INTRODUCTION

The escape requirements of a Car Park differ depending on the use of the Car Park. On this basis, the following strategy is based on the more onerous assumption that the occupancy above the Car Park is an office, however, commentary has also been provided should the accommodation above the Car Park be used for residential purposes.

Building Height (Depth)

The building measures approximately 6m in depth, as measured from the highest adjacent external ground level to the finished floor level of Level -2.

Note: the building above Ground Level has not been considered.

Building Occupancy

The number of occupants that can be expected in the Basement Car Park is generally governed by the main use of the building. For this assessment the building use is considered to be an office and, as such, the maximum anticipated occupancy of the basement should be based on Table C1 of Approved Document B (AD-B). On this basis, the occupancy is determined based on two persons per parking space. There are 405 spaces at Level -1 and 428 spaces at Level -2 and, as such, the resulting occupancies are 810 persons and 856 persons respectively.

If the building above, was a residential building it could be considered that the maximum anticipated occupancy at Basement level would be not more than a few people. This is based on the assumption that only a few residents would be arriving and leaving at the same time. This cannot be assumed for an office Car Park where the majority of occupants start at 9 in the morning and finish at 5 in the evening.

Purpose Group

Regardless of the occupancy on the floors above (i.e. Residential or Office), the Car Park is considered to be a purpose group in its own right. On this basis, the Car Park is considered to be Purpose Group 7(b) Storage.

Automatic Sprinkler System

Under the Building Regulations 2010, the Car Park is not required to be provided with sprinkler protection. However, it is proposed to provide comments where the provision of sprinklers will provide design benefits.
STATUTORY CONSIDERATIONS

The Building Regulations

The development will be subject to the requirements of the Building Regulations 2010(2) and, therefore, it will be necessary for it to meet the requirements of Schedule 1 of the Regulations relating to:

- 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).

Guidance on how these functional requirements can be met is provided in Approved Document B – Fire Safety (AD-B). AD-B is one of several Approved Documents issued by the Department for Communities and Local Government (DCLG) to provide guidance for some of the more common building arrangements.(1)

However, there is no obligation to adopt any particular solutions contained in the document. The document recognises that the functional requirements can also be demonstrated to have been satisfied by an alternative solution not contained within AD-B. Such alternative solutions are acceptable, on the basis that an equivalent or greater level of fire safety to that provided by the standard solutions can be demonstrated.(3)

Clause 0.30 of AD-B states that “Fire safety engineering can provide an alternative approach to fire safety. It may be the only practical way to achieve a satisfactory standard of fire safety in some large and complex buildings and in buildings containing different uses. Fire safety engineering may also be suitable for solving a problem with an aspect of the building design which otherwise follows the provisions in this document.”(1)

This report is primarily intended to assess the statutory Life Safety requirements of Part B of the Building Regulations and, therefore, property protection is not explicitly addressed.

The Regulatory Reform (Fire Safety) Order

The Regulatory Reform (Fire Safety) Order (RRO)(4) is based on risk-appropriate compliance and requires a fire risk assessment to be carried out. The Fire Service will conduct inspections of premises to enforce the regulations. It will be necessary for a risk assessment to be conducted on the premises, to parts of the premises where employees may work (i.e. not within residential apartments). However, the management and risk assessment requirements of the RRO are outside the scope of this report.
MEANS OF WARNING AND ESCAPE

Functional Requirements

“The building shall be designed and constructed so that there are appropriate provisions for the early warning of fire, and appropriate means of escape in case of fire from the building to a place of safety outside the building capable of being safely and effectively used at all material times.”

Means of Warning and Detection

In accordance with AD-B, non-residential buildings are not required to be provided with an automatic fire alarm and detection system. Therefore, an office type building would not be required to be provided with an automatic fire alarm and detection system but rather a manually operated fire alarm and detection system.

However, in accordance with Section 1.36 of AD-B, where a fire could break out in an unoccupied part of the premises (e.g. the car park) and prejudice the means of escape from the building, it is recommended that an automatic fire alarm and detection system is provided, designed and installed in accordance with BS 5839 Part 1 to an L3 standard. This system would also be responsible for activating the smoke control system in the Car Park.

Note: the system sensitivity would be critical to avoid false alarms.

In residential buildings, the Car Park would not be required to be provided with an automatic fire alarm and detection system to initiate the building evacuation. In residential buildings only the apartment of fire origin is required to evacuate. On this basis, the Car Park would be provided with an L5 standard fire detection system designed to activate the smoke control system in the Car Park only.

Means of Escape Principles

Travel Distance

In accordance with Table 2 of AD-B, the maximum travel distance in a single direction should not exceed 25m, however, where escape is possible in more than one direction, the maximum travel distance to the closest exit should not exceed 45m.

Generally these distances are achieved, however, there is a dead-end section of car park where the travel distance is increased. The maximum single direction travel distance is approximately 62m (i.e. 148% increase in travel) and, therefore, it is proposed that an additional escape route is provided.

It is considered that this increased travel distance, which is significantly over the permitted limit, would not be accepted by the Statutory Authorities.

Figure 1 – Extended single direction of escape within the car park
This is not considered to change based on the building being designed as a residential building.

**Escape Widths**

Each level is provided with 6 storey exits which are assumed to discharge occupants direct to the outside at Ground floor level (where the stair is not on the peripherals of the building, the exit route should be via a protected corridor). All exits are assumed to provide equivalent clear width. On this basis, assuming one exit is discounted due to a fire, the remaining exits would be required to accommodate 162 persons at Level -1 and 172 persons at Level -2. Therefore, in accordance with Table 4 of AD-B, each exit should provide a minimum clear width of 1050mm.

All doors across escape routes which serve more than 60 persons are required to open in the direction of escape.\(^{(1)}\)

In residential buildings where the floor level consists of living accommodation only, for the purpose of this fire strategy, the means of escape is based solely on a single apartment.\(^{(1)}\) Therefore, the occupancy per floor level has minimal impact when considering escape widths within the residential apartments or common corridors.

**Vertical Means of Escape**

The building is provided with 6 stair cores, considered to be dedicated escape stairs which are assumed to discharge occupants direct to outside (or into a protected corridor leading to external air) at Ground level. Therefore, assuming all stairs are the same size and considering that one stair is discounted due to fire the remaining stairs are required to achieve a clear width of 1200mm.

The final exit from stairs should be at least as wide as the stair it serves.\(^{(1)}\)

In residential buildings containing apartments, where a ‘stay-in-place’ evacuation strategy is adopted, the evacuating occupancy is considered to be limited to a single compartment and, as such, there is no reason for a minimum width of escape stairs from the residential accommodation and similar from the associated Car Park.

Note: where a fire-fighting shaft is provided the stairs are required to be a minimum of 1100mm.\(^{(1)}\)

**Disabled Means of Escape**

AD-B requires that a disabled refuge space (1400mm x 900mm) should be provided within each escape stair at every floor level above stair discharge level and should be provided with an appropriate two-way communication device that complies with BS 5839: Part 9 (i.e. comprising of a Type B outstation that communicates with a master station located adjacent to the fire alarm panel).\(^{(6)}\)

As it is no longer considered reasonable to rely upon the Fire Service for the evacuation of non-ambulant persons, a managed procedure for the safe evacuation of disabled persons is required to be considered, devised, and implemented by building management.

If the Car Park was part of a residential building (i.e. used by residential occupants only), there is no requirement to provide a disabled refuge as a disabled refuge will not be provided at the upper floor levels.
**Emergency Lighting**

All emergency escape routes should have adequate artificial lighting provided. Lighting to escape stairs should be on a separate circuit from that supplying any other part of the escape route. In addition, all escape routes and communal areas should be provided with emergency lighting in compliance with BS 5266-1:2011.\(^{(7)}\)

**Signage**

In accordance with Approved Document B, every escape route (other than those in ordinary use) should be distinctively and conspicuously marked by emergency exit signs of adequate size complying with the Health and Safety (Safety signs and signals) Regulations 1996.

In general, signs containing symbols or pictograms which conform to BS ISO 3864-1:2011 satisfy these regulations.\(^{(8)}\)
SMOKE CONTROL PRINCIPLES

Car Park

It is not considered possible to ventilate the car park by natural means and, as such, a mechanical smoke extraction system should be provided. The system should be designed based on the following principles:

- the system should be independent of any other ventilation system (other than normal ventilation to the Car Park) and be designed to operate at 10 air changes per hour in a fire condition;
- the system should be designed to run in two parts, each part capable of extracting 50% of the rates set out above and designed so that each part may operate singly or simultaneously;
- extract points should be arranged so that 50% of the outlets are at high level and 50% at low level; and
- the fans should be rated to run at 300°C for a minimum of 60 minutes and the ductwork and fixings should be constructed of materials having a melting point not less than 800°C.

Car Park Stair Lobbies

As the Car Park is not defined as a place of special fire hazard there is no requirement to provide ventilation to the protected lobbies which access the Car Park, with the exception of ventilation to the fire-fighting lobbies associated with the fire-fighting shafts.

If the building above, was a residential building, in accordance with Section 2.47 of AD-B, the lobbies at basement level is to be provided with a mechanical smoke ventilation system providing 10 air changes per hour or 0.4m² permanent natural ventilation (the latter is considered unachievable in this situation).\(^{(1)}\)

The extract should ventilate direct to the outside and not into the car park.
INTERNAL FIRE SPREAD (LININGS)

Functional Requirements

“To inhibit the spread of fire within the building the internal linings shall adequately resist the spread of flame over their surfaces; and have, if ignited, either a rate of heat release or a rate of fire growth, which is reasonable in the circumstances. In this paragraph “internal linings” mean the materials or products used in any partition, wall, ceiling or other internal structure.”

(1)

Wall and Ceiling Linings

All wall and ceiling linings should comply with the relevant guidance in AD-B for surface spread of flame, as summarised in Table 1.

Table 1 – Classification of Linings(1)

<table>
<thead>
<tr>
<th>Location</th>
<th>National Class</th>
<th>European Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small rooms of area not more than 4m²</td>
<td>3</td>
<td>D-s3, d2</td>
</tr>
<tr>
<td>Other rooms</td>
<td>1</td>
<td>C-s3, d2</td>
</tr>
<tr>
<td>Other circulation spaces, including the common areas of blocks of flats</td>
<td>0</td>
<td>B-s3, d2</td>
</tr>
</tbody>
</table>
INTERNAL FIRE SPREAD (STRUCTURE)

Functional Requirements

“The building shall be designed can constructed so that, in the event of fire, its stability will be maintained for a reasonable period.

A wall common to two or more buildings shall be designed and constructed so that it adequately resists the spread of fire between those buildings. For the purposes of this sub-paragraph a house in a terrace and a semi-detached house are each to be treated as a separate building.

To inhibit the spread of fire within the building, it shall be sub-divided with fire-resisting construction to an extent appropriate to the size and intended use of the building. The building shall be designed and constructed so that the unseen spread of fire and smoke within concealed spaces in its structure and fabric is inhibited.”

Loadbearing Elements of Structure

The depth of the bottom storey (i.e. level -2) below the external ground level is assumed to be not more than 10m and, therefore, all elements of the structure (e.g. structural frames, beams, columns, loadbearing walls [internal and external] and floor structures) are required to be provided with 60 minutes fire resistance.

Compartmentation

In accordance with Table 12 of AD-B there is no requirement to sub-divide the car park with vertical compartmentation.

However, the Ground floor level (regardless of use) is required to be separated from the basement levels by a 60 minutes fire rated compartment floor.

Protected Shafts

On the basis that compartment floors are required between Ground and Second, the escape stairs, lift shafts, ventilation shafts, service risers (containing pipes, ducts or chutes) and any other floor penetrations are needed to be constructed as a protected shaft. The protected shaft should provide 60 minute fire resistance and access via a FD30S self-closing fire door (lift shaft should be accessed via FD30 fire rated doors).

Fire-fighting shafts

There are two basement storeys with a floor area in excess of 900m² and, as such, the building is required to be provided with two fire-fighting shafts (which need not include a lift).

The firefighting shaft (stair, and lobby enclosure) should be enclosed in 120 minutes fire resisting construction. Doors separating the stair from the accommodation should be FD60S self-closing fire doors.

Internally within the shaft, the stair and lobby should be enclosed in 60 minutes fire resisting construction and the doors between the stair and the lobby are required to be FD30S self-closing fire doors.

Places of Special Fire Hazard

AD-B recommends that enclosed places of special fire hazard should be protected with 30 minutes fire resistance structure and accessed via a FD30 door. Places of special fire hazard include:
- Oil-filled transformer rooms,
- Switch gear rooms,
- Boiler rooms,
- Storage spaces for fuel or highly flammable substances, and
- Rooms housing a fixed internal combustion engine.

**Concealed Spaces (Cavities) and Fire Stopping**

Section 9 of AD-B provides recommendations to prevent the unseen spread of smoke and flames through the cavities and/or any concealed spaces used in cavity barriers.\(^{1}\) It is considered that there will be no cavities in the car park.

Openings in any fire-separating element (e.g. compartment walls, cavity barriers, protected corridor etc.) should be protected with appropriate fire stopping or sealing to ensure that the fire resistance of the element is not compromised. The provision of any such protection should meet the general recommendations of Section 10 of AD-B.\(^{1}\)
EXTERNAL FIRE SPREAD

Functional Requirements

“The external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building. The roof of the building shall adequately resist the spread of fire over the roof and from one building to another, having regard to the use and position of the building.” (1)

Space Separation Analysis

Space separation analysis will not be undertaken as part of this study as the building under assessment is a basement and, as such, there is no risk of external fire spread.
ACCESS AND FACILITIES FOR THE FIRE SERVICE

Functional Requirements

“The building shall be designed and constructed so as to provide reasonable facilities to assist fire fighters in the protection of life. Reasonable provision shall be made within the site of the building to enable fire appliances to gain access to the building.”

Fire Service Access

In order to comply with the guidance in clause 17.3 of AD-B, vehicle access should be provided for a pump appliance to within 45m of all points within each compartment, and where this cannot be achieved, fire mains should be provided.

In order to meet the hose laying distance requirements, all protected stairs will be provided with a dry rising main. Outlets should be provided at each floor level.

Note: this can be increased to 60m if sprinklers are provided.

There should be access for a pumping appliance to within 18m of the fire main inlet connection point, typically on the face of the building at Fire Service access level, and the inlet must be visible from the appliance. The fire main should be designed and installed in accordance with BS9990.

The outlets of the dry mains should be located such that they do not directly face the firefighting lift. Therefore in the event of failure of the hose connection water will not spray directly towards the lift.

Fire-fighting shafts

Access to Fire-Fighting Shafts

The layout of the fire-fighting shaft at fire and rescue service access level should be such that fire-fighters entering the fire-fighting lift, and persons escaping down the fire-fighting stair do not obstruct each other.

Entry to a fire-fighting shaft at fire and rescue service access level should be available either:

- directly from the open air; or
- by way of a protected corridor not exceeding 18 m in length. The corridor is considered to be part of the fire-fighting shaft, and any access to it from the accommodation should be by way of protected lobbies.

Firefighting Stair

The minimum width of a firefighting stair is 1100mm and should be provided with a 1m² vent at the head of the stair which can be remotely operated from fire and rescue service access level.

Fire-fighting lobby

The fire-fighting lobby should have a clear operating area of at least 5m², however, the lobby should not be too big as to encourage building users to dump rubbish.
AD-B refers users to BS 5588 (now superseded by BS 9999) for more information regarding fire-fighting shafts. BS 9999 suggests that basement levels more than 10m deep should be provided with a pressurised stair and lobby or where the basement is not more than 10m deep ventilation may be provided by natural means. (10) However, ventilation by natural means (in this context we would consider a smoke shaft) is limited to a single level.

It is therefore, proposed that a mechanical smoke shaft is provided which will serve all basement levels. This smoke shaft would operate (at the floor of fire origin) upon detection of smoke in the lobby. This approach is considered reasonable however, it may require CFD modelling and would be subject to discussion and approval with the Statutory Authorities.

Other Services and Risers

Only services associated with the fire-fighting shaft should pass through or be contained within the fire-fighting shaft. Fire-fighting shafts should not contain any cupboards or provide access to service shafts serving the remainder of the building. (1)

Vehicle Access

Access routes for the Fire Service vehicles should satisfy the specification in Table 2.

**Table 2 – Pumping Appliance access specification**

<table>
<thead>
<tr>
<th>Application Type</th>
<th>Minimum width of road between kerbs (m)</th>
<th>Minimum width of gateways (m)</th>
<th>Minimum turning circle between kerbs (m)</th>
<th>Minimum circle between walls (m)</th>
<th>Minimum height clearance (m)</th>
<th>Minimum carrying capacity (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump</td>
<td>3.7</td>
<td>3.1</td>
<td>16.8</td>
<td>19.2</td>
<td>3.7</td>
<td>12.5</td>
</tr>
</tbody>
</table>

AD-B recommends that if any portion of the route is a ‘dead-end,’ turning facilities will be required (e.g. turning circle, hammerhead, or other point at which vehicle can turn) so that Fire Service vehicles do not have to reverse more than 20m.

**Hydrants**

In accordance with AD-B, where a building with a compartment area over 280m$^2$ is more than 100m from existing hydrants should be provided with hydrants which are within 90m of the entry point to the building and not more than 90m apart. (1) The provision of hydrants to the site is subject to survey.
SUMMARY

The building is generally considered to meet the functional requirements of the Building Regulations based on the fact that it is generally in compliance with the basic requirements given in AD-B. However, in a few circumstances the proposed design does not meet this guidance. Nevertheless, we would consider the proposed design to be acceptable based on the following:

- A new Stair core serving the area with the extended travel distance should be provided to allow for compliant travel distances (this will also assist with Fire-fighting operations).
- The Car Park should be provided with a mechanical smoke control system that achieves 10 air changes per hour.
- Two stairs should be provided as Fire-Fighting shafts, and all others should be provided with dry rising fire mains.
- It is proposed to provide a mechanical smoke extraction system to the fire-fighting lobbies. This system will be designed to operate (at the floor of fire origin) upon activation of the smoke detector in the fire-fighting lobby.
REFERENCES


