table 4.

Table 4: Tenability limit for convective heat as referenced in BS 7974-6 Annex I Table I.4.

Intensity	Tolerance time
<60°C 100% saturated	>30 min
100°C <10% H_2O	8 min
110°C <10% H_2O	6 min
120°C <10% H_2O	4 min
130°C <10% H_2O	3 min
150°C <10% H_2O	2 min
180°C <10% H_2O	1 min

Fractional effective dose (FED)

Purser's FED concept has been used to assess the toxicity levels within the corridor. FED is calculated by assessing the concentration of narcotic gasses, namely Carbon Monoxide (CO), Carbon Dioxide (CO_2), and Oxygen (O_2). These are combined in the following formula:

$$FED_{total} = \left(FED_{CO} + FED_{CN} + FED_{NO_2} + FLD_{irr}\right) \times HV_{CO_2} + FED_{O_2}$$

It should be noted that the formula above only considered the hyperventilation factor induced by carbon dioxide and does not consider that the carbon dioxide concentration is high enough to have a narcotic effect. Carbon dioxide does not have toxic effects at concentrations of up to 5% but it does simulate breathing which increases the rate at which the other fire products are taken up.

FED is considered to be untenable when it reaches a value of unity (1) as detailed in the SFPE Handbook. However, it is proposed to adopt a tenability criterion of 0.3 will be used for this assessment based on the guidance of PD 7974-6, which corresponds to the incapacitation of less than 1% of the exposed population. It is our considered opinion that this safety factor is sufficient to allow for variation in the general health and age of occupants.

Radiative heat flux (thermal radiation)
Smoke temperature itself is not the sole thermal effect of fire that can lead to conditions in the corridor becoming untenable. Thermal radiation (radiative heat flux (RHF)) of $2.5kW/m^2$ can cause severe skin pain and burns. On this basis, and in accordance with guidance given in CIBSE Guide E, a tenability limit of $2.5kW/m^2$ for RHF at 2m above floor level has been set.

Pressure
While not a factor that will affect the tenability conditions within the corridor, the effects of excess pressure differentials can result in difficulty in opening doors which would make it difficult to escape.

BS EN 12101-6:2005 [11] recommends that the force required to open a door should not exceed 100N and, as such, the pressure difference between enclosures should not exceed +/-60Pa as per Appendix A.6.1 of BS EN 12101.

8.1.1.2 Firefighting phase tenability criteria
When assessing firefighting conditions there are three tenability conditions that should be reviewed; smoke temperature, RHF, and pressure. Due to the provision of breathing apparatus for responding Fire Service personnel and that the Fire Service are able to operate in zero visibility, there is no requirement to assess the impact of toxic smoke and visibility on Fire Service performance. However, it is important that during firefighting operations the stair should be provided with relatively smoke free conditions.

It is stated in the SCA Guide that due to the stair door remaining open throughout the assessment, it is almost impossible to totally mitigate against smoke entering the stair. On this basis, some very minor localised smoke spreading into the stair may occur. However, it is considered that all occupants of the apartment of fire origin will have evacuated the building by the time the fire and rescue service have entered the building to carry out the firefighting phase. The stair is used to allow the Fire Service to escape in the event of critical conditions being reached and to allow them to evacuate other residents and, as such, a failure will be recorded if the stair becomes smoke logged so that escape is not possible.

In addition, it is also proposed to review the conditions in the corridor against known Fire Service tenability limits, to ensure the highest levels of firefighter safety.

Smoke temperature and RHF
The assessment for the conditions for the FSA will be based on the criteria set out in Table 5 for hazardous and extreme conditions at a height of 1.5m above floor level, as per the guidance set out in Section 5.3.3 of the SCA Guide.

Table 5: Fire Service Access Acceptance Criteria

Exposure Condition	Maximum exposure time (minutes)	Maximum air temperature (°C)	Maximum radiated heat flux (kWm^{-2})	Remarks	Recommended distance from flat door
Routine	25	100	1	General fire-fighting.	15-30m

Exposure Condition	Maximum exposure time (minutes)	Maximum air temperature (°C)	Maximum radiated heat flux (kWm^{-2})	Remarks	Recommended distance from flat door
Hazardous	10	120	3	Short exposure with thermal radiation.	4-15m
Extreme	1	160	4-4.5	For example, snatch rescue scenario.	2-4m
Critical	<1	>235	>10	Considered life threatening.	0-2m

Note 1: This table has been reproduced from the SCA Guide for smoke control to common escape routes in Apartment buildings (rev3) as stated in this document the remarks and distance columns are not part of the original research document and are the opinion of the SCA.

Pressure

The Fire Service may be required to enter rooms to assist in the evacuation of trapped occupants, fight fires etc. As no guidance is available on the door opening forces suitable for the Fire Service, the guidance outlined in Section 8.1.1.1 for means of escape will be used i.e. the pressure difference between enclosures should not exceed +/-60Pa.

8.2 Property protection

Property protection has not been specifically addressed but indirectly benefits from life safety provisions.

8.3 Business continuity

Business continuity has not been specifically addressed but indirectly benefits from life safety provisions.

9. Methods of analysis.

As described above in order to demonstrate the effectiveness of the smoke ventilation systems, the proposal is subject to validation by CFD modelling. The CFD software package to be used in this assessment is Fire Dynamics Simulator (Version 6.8.0 or later) [12], produced by the National Institute of Science and Technology (NIST).

The simulator has been extensively validated against both real and laboratory fires and is an industry standard. The assumptions and limitations of the simulator are not reviewed here, and full reference should be made to NIST Special Publication 1018 'Fire Dynamics Simulator Technical Reference Guide' [13]. All models are to be undertaken and checked by experienced users in line with the recommendations of NIST.

It is proposed to undertake the analysis of the common corridor smoke ventilation systems in accordance with the recommendations outlined in the SCA Guide. Following Section 5.1 of the SCA Guide, the travel distances are outside the recommendations of standard guidance (i.e. ADB), therefore the proposed smoke control system should demonstrate that the conditions in the common corridor should provide an acceptable level of safety when compared to an established tenability criteria. On this basis, a deterministic study is proposed.

10. Establish fire scenarios for analysis.

It is proposed to model up to two Fire Scenarios (FS) for the corridors with extended travel distances to determine whether the smoke ventilation system is suitable: one for the means of escape phase (FS1) and one for the firefighting phase (FS2) of operation of the DRME system.

For each phase of operation, a single worst-case scenario will be modelled, the results of which are considered to be applicable to all other extended travel distance common corridors in Hayes Park South. The worst case scenarios will be selected based on the following:

- Layout of the corridor, particularly considering arrangements which may inhibit the efficiency of the smoke ventilation system;
- Travel distance between the apartment of fire origin to the storey exit (stair door);
- Travel time for evacuees (unimpeded horizontal travel speed = 1.2 m/s. In accordance with BS 7974-6); and
- Location of the apartment bedroom of fire origin.

Generally speaking, the means of escape scenarios will consider the apartments with the greatest travel distances from the apartment door to the stair door. While the fire service access scenarios will consider the apartment doors which are located closest to the stair door to represent the apartment fires which represent the greatest possibilities of smoke spread into the single stair.

As the apartment and corridor layouts are still subject to change currently the number of fire scenarios could change. This will be assessed in more detail at the detailed design stage of the project.

11. Conclusion.

This document outlines the qualitative design review for the proposed fire engineered design of the extended travel distances in the Second floor common corridors in Hayes Park South. The QDR report has been structured to follow the process outlined in BS 7974 and including the appropriate sections within.

The CFD modelling itself is proposed to be carried out at a later stage once the layouts are more developed and the general corridor arrangement is frozen.

The design of the building with respect to the extended travel distances will be demonstrated by CFD modelling at a later design stage to meet the functional requirements of the Building Regulations.

This document is considered to address the concerns raised by the GLA in relation to the proposed extended common corridor travel distance as part of their planning review process.

12. References.

[1] Her Majesty's Stationery Office (HMSO), *The Building Regulations 2010, England and Wales*. The Stationary Office, 2010.

[2] Mayor of London, *London Plan*. 2021.

[3] Department for Communities and Local Government (DCLG), *Amendments to the Approved Documents - Approved Document B: Fire Safety Volume 1 (dwellings) and 2 (Buildings other than dwellings) June 2022*. 2022.

[4] Smoke Control Association (SCA), "Guidance on Smoke Control to Common Escape Routes in Apartment Buildings (Flats and Maisonettes)," Federation of Environmental Trade Association, Revision 3, Jan. 2020.

[5] British Standards Institution (BSI), *BS 9251 : Sprinkler systems for residential and domestic occupancies. Code of practice*. BSI Global, 2021.

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[13] K. McGrattan, S. Hostikka, R. McDermott, J. Floyd, C. Weinschenk, and K. Overholt, "Fire Dynamics Simulator (Version 6) Technical Reference Guide Volume 1: Mathematical Model, NIST Special Publication 1018 Sixth Edition," National Institute of Standards and Technology (NIST), 2014.