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Draft Fire Strategy 4

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Executive Summary

Background

This Fire Strategy has been prepared for the East Durham and Houghall Community College development.

The proposed college building is at the site of the current college between Beverley Way and Burnhope Way. It will house mainly 14-18 year old students and is therefore classed in the Assembly & Recreation purpose group.

A detailed description of the building can be found in Section 2 of this Report.

Fire Strategy

The fire strategy is based upon a fire engineering approach which achieves the functional objectives of Building Regulations Approved Document B (AD B).

The fire strategy is explained fully in Section 3 of this Report.

Significant Issues for the Regulator

Table E1 lists the fire safety issues and our proposed strategy to achieve the functional objectives of the Building Regulations Approved Document B.

Table E1: Fire safety issues

Location	Issue	Strategy
Throughout	An L3 type detection and alarm system is provided, with aspirating type detection system for the atrium area.	The aspirating system will provide early warning for occupants and reduce the pre-detection and pre-movement time during evacuation.
Construction block, ground floor	Two-way travel is available for all rooms in this block but travel distances from some classrooms are up to 52m.	It is considered that the cross-corridor door separation provided makes the arrangement acceptable.
Construction block, ground floor	A second exit should be provided from painting and decorating workshop.	The travel distance within it exceeds the AD B recommendation.
Theatre Gallery, first floor	Escape from this area is only possible in one direction, with the maximum travel distance being approximately 54m.	The occupancy of the Theatre Gallery is 58 people and therefore a single route is acceptable. The route from the Theatre to the stair is via a protected corridor. The arrangement is considered acceptable as a result of this separation, the provision of sprinklers and the low occupancy of the area.
Performance wing, first floor	The music room and associated practice rooms are	The arrangement is considered acceptable as a

	in a dead end situation.	result of the separation provided by the protected corridor, the provision of sprinklers and the low occupancy of the area
Commercial salons, ground floor	Escape from the commercial beauty and hair salons on the ground floor is only available into the base of the atrium via the lobbies provided.	The arrangement is considered acceptable as a result of this separation provided by the protected lobbies, the provision of sprinklers and the low occupancy of the area.
Throughout	Four escape stairs are external to building.	The escape stairs protrude from the building, but are considered only semi-external stairs, and are considered acceptable.
North core	Stair 10 is enclosed in non-fire rated glazing.	This would prevent smoke from a fire on the ground floor prejudicing escape. Due to the sprinkler coverage within the atrium, the possibility of a fire starting on the ground floor adjacent to the glazing and rendering the stair unusable is very low. The non-fire rated enclosure around the stair is therefore considered acceptable.
Throughout	The accommodation stairs will be used as alternative means of escape.	The stairs will be available if the fire is remote from them.
Ground floor	The base of escape stairs serving upper levels are used as means of escape.	The method adopted for sizing the final exit door is to treat the ground floor as an additional level served by the stair. The occupants are then added to the stair occupancy, and the final exit is sized according to the recommended stair size. This stair width is based on a flow rate of people down a stair which is slower than that through a door. This method is therefore more conservative than allowing 5mm per person.
Throughout	The main building is provided with a custom designed sprinkler system.	See Appendix A for full details.

Construction block	This area is not provided with sprinklers.	The primary reason for sprinklers in the building was to prevent a fire growing uncontrollably through the atrium until it were large enough to endanger the Fire Service personnel. The construction block is not in direct communication with the atrium, and it is a compartmentalised area with fire resistance around the individual rooms. It is therefore considered that the possibility of a fire growing sufficiently to present a risk to Fire Service personnel was low enough to warrant the omission of sprinkler protection.
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Conclusions

The design achieves the functional objectives of the AD B by compliance with the prescriptive requirement in most cases, and with the application of fire engineering principles where strict compliance would conflict with the building design concept.

The solutions proposed provide, at a minimum, equivalency with a code compliant solution, without compromising the safety of occupants of the building or fire-fighters.

1 Terms of Reference

1.1 **Basis for fee commission**

The East Durham and Houghall Community College has requested that Faber Maunsell Fire & Risk Engineering (FMFR) provide a Fire Strategy for the development.

The base document for the design of the fire precautions is Approved Document B, fire safety [AD B], and this fire strategy is based upon a fire engineering approach which achieves the functional objectives of AD B.

1.2 **Scope of Work**

This Report outlines the fire safety strategy for the building and is a summary of the provisions discussed with the Approving Authorities.

The base document for the design of the fire precautions is the Building Regulations Approved Document B, fire safety [AD B] and its recommendations are assumed to be included in the design unless highlighted in this or later reports. All five aspects of the AD B will be addressed.

The AD B refers to other documents and the recommendations they contain are assumed to be included in the design unless highlighted in this or subsequent Reports. They include BS5588: Pts 5, 7, 8 and 12 addressing fire-fighting, atria, managing the disabled and building management respectively. BS5839 and BS5266 are assumed to be included for detection and escape lighting.

The fire strategy addresses life safety under the Building Regulations and The Regulatory Reform (Fire Safety) Order, but not fire risk assessments, which are the client's responsibility. It does not specifically address either property protection or business disruption. Building insurers should be consulted over the proposals since their preferences are sometimes more onerous. However, in that much damage is attributable to the effects of smoke, by addressing the needs of life safety, these other aspects are to some extent also addressed.

The fire strategy does not address fire precautions during the building works for which the risks and hazards can often be higher. The HSE issues guidance on identifying and managing fire precautions during the works and they should be consulted accordingly.

2

The Building Use and Structure

The proposed college development is at the site of the current college between Beverley Way and Burnhope Way. It consists of the main college building and an extension to the existing single level sports hall to the east of the main building. It will house mainly 14-18 year old students, so is therefore classed in the Assembly & Recreation purpose group. It houses primarily teaching and office space, with ancillary space for dining, plant, library etc. As a community college significant teaching space is given over to vocational courses, and as a result there are workshop areas for joinery, welding etc. There are also commercial hair and beauty salons at ground floor. The new extended sports hall building will house a main hall, fitness suite, boxing gym, changing rooms, a physio room and stores.

The main building comprises lower ground, ground and two upper floors. The building height to the finished floor level of the highest occupied floor is approximately 8.4m when measured from ground floor level, and its maximum dimensions are 170m long by 50 wide. The south wing, which for the purpose of this report will be referred to as the construction block, does not continue above ground floor and is the only part of the building with a lower ground floor. The ground level slopes so that the lower ground floor is at access level, and therefore the yards are at access level. A central atrium is present which runs the whole height of the building, and almost the full length (does not serve the construction block). The sports hall building is single level, and its maximum dimensions are 75m long by 32m at its widest point.

The total approximate floor areas are 16,000m² for the main building and 2300m² for the new sports hall. Table 2.1 details the occupancy of the development. These occupancy figures are based on the floor space factors from AD B and DD 9999 (for the teaching and gym areas). The typical factors used were: -

- Offices – 6m² / person
- Classrooms – 2m² / person
- Teaching labs – 3m² / person
- Workshops – 5m² / person
- LRC – 7m² / person
- Dining room – 1m² / person
- Sports Hall – 10m² / person
- Fitness suite – One person per machine
- Boxing gym – 10m² / person

Where seating is provided, for example in the theatre, occupancy has been calculated on the number of seats. Further to this, occupancy has been assumed on what was considered to be reasonable.

The Dining Hall was not included in the total occupancy as the Dining Hall would be full when other parts of the building are not (i.e. lunch time). The total occupancy not including the seating in the dining room is 2428 people, and the dining room holds 594 people. Therefore assuming that if the dining room were full, other parts of the building would not be does not assume that all the classrooms are empty. It assumes that approximately 25% of the occupants are in the dining room, while up to 75% of the rest of the building is occupied.

This 'double counting' assumption has also been applied to the changing facilities in the sports hall.

Table 2.1 Building Occupancies

Floor	Use	Occupancy
Main Building		
Lower ground	Teaching workshops	270
	Ancillary accommodation	4
	Total	274
Ground	Teaching	667
	Office	35
	Dining Hall	594
	Performance Theatre	180
	LRC	39
	Ancillary accommodation	23
	Total without Dining	944
First	Teaching	488
	Office	116
	LRC	102
	Ancillary accommodation	10
	Total	716
Second	Teaching	402
	Office	92
	Total	494
Sports Hall building		
Ground	Sports hall	128
	Fitness Suite	31
	Boxing Gym	33
	Ancillary accommodation	5
	Total	197
Overall total (without dining hall)		2625

The building is served by five escape stairs plus four accommodation stairs. These stairs are numbered as follows: -

- Stair 2 – The escape stair in the south core.
- Stair 3 – The accommodation stair at the centre of the south core. This stair serves the lower ground floor.
- Stair 4 – The escape stair in the south core.
- Stair 5 – The escape stair in the central core.
- Stair 6 – The accommodation stair at the centre of the central core serving ground and first floor only.
- Stair 7 – The escape stair in the south core.
- Stair 8 – The accommodation stair linking the ground and first floor LRC.
- Stair 10 – The escape stair in the north core, enclosed in non-fire rated glazing.
- Stair 12 – The accommodation stair in the atrium base linking ground and first floors.

3 The Fire Strategy

3.1 Aims

The aim of the strategy is to provide early warning of fire, adequate and secure means of escape and well protected access for firefighters.

3.2 Fire Alarms and Detection

For a single-stage evacuation regime to be adopted for the development, a detection system to at least the L3 standard of BS5839: Pt 1 should be provided. To avoid unwanted alarms and unnecessary disruption to a building of this nature, an investigation time could be incorporated into the system. The building is provided with a custom designed sprinkler system.

3.3 Evacuation

The development is served by nine stairs in total, which are a mixture of accommodation and external stairs. Where possible, evacuation is via enclosed stairs, with alternative routes provided by the accommodation stairs.

3.4 Access for Emergency Services

With a height not more than 11m, the building does not require firefighting shafts or dry rising mains. The location of public and private roads and car parks around the development provides access to 100% of the perimeter, therefore the Fire Service access to the development is code-compliant.

4 Building Regulation Approval

4.1 Means of Escape – B1

4.1.1 Evacuation regime

For a single-stage evacuation regime to be adopted for the development, a detection system to at least the L3 standard of BS5839: Pt 1 should be provided. To avoid unwanted alarms and unnecessary disruption to a building of this nature, an investigation time could be incorporated into the system.

An aspirating type detection system is provided for the atrium area. This will provide early warning for occupants and reduce the pre-detection and pre-movement time during evacuation. In the rest of the building, conventional fixed point smoke and heat detectors are provided.

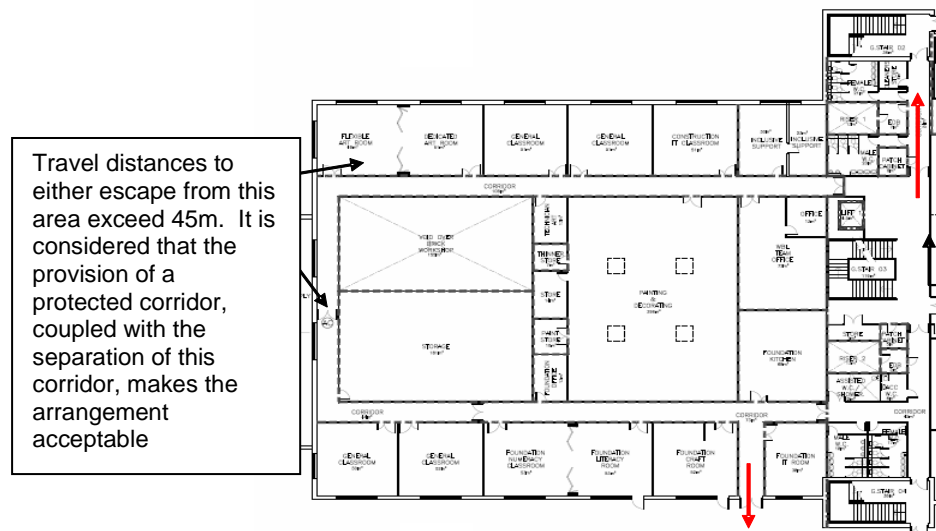
The detection and alarm system in the sports hall building can be a stand alone system, or can be linked in as a zone of the main building system.

4.1.2 Travel distances

The recommended travel distances for Assembly & Recreation buildings are 18m where travel is possible in one direction only, or 45m when possible in more than one direction. Generally these distances are not exceeded, apart from in the following locations: -

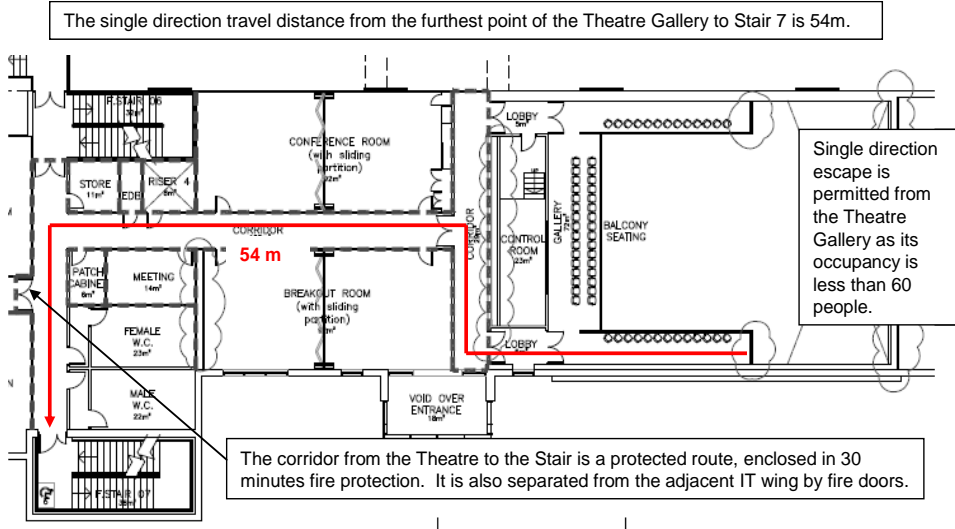
Construction block at ground floor – Two-way travel is available for all rooms in this block but travel distances from some classrooms are up to 52m. Self-closing cross-corridor doors are provided to separate the escape routes, so that travel is potentially smoke logged atmospheres is kept to a minimum, see figure 4.1.2.1. It is considered that the provision of a protected corridor, coupled with the separation of that corridor, makes the arrangement acceptable. In addition, a second exit should be provided from painting and decorating workshop as the travel distance within it exceeds the AD B recommendation. The door should be provided on the opposite side of the room from the current door.

Figure 4.1.2.1 Extended travel distances in south block.



Theatre Gallery at first floor – Escape from this area is only possible in one direction, with the maximum distance being approximately 54m from the end of the gallery into Stair 7 as shown in Figure 4.1.2.2. Escape is not only available into Stair 7, but it is shown in this case as it is the closest stair to the Theatre.

Figure 4.1.2.2 Extended travel distances from the Theatre Gallery.



The occupancy of the Theatre Gallery is 58 people (taken from the number of seats), and therefore a single route is acceptable. The route from the Theatre to the stair is via a protected corridor, enclosed in 30 minutes fire rated construction. If a fire occurs in the Theatre, occupants will be out of the area of risk when they reach this line, a travel distance of 22m. If a fire occurs within one of the rooms between the Theatre and the stair, it will be contained within the room by the fire rated enclosure and self-closing fire door.

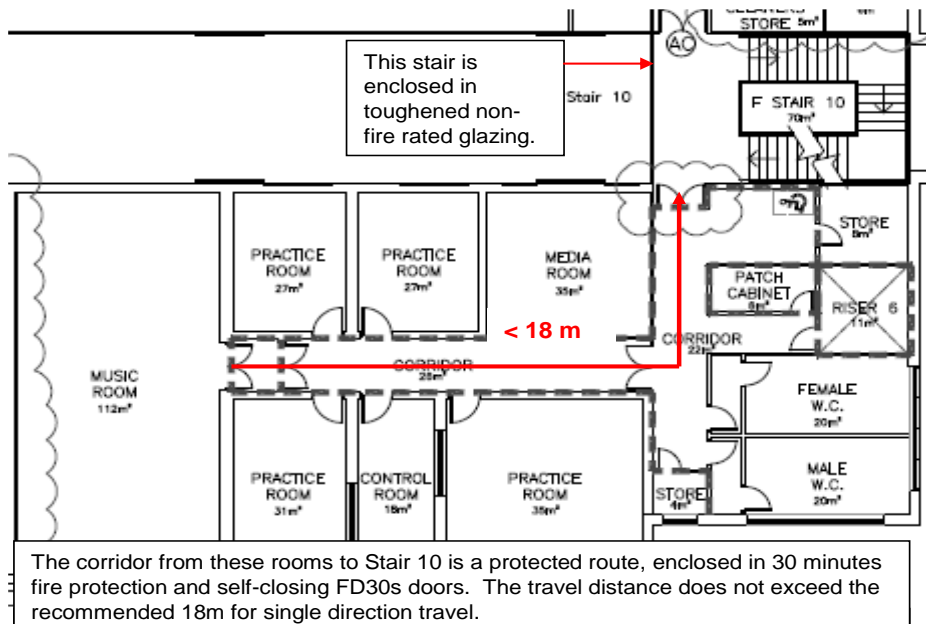
The arrangement is considered acceptable as a result of this separation, the provision of sprinklers and the low occupancy of the area.

4.1.3

Dead-end conditions

The section of the main building housing the music room and associated practice rooms is a dead end situation, as each room is served by a single corridor as shown in Figure 4.1.3.1.

Figure 4.1.3.1 Dead end situation in the performance wing.



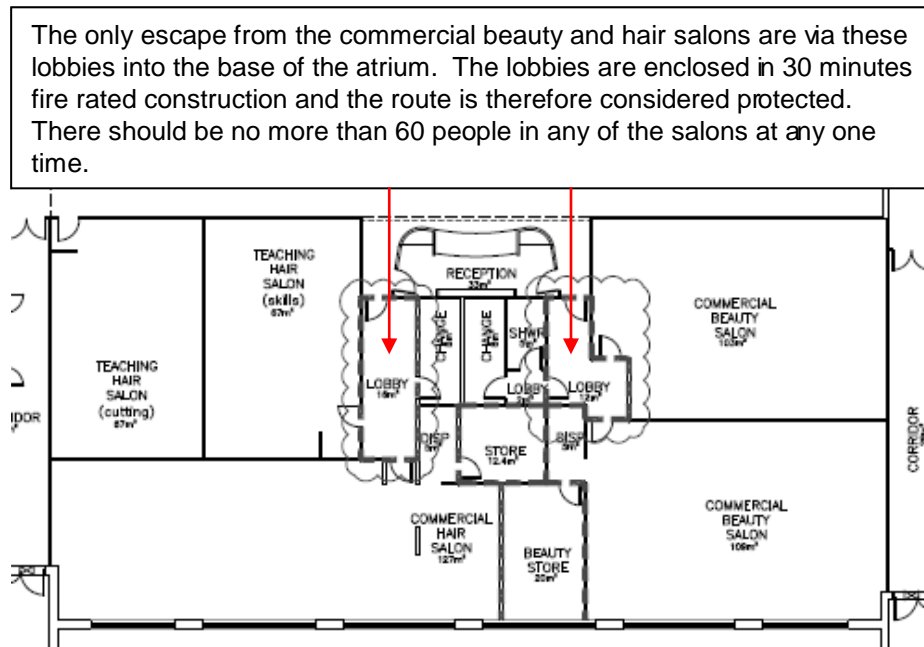
The travel distance in this dead end do not exceed the recommended distances in AD B, but it should be ensured that no more than 60 people are in these rooms at any one time. The route from the rooms to the stair is via a protected corridor, enclosed in 30 minutes fire rated construction. If a fire occurs within one of the rooms, it will be contained within the room by the fire rated enclosure and self-closing fire door.

The arrangement is considered acceptable as a result of this separation, the provision of sprinklers and the low occupancy of the area.

Escape from the commercial beauty and hair salons on the ground floor is only available into the base of the atrium via the lobbies provided, as shown in Figure 4.1.3.2 below. The travel distance in this dead end do not exceed the recommended distances in AD B, but it should be ensured that no more than 60 people are in these rooms at any one time. The lobbies are enclosed in 30 minutes fire rated construction, and are therefore considered protected routes.

The arrangement is considered acceptable as a result of this separation, the provision of sprinklers and the low occupancy of the area.

Figure 4.1.3.2 Dead end situation in the commercial salons.



4.1.4

Escape stairs - enclosure

The 4 enclosed escape stairs, Stairs 2, 4, 5 and 7, protrude from the building, but are not considered external stairs. They will be provided with weather protection at the head and sides of the cores, and will be compliant with Diagram 22 of AD B. They are therefore considered only semi-external stairs, and are considered acceptable. In line with their classification as semi-external stairs the doors onto them should be self-closing FD30s doors, apart from at the second floor where the doors are not required to be fire rated. In addition, any part of the external envelope of the building within 1800mm of (and 9m vertically below), the flights and landings of the stairs should be of 30 minutes fire-resisting construction, except that the 1800mm dimension may be reduced to 1100mm above the top level of the stair.

Stair 10 is the escape stair located at the north of the building. It is enclosed in non-fire rated glazing, which would prevent smoke from a fire on the ground floor prejudicing escape. Due to the sprinkler coverage within the atrium, the possibility of a fire starting on the ground floor adjacent to the glazing and breaking the glass to render the stair un-usable is very low. The non-fire rated enclosure around the stair is therefore considered acceptable.

4.1.5

Escape stairs – widths

The building is served by 9 stairs in total, but Stairs 6, 8 and 12 are not included in the means of escape strategy.

In addition to the escape stairs detailed above, Stair 3 is used as an alternative means of escape, on the grounds that it will be available if the fire is remote from it. For example, if the fire were located close to Stair 10, it would be highly unlikely that access to Stair 3 would also be unavailable in the escape period. Therefore the worst case scenario for stair width calculation would be a fire local to one of the accommodation stairs discounting that stair throughout the whole height of the building. Table 4.1.4.1 details the stair occupancies and resulting minimum stair width requirements.

Table 4.1.4.1 Stair occupancies and resulting minimum width if fire discounted one accommodation stair throughout the height of the building.

Floor	Stair occupancy					
	2	3	4	5	7	10
1	143	143	143	143	143	143
2	99	99	99	99	99	99
Total	242	242	242	242	242	242
Required stair width (mm)	1100	1100	1100	1100	1100	1100

4.1.6

Exit widths

The doors into the stairs at upper levels should be not less than 1050mm.

The ground floor of the main building houses approximately 1538 people when the dining room is full, and there are several exits from this level, including through the base of the escape stairs. In order to prevent bottle-necking at the base of the stair the final exits are sized so that they have adequate exit flow capacity.

There are nine exits from the ground floor, and for the calculation of final exit width the widest needs to be discounted, resulting in 193 people per exit. The current provision of final exit doors at ground level is suitable for this number of occupants.

People at the ground floor evacuating via the base of a stair serving the upper levels is not dissimilar to occupants of a storey entering the stair itself. For this reason, the method adopted for sizing the final exit door is to treat the ground floor as an additional level served by the stair. The ground floor occupants are then added to the stair occupancy, and the final exit is sized according to the recommended stair size from Table 7 of AD B. This stair width is based on a flow rate of people down a stair which is slower than that through a door. This method is therefore more conservative than allowing 5mm per person.

As stated above, the dining room will only be full at mealtimes, in which case the occupants in there will not be in the classrooms. To calculate the required final exit width, therefore, the 594 people in the dining room will be substituted from the stair occupancies. The stairs, therefore, house 123 occupants at the two upper levels and 193 people at ground level resulting in a final exit door width of 1580mm at the base of the stairs. The final exit doors, therefore, should be not less than 1600mm wide.

The sports hall maximum occupancy is 197 people, and there are 8 exits, all leading to places of safety outside the building. These doors should be no less than 850mm wide, and if the so the escape provision from the sports hall building is acceptable.

4.1.7 *Evacuation of the disabled*

A disabled refuge will be accommodated in each escape stair. Typically an area of 1400 x 900mm is recommended, provided with a two-way communication system and the location of the refuge should not interrupt the flow of persons leaving the building. The system should be linked so that at a control point somebody will be able to communicate to all the building refuges.

A regime for managing the evacuation of the disabled should be drawn up and agreed with the fire authority.

4.2 **Internal Fire Spread Linings – B2**

On wall and ceiling linings, the proposals will be code-compliant, Class 0 being provided on escape and circulation routes and Class 1 elsewhere.

4.3 **Internal Fire Spread Structure – B3**

4.3.1 *Fire resistance to elements of structure*

Fire resistance to the elements of structure should be code compliant. The main building height is not more than 18m, and Table A2 of the AD B recommends 1-hour fire resistance for the elements of structure.

4.3.2 *Sprinklers*

During the initial discussion with the Fire Service, it was stated that the primary reason for sprinklers in the building was to prevent fires growing uncontrollably until they were large enough to endanger the Fire Service personnel. The atrium offers a route for fire spread between floors, and the client wants the flexibility to locate combustible material in the base. The Fire Service therefore considered the possibility of a fire growing, involving the atrium, and then potentially involving the majority of the building too high and wanted sprinkler protection to reduce this risk. Sprinkler protection, however, is not provided to the lower ground and ground floor construction block, as they are not in direct communication with the atrium. In addition, they are compartmentalised areas with small rooms and fire resistance around the individual rooms. It was therefore considered that the possibility of a fire growing sufficiently to present a risk to Fire Service personnel was low enough to warrant the omission of sprinkler protection.

4.3.3 *Compartmentation*

The main building is provided with a custom designed sprinkler system, full details of which are provided in Appendix A of this report. In line with its assembly & Recreation classification, the maximum sprinklered compartment size is 4000m² per floor.

The construction block is not covered by the sprinklers, and is compartmented from the rest of the main building by 60 minutes fire rated construction. There is no compartment construction within the main building apart from this separation, as no floor exceeds 4000m².

The sports hall building is not sprinklered, and therefore the maximum compartment size is 2000m². The main sports hall is separated by 30 minutes fire rated compartment construction. This results in two compartments of approximately 1280m² and 1110m², and is therefore considered code-compliant.

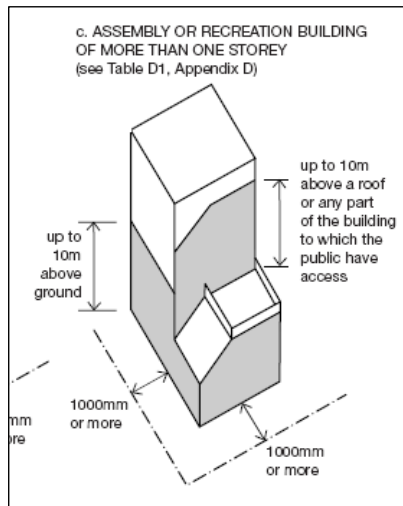
The Approving Authorities require the Cleaners Cupboards to be enclosed in 30 minutes fire protection, with self-closing FD30s doors.

4.4 External Fire Spread – B4

4.4.1 External walls and roof

Due to its use as an Assembly and Recreation building, the external PVC wall cladding and timber planking will satisfy Diagram 40c of the AD B, below.

AD B Diagram 40c Provisions for external surfaces of walls, Assembly or recreation building of more than one storey.



The grey construction represents index (I) not more than 20 (National class) or class C-s3, d2 or better (European Class). Timber cladding at least 9mm thick is also acceptable. (This index I relates to tests specified in BS476: Part 6).

4.4.2 Proximity to boundaries

There are no other buildings close to the boundaries of the site, and therefore no risk of external fire spread across this boundary.

4.5 Access and Assistance to the Fire Services – B5

4.5.1 Access to and into the building

With the building height not more than 18m there is no recommendation in AD B for firefighting shafts. With the location of roads and car parks around the development, the fire service can get access to 100% of the perimeter of the main building. Access is also provided to more than 15% of the sports hall building, and therefore the development is code-compliant.

4.5.2 Fire hydrant provision

As far as we are aware from the Durham and Darlington Fire Hydrant map, there is an existing hydrant within 100m from the building adjacent to Beverley Way. It is therefore not required to provide any additional fire hydrants.

Appendix A - Sprinklers

The following sprinkler specification is taken from Technical Bulletin 221: 2005: 1 Sprinkler protection of schools.

The sprinkler system will be fed by a town main which, in line with the OH2 classification, should have a minimum flow rate of 725 l/min and pressure of 1.4 bar.

The pumpset will be electrically powered, with supply to the pump controller used solely for the sprinkler pumpset and separate from all other connections. It shall be taken from the input side of the main switch on the incoming supply to the premises. All cables should be protected against fire and mechanical damage. The electrical connections in the main switchboard shall be such that the supply to the pump controller is not isolated when isolating other services.

The following conditions shall be monitored: -

- Power available to the motor and, where AC, on all three phases;
- Pump on demand;
- Pump running;
- Start failure.

All monitored conditions shall be visually indicated individually in the pump room. They shall also be visually indicated at a location permanently attended by responsible personnel. Pump running and fault alarms shall also be audibly indicated at the same place.