September 2020

SYON GARDENS

HOMEBASE BRENTFORD SITE, TW7 5QE

Fire Strategy Report

Consultant: International Fire Consultants Ltd.

St Edward
Designed for life

INTERNATIONAL FIRE CONSULTANTS LIMITED

PRIVATE & CONFIDENTIAL

Syon Gardens, Syon Lane

Fire Strategy Report

IFC Report FSS/19701/01D

Prepared on behalf of:

St Edward Homes Limited
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London
SW8 4PE

NOTE: This report should not be manipulated, abridged or otherwise presented without the written consent of International Fire Consultants Ltd.

10 September 2020

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ISSUE RECORD

Rev	Date	Author	Review	Section	Amendments
-	09/04/2020	AH	JP	-	-
A	07/07/2020	AH	JP	All	Minor amendments throughout to account for updated design drawings. Notable changes include common corridor layouts and ventilation provisions for Cores A and B3.
B	31/07/2020	AH	JP	-	Minor amendments to project and client references throughout.
				10.2	Additional sentence confirming design standard for fire-fighting lifts
C	09/09/2020	AH	JP	General	Travel distances in corridors updated in line with updated drawings
D	10/09/2020	AH	JP	General	Minor updated following comments from design team.

CONTENTS

1. INTRODUCTION

International Fire Consultants Ltd. (IFC) has been commissioned by St Edward Homes Limited to advise on fire strategy for the proposed Syon Gardens, Syon Lane, development.

This report is intended to describe the fire strategy for the Syon Gardens development and has been produced at the RIBA stage 2 of design.

This report is based on confirming compliance with the fire safety legislation listed in Section 2 below. It does not include for compliance with any other criteria (e.g. additional client requirements, insurance etc.), unless specifically described in this report.

The report has been based on the drawings provided by Patel Taylor, as listed below in Table 1.

Drawing title	Drawing number	Rev	Date	Drawn by
Site Block Plan Proposed	579-PTA-ZZ-ZZ-DR-A-0051	P03	28/07/20	Patel Taylor
General arrangement plan Lower ground floor	579-PTA-ZZ-B1-DR-A-1001	P30	09/09/20	Patel Taylor
General arrangement plan Ground floor	579-PTA-ZZ-00-DR-A-1001	P35	09/09/20	Patel Taylor
General arrangement plan Upper ground floor	579-PTA-ZZ-01-DR-A-1001	P18	09/09/20	Patel Taylor
General arrangement plan Level 01	579-PTA-ZZ-01-DR-A-1001	P36	09/09/20	Patel Taylor
General arrangement plan Level 02	579-PTA-ZZ-02-DR-A-1001	P43	09/09/20	Patel Taylor
General arrangement plan Level 03	579-PTA-ZZ-03-DR-A-1001	P31	09/09/20	Patel Taylor
General arrangement plan Level 04 – Podium	579-PTA-ZZ-04-DR-A-1001	P29	09/09/20	Patel Taylor
General arrangement plan Level 05	579-PTA-ZZ-05-DR-A-1001	P34	27/08/20	Patel Taylor
General arrangement plan Level 06	579-PTA-ZZ-06-DR-A-1001	P30	27/08/20	Patel Taylor
General arrangement plan Level 07	579-PTA-ZZ-07-DR-A-1001	P29	27/08/20	Patel Taylor
General arrangement plan Level 08	579-PTA-ZZ-08-DR-A-1001	P26	27/08/20	Patel Taylor

General arrangement plan Level 09	579-PTA-ZZ-09-DR-A-1001	P26	02/09/20	Patel Taylor
General arrangement plan Level 10	579-PTA-ZZ-10-DR-A-1001	P25	02/09/20	Patel Taylor
General arrangement plan Level 11	579-PTA-ZZ-11-DR-A-1001	P26	02/09/20	Patel Taylor
General arrangement plan Level 12	579-PTA-ZZ-12-DR-A-1001	P26	02/09/20	Patel Taylor
General arrangement plan Level 13	579-PTA-ZZ-13-DR-A-1001	P25	02/09/20	Patel Taylor
General arrangement plan Level 14	579-PTA-ZZ-14-DR-A-1001	P25	02/09/20	Patel Taylor
General arrangement plan Level 15	579-PTA-ZZ-15-DR-A-1001	P21	27/08/20	Patel Taylor
General arrangement plan Level 16	579-PTA-ZZ-16-DR-A-1001	P21	27/08/20	Patel Taylor
General arrangement plan Roof plan	579-PTA-ZZ-RF-DR-A-1001	P10	29/07/20	Patel Taylor

Table 1 – Drawings reviewed

2. LEGISLATION AND GUIDANCE DOCUMENTS

2.1 Building Regulations

The building will be subject to approval under the Building Regulations 2010 as modified by the Building (Amendment) Regulations 2018.

That will require the design and construction to comply with the functional Requirements as shown below:

- B1 – Means of warning and escape;
- B2 – Internal fire spread (linings);
- B3 – Internal fire spread (structure);
- B4 – External fire spread; and
- B5 – Access and facilities for the fire service.

In order to demonstrate compliance with functional Requirements B1 to B5, it is conventional to base the design on standard fire safety design documents. Variations to the guidance given in those documents is permitted, as long as it can be demonstrated to have still met the function Requirements shown above.

In addition, under changes introduced in the Building (Amendment) Regulations 2018, for buildings classified as "relevant buildings", Regulation 7(2) (and other modified Regulations) applies additional criteria on the combustibility of materials within the external walls.

The definition of a "relevant building" is a building with a storey that is 18m or more above ground level (excluding roof-top plant areas and storeys consisting solely of plant rooms) and contains one or more dwellings, an institution or a room for residential purposes (excluding rooms in hostels, hotels or boarding houses).

This building does meet the criteria above. As such, the additional requirements needed for "relevant buildings" under Regulation 7(2) would apply.

The additional criteria for "relevant buildings" under Regulation 7(2) are prescriptive and so need to be complied with. Variations to that are not allowed.

This report has based the design of the building on BS 9991 for the residential areas and BS 9999 for the non-residential areas. These documents have not yet been modified to include the additional requirements of the Building (Amendment) Regulations 2018 and so the changes shown in the Amendments to the Approved Documents (November 2018) have also been incorporated into this fire strategy.

In situations where the building design varies from the guidance in these documents, that has been highlighted and justified in this report.

This report describes the main fire safety issues relating to the building. In any areas that are not mentioned in this report, the design should comply with the guidance of the relevant guidance documents mentioned above.

2.2 Regulatory Reform (Fire Safety) Order 2005

Once completed, the building will be subject to the Fire Safety Order. That will require the Responsible Person for the building to ensure that a fire risk assessment has been carried out by a competent person.

This report (or subsequent updated versions of this report) could be used to assist that fire risk assessment.

2.3 Construction Design and Management Regulations 2015

The CDM Regulations require that the design of the building should ensure that it can be constructed and managed safely.

This report deals with the fire safety design of the building when completed and does not address fire safety during construction.

There are a number of standard guidance documents available giving guidance on managing fire safety within construction sites (such as HSG 168 produced by the HSE) and so the relevant main contractor will need to ensure that the construction site complies with that guidance.

2.4 The Draft London Plan 2019

Under the legislation establishing the Greater London Authority (GLA), the Mayor is required to publish a Spatial Development Strategy (SDS) and keep it under review. The SDS is known as the London Plan. As the overall strategic plan for London, it sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years.

Following client request, the development proposals have been developed to achieve the highest standards of fire safety in line with Draft London Plan Policy D12 (Fire Safety) by ensuring the following (Part A):

1) Identify suitably positioned unobstructed outside space:
    a) For fire appliances to be positioned on; and
    b) Appropriate for use as an evacuation assembly point.
2) Are designed to incorporate appropriate features which reduce the risk to life and the risk of serious injury in the event of a fire including appropriate fire alarm systems and passive and active fire safety measures;
3) Are constructed in an appropriate way to minimise the risk of fire spread;
4) Provide suitable and convenient means of escape, and associated evacuation strategy for all building users;
5) Develop a robust strategy for evacuation which can be periodically updated and published, and which all building users can have confidence in; and
6) Provide suitable access and equipment for firefighting which is appropriate for the size and use of the development.

In line with Part B, this Fire Statement has been produced by a third party, suitably qualified assessor (i.e. IFC). The statement details how the development proposal will function in terms of:

1) The building's construction: methods, products and materials used, including manufacturers' details;
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;
3) Features which reduce the risk to life: fire alarm systems, passive and active fire safety measures and associated management and maintenance plans;
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;
5) How provision will be made within the curtilage of the site to enable fire appliances to gain access to the building; and
6) Ensuring that any potential future modifications to the building will take into account and not compromise the base build fire safety/protection measures.

3. RELEVANT PROJECT INFORMATION

3.1 Design approach

The Syon Gardens development is a large-scale mixed-use development. It is primarily made up of residential apartments in the form of 5 tower "blocks" (i.e. A-E) located above a 6-storey podium (i.e. Lower Ground, Ground, Upper Ground, First, Second and Third Floors) comprising a Tesco foodstore and flexible retail / office floorspace, Tesco BOH and car park areas. Some areas within Cores B3 and C1 also have a mezzanine level between Ground Floor and Level 01.

Each block of the development has been indicated below in Figure 1, in addition to indication of each residential core.

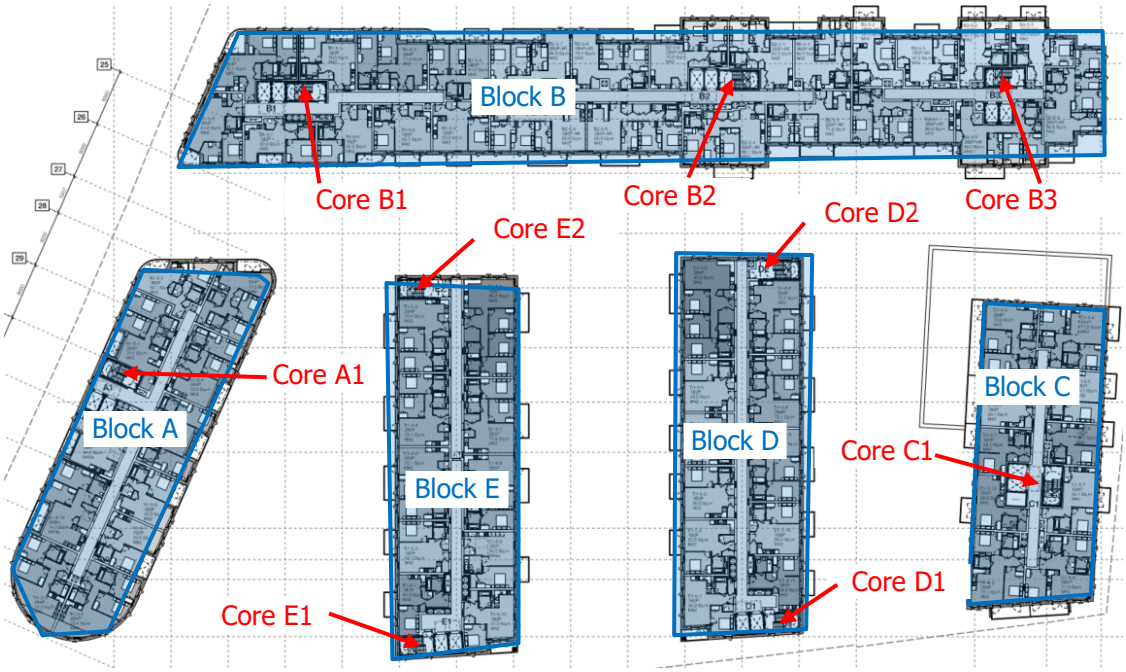

Figure 1 – Indication of residential block and core references

The cores detailed above all connect to the podium block and in most cases continue down, independently to the podium areas, to Ground / access level. The exceptions to this are cores D2 and E2 which both finish at podium level.

In addition to the above, there are 6 further stairs located within the podium to independently serve the podium areas, i.e. back of house and car park areas. These cores have been detailed below in Figure 2.

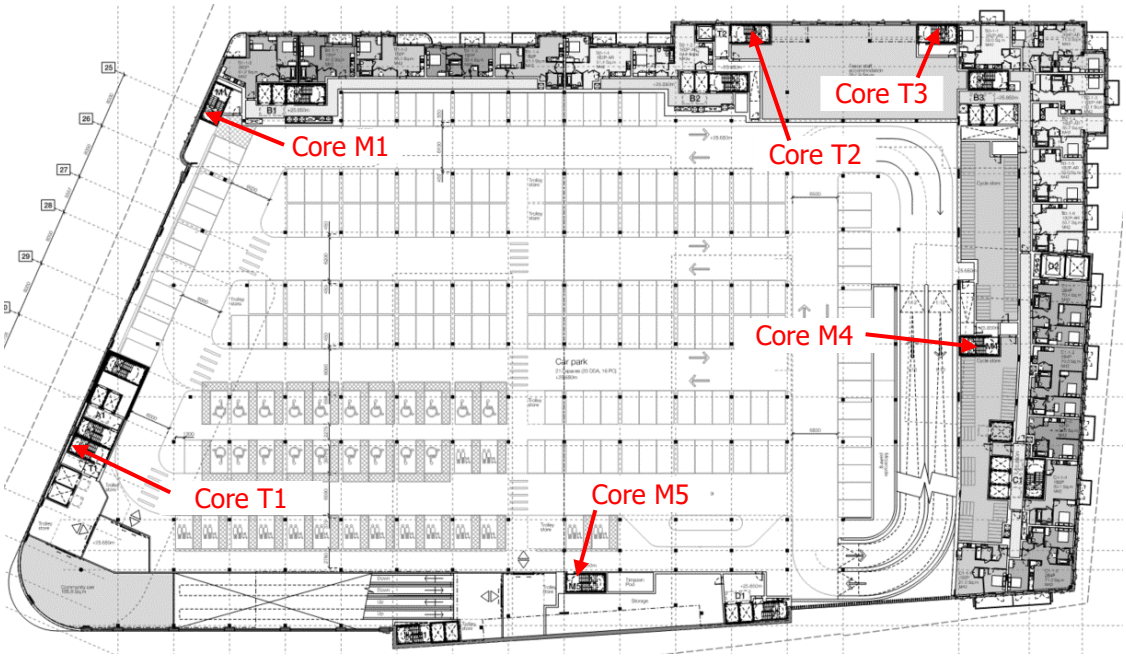

Figure 2 – Indication of podium core references

In order to apply the recommendations, set out in BS 9991 for single stair (residential) buildings, sufficient fire separation will be provided between all blocks / adjacent areas.

The "defend in place" evacuation strategy, which is to be adopted for the residential Blocks, does not include disabled refuges (as is normal in the UK).

The design approach for the non-residential areas will be in accordance with BS 9999, whereby simultaneous evacuation will be adopted.

3.2 Occupant characteristics and risk profiles

BS 9999 (which applies to the non-residential areas, as mentioned earlier) requires that the occupants are categorised in order that the appropriate fire precautions can be specified. This is not a requirement for the residential areas under BS 9991.

People using the back of house areas are expected to be Tesco staff or building maintenance personnel who may be present on occasion. Tesco staff are there as a function of their employment and will be awake and familiar with the building layout.

The Tesco sales areas will be occupied mostly by visitors who will be awake but potentially unfamiliar with the internal layouts. In this instance, occupants will rely on escape route signage and will likely also be accompanied / coordinated by the Tesco staff / those who are familiar.

Maintenance personnel would also be present as a function of their employment. Such persons will be trained and require permits to access the building. Not all maintenance personnel may be familiar with the layout of the building but an induction on evacuation procedures should be provided by management.

Table 4 of BS 9999 provides recommendations for associated risk profiles. Based on this, most of the back of house areas within the development can be classified under risk profile A1 (increased from A2 due to provision of sprinklers throughout).

It should be noted that the internal design of the Tesco unit is not covered within this report. However, the occupancy profile of the relevant areas would be:

- A1 for the office-type and staff room areas (reduced from A2 due to provision of sprinklers throughout);
- A2 for the storage, BOH and plantroom areas (reduced from A3 due to provision of sprinklers throughout); and
- B2 for the sales / shopping areas (reduced from B3 due to provision of sprinklers throughout).

3.3 Evacuation strategies

The primary objective of an evacuation strategy is to ensure that, in the event of a fire, the occupants of a building can reach a place of ultimate safety outside the building.

The evacuation strategy should not rely on external assistance (e.g. from the fire and rescue service) and will be chosen to take into account the risk profile of a building and the allowable travel time.

3.3.1 Residential

In purpose-built blocks of flats, special provisions are made to ensure that a fire is contained within the flat of origin and that common escape routes and stairways remain relatively free from smoke and heat in the event of a fire within a dwelling. For this reason, the general fire strategy is a 'defend in place' strategy. In this case, when a fire occurs in a flat, the occupants of that dwelling evacuate, but occupants of all other dwellings can safely remain in their dwellings unless directly affected by heat and smoke or directed to leave by the fire and rescue service.

There are a number of areas within the podium block that are associated with the residential (e.g. Cycle stores / Bin Stores). Those areas will be covered by a fire alarm system which will use simultaneous evacuation.

3.3.2 BOH / ancillary areas / Tesco / car park

A simultaneous evacuation strategy will be adopted for the non-residential areas, whereby all of these areas will evacuate immediately as a single phase on receiving an evacuation signal or instruction.

As part of the design development (and subject to confirmation on management response procedures) it may be possible to introduce a 'double knock' system whereby activation of any one smoke detector will allow an investigation period prior to full evacuation. Activation of any second device (e.g. a manual call point or a second detector) during the investigation period would immediately trigger a full evacuation.

Activation of a manual call point would lead to immediate investigation without any investigation period.

4. FIRE SAFETY SYSTEMS

4.1 Automatic fire detection and alarm

4.1.1 Landlord system

The podium levels of Syon Gardens include a number of ancillary areas to the residential, such as a cycle store and various back of house areas. These areas will be provided with Landlord fire alarm system designed to BS 5839-1[1] with manual call points and sounders as well as automatic smoke detection to an L2 standard.

In addition, there would be links from all the other fire alarm systems within the development to that Landlord alarm. The details of those links are described in each section below.

In all areas of the development, consideration should be given when selecting the appropriate type of detector for any room with respect to the speed of detection required, the likely type of fire and the need to avoid false alarms.

4.1.2 Apartments

As a minimum, each apartment should be fitted with a mains-powered automatic fire detection and alarm (AFD) system to a minimum Grade D Category LD2 standard in accordance with BS 5839-6[2].

A Grade D system involves having one or more mains-powered smoke alarms. The system may also incorporate one or more mains-powered heat alarms for areas deemed appropriate such as kitchens. In both instances, the AFD system should have an integral standby power supply. Where more than one smoke and/or heat alarm is installed, those alarms should be interlinked.

In a Category LD2 system, smoke detector(s) should be installed in each circulation route within the apartment, within the principal habitable room and within any identified fire risk area.

Where an LD2 system is used, there is no need for interconnection between smoke alarm systems in different apartments.

For open plan apartments, that do not have protected entrance halls / corridors but have bedrooms that are inner rooms accessed directly from a lounge or similar type of accommodation, the alarms will be upgraded to a Grade D Category LD1 system.

In a Category LD1 system, smoke detectors will be installed throughout the premises, incorporating detectors in all circulation spaces and all rooms in which a fire might start. This excludes toilets and bathrooms.

[1] BS 5839-1:2017, Fire detection and fire alarm systems for buildings, Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises.
[2] BS 5839-6:2013, Fire detection and fire alarm systems for buildings, Code of practice for design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic premises, BSI Third edition May 2013.

4.1.3 Common residential corridors

It is not a recommendation of any code of practice to provide fire alarms in the common corridors within the apartment levels of typical residential buildings when a 'defend in place' strategy has been adopted.

Smoke detectors will be required to activate smoke control systems or ventilation systems within common lobby/corridor areas. In these cases, there would be detectors but no sounders. As recommended in BS 9991 these will be provided via fire alarm systems designed to BS 5839-1.

Smoke management is to be provided in common residential corridors and this is discussed further in Section 5.4.

Each core will have its own system with a control panel provided in or near the entrance area at ground level which will provide manual override control for fire service use.

In addition, each system will be linked back to the concierge in order to provide notification of any activations which have occurred. This will be an information link only and all controls will be locally in each core.

4.1.4 Fire brigade evacuation alert system

BSI have recently produced a new British Standard, BS 8629 "Code of practice for the design, installation, commissioning and maintenance of evacuation alert systems for use by fire and rescue services in buildings containing flats". It gives the design criteria for a new type of evacuation system for residential buildings. It consists of a separate system with a control panel at ground floor and sounders within every apartment. It would only be activated by the fire brigade in the unlikely event that a large fire has occurred and that the 'defend in place' approach is no longer considered viable.

The new system would not link to the LD2 alarms within apartments, the smoke detection within the residential corridors or any other form of automatic fire detection system.

It should be emphasised that this system does not change the conventional 'defend in place' approach which would still be the default procedure.

At the time of issue of this report, MHCLG have carried out a consultation on whether this type of system would be beneficial, and if so, what type of buildings it would be required in. As such, by the time this building is into detailed design it is likely that MHCLG's position will be clear and it may include this system throughout the residential areas of the development. Further details of this item can be agreed via an appropriate planning condition at a later stage in design.

4.1.5 Tesco unit

The Tesco unit will have its own fire alarm system provided as part of the fitout which will be connected to the landlord fire alarm system.

The car park, although partly including spaces for the residential occupants, is predominantly part of the Tesco unit. It is currently assumed that the car park will be

covered by the Tesco fire alarm system. However, this would result in the Tesco alarm system being responsible for the safety of people who are not Tesco customers or staff, so this will be further developed during later design stages.

4.2 Automatic Fire Suppression Systems

Due to the building exceeding 30m in height, sprinklers will be provided throughout all parts of the development.

In the residential areas this will include sprinklers designed and installed to BS 9251[3].

The residential sprinklers will also cover any other rooms or non-sterile areas that are part of the residential cores, such as cleaners' rooms and the entrance/reception areas at ground level.

In the non-residential areas (including the Tesco unit, the car park, BOH and ancillary residential areas) this will include sprinklers designed and installed to BS EN 12845[4].

In order to avoid separate sets of tanks and pumps the sprinklers in the Tesco unit will be fed from a connection supplied from the landlord sprinkler system which will be sized appropriately. The distribution pipe work within the Tesco unit will be provided by Tesco as part of the fitout.

4.3 Fire mains

Where a building has a topmost occupied floor height of greater than 50m, wet fire mains comprising outlets located within fire-fighting shafts should be provided in addition to the required automatic pumps and water tanks, in accordance with BS 9990[5].

Due to the Syon Gardens development exceeding 50m in height, it has been proposed to provide a wet fire main. Despite only one of the residential towers exceeding 50m in height, all of the fire mains within the development will be fed by the wet main.

4.4 Smoke ventilation

4.4.1 Residential corridors

Smoke ventilation will be provided in residential corridors as described later in this report.

4.4.2 Fire-fighting shafts

The fire-fighting shafts will be provided with smoke ventilation as described later in this report.

In residential areas, this will be designed to BS 9991 and consists of smoke ventilation at the top of the stairs and ventilation within the residential corridors.

In non-residential areas, this consists of smoke ventilation at the top of the stairs and ventilation to the fire-fighting lobbies on each level in accordance with BS 9999.

[3] BS 9251:2014, Fire sprinkler systems for domestic and residential occupancies – Code of practice.
[4] BS EN 12845:2015, Fixed firefighting systems – Automatic sprinkler systems – Design, installation and maintenance.
[5] BS 9990:2015 – Non-automatic fire-fighting systems in buildings – Code of practice.

4.4.3 Car park

Where car parks are not open-sided, natural ventilation will be provided by permanent openings having an aggregate vent area not less than 1/40th of the total floor area at least half of which will be equally provided between two opposing walls (1/160th on each side) and the remaining area made up of openings within the perpendicular wall.

If it is not possible to provide a natural ventilation system, then a system of mechanical ventilation should be provided in accordance with the following:

a) The system will be independent of any other ventilation system (other than any system providing nominal ventilation to the car park) and be designed to operate at 10 air changes per hour in a fire condition;

b) The system will be designed to run in two parts, each part capable of extracting 50% of the rates set out in (a) above and designed so that each part can operate singly or simultaneously;

c) Each part of the system will have an independent power supply which will operate in the event of failure to the main supply;

d) Extract points will be arranged so that 50% of the outlets are at high level and 50% are at low level; and

e) The fans will be rated to run at 300°C for a minimum of 60 minutes and the ductwork and fixings will be constructed of materials having a melting point not less than 800°C.

For this development, the car parks at Lower Ground Floor and Levels 01 and 02 will be ventilated by mechanical ventilation systems. It has also been proposed to introduce a number of impulse fans to increase the efficiency of each system and prevent areas of smoke-logging. However, more detail of these systems will be provided as the design develops.

4.4.4 Basement

All basement areas will be provided with smoke ventilation based on mechanical ventilation at 10 air changes per hour.

5. B1 – MEANS OF WARNING AND ESCAPE

5.1 General

Apartments need to be planned so that it is reasonably likely that the occupants can safely and quickly escape in the event of a fire within the apartment. UK design guidance recognises that it is not common practice to provide more than one entrance / exit from an apartment constructed on a single level.

The fire doors within protected hall enclosures (to other rooms or to areas such as cupboards) will as a minimum be FD30 standard doorsets when tested in accordance with BS 476-22[6]. Self-closing devices need not be provided.

All apartment entrance doors will be self-closing FD30S with no non-insulating glass or other non-fire resisting apertures permitted.

Security requirements will not override the need to provide adequate means of escape. All security locks and/or devices fitted to a dwelling entrance door will be openable from the inside by a single manual operation not requiring the use of a key.

Apartment cooking facilities will be located in such a way that they do not prevent exit if they are involved in a fire. Guidance does not provide clear direction in terms of distance from the potential fire source, however IFC recommend that a 1.8m horizontal distance between the cooking appliance and the escape route should be achieved where possible. This 1.8m distance draws similarities to recommendations related to final exits and the need for them to be sited such that they are clear of immediate risk from fire or smoke.

Any air handling systems installed within the apartments will be designed and installed so as not to compromise evacuation, or to spread fire and smoke out of the apartment of fire origin.

5.2 Means of warning

The fire detection and alarms are covered in Section 4.1 of this report.

5.3 Apartment layouts

Acceptable apartment layouts under Clause 9.4 of BS 9991 should conform to the following recommendations:

- For studio flats, a total travel distance from any point within the apartment to the entrance door not exceeding 9m with any cooking facilities sited away from the apartment entrance door and the internal escape route; or
- A protected entrance hall leading off from all habitable rooms having a total travel distance not exceeding 9m from the apartment entrance door to any habitable room; or
- Apartments should be provided with an alternative exit.

[6] Fire tests on building materials and structures - Methods for determination of the fire resistance of non-loadbearing elements of construction.

Where open plan apartment layouts are proposed, the design should comply with the following recommendations under Clause 9.7 of BS 9991:

- The apartment should not exceed 16m × 12m in area;
- The apartment should be provided with sprinklers and LD1 alarm systems;
- The apartment should be located on a single level only; and
- The ceiling within the apartment should have a minimum height of 2.25m.

It should be noted that BS 9991 states that if an open plan apartment exceeds 8m × 4m, the kitchen should be enclosed. However, it is relatively conventional for open plan kitchens to be permitted as long as the escape routes through the living room / kitchen areas do not lead within 1.8m horizontally of the kitchen. This will need to be assessed on an individual basis in conjunction with the relevant approving bodies.

5.4 Escape via common residential corridors

5.4.1 Security and egress arrangements

Doors on the escape route outside an apartment should remain readily openable with simple fastenings on the side where a person is seeking egress. The operation of these fastenings should be readily apparent, without the use of a key and without having to manipulate more than one mechanism. Where electrically powered locks are introduced for security purposes, such locking mechanisms should return to the unlocked position following:

- Operation of the smoke detectors within the relevant corridor; or
- Loss of power or system error; or
- Activation of a manual door release unit.

Where manual door release units are proposed, they should be positioned in a prominent location, adequately signed and fixed in manner readily visible by occupants seeking egress.

The designer should also consider the needs of attending Fire and Rescue Service who may need to enter the building to effect rescue or for fire-fighting purposes and how access will be achieved when compared to standard design where doors unlock and/or fail open on fire alarm – i.e. doors open upon arrival.

5.4.2 Travel distances and ventilation

In accordance with BS 9991 recommendations, escape provisions within the residential common areas of a single-stair building should conform to one of the following options:

- The common corridor/lobby should be ventilated with a maximum single direction travel distance of 15m (as all the apartments are sprinklered); or
- Common corridors remain unventilated and the travel distance is no more than 7.5m within them. In this case, a ventilated lobby is required to separate the stairwell from the non-ventilated corridor portion.

These recommendations are further detailed below in Figure 3.

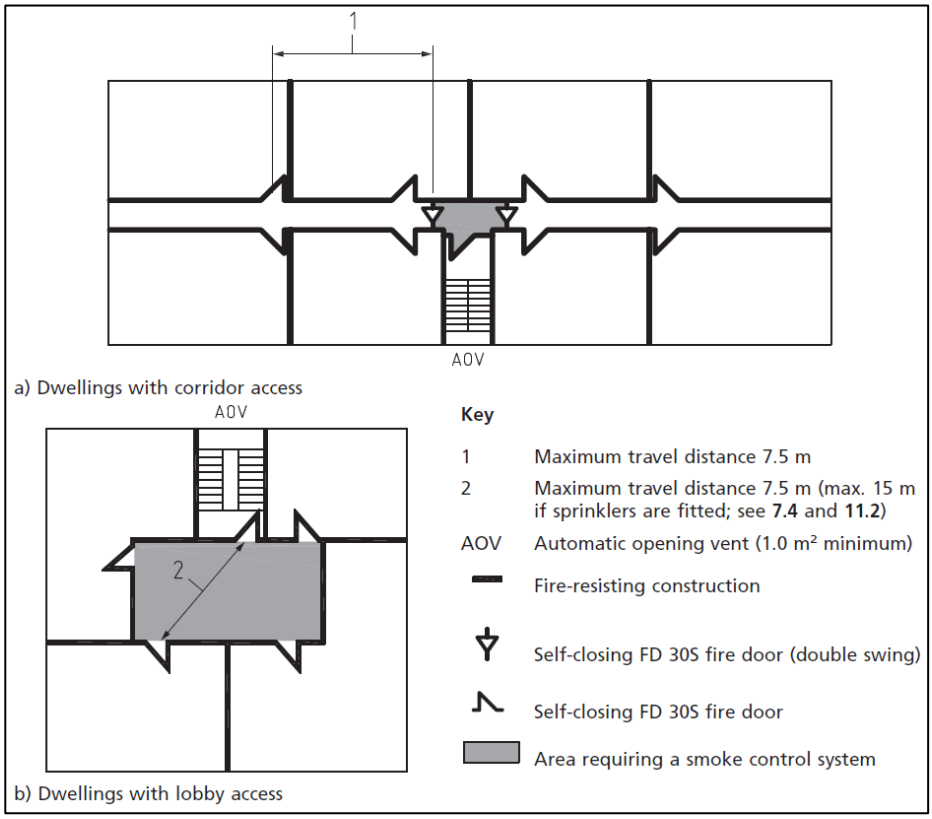

Figure 3 – BS 9991 recommended common escape route arrangements for single-stair buildings

The 7.5m limit above can be increased to 15m for ventilated corridors in buildings where all of the apartments are provided with sprinklers.

Where travel distances within corridors exceed the increased 7.5m / 15m limits, acceptable / tenable conditions for means of escape can often be justified by providing an enhanced mechanical ventilation system within each of the common corridors. Utilisation of this type of ventilation system requires ventilation (usually via shafts) close to both ends of the corridor. Each case would have to be analysed using CFD analysis. This report identifies any areas in which this type of enhanced smoke ventilation (and CFD) are required.

It should be noted that the absolute limit in single direction travel distance, set by Building Control and the fire service, is 30m. Travel distances that exceed this would be unacceptable. IFC would also advise that this is a maximum and that designing to maximum limits would not be best practice and would introduce risks to the design (e.g. the CFD analysis may be more difficult to complete).

In accordance with BS 9991 recommendations, escape provisions within the residential common areas of a multi-stair building should conform to one of the options depicted in Figure 4.

In the case of multi-stair buildings, it can also be noted that the 7.5m and 30m limits can be increased to 15m and 60m, respectively, for ventilated corridors in buildings where all of the apartments are provided with sprinklers.

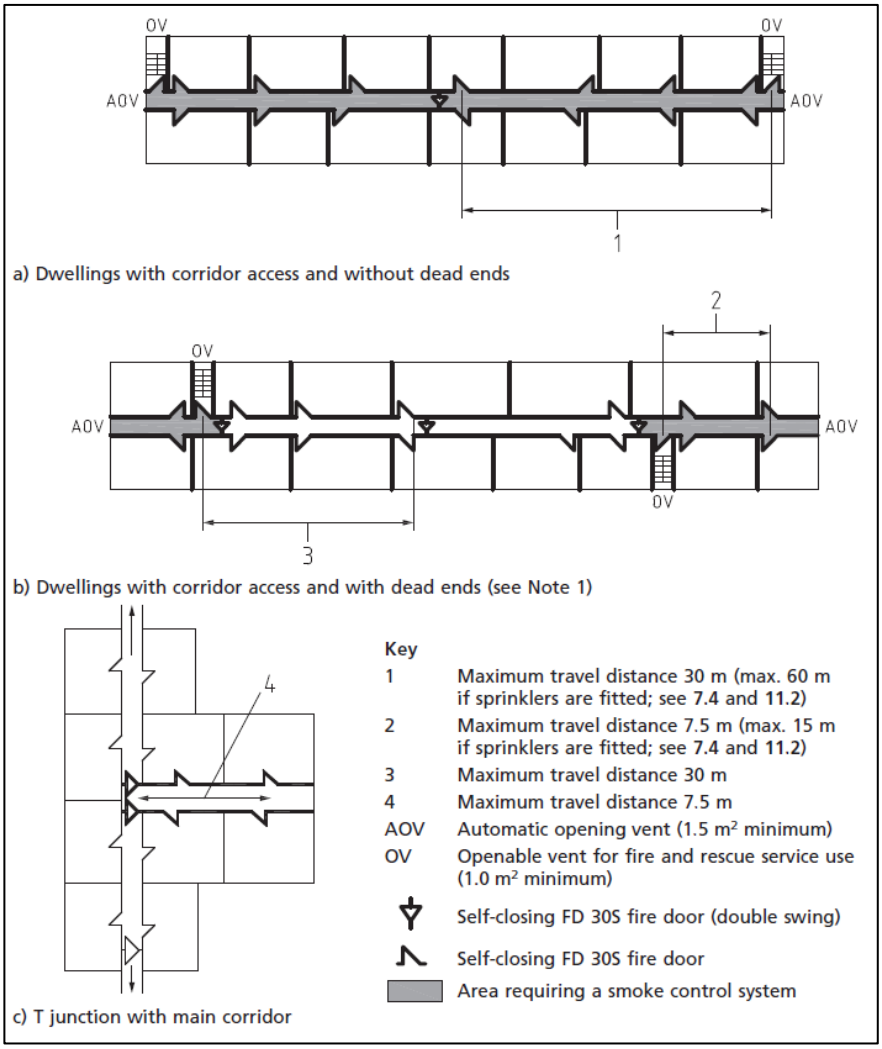

Figure 4 – BS 9991 recommended common escape route arrangements for multi-stair buildings

5.5 Escape via common stairs

5.5.1 Ventilation

An AOV should be sited at as high a level as is practicable on the top storey of each residential stairway, having a minimum free area of 1.0m^2, which will be activated at the same time as any lobby or corridor vents.

Override switches for the stair and corridor ventilation systems should be provided in locations to be agreed with the fire service. This would typically include a control panel in the entrance lobby of each core adjacent to the main fire alarm control panel (FACP) and override switches within the stair on each level.

The override system should not allow the smoke ventilation system to be activated on more than one level at the same time (otherwise it may allow smoke to spread between levels via the smoke vent shaft).

The system should interlock so that once the automatic detection has triggered the smoke ventilation on any one level, further activation of automatic detection on other levels should not activate ventilation on those other levels (although the manual override would allow the ventilation to be switched to those other levels if necessary).

5.5.2 Final Exit

Under Clause 34 of BS 9991 every protected stairway should discharge either:

- Directly to a final exit; or
- Into a protected corridor leading to a final exit which is itself separated from any accommodation by vented lobbies.

These spaces as well as the rest of the stair cores should have a limited fire load. Guidance states that a protected stairway needs to be relatively free of potential sources of fire and will not be used for anything else, except for a lift well or electricity meters provided that the meters are enclosed in a non-combustible box. IFC would not consider post boxes as a significant fire load if they are to be located in these entrance halls, but would recommend robust (non-combustible) construction.

5.5.3 Fire-fighting shafts

All stairs to the residential areas should be designed as fire-fighting stairs due to the topmost storey heights. With regards to means of escape, these stairs will be designed with a width between the walls or balustrades of not less than 1.1m. This width will be kept clear for a vertical distance of 2.0m, as measured from the pitch line or landing floor level, with the following exceptions:

- Stringers, each intruding into the stair by not more than 30mm; and
- Handrails, each intruding into the stair by not more than 100mm.

5.6 Refuse storage

Rooms provided for the storage of refuse should be separated from other parts of the building by fire-resisting construction and should not be located within protected stairways or protected lobbies.

Rooms containing refuse should be approached either directly from the open air or by way of a protected lobby provided with not less than 0.2m^2 of permanent ventilation.

Access to refuse storage areas should not be sited adjacent to escape routes or final exits.

5.7 Fire safety provisions for disabled occupants

In general, apartment storeys do not need specific measures for disabled occupants based on adopting a 'defend in place' evacuation strategy. Disabled occupants not

affected by the fire would remain in their apartments and only those who are affected would escape to the stair. This is in accordance with BS 9991.

The non-residential areas (including the car park) and ancillary residential areas should be provided with disabled refuges within each stair (or adjacent lobby) designed in accordance with Annex G of BS 9999.

Where refuges are needed Annex G states (among other provisions) that a disabled refuge is provided within a protected lobby or stair enclosure at each point where the escape route requires vertical movement. The refuge should be no smaller than 1400mm × 900mm and be provided with a two-way communication device for talking to the building management.

5.8 Mechanical ventilation or air-conditioning systems

Unless forming part of a smoke control system, any mechanical ventilation or air-conditioning system that re-circulates air should automatically shut down or be designed to exhaust smoke outside the building. Guidance on the provision of smoke detectors in ventilation ductwork is given in BS 5839-1.

5.9 Emergency lighting and exit signage

Lighting on escape routes and exit signage will be provided throughout the building to the extent nominated under BS 5266-1[7] and BS ISO 3864-1[8].

5.10 Fire safety management

A Fire Risk Assessment will be required for the common areas of the building, according to The Regulatory Reform (Fire Safety) Order (FSO) 2005.

It will be the responsibility of the Landlord to ensure that adequate information will always be available on fire safety procedures for any operatives working in the common areas.

[7] BS 5266-1:2011, Code of practice for the emergency escape lighting of premises.
[8] BS ISO 3864-1:2011, Graphical symbols. Safety colours and safety signs Design principles for safety signs and safety markings.

6. RESIDENTIAL AREAS

6.1 General

Syon Gardens includes five residential "blocks" (i.e. A-E), with numbered cores referred to as Cores A1, B1, B2, B3, C1, D1, D2, E1, and E2.

These cores all connect to the podium block. Some cores are also connected via corridors at some of the lower levels before they split into individual 'towers' above the podium level.

The cores vary in height, with the tallest spanning 18 storeys and a topmost occupied floor height of just over 50m.

This development will therefore comprise the following:

- Sprinklers throughout;
- Fire-fighting shafts (comprising fire-fighting stairs and fire-fighting lifts); and
- A wet fire main serving all fire-fighting cores.

Each core of the development has been detailed in the following Sections.

6.2 Escape via common stairs

6.2.1 Ventilation

A 1.0m² free area AOV will be provided at the topmost floor of each stair serving the apartments, which will be activated at the same time as any of the lobby / corridor vents.

6.2.2 Final exit

At Ground Floor level the exit routes from each residential escape stair to the outside is via a protected corridor. This is with the exception of Cores D2 and E2 which do not continue down to access level.

Cores D2 and E2 do not extend down to Ground Floor level but, instead, exit out onto the podium deck (from which escape is then possible to Ground Floor level by entering one of the other residential cores).

In order to escape off the podium level, signage will be provided to direct occupants to Core C1, whereby they can continue their route of escape down to access level.

6.3 Escape via common corridors

6.3.1 Travel distances and ventilation provisions

Due to provision of sprinklers throughout the site, the maximum 'code compliant' single direction travel distance within the ventilated common corridors would be 15m.

As the common corridors of this site comprise travel distances in excess of the BS 9991 recommended limit (i.e. 15m), provision of enhanced mechanical ventilation systems are

required for justification of the increased travel distances. These justifications are subject to Building Control approval which will, in each case, require supporting CFD analyses.

It should be noted that some of the blocks / cores are connected via common residential corridors within the podium levels. It is important that these corridors are provided with suitable and sufficient ventilation provisions, that can be continued up for application to the upper levels of each core, as well as adequate separation to prevent fire spread between blocks / cores.

Based on the above, Cores B3 and C1 will need to be considered simultaneously as part of their design, construction and occupation.

6.3.2 Block A – Core A1

Block A serves apartments from Level 04 (Podium) to Level 11 and comprises a single escape stair. Core A1 spans the full height of the block. Therefore, the single direction limit will apply.

Block A has a receding floor area towards the upper levels, forming a series of staggered apartment levels. As a result of this, the proposed ventilation systems will need to be specifically tailored to include a single and consistent mechanical extract shaft located near Core A1 and a series of natural ventilation shafts at the receding end of the corridor. A mechanical system is required due to the extended single direction travel distances within the common corridors from Levels 08-11. These systems have been indicated in the following Sections.

6.3.2.1 Levels 00-03

Core A1 does not serve any residential accommodation from Level 00-03. However, it does serve the residential areas of the car park and so will be separated via provision of protected and ventilated lobbies such that the stair would remain sufficiently protected.

6.3.2.2 Levels 04-05

The maximum single direction travel distances within the common corridor at Levels 04-05 are 27.9m and 16.8m, which are both not within the code-compliant limits. It is therefore proposed to provide a mechanical ventilation system as depicted in Figure 5.

It should be noted that, due to the considerable travel distances, a mechanical push/pull system may be required (comprising 0.6m^2 mechanical shafts at both ends of the corridor) if the indicated system is shown to be insufficient by the CFD analysis.

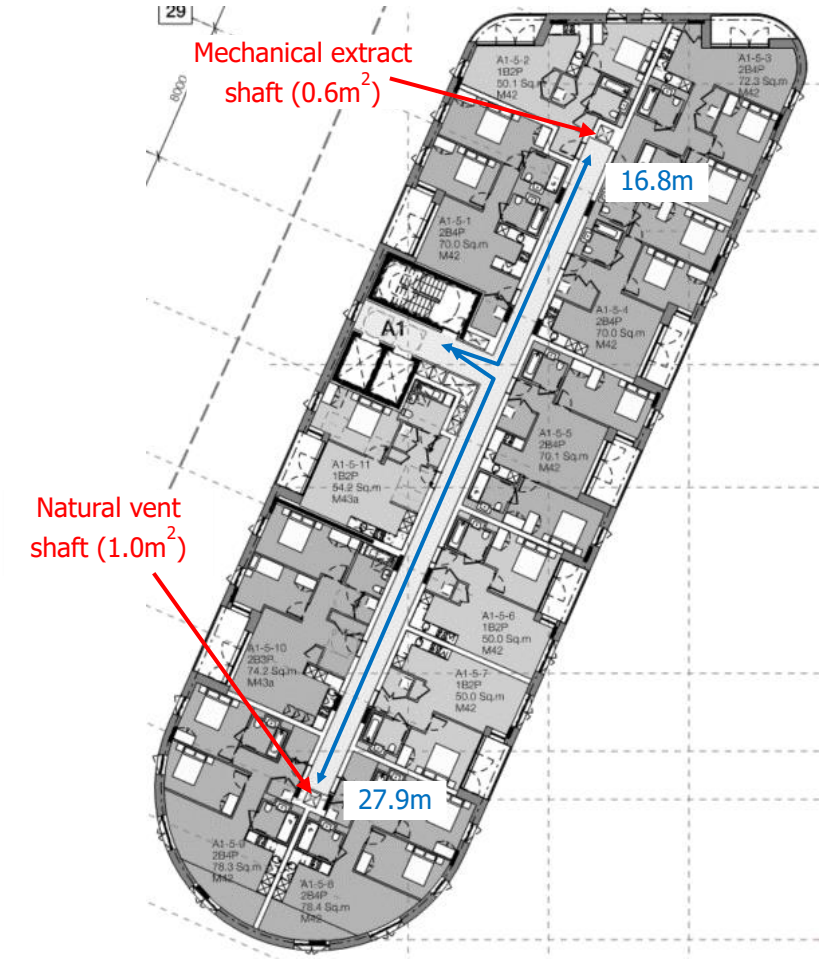

Figure 5 – Cores A1 Levels 04-05 travel distances and ventilation provisions

6.3.2.3 Levels 06-07

Levels 06-07 are almost identical to Levels 04-05, with the exception of a shorter single direction travel distance at the receding end of the block. Based on this, ventilation provisions will be similar to the lower levels with the exception of a relocated natural ventilation shaft, as indicated in Figure 6.

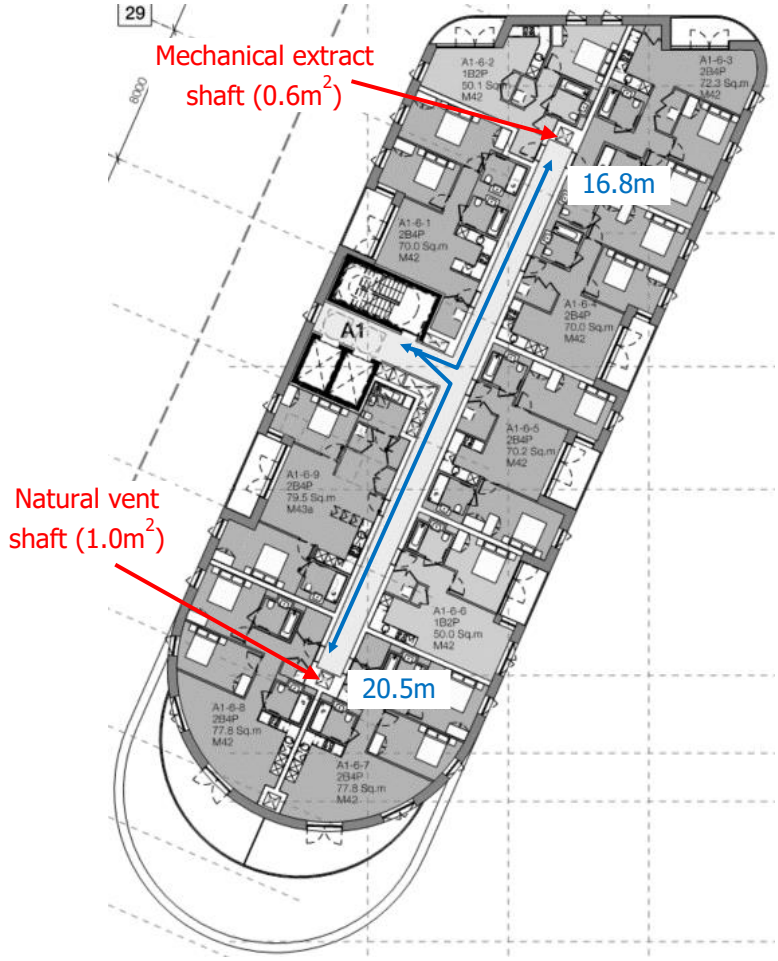

Figure 6 – Cores A1 Levels 06-07 travel distances and ventilation provisions

6.3.2.4 Levels 08-09

The maximum single direction travel distance within the common corridor at Levels 08-09 is 16.8m, which is not within code-compliant limits. It is therefore proposed to provide a mechanical ventilation system as depicted in Figure 7.

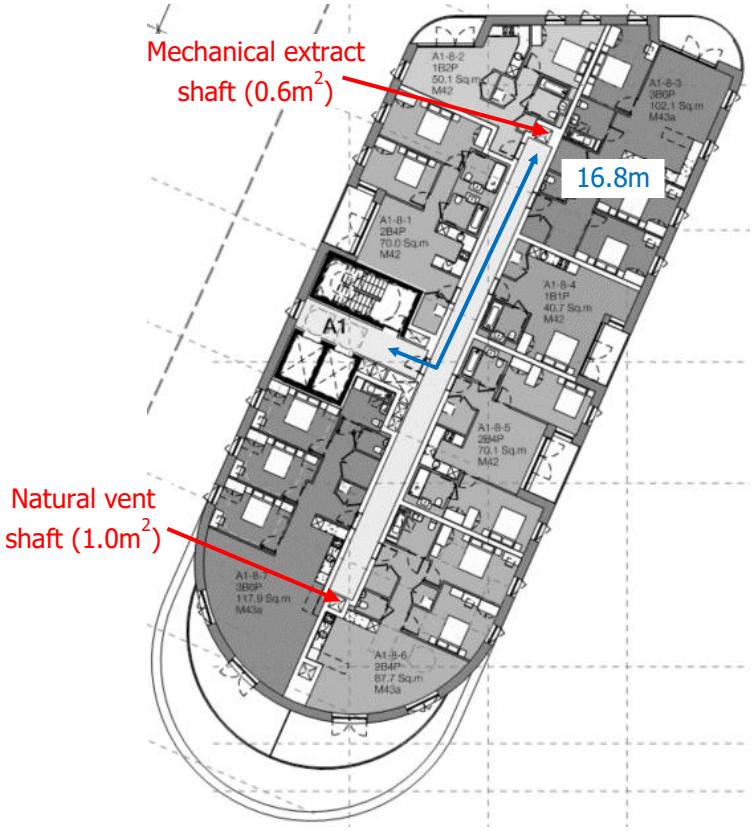

Figure 7 – Cores A1 Levels 08-09 travel distances and ventilation provisions

6.3.2.5 Levels 10-11

The maximum single direction travel distance within the common corridor at Levels 10-11 is 16.8m, which is not within code-compliant limits. It is therefore proposed to provide a mechanical ventilation system as depicted in Figure 8.

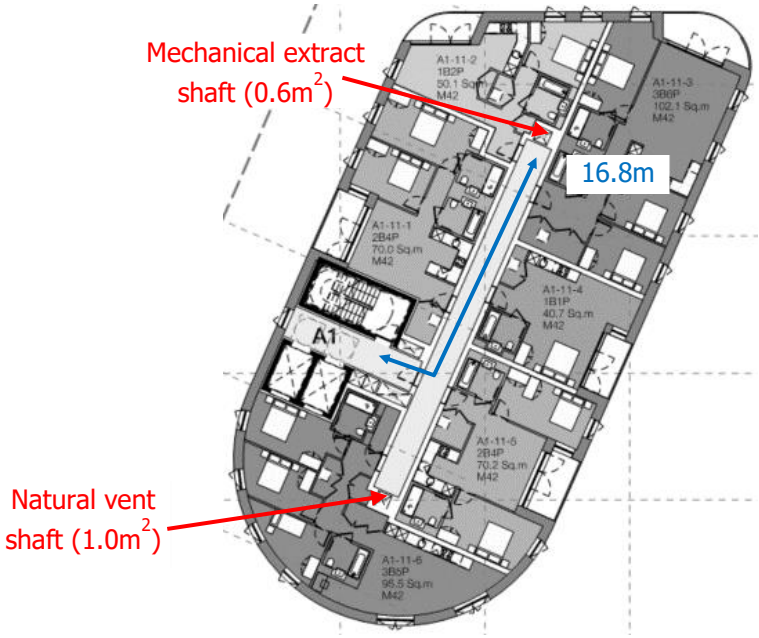

Figure 8 – Cores A1 Levels 10-11 travel distances and ventilation provisions

6.3.3 Block B – Core B1

Block B serves apartments from Level 01 to Level 16 and comprises three escape stairs. Core B1 is served by a single stair and so the single direction travel distance limit will apply.

The floorplan of Core B1 reduces towards the upper levels and so the proposed ventilation systems will need to be specifically tailored to accommodate changes between levels. These systems have been indicated in the following Sections.

6.3.3.1 Level 00-Upper Ground Floor

Core B1 does not serve any residential accommodation at Level 00-Upper Ground Floor and are not connected to any of the Tesco BOH areas.

6.3.3.2 Levels 01-03

The maximum single direction travel distance within the common corridor at Levels 01-03 is 30.0m, which is not within code-compliant limits. It is therefore proposed to provide a mechanical 'push/pull' ventilation system, as depicted in Figure 9.

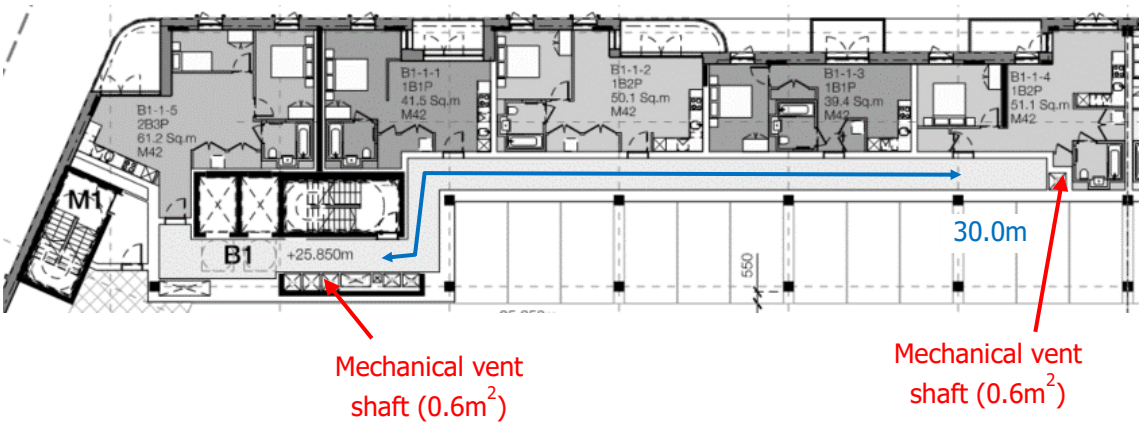

Figure 9 – Core B1 Level 01-03 travel distances and ventilation provisions

It is worth noting that, at these levels, a single apartment is located to the left of the stair core and, due to the location of the mechanical vent shaft opposite the stair, a dead end portion of corridor has been created in which smoke logging could occur. The current distance from the apartment entrance door to the vent shaft is approximately 7.8m, which is significant. It is therefore recommended that this distance is reduce as much as possible by either relocating the entrance door to the apartment closer to the vent shaft or relocating the vent shaft closer to the far end of the corridor, or a combination of both.

6.3.3.3 Levels 04-09

The maximum single direction travel distance within the common corridor at Levels 04-09 is 17.5m, which is not within code-compliant limits. It is therefore proposed to provide a mechanical ventilation system as depicted in Figure 10.

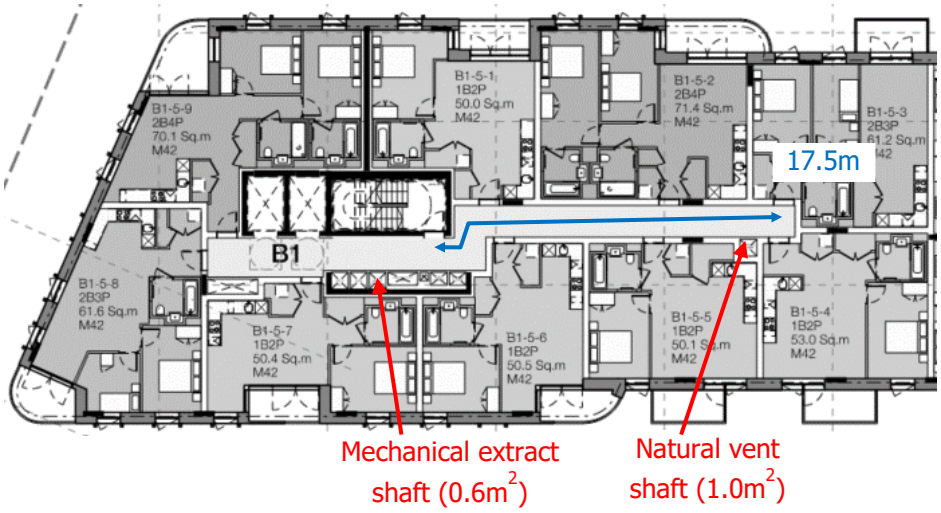

Figure 10 – Core B1 Levels 04-09 travel distances and ventilation provisions

6.3.3.4 Levels 10-16

The maximum single direction travel distance within the common corridor at Levels 10-16 is 10.7m, which is within code-compliant limits. It is therefore proposed to continue the mechanical ventilation system from the lower levels, as depicted in Figure 11. Although, on this level, it will be designed to create a depressurisation within the corridor / protection to the escape stair equivalent to that of providing a natural ventilation system. This would either require pressure sensors within the corridor, or to reverse the swing of the stair door so that it swings into the corridor (which would then provide automatic pressure relief).

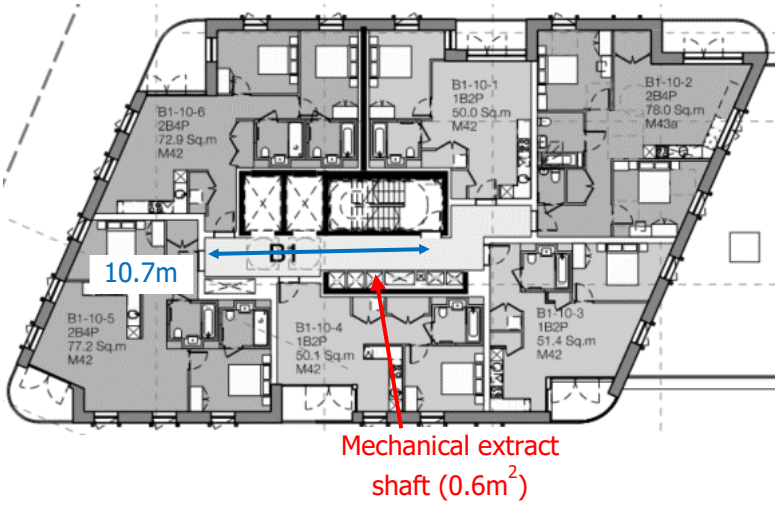

Figure 11 – Core B1 Levels 10-16 travel distances and ventilation provisions

6.3.4 Block B – Core B2

Block B serves apartments from Level 01 to Level 16 and comprises three escape stairs. Core B2 is served by a single stair and so the single direction travel distance limit will apply.

The floorplan of Core B2 reduces towards the upper levels and so the proposed ventilation systems will need to be specifically tailored to accommodate changes between levels. These systems have been indicated in the following Sections.

6.3.4.1 Level 00-Upper Ground Floor

Core B2 does not serve any residential accommodation at Level 00-Upper Ground Floor and is not connected to any of the Tesco BOH areas.

6.3.4.2 Level 01

The maximum single direction travel distance within the common corridor at Level 01 is 16.7m, which is not within code-compliant limits. It is therefore proposed to provide a mechanical ventilation system as depicted in Figure 12.

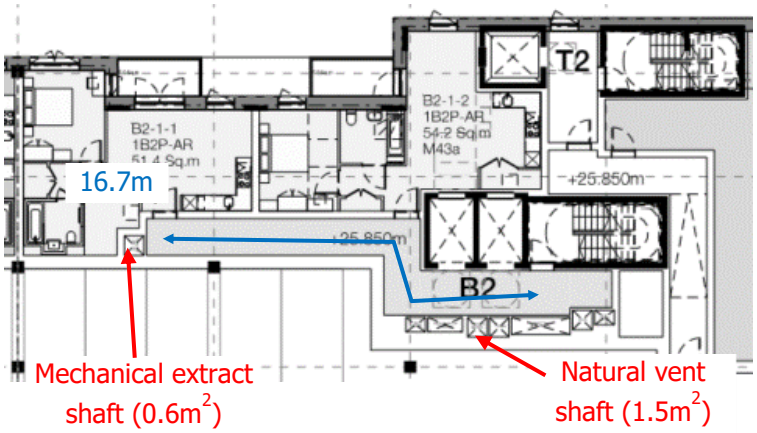

Figure 12 – Core B2 Level 01 travel distances and ventilation provisions

6.3.4.3 Levels 02-03

The maximum single direction travel distance within the common corridors at Levels 02-03 is 21.1m, which is not within code-compliant limits. It is therefore proposed to provide a mechanical ventilation system as depicted in Figure 13.

It should be noted that a mechanical push/pull system may be required (comprising 0.6m^2 mechanical shafts at both ends of the corridor) if the indicated system is shown to be insufficient by the CFD analysis.

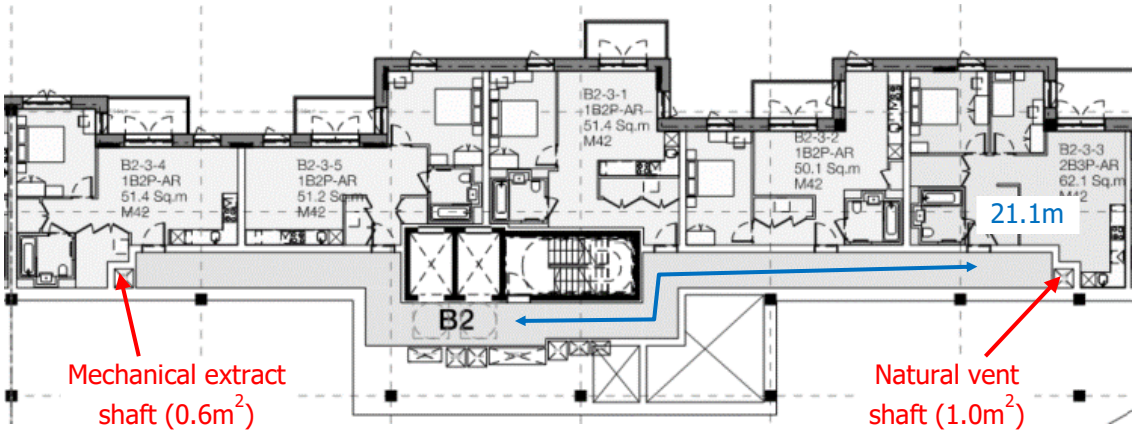

Figure 13 – Core B2 Levels 02-03 travel distances and ventilation provisions

6.3.4.4 Levels 04-08

The maximum single direction travel distance within the common corridors at Levels 04-08 is 24.5m, which is not within code-compliant limits. It is therefore proposed to provide a mechanical ventilation system as depicted in Figure 14.

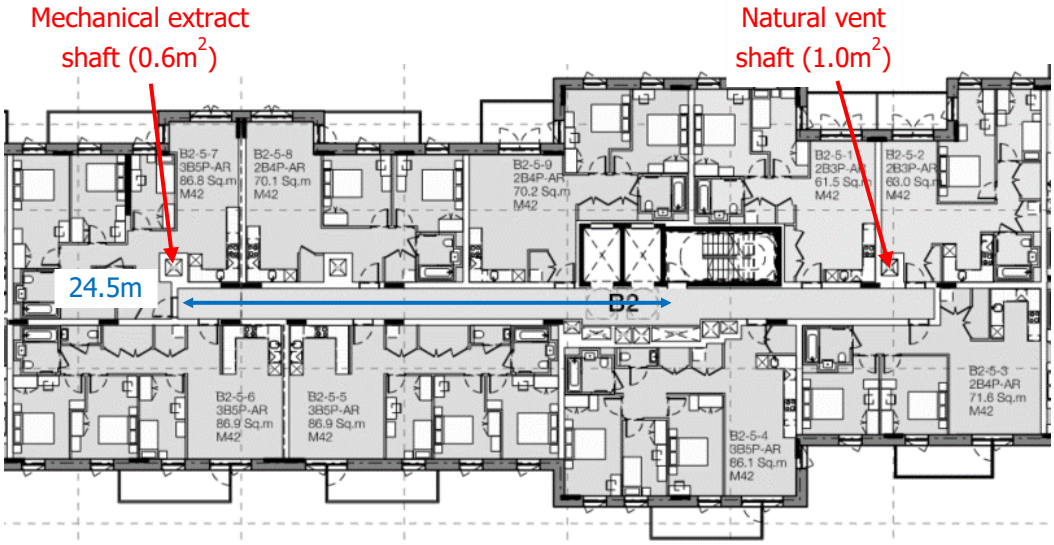

Figure 14 – Core B2 Levels 04-08 travel distances and ventilation provisions

6.3.4.5 Level 09

The maximum single direction travel distance within the common corridor at Level 09 is 24.5m, which is not within code-compliant limits. It is therefore proposed to provide a mechanical ventilation system as depicted in Figure 15.

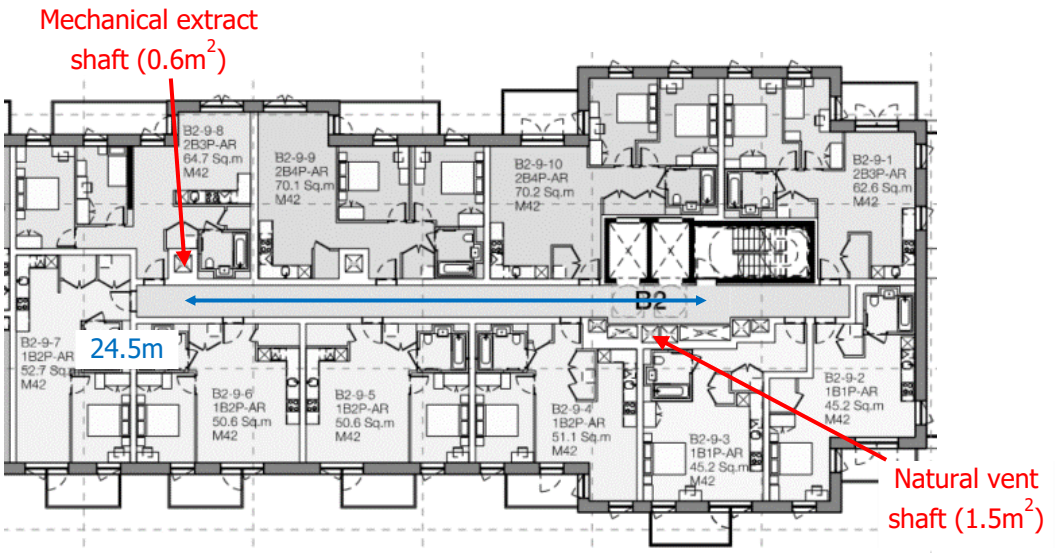

Figure 15 – Core B2 Level 09 travel distances and ventilation provisions

6.3.4.6 Levels 10-14

The maximum single direction travel distance within the common corridors at Levels 10-14 is 6.5m, which is within code-compliant limits. It is therefore proposed to provide a natural ventilation system as depicted in Figure 16.

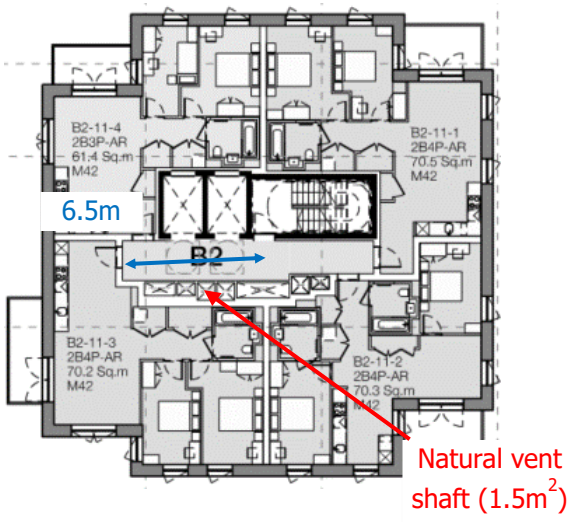

Figure 16 – Core B2 Levels 10-14 travel distances and ventilation provisions

6.3.5 Blocks B and C – Cores B3 and C1

Block B serves apartments from Level 01 to Level 16 and comprises three escape stairs.

Block C serves apartments from Upper Ground Floor to Level 09 and comprises a single escape stair.

Cores B3 and C1 are connected at Levels 01-03 and so the cores are addressed together in this section.

Based on the above, in some cases (i.e. at Levels 01-03) the two-directional travel distance limit will apply with the exception of dead-end corridors, whereby the single direction limit will apply. Where the cores are independent (i.e. at Levels excluding 01-03) and each is served by a single stair, the single direction travel distance limit will apply.

The floorplan of Cores B3 and C1 are not consistent for all levels and so the proposed ventilation systems will need to be specifically tailored to accommodate changes between levels. These systems have been indicated in the following Sections.

6.3.5.1 Lower Ground Floor-Level 00

Cores B3 and C1 do not serve any residential accommodation from Lower Ground Floor-Level 00 and are not connected to any of the residential ancillary or Tesco BOH areas.

6.3.5.2 Upper Ground Floor

The maximum single direction travel distances within the common corridors at the Upper Ground Floor are 12.9m and 6.6m, both of which are within code-compliant limits. It is therefore proposed to provide mechanical / natural ventilation systems as depicted in Figure 17.

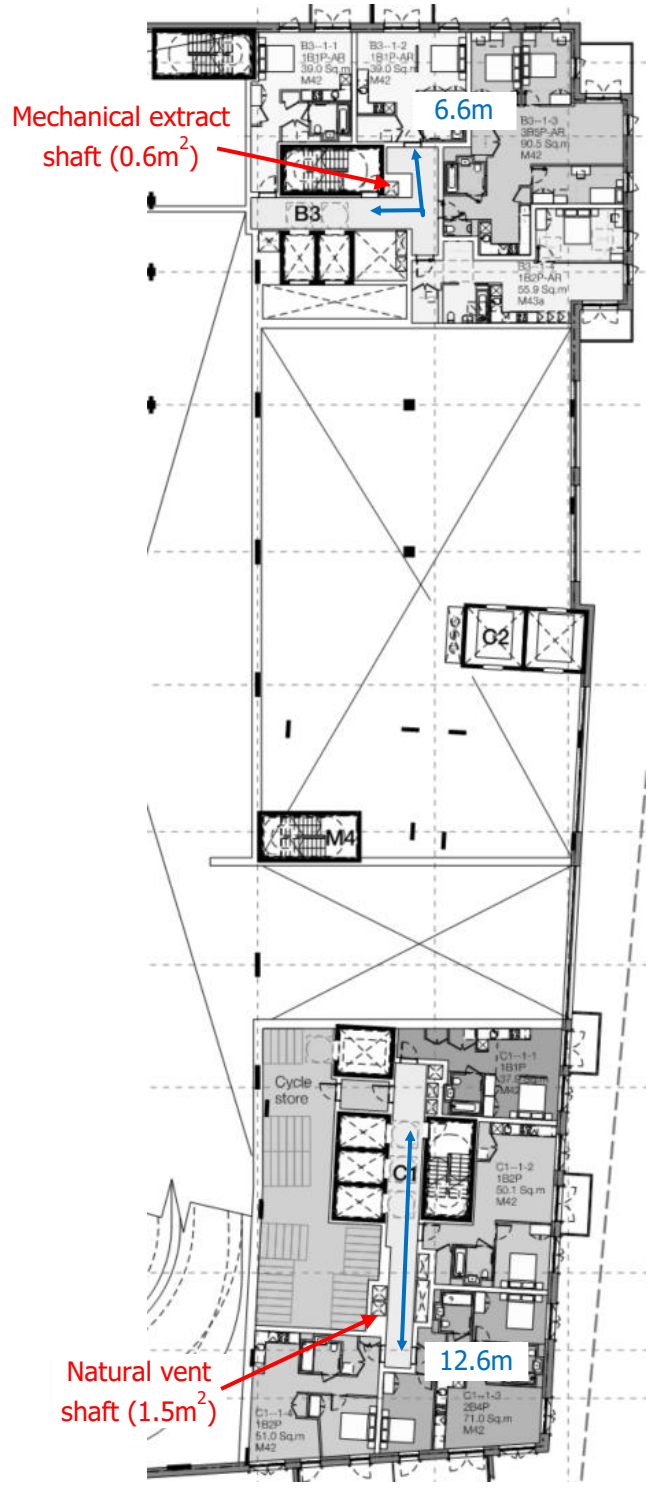

Figure 17 – Cores B3 and C1 Upper Ground Floor travel distances and ventilation provisions

6.3.5.3 Level 01

The maximum single direction travel distance within the common corridors at Level 01 is 12.9m, which is within code-compliant limits. The travel distances where two directions of escape are available are also within code-compliant limits. It is therefore proposed to provide mechanical / natural ventilation systems as depicted in Figure 18.

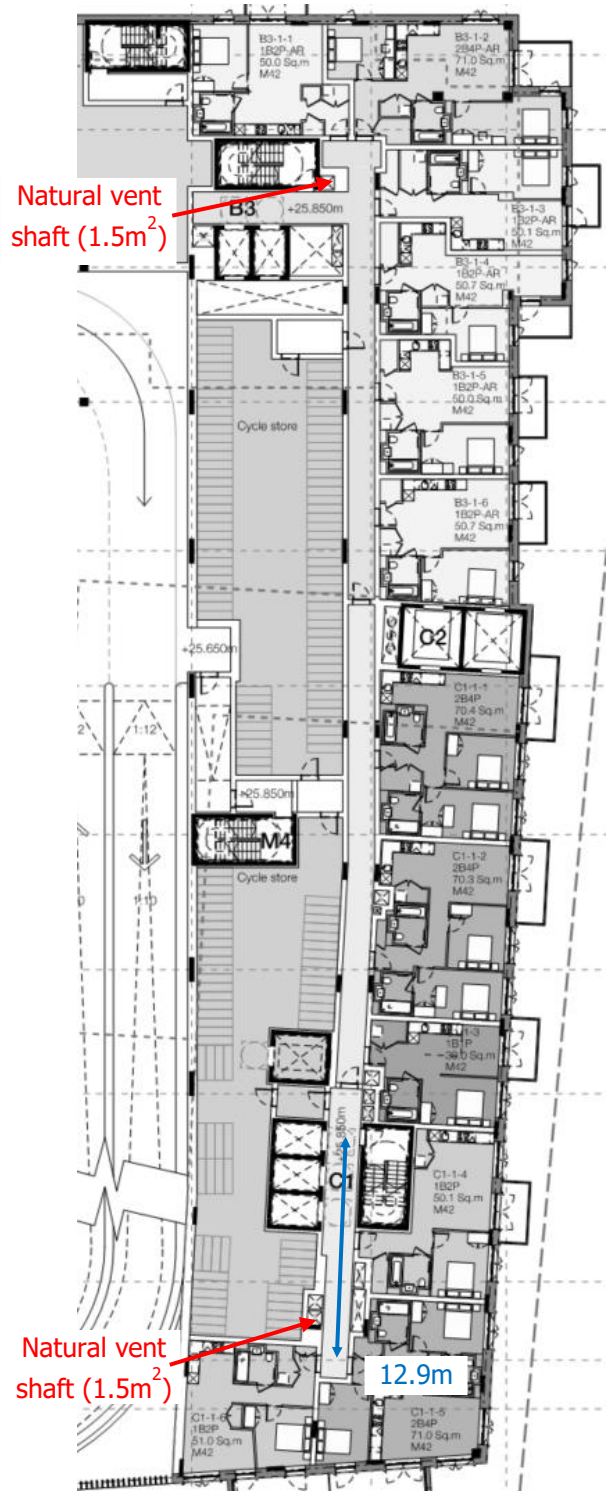

Figure 18 – Cores B3 and C1 Level 01 travel distances and ventilation provisions

6.3.5.4 Levels 02-03

The maximum single direction travel distances within the common corridors at Levels 02-03 are 9.3m and 12.9m, both of which are within code-compliant limits. The travel distances where two directions of escape are available are also within code-compliant

limits. It is therefore proposed to provide mechanical / natural ventilation systems as depicted in Figure 19.

Figure 19 – Cores B3 and C1 Levels 02-03 travel distances and ventilation provisions

6.3.5.5 Level 04

The maximum single direction travel distances within the common corridors at Level 04 are 19.9m and 12.9m, one of which is within code-compliant limits. It is therefore proposed to provide mechanical / natural ventilation systems as depicted in Figure 20.

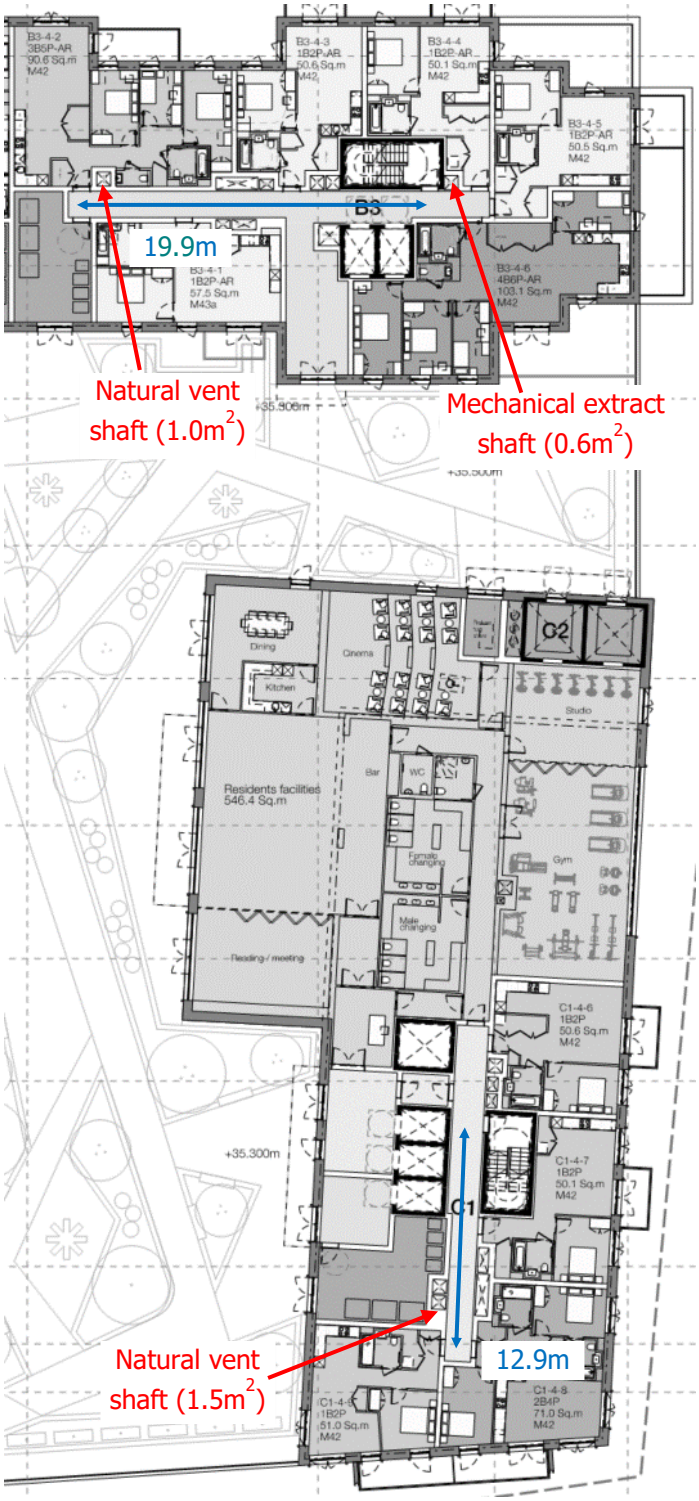

Figure 20 – Cores B3 and C1 Level 04 travel distances and ventilation provisions

6.3.5.6 Levels 05-08

The maximum single direction travel distances within the common corridors at Levels 05-08 are 18.0m and 16.2m, one of which is within code-compliant limits. It is therefore proposed to provide mechanical ventilation systems as depicted in Figure 21.

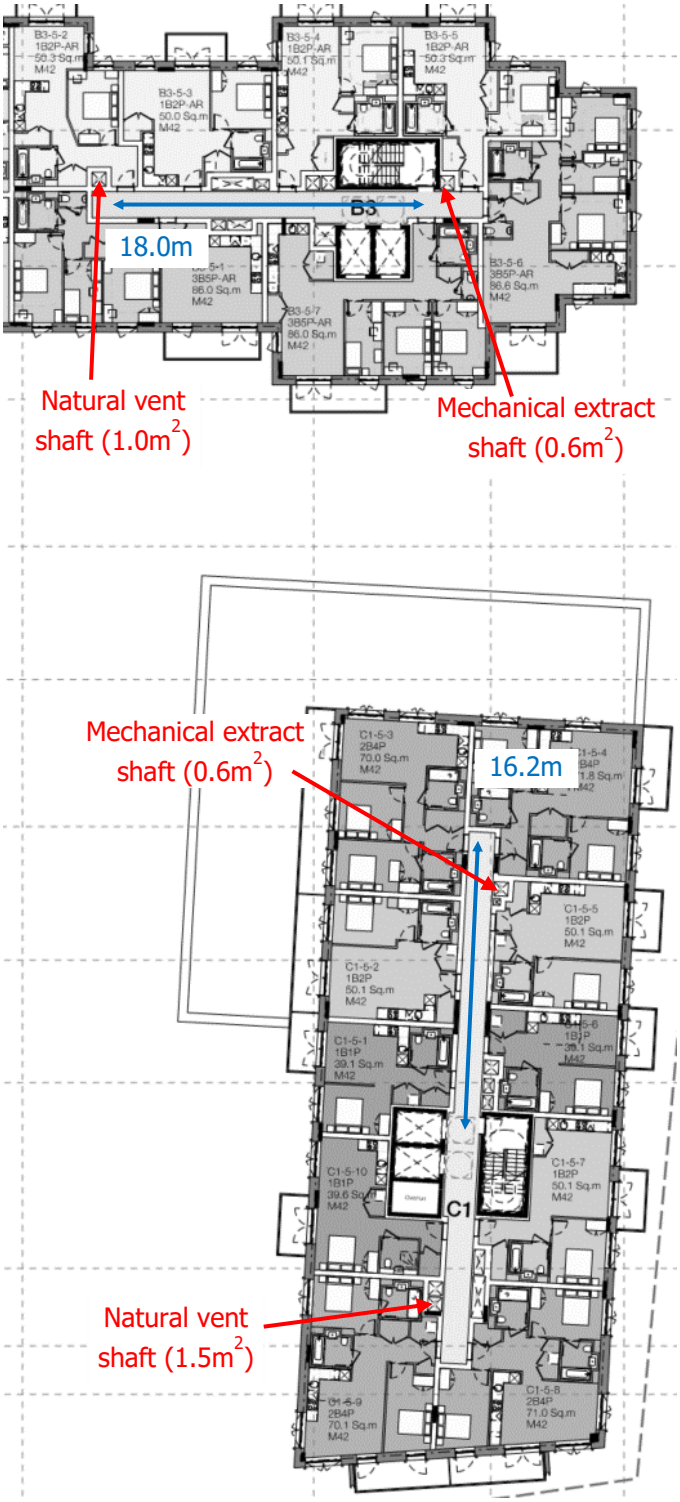

Figure 21 – Cores B3 and C1 Levels 05-08 travel distances and ventilation provisions

6.3.5.7 Levels 09-14

The maximum single direction travel distances within the common corridors at Levels 09-14 are 7.2m and 16.2m, one of which is within code-compliant limits. It is therefore proposed to provide mechanical ventilation systems as depicted in Figure 22.

It should be noted again that only Core B3 continues to Level 14 and Core C1 finishes at Level 09.

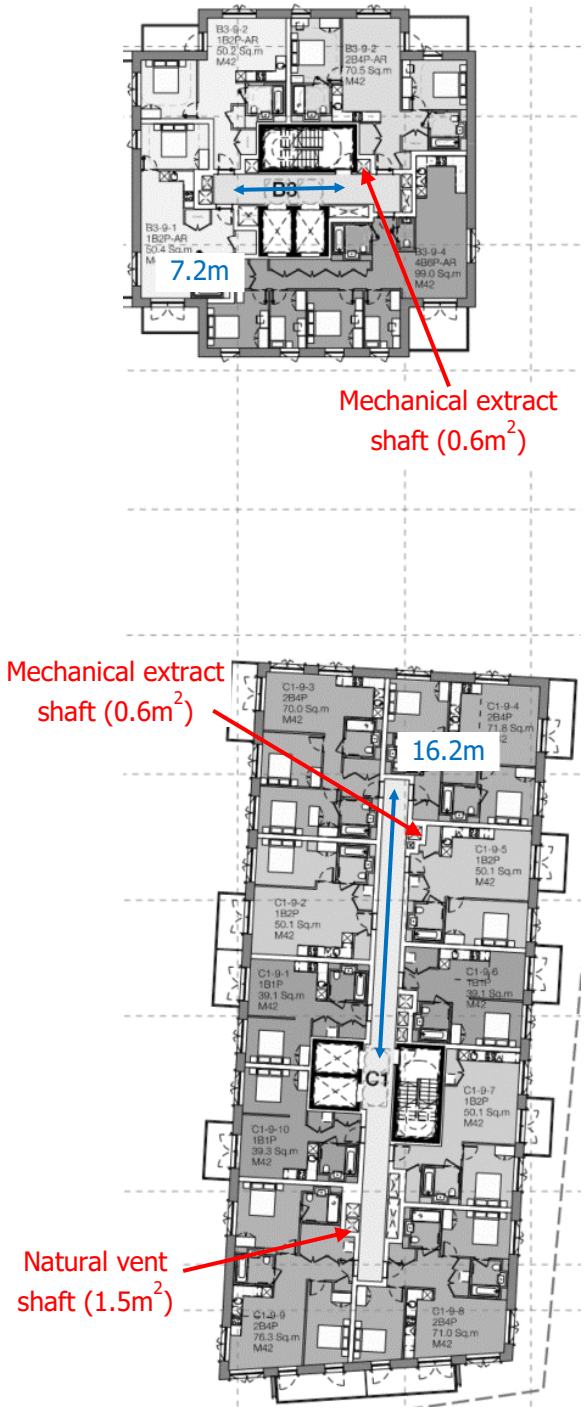

Figure 22 – Cores B3 and C1 Levels 09-14 travel distances and ventilation provisions

6.3.6 Block D – Cores D1 and D2

Block D serves apartments from Level 04 (Podium) to Level 07 and comprises two escape stairs. It should be noted that Level 07 of the Block comprises the upper levels of duplex apartments which are accessed at Level 06. Core D1 spans the full height of the block and Core D2 spans from Level 04 to Level 07. Therefore, the two-directional travel distance limit will apply.

6.3.6.1 Levels 00-03

Core D1 does not serve any residential accommodation from Level 00 to 03. However, it does serve the residential areas of the car park and so will be separated via provision of protected and ventilated lobbies such that the stair would remain sufficiently protected.

6.3.6.2 Levels 04-06

Travel distances within the common corridors at Levels 04-06 are within the code-compliant limits. It is therefore proposed to provide natural ventilation systems as depicted in Figure 23.

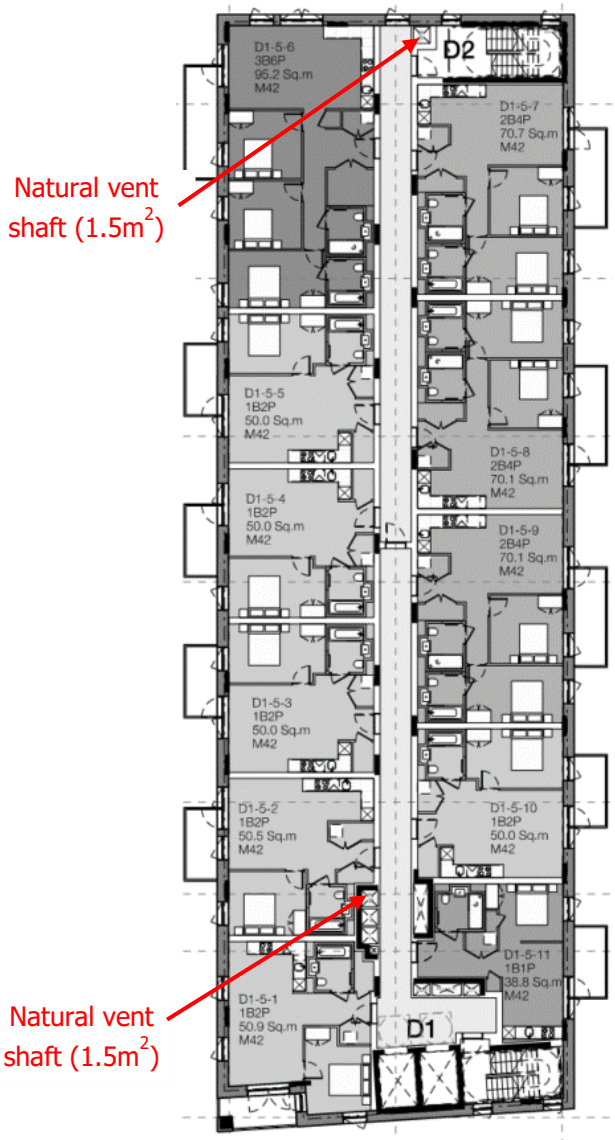

Figure 23 – Cores D1 and D2 Levels 04-06 travel distances and ventilation provisions

6.3.7 Block E – Cores E1 and E2

Block E serves apartments from Level 04 (Podium) to Level 07 and comprises two escape stairs. It should be noted that Level 07 of the Block comprises the upper levels of duplex apartments which are accessed at Level 06. Core E1 spans the full height of the block and Core E2 spans from Level 04 to Level 07. Therefore, the two-directional travel distance limit will apply.

6.3.7.1 Levels 00-03

Core E1 does not serve any residential accommodation from Level 00 to 03.

6.3.7.2 Levels 04-06

Travel distances within the common corridors at Levels 04-05 are within the code-compliant limits. It is therefore proposed to provide natural ventilation systems as depicted in

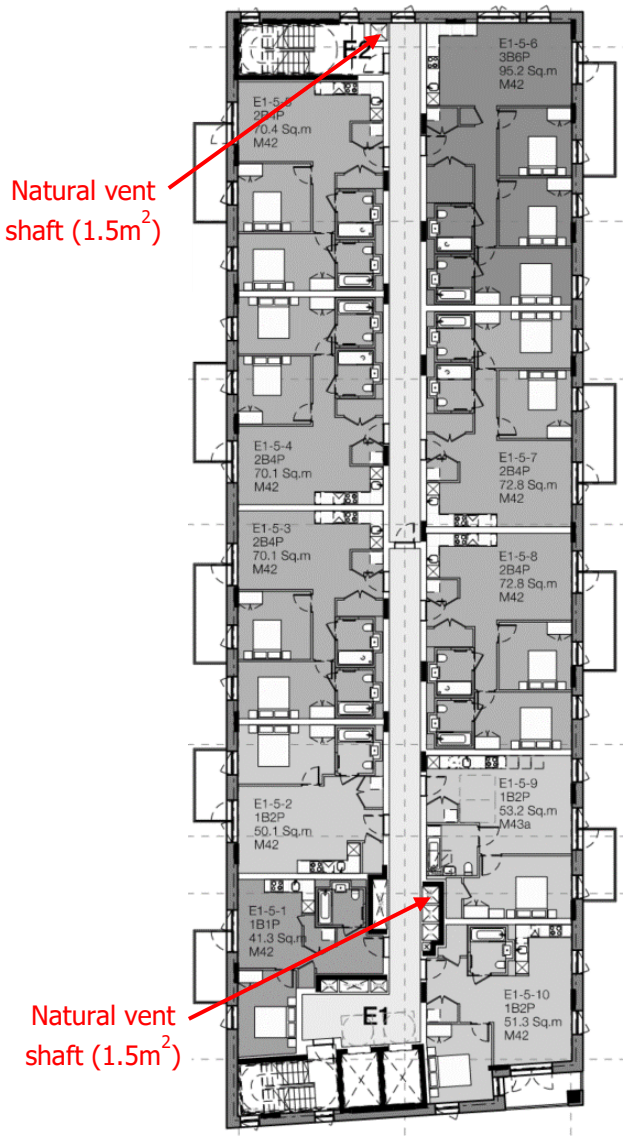

Figure 24 – Cores E1 and E2 Levels 04-06 travel distances and ventilation provisions

6.4 Escape from residential ancillary areas

6.4.1 General

The Syon Gardens development also comprises residential ancillary areas from Lower Ground Floor to Level 04. A summary of areas included at each floor level is provided below:

- Lower Ground Floor – Bin stores, Cycle stores and plantrooms;
- Ground Floor (Level 00) – plantrooms;

- Upper Ground Floor – Cycle stores;
- Level 01 – Cycle Stores;
- Level 02 – Cycle stores and plantrooms;
- Level 03 – Cycle stores; and
- Level 04 – Residential hub (including: communal reading / meeting space, bar, dining areas, cinema, gym and changing rooms) and Bin stores.

Recommendations for means of escape from the areas listed above are provided in the following. It should be noted that the following are concept design recommendations as it is expected that the design is yet to undergo detailed development, especially for the Residential hub.

It should also be noted that, where ancillary areas are accessed via the common residential cores / corridors, a protected and ventilated lobby should be provided to separate them.

6.4.2 Bin Stores, Cycle stores and plantrooms

The internal design of Bin Stores, Cycles stores and plantrooms will be dependent on the number and sizes of exits provided. Where one of these areas is provided with a single exit only, the maximum allowable occupancy would be restricted to 60 persons.

Where multiple exits are provided within close proximity, the single direction travel distance limit would apply from the farthest point to a point where more than a single exit is available and separated by an angle of at least 45°.

Maximum travel distances within each of these areas will be based on risk profiles, a summary of which have been provided in Table 2.

Area	Risk profile	Maximum travel distance (m)			
		One-way travel		Two-way travel	
		Direct	Actual	Direct	Actual
Bike stores	A1	17	26	44	65
Bin stores and plantrooms	A3	12	18	30	45

Table 2 – First Floor ancillary area risk profiles and associated maximum travel distances

Where internal layouts are not known, maximum travel distances should be taken as the direct distances indicated in Table 2.

Following review of the current layouts, no areas were highlighted as not being within these recommended limits.

6.4.3 Residential hub

The Residential hub has been depicted below in Figure 25.

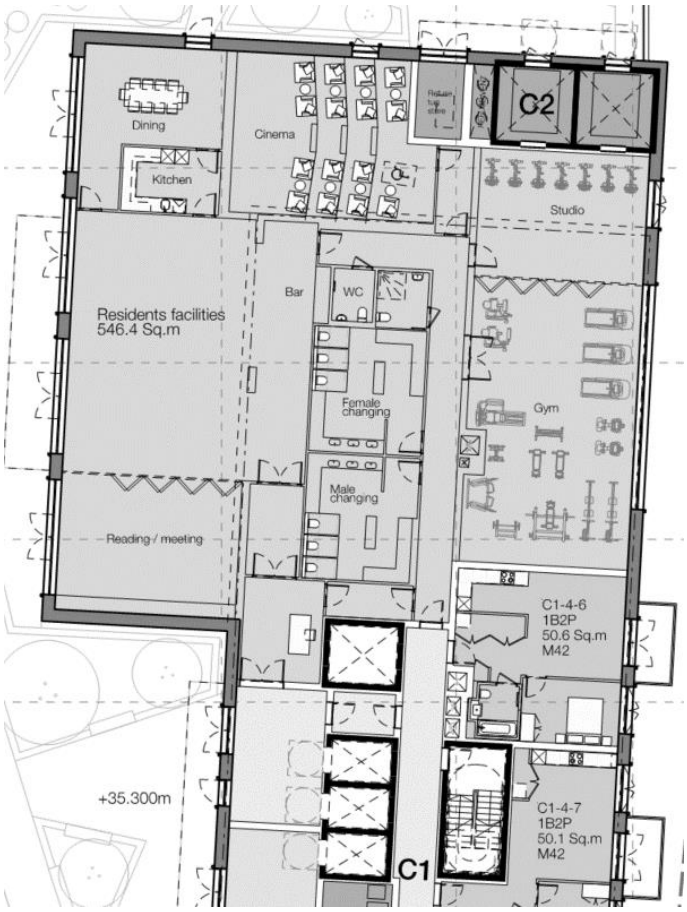

Figure 25 – Block C Level 04 Residential hub

The Residential hub is currently proposed to be accessed via residential Core C1, which would not be code-compliant. As an area that will likely be used by residents of more than just Block C, the hub should be separated from the residential areas by fire resisting construction (as it forms a different occupancy type) as well as have its own independent means of access.

It is therefore recommended that either Core M4 is extended up to serve this area or a new stair core is provided specifically for this area. Based on exceeding 18m in height above access level, this extended Core M4 or new core would need to be designed as a fire-fighting shaft (i.e. fire-fighting stair, fire-fighting lift, fire-fighting lobby and wet fire main).

Further review of this area will be required as the design progresses and once an independent access shaft has been included.

6.5 Escape from car parks

6.5.1 General

The majority of the car park areas at Level 01 and 02 are part of the Tesco unit and so will be covered by the Tesco design. However, there is a designated car park at Lower Ground Floor for the residential areas. The information below is in order to show the assumptions in relation to the 'shell and core' design of the car park.

6.5.2 Travel distances

Single direction travel distances, to either an exit or a point where more than one route of escape is possible (more than 45° apart), within the car parks should not exceed the recommended limit of 18m.

When a point where escape is possible in more than one direction is reached, the overall travel distance to the closest exit must be within the maximum limit for escape in more than one direction, i.e. 45m. All areas within the proposed car park are within 45m of a final exit.

The limitations above are met within the car park area at Lower Ground Floor level, as indicated in Figure 26.

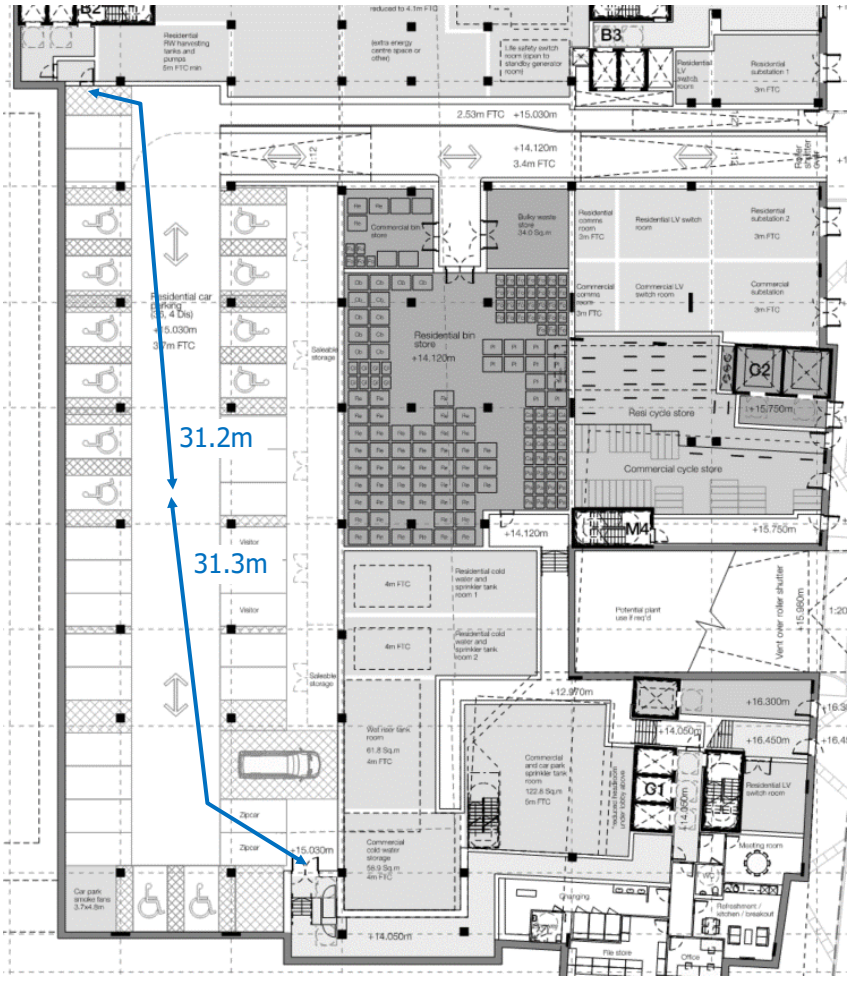

Figure 26 – Lower Ground Floor Car Park

7. B2 – INTERNAL FIRE SPREAD (LININGS)

7.1 Material classifications

Although unlikely to be the first materials to ignite, wall and ceiling linings of an enclosure such as a room can have a dramatic effect on the development of a fire and, in particular, the time it takes for the room to become completely involved.

Surface finishes and floor coverings should not comprise of materials that might contribute to surface spread of flame and/or fire or adversely affect the means of preventing such propagation.

The recommendations in relation to surface spread of flame are shown in Table 3 below. In each situation it gives two options, for the materials to comply either with the National Class or the European Class. Use of either option would be acceptable.

- National Class would relate to testing under BS 476-7 and gives a result of Class 1, 2 or 3. For Class 0, testing is also needed under BS 476-6 as described below.
- European Class would relate to the material's classification under BS EN 13501.

Location	National Class [a)]	European Class [b)]
Small rooms of area not more than $4m^2$ in residential accommodation or $30m^2$ in non-residential accommodation	Class 3	D-s3, d2
Rooms, general	Class 1	C-s3, d2
Circulations spaces within dwellings	Class 1	C-s3, d2
Other circulation spaces including the common areas of blocks of flats	Class 0	B-s3, d2

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

Table 3 – Classification of linings

In this table, Class 0 is better than Class 1. It is not identified in any BS test standard. A Class 0 product is either:

- Composed throughout of materials of limited combustibility; or
- A material having a Class 1 surface spread of flame and which has a fire propagation index (I) of not more than 12 and a sub-index (i1) of not more than 6.

IFC recommends that Class 3 products should be avoided where possible.

8. B3 – INTERNAL FIRE SPREAD (STRUCTURE)

8.1 Structural fire resistance

It is important that the structure and key construction elements of a building remain fully functional for a reasonable period of time during a fire. It is obviously beneficial if these elements remain in a serviceable condition after the fire for ease of reinstatement. In addition, a fire should be contained by fire resisting elements of the building to prevent it spreading to other parts of the building. This containment should include voids and cavities that could provide a path for fire.

Guidance suggest that all elements of a structure should be given the period of fire resistance in respect of the criteria of loadbearing capacity, integrity and insulation when evaluated in accordance with the relevant part of BS 476, BS EN 1363, BS EN 1364, BS EN 1365 or BS EN 1366.

With respect to fire resistance periods for structural elements, the design of the building will be such that failure of one part will not lead to progressive collapse of another in the event of fire.

Following Table 4 of BS 9991 and Table 23 of BS 9999, as the highest occupied floor level is more than 30m above ground level, the structural fire resistance requirements for load bearing elements is 120 minutes.

The structural elements include; floors, beams, columns, load-bearing walls, shear walls and any other load-bearing members.

Structure that only supports a roof does not need any specific fire resistance unless it also supports a fire resisting wall or rooftop plant.

8.2 Compartmentation

The fire resistance performance of compartment walls and floors (or any other parts of the building which are required to prevent fire spread) should be not less than that specified below when tested in accordance with the relevant part of BS 476: Parts 20 to 24 or classified in accordance with BS EN 13501 Parts 2, 3 or 4.

This applies to:

a. Load-bearing walls, for load-bearing capacity, integrity and insulation from either side;
b. Non-load-bearing walls and partitions, for integrity and insulation from either side;
c. Fire doors for integrity from either side, with the exception of doors to lift wells where performance is in respect of exposure of the landing side only; and
d. Floors, for load-bearing capacity, integrity and insulation with respect to exposure of the underside only.

The main elements of compartmentation and the relevant fire performance is summarised below. Any items not described below would be in accordance with Table 3 of BS 9991 and Table 22 of BS 9999.

Element	Fire resistance
Floors	120 mins
Walls separating Dwelling from Corridor	60 mins (doors in walls to be FD30S)
Walls separating Dwelling from Dwelling	60 mins
Walls separating different occupancy classes (e.g. residential from non-residential areas)	120 minutes
Enclosure of stairs	120 mins (doors to stairs to be FD60)
Enclosure of risers	120 mins (doors to risers to be FD60)
Walls enclosing back of house (not high fire risk)	60 mins (doors to rooms to be FD30S)
Walls enclosing high fire risk back of house rooms (e.g. generator, transformer, switchrooms, bin stores)	120 mins (doors to rooms to be FD60S)
Enclosure of lift shafts	120 mins (doors to be FD60)
Enclosure of smoke shafts	120 mins (doors to be FD30S)
External walls	See Section 9 of this report
Walls/floors enclosing substations	240 mins (due to typical requirements of suppliers)

Table 4 – Fire Compartmentation Requirements

Any fire doors should be fitted with self-closing fire doors so they return to the closed position, except for internal doors within dwellings, cupboards and doors into service risers which are kept locked shut.

Fire doors should be capable of demonstrating compliance with the relevant standard (as shown above) when tested as a complete installed assembly.

Magnetic hold-open devices should be employed to doors in common areas where such doors are expected to be rendered ineffective by occupants – i.e. chocked open or continued overuse. These should be linked to the fire alarm system/local automatic smoke detection so that the doors are released to the closed position in the event of a fire.

To prevent extensive cavities, concealed cavities i.e. the void between a suspended ceiling and the soffit of the floor above, raised floors that are used for services etc. will require cavity barriers typically installed so as to observe a 20m maximum linear dimension. This includes cavities in external walls where compartment walls or floors abut to the external wall.

All pipes, ductwork and services passing through fire-resisting barriers should be penetration sealed with an appropriate sealing system and/or fire/smoke damper which has been shown by an appropriate test or assessment to maintain the period of the fire

resistance of the barrier. The penetration sealing system should be designed and installed in accordance with the recommendations contained within The Association for Specialist Fire Protection (ASFP) "Fire Stopping and Penetration Seals for the Consultation Industry" (commonly referred to as The Red Book).

Any fire and smoke control assemblies should be provided with an appropriate certificate from a recognised third-party accreditation body, such as IFC Certification Ltd., in order to demonstrate compliance with Regulation 38 of the Building Regulations 2010. Assessment and test evidence should also be available for inspection by the approving authorities and other interested parties.

In accordance with paragraph 8.11 of ADB, parts of a building occupied mainly for different purposes should be separated from one another by compartment walls and/or compartment floors.

8.3 Cavity barriers

Cavity barriers should be provided in all areas in accordance with BS 9991 and BS 9999.

Cavity barriers should be provided to limit the extent of any unseen cavities to no more than 10m (which can be increased to 20m if all the surfaces within the cavity achieve a UK Class 1 or European Class C performance or better). IFC would note that this normally only applies to non-domestic buildings but IFC would recommend that this restriction should apply to all types of buildings.

Within external walls, cavity barriers should be provided in line with any locations where fire rated walls or floors meet the façade.

Cavity barriers should also be provided around all openings in the external walls, such as windows, doors and service penetrations and at the top and bottom of the cavity. Cavity barriers should be provided around service penetrations through the external walls in accordance with Building Control Alliance (BCA) Technical Guidance Note 26.

Cavity barriers in external walls should pass through all insulation and other materials within the external wall, forming a seal between the edge of the fire rated wall/floor and the inner face of the external cladding. If the external cladding comprises composite panels which contain materials that are not of limited combustibility, the cavity barrier should be extended to continue through the core of the external panel as well (to prevent the combustible core of the panel bypassing the cavity barrier).

Cavity barriers should achieve a fire resistance of at least 30 minutes for integrity and 15 minutes for insulation. Alternatively, if located in a stud wall or partition, or provided around openings in the external wall, they may be formed of:

a) Steel at least 0.5mm thick;
b) Polythene-sleeved mineral wool, or mineral wool slab, in either case under compression when installed in the cavity; or
c) Calcium silicate, cement-based or gypsum-based boards at least 12mm thick.

Fire stopping (the seal between the fire rated wall/floor and the external wall) should be of the same fire resistance as the fire rated wall/floor.

9. REGULATIONS 7 AND B4 – EXTERNAL FIRE SPREAD

9.1 Regulation 7

As noted in Section 2.1 of this report, The Building (Amendment) Regulations 2018 introduced additional fire safety requirements into Regulation 7(2) (and other associated Regulations) of the Building Regulations. These additional requirements relate to the combustibility of materials within the external wall and so they have been covered in the following Sections of this report.

Regulation B4 of the Building Regulations also applies to the external wall construction. The building design needs to comply with both Regulation B4 and Regulation 7 and so this report includes the most onerous requirements of each regulation.

It should be noted that Regulation B4 is a functional requirement which means that under Regulation B4 it is possible to use alternative solutions as long as they comply with the functional requirement. However, Regulation 7 is a prescriptive requirement and so strict compliance with the detailed criteria is required. Alternative solutions (e.g. such as risk assessment, or 'boxing in' of non-compliant materials) are not permitted under Regulation 7.

9.2 External walls

9.2.1 External wall surface

The external surfaces of the building should comply with the guidance of Figure 17 of BS 9991 / Figure 47 of BS 9999. That essentially means that the external walls should achieve a UK Class 0 or European Class B / European Class 'A2-s1, d0' for surface spread of flame.

9.2.2 External wall materials

Regulation 7(2) of the Building (Amendment) Regulations 2018 introduces strict restrictions on the combustibility of materials that are contained within (or attached to) external walls of "relevant buildings". As noted in Section 2.1 earlier this building is classified as a "relevant building" and so those restrictions will apply. The implications are summarised below.

All materials which become part of an external wall or specified attachment (see below) of a relevant building must be of European Class 'A2-s1, d0' or class A1. The definition of "external wall" includes anything contained within the wall, so it includes any materials used in the construction of the wall as well as anything passing through external walls such as ductwork or pipes.

The definition of an "external wall" includes all materials contained within the wall, from the external surface all the way through to the inner surface within the room although decorations and finishes to the internal surface are excluded. This therefore includes all materials used within any part of the external wall construction as well as any materials which pass through the external wall (such as ducts or pipes).

A "specified attachment" is defined as*:

a) a balcony attached to an external wall; or

b) a device for reducing heat gain within a building by deflecting sunlight which is attached to an external wall; or

c) a solar panel attached to an external wall.

* Note: The regulations also mention "a device for reducing heat gain within a building by deflecting sunlight which is attached to an external wall". However, following a court ruling in November 2019, the regulations have been amended so that item is removed.

The following materials are exempt from the requirements shown above. This is a specific list of exceptions and if a particular material is not included in the list below, it would need to comply with the combustibility restrictions shown above.

- Cavity trays when used between two leaves of masonry;
- Any part of a roof (other than any part of a roof that falls within paragraph (iv) of regulation 2(6)) if that part of the roof is connected to an external wall;
- Door frames and doors;
- Electrical installations;
- Insulation and water proofing materials used below ground level;
- Intumescent and fire stopping materials where the inclusion of the materials is needed to meet the requirements of ADB;
- Membranes (see note below);
- Seals, gaskets, fixings, sealants and backer rods;
- Thermal break materials where the inclusion of the materials is needed to meet the thermal bridging requirements of Part L of Schedule 1 of the Building Regulations; and
- Window frames and glass.

Note: Whilst membranes are in the list of excluded items in relation to Regulation 7, there would still be a requirement for membranes within external walls to achieve at least a Euro Class 'B-s3, d0' performance under functional requirement B4.

The Euro Class 'A2-s1, d0' / A1 performance is a relatively strict standard. In practice, materials that contain any significant amount of organic material (e.g. plastic or wood products) are unlikely to achieve that rating.

As noted earlier, the criteria listed above is prescriptive – i.e. there is no allowance for any flexibility. Typical issues that would need to be considered would be:

a) there is no relaxation or exclusion for materials that are only used in small quantities;

b) the list of exclusions includes "electrical installations". That is a defined term in the Building Regulations and would include electrical cabling and

equipment, but would not include conduit. As a result, plastic conduit should not be used within external walls; and

c) adhesive is not included in the list of excluded items (adhesive would not come under the definition of "fixings"). However, "seals" are excluded. As a result, adhesive would only be allowed if it:

   a. complied with the Euro Class 'A2-s1, d0' / A1 criteria; or

   b. is being used as a "seal" (or other excluded item); or

   c. is included within a component that achieved the Euro Class 'A2-s1, d0' / A1 classification for the component as a whole.

If, during construction, a non-compliant material is found to have been introduced within the external walls (even in small quantities) then that material will have to be removed, irrespective of the costs or delays that may incur.

As a result of the amendment to Regulation 7(2), IFC would suggest that the design team take this issue very seriously and adopt a very strict procedure for ensuring the compliance of all materials within the external walls.

9.3 Unprotected areas

When a building is on fire, heat will radiate through non fire-resisting openings in the external walls. This heat can be intense enough to set fire to adjoining buildings. In order to reduce the chance of this occurring, the Building Regulations place limits on the area of external elevation with no fire resistance. This area is known as the 'unprotected area' and is affected by such factors as distance from the boundary, use of the building and compartment size.

Walls within 1m of the site boundary, which have no openings, will provide 120 minutes fire resistance (integrity and insulation) from both sides. Small openings (up to $1m^2$) in the external wall can be permitted, depending on size and separation (see Figure 21 of BS 9991 / Figure 45 of BS 9999).

For other openings, BRE Report BR 187 *External fire spread: building separation and boundary distances* has been applied as a suitable method for calculating minimum boundary distances or maximum unprotected areas, as referenced in BS 9999 / BS 9991. This approach assumes that:

- A fire has spread throughout the full extent of any fire compartment (i.e. full flashover fire throughout the compartment);
- Any non-fire rated parts of the external wall have failed; and
- The heat and flames are radiating from the entire façade.

Boundary locations are taken as the centre of a public highway, the boundary of the site or a notional boundary mid-way between buildings on the same site (as Regulation B4 is concerned with the heat flux at half the distance between buildings). The selected boundary line (blue) following these recommendations can be seen in Figure 27.

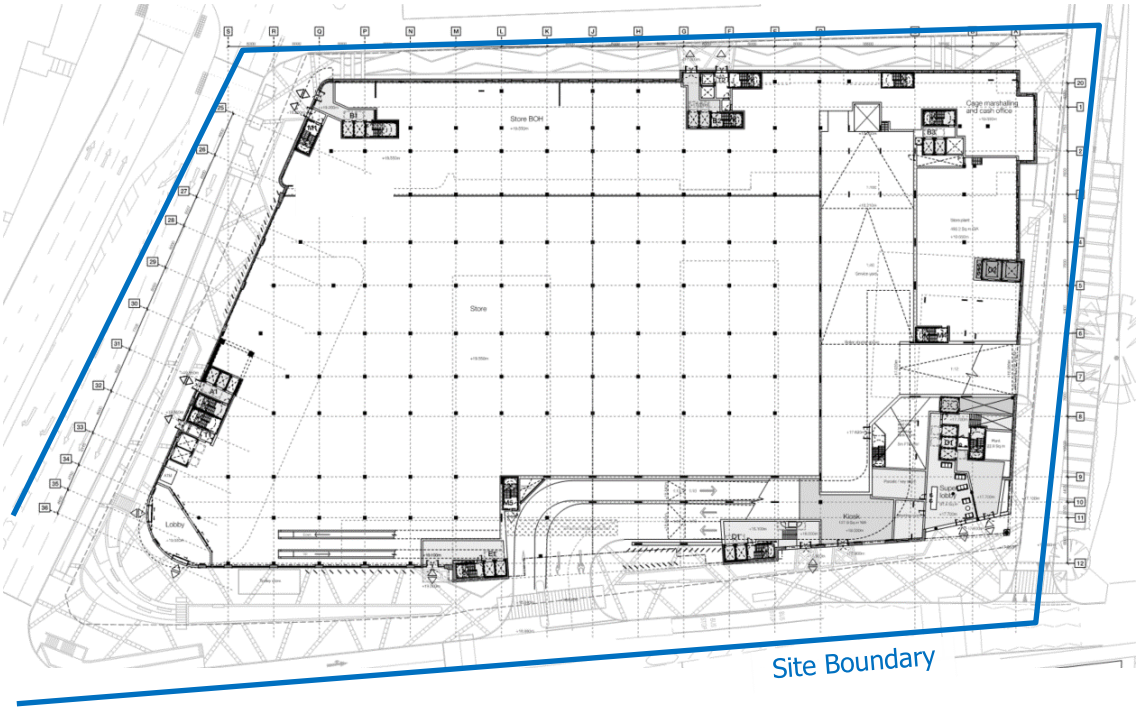

Figure 27 – Site boundaries

Residential buildings are typically well compartmented internally, with each apartment being a 60-minute fire resisting compartment in this case, and so areas of concern in this case will be the larger podium areas (i.e. car park and Tesco store).

Separation distances to site and notional boundaries have been indicated in Figure 27. The external walls of the block are not within close proximity to the notional boundaries between adjacent blocks but, in some cases, are within close proximity to site boundaries. Guidance provides a general recommendation that any wall within 1m of the site boundary or separation boundaries between blocks will need to be fire rated in its entirety, relevant to the building height / risk.

It has been stated earlier that all blocks are to be sprinkler protected. Where a building is provided with automatic sprinklers, the distance to the boundary for a given amount of unprotected area may be halved. This is likely to compensate for areas where there are reduced distances to boundaries, subject to more detailed review through design progression.

9.4 External fire spread calculations

Further detail of building elevations will be required before external fire spread calculations can be undertaken. This should be carried out at a later design stage as the design progresses and more detailed elevations are available.

10. B5 – ACCESS AND FACILITIES FOR FIRE SERVICE

10.1 Fire service access

In order to extinguish a fire within a building it is important that the fire service can gain access to the premises and into the building.

The fire safety strategy relies upon the intervention of the fire service to extinguish the fire before it has the opportunity to spread significantly, as the fire separation is not designed to operate indefinitely.

All roadways to each of the buildings when on site should be constructed to allow access for pump appliances which include the following recommendations:

- Minimum width of 3.7m when measured between kerbs;
- Minimum width of 3.1m when measured between gateways;
- Maximum dead-end distance of 20m before a turning circle is required; and
- Minimum carrying capacity of 12.5 tonnes.

Where a building is fitted with a wet fire main, vehicle access will be within 18m of each fire service entry point to the building (i.e. each fire-fighting core). Each point within a building will then be within 60m of the outlet of a fire main when measured along a route suitable for laying a hose. As parts of the development exceed 50m in height when measured from access level to the topmost occupied floor, a wet fire main should be provided for the site.

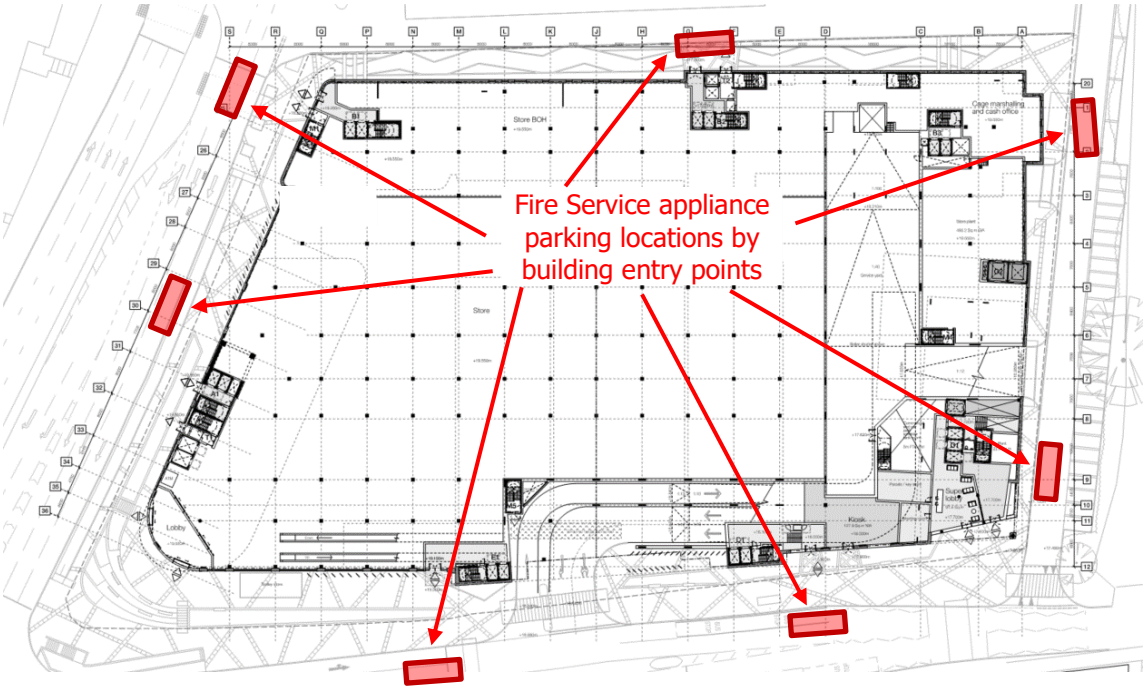

Figure 28 – Fire Service Access to Site

The fire service will have access to the entire perimeter of the development and so can achieve parking locations within 18m of each building entrance point.

10.2 Fire-fighting shafts

All parts of the site are served by fire-fighting shafts.

Blocks A, B1, B2, B3 and C1 are all single stair blocks and so the stairs within those blocks will be fire-fighting shafts and continue down to ground level where they are accessible by the fire brigade.

Blocks D and E are each served by two stairs, connected by corridors on all residential levels. In each case, one of those stairs terminates at podium level and the other continues to ground level.

The cores that terminate at podium level (D2 and E2) will be designed as escape stairs and the cores that continue to ground level (D1 and E1) will be designed as fire-fighting shafts. This provides fire-fighting shaft access to all flats within 60m hose lengths.

Where fire-fighting shafts serve residential areas only, they should include a fire-fighting stair, fire-fighting lift and wet fire main. Where fire-fighting shafts serve non-residential areas, they should include a fire-fighting stair, fire-fighting lift, wet fire main and a fire-fighting lobby.

Stairs serving the podium / commercial areas independently to the residential areas will also be required to be designed as fire-fighting stairs as they will be required for dedicated access.

The fire-fighting stairs will be designed to the relevant criteria of BS 9991, which includes a 2-hour fire rated enclosure and a wet fire main (due to building height) located within the staircase (or within the fire-fighting lobby for the non-residential areas), designed to BS 9990.

Fire-fighting lifts should be designed and installed in accordance with all relevant criteria within BS EN 81-72[9], including but not limited to provisions for rescue of firefighters.

10.3 Water supplies

Fire mains should be designed and installed in buildings with a topmost occupied floor greater than 18m above access level or any buildings provided with a fire-fighting shaft.

This development includes a topmost occupied floor height of greater than 50m and so wet fire mains comprising outlets located within fire-fighting shafts should be provided for the site in addition to the required automatic pumps and water tanks, in accordance with BS 9990.

External water supplies / hydrants should be provided for fire-fighting. Hydrants should be located in positions near to the building entry points / entry points to fire-fighting shafts and appliance parking positions so that the distance from the supply to the appliance, which is to be covered by the laying of hose, can be kept to a minimum.

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

External street hydrants should be within 90m of a building entry point. Checks should be carried out to ensure that this is available within the streets adjacent to the site.

10.4 Smoke ventilation

The detailed information for smoke ventilation is covered in the sections of this report regarding means of escape.

The car park areas will be provided with smoke ventilation. If a mechanical system is provided it will be based on 10 air changes per hour, activated by either the fire alarm system or sprinkler system.

11. LIMITATIONS

International Fire Consultants Ltd. (IFC) has been commissioned by St Edward Homes Limited to advise on fire strategy for the Syon Gardens, Syon Lane, development.

International Fire Consultants Ltd. have not reviewed any other issues within the project other than those identified in our report. We offer no comment on the adequacy or otherwise of any other aspects of the development (whether related to fire safety or any other issue) and any absence of comment on such issues should not be regarded as any form of approval. The advice should not be used for buildings other than that named in the title.

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