Fire Safety Design in Education Premises

Common design practices and guidance documents that drive the design of new and existing educational buildings, looking at Life Safety and Property Protection principles and following prescriptive and performance designs.

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Work Experience

Hammersmith and Fulham Gateway
Sobell Secondary School
All Saints Primary
University of Bristol
Welldon Park Juniors School

Richmond Upon Thames College
Orchard Hill Secondary and SEN
North Brent Secondary
University of Leeds
Manchester Metropolitan University

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What is Fire Engineering?

The What, the Why and the How.

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WHAT is Fire Engineering

The term fire engineering continues to be widely misused and not well understood. It is worth noting at this point that there are two main types of fire engineering:

Fire ***protection*** engineering; and

Fire ***safety*** engineering

Fire Safety Engineering

Where the engineer is responsible for the design of fire strategies and evacuation planning where we design a safe route of egress from a building to allow all occupants to reach a place of relative or ultimate safety.

This includes the location and number of stairs, design of smoke control regimes and designed structural fire protection measures.

But WHY is it important

Building Regulations

Since April 2001, all new building work in schools has been subject to approval under the Building Regulations.

The functional requirements B1 to B5 of Schedule 1 of the Building Regulations are as follows:

- B1: Means of detection, warning and escape
- B2: Internal flame spread, surfaces and linings.
- B3: Internal flame spread, structure and compartmentation.
- B4: External flame spread.
- B5: Access for the fire services.

Regulation 38

Simple Buildings

For most simple buildings, basic information on the location of fire protection measures may be all that is necessary. This could be provided by way of an "as-built" plan of the building showing:

- Escape routes;
- Comparmentation;
- Fire doors; etc.

Complex Buildings

For more complex buildings, a more detailed record of the fire safety strategy is required to detail:

- a detailed fire strategy report;
- details of passive fire protection measures;
- details of active fire protection measures; etc.

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A Note of “Complex” Buildings

Just because a building may be of simple geometry, this does not mean it is a “simple” building.

The use and operations may create complexities, for example:

- A zoned/phased evacuation
- Mobility impaired person, e.g. a hospital or nursing home;
- Specialist operations, e.g. SEN Schools, etc.

So HOW do you design it

There are generally two ways of demonstrating compliance with statutory Building Codes and Regulations:

- Prescriptive design; or
- Fire engineering approach

What is engineered

Typically, there are two main ways in which to approach a fire engineered solution, these are:

1. Equivalency; and
2. Deterministic approach

What is prescriptive

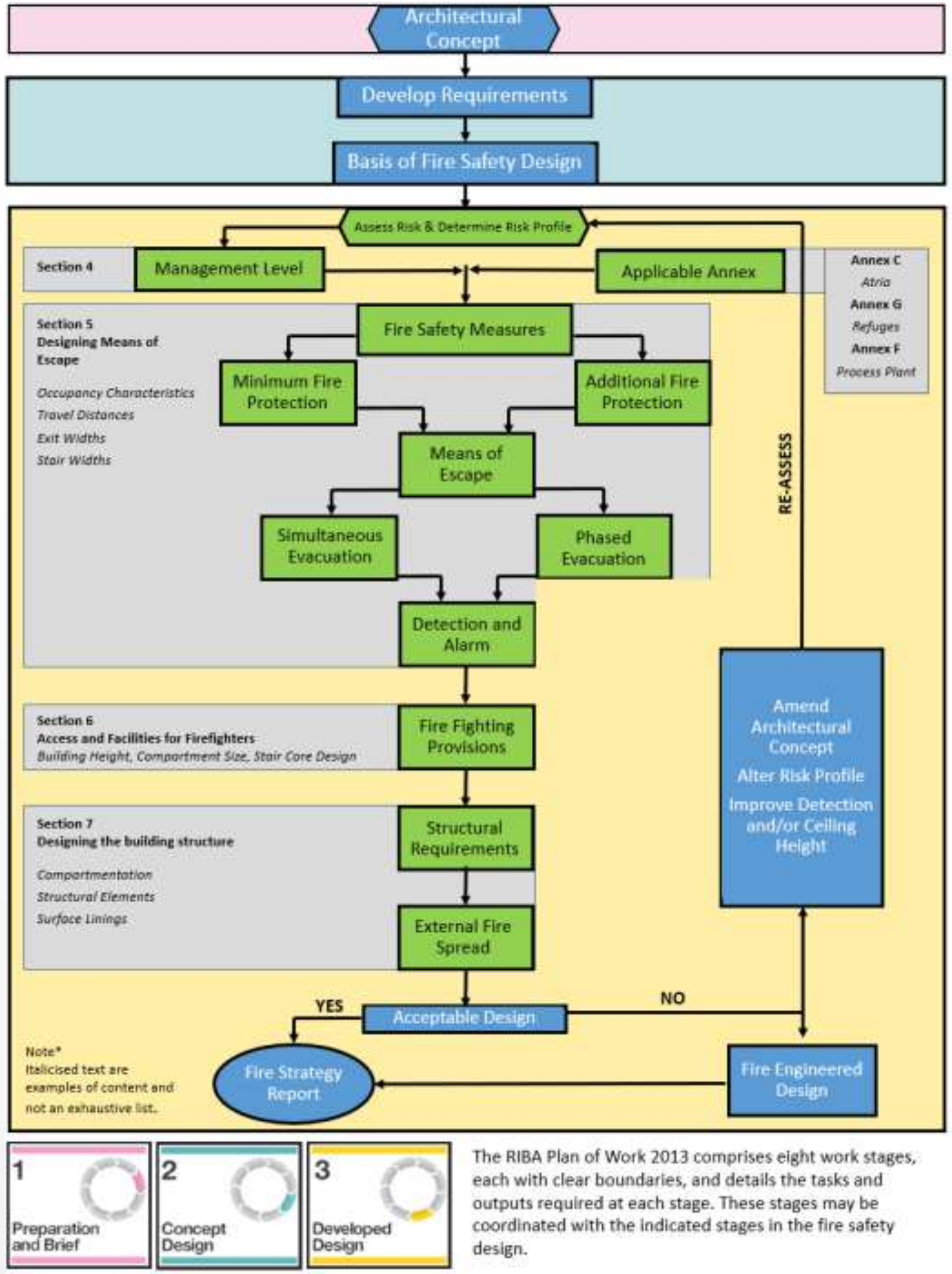
There are primarily three design guidance used in the UK:

Approved Document B, BS 9999 and BB100

Fire Engineering Services

RIBA STAGE	CONSTRUCTION STAGE	FIRE ENGINEERING SERVICES
RIBA Stage 1	Preparation	• Confirm relevant fire safety design objectives for the project • Advise of key fire safety requirements • Highlight any significant constraints • QDR/BoD development
RIBA Stage 2	Concept Design	• Feasibility Review • Fire strategy development • Confirm preliminary principles and strategy with Approving Authorities
RIBA Stage 3	Developed Design	• Full scheme review based on previous stages and agreed principles • Fire engineering analysis (calculations & modelling as applicable) • Address Approving Authority concerns
RIBA Stage 4	Technical Design	• Technical design assistance • Update fire engineering analysis • Fire strategy review and update
RIBA Stage 5	Construction	• Construction stage advice • Site Inspection/commissioning (if required) • Construction phasing fire safety review (if required)
RIBA Stage 6	Handover and Closeout	• Fire systems test attendance • Preoccupation fire risk assessment
RIBA Stage 7	Use and Operation	• Post-occupation fire risk assessment • Fire safety management plan (FSMP)

The Design Steps



Fire Safety in Educational Premises

A general guide to using BB100 and other design guides

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Occupancy

The occupancies of schools are generally taken by using floor space factors.

However, doing this for every space in a school sometimes results in significantly high numbers means much bigger stairs.

This may be rationalised by using a multi-disciplinary review of other services provided, mainly: Toilets.

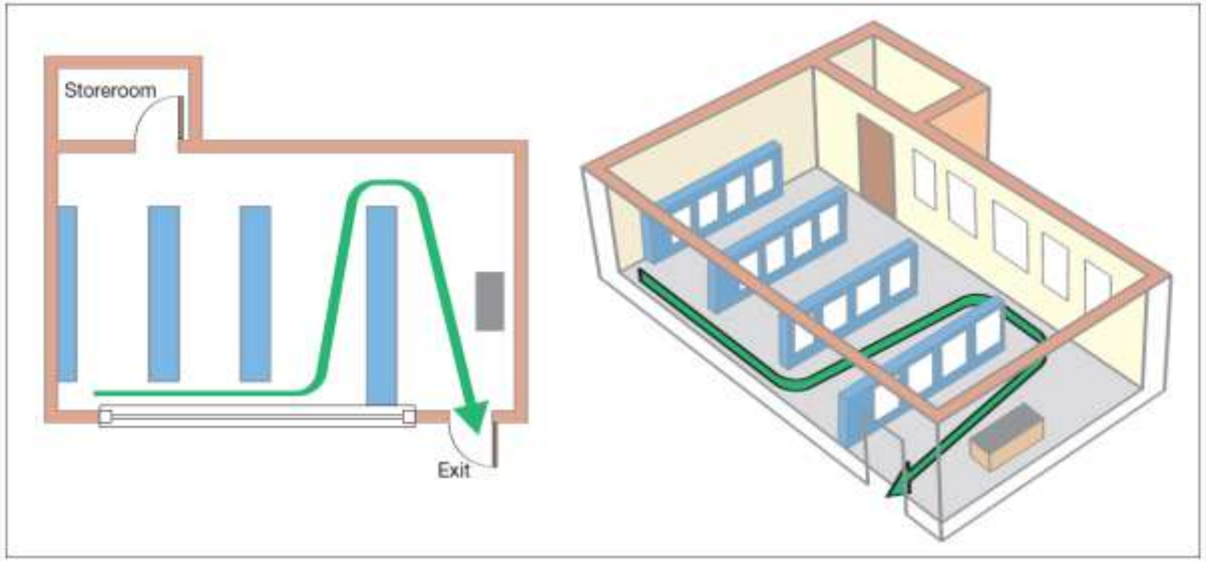
Table 2 Occupant capacity in rooms or areas

Room/Area	Occupant capacity based on floor space factor (m^2/person) or design intent
Classroom/Lecture Room/Study Room	Maximum design capacity (eg, no. of seats)
Dining Room	0.9
Assembly Hall/Dual Purpose Area	0.45
Sports Hall (not used for assembly or examinations, etc)	5.0
Store Room	30.0
Office	6.0
Staff Common Room	1.0

Means of Escape

- Determining the required travel distances and route widths
- Providing protected corridors and stairs
- Providing refuges for disabled occupants
- Ensuring all routes have adequate signage and emergency lighting, etc.

Horizontal Escape



Travel Distances are generally taken as:

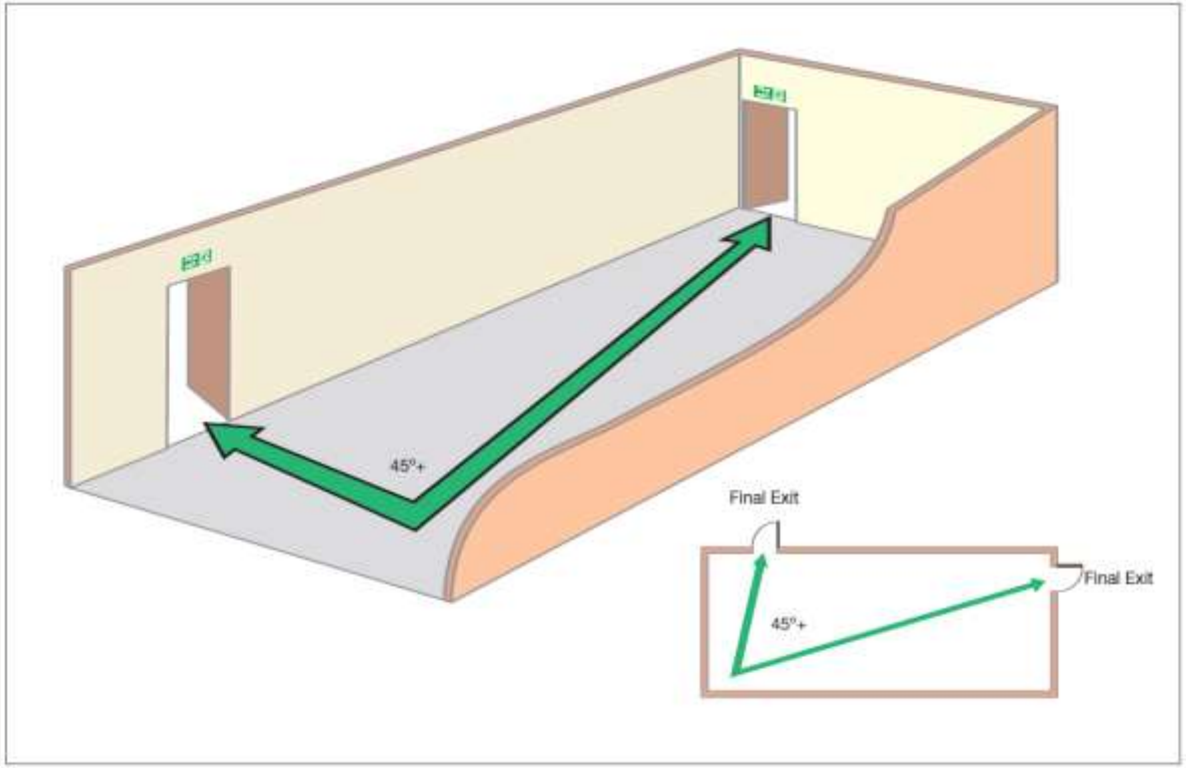
18m in SDT

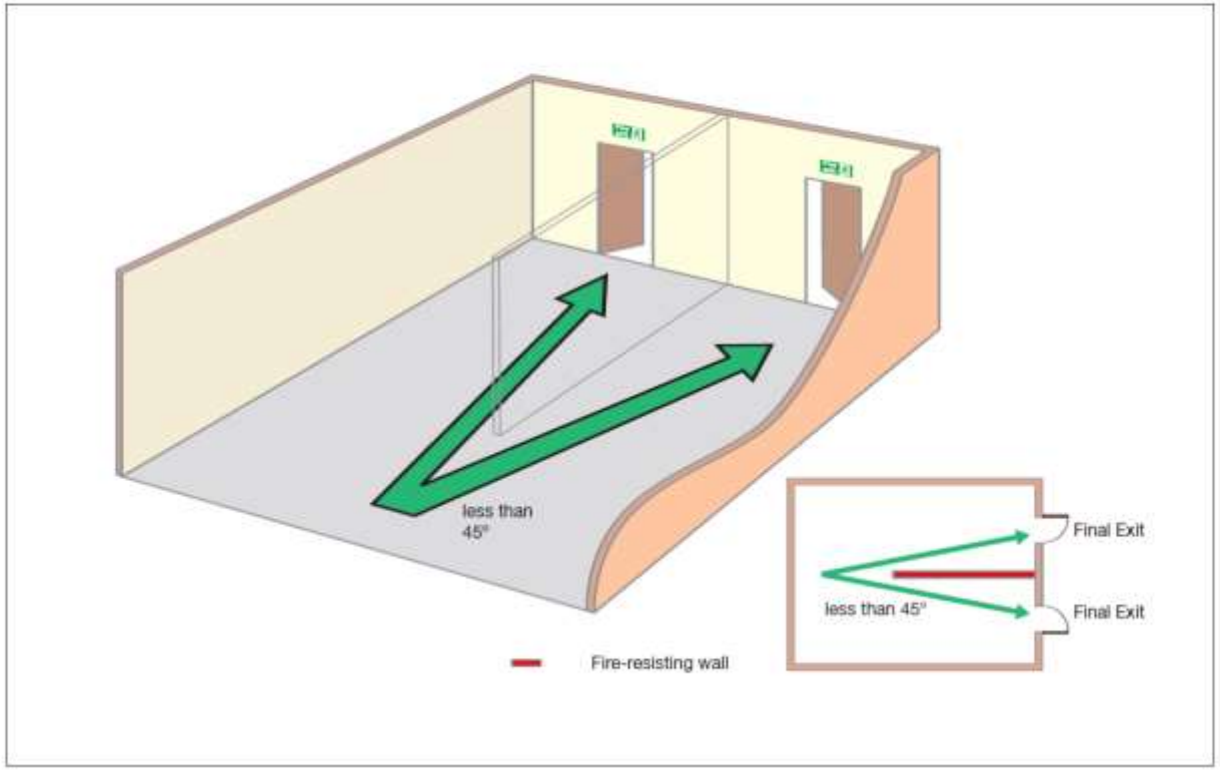
45m in MDT

This is taken around obstacles, as direct travel is taken as 2/3 the actual

Alternative Exits

At least 45º difference between each exit





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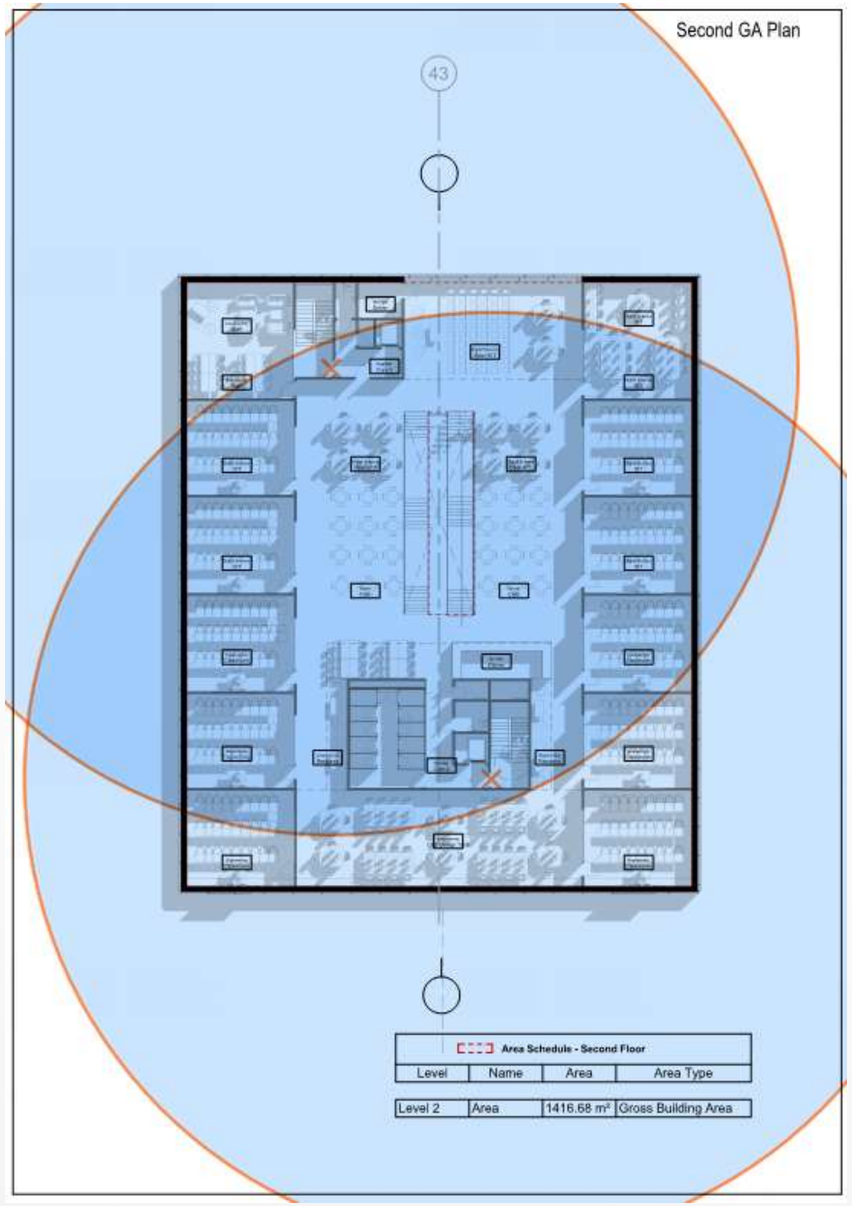
Stair Design

Travel Distances are generally taken as:

- 18m in SDT
- 45m in MDT

This is taken around obstacles, as direct travel is taken as 2/3 the actual.

Therefore, a tip for stair placement is to use a 12m radius for a single stair or 30m radius for multiple stairs to show full coverage for escape.



Open Spatial Planning

Where an open-plan space connects more than one storey.

Escape routes should not be within 4.5m of openings unless:

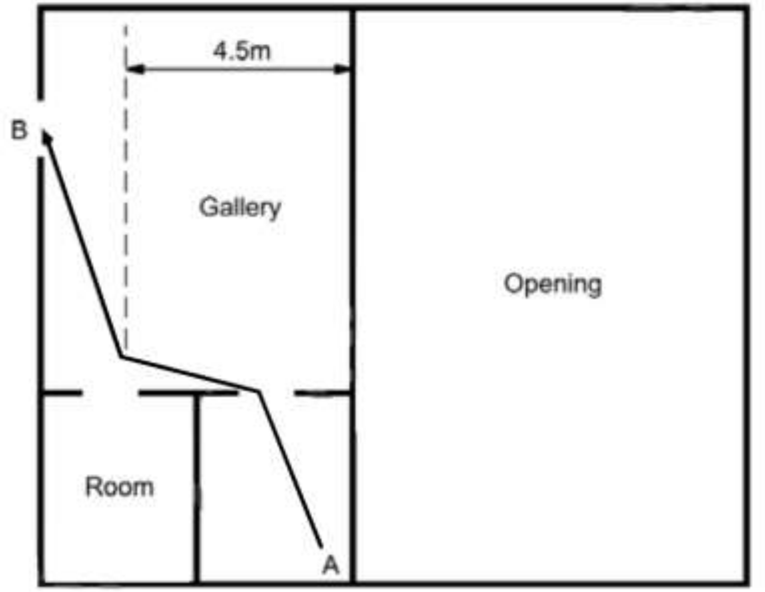
- the direction of travel is away from the opening (e.g, A-B in figure 16a); or
- there is an alternative escape route which does not pass within 4.5m of the open connection (e.g, the rooms with alternative exits in 16b).

Shotton Hall Secondary

Open Spatial Planning

Figure 16a Open connections and balconies

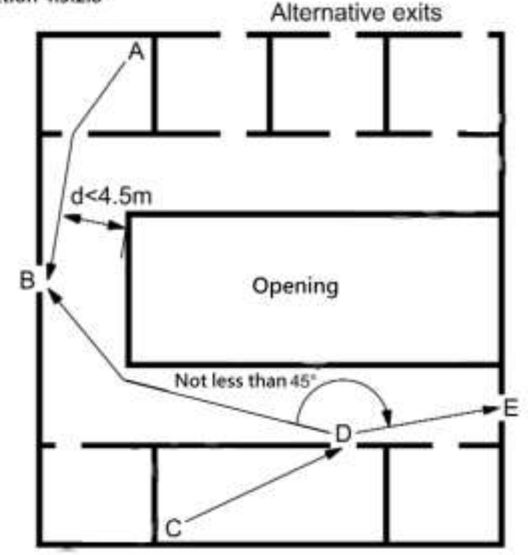
See section 4.3.2.8



The travel distance A-B should be in accordance with table 1.

Figure 16b Open connections and balconies

See section 4.3.2.8



A-B not to exceed 18m (if alternative exits do not exist)

C-D not to exceed 18m (max. length of a dead end)

The shorter of D-B or D-E not to exceed 18m

Rooms without alternative exits are treated as inner rooms (see section 4.3.2.6)

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Opening Separation

For simple balcony openings, single vertical fire curtains can be used.

For larger floor voids, horizontal or concertina curtains are available.

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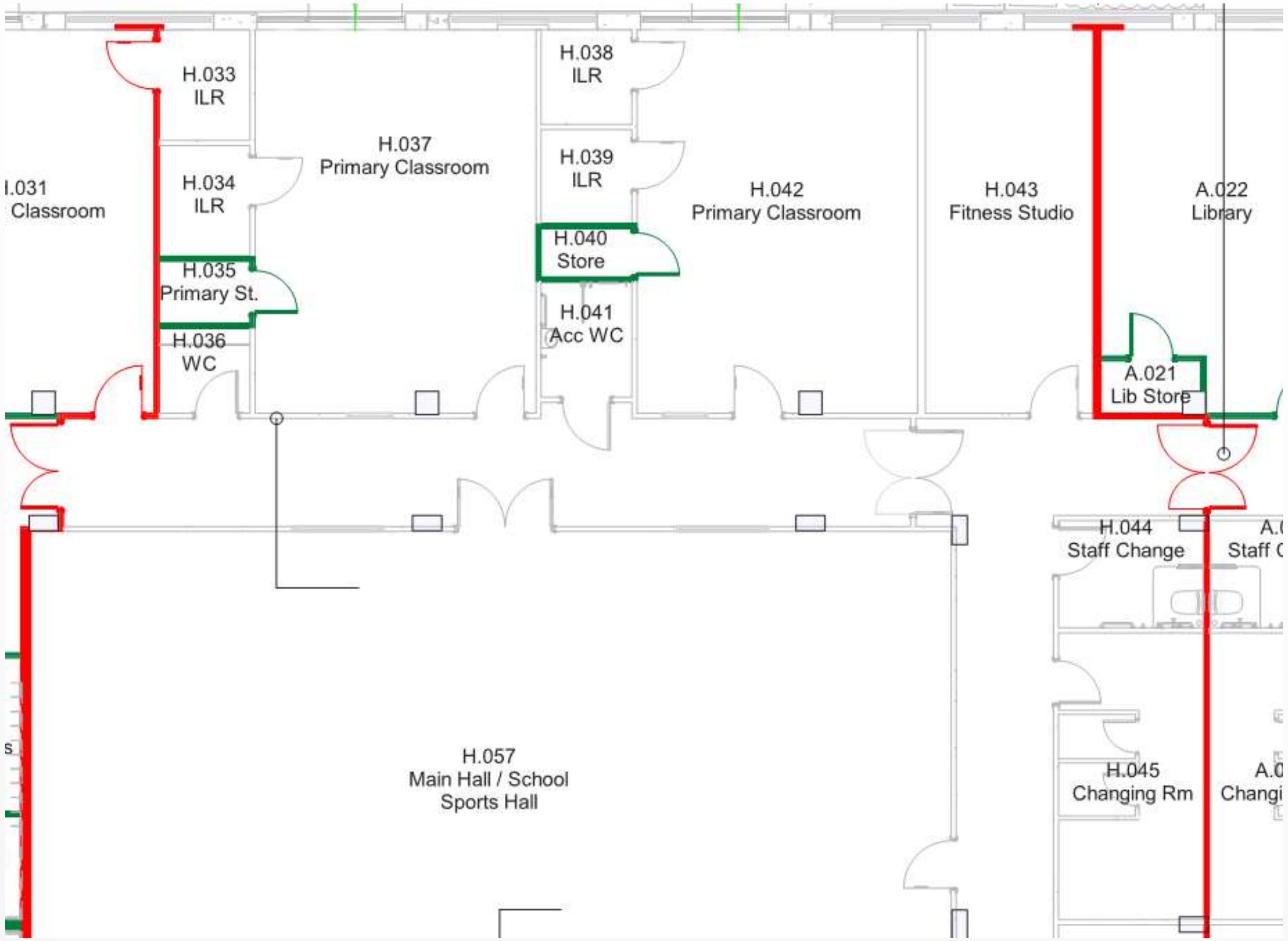
Part M
Corridors

In new schools this minimum width should be at least 1.9m; if the corridor contains lockers the width should be 2.7m; and, smaller corridors (to not more than one or two teaching spaces) should have a clear width of at least 1200mm – this conforms with Approved Document M Access to and Use of buildings.



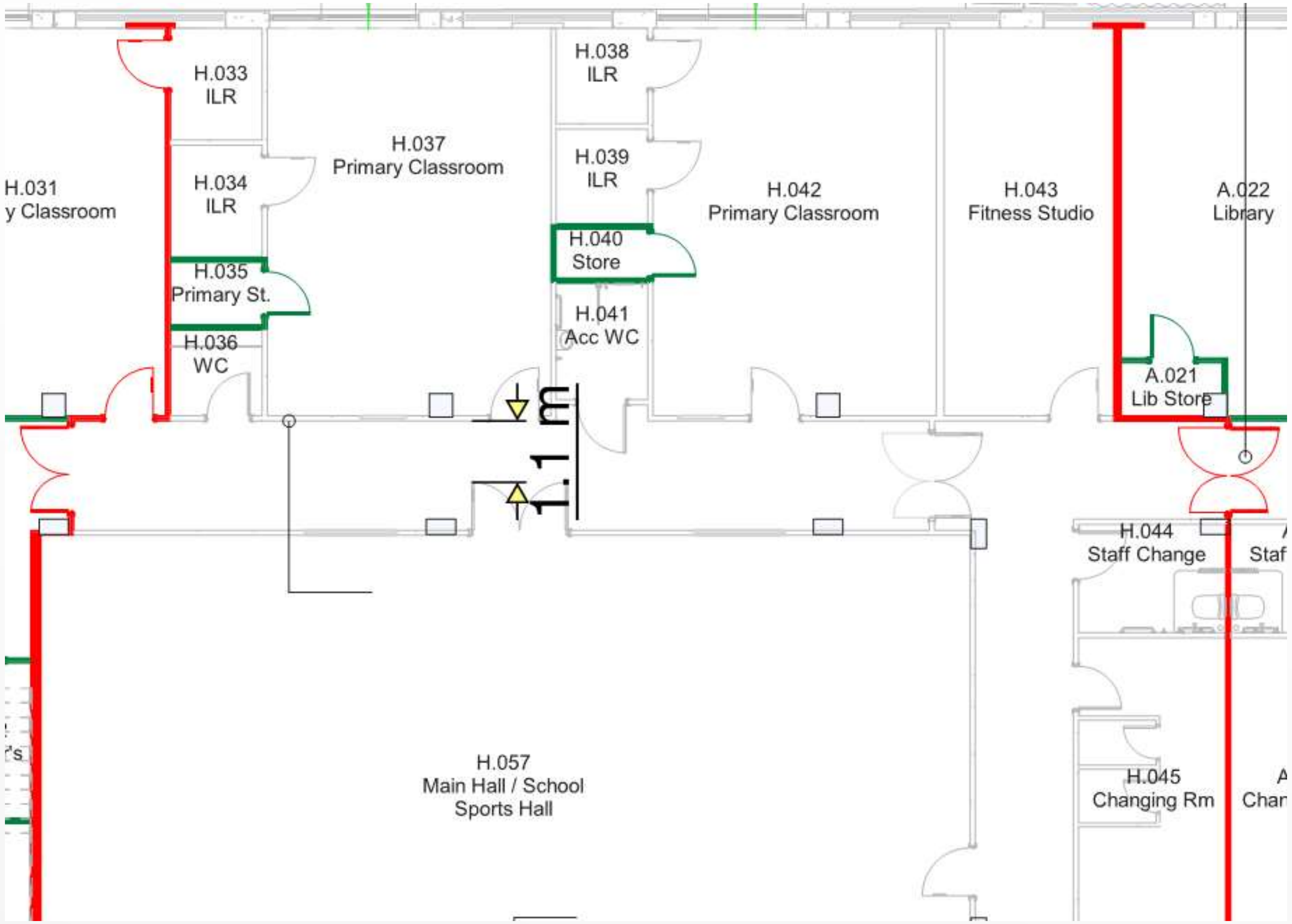
Part M Corridors

Door swings from sports halls typically open outwards, due to the number of occupants.

This impacts on the requirements of Part M.

A solution, although not very architecturally pleasing, is to provide enough doors so that no one door serves more than 60.

This allows you to swing inwards, leaving the corridor clear.



Corridors and Circulation Spaces

The schools' circulation routes will almost certainly be important for relaying information to the pupils by means of notice boards, or used as a display area for eg, pupils' work.

Circulation spaces should therefore have the following considerations:

- Notice boards should be limited to 3m wide with a separation of at least 1m between them.
- If a corridor is lined with lockers then:
  - These should be made from materials of limited combustibility, and
  - any rooms off the corridor should be regarded as inner rooms with the corridor treated as the access room

Enclosure of Special Fire Risk

These are areas that will pose a higher risk to occupants in buildings and therefore need to have additional protection.

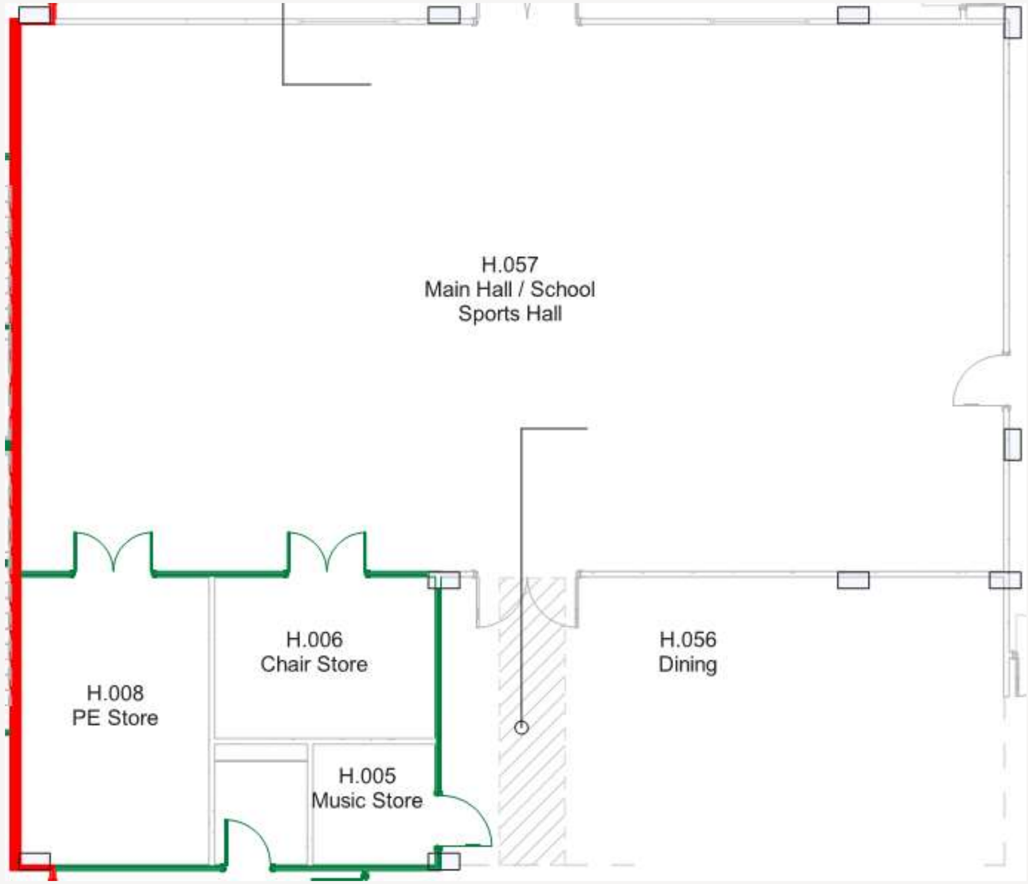
Most buildings will require special fire risks to be enclosed. These areas include:

- Oil-filled transformer and switch-gear rooms,
- boiler rooms,
- storage space for fuel or other highly flammable substances; and
- rooms housing a fixed internal combustion engine.

Special Fire Risks in Schools

Additionally, in schools the list includes:

- science classrooms,
- technology rooms with open heat sources,
- kitchens; and
- stores for PE mats or chemicals.



Automatic Suppression Systems

An on-going debate on whether sprinklers should be installed in schools.

In Scotland and Wales it is now a mandatory policy for new and refurbished schools. However, is there a need for them and what are the pro's and cons?

Is a sprinkler system needed?

Not really
?

So is it worth it?

Pros

They limit the growth of a fire and allow for a more flexible design (BS 9999 vs BB100);

Defends against internal fires and arson;

Business/societal continuity is not as badly affected, loss of a small zone over the whole building;

Protect the property from significant loss; and

Cons

Higher capex and opex;

Space take requirements for tank and pumps;

Limited defence against external fire sources;

Subject to malicious interference (unless concealed heads – con in itself); and

Increase burden on management (testing and maintenance).

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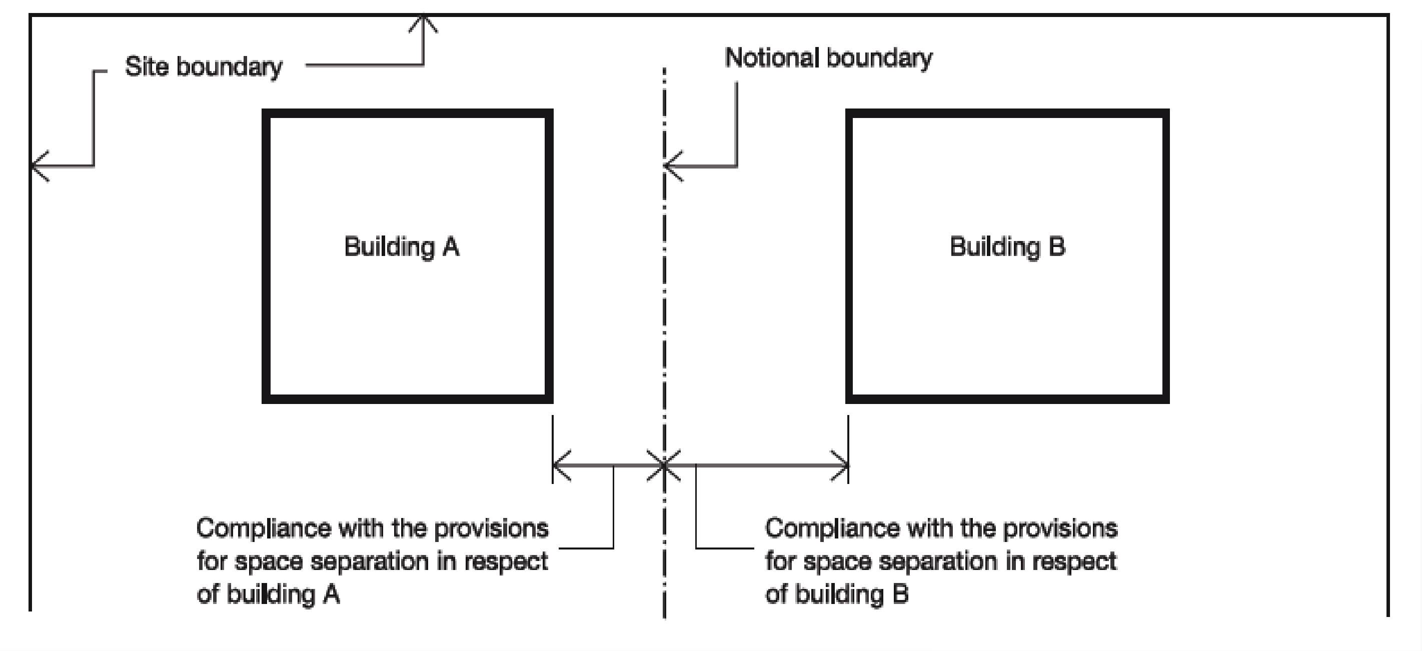
Boundary Conditions

The notional boundary should be set as the site boundary and in the area between two buildings.

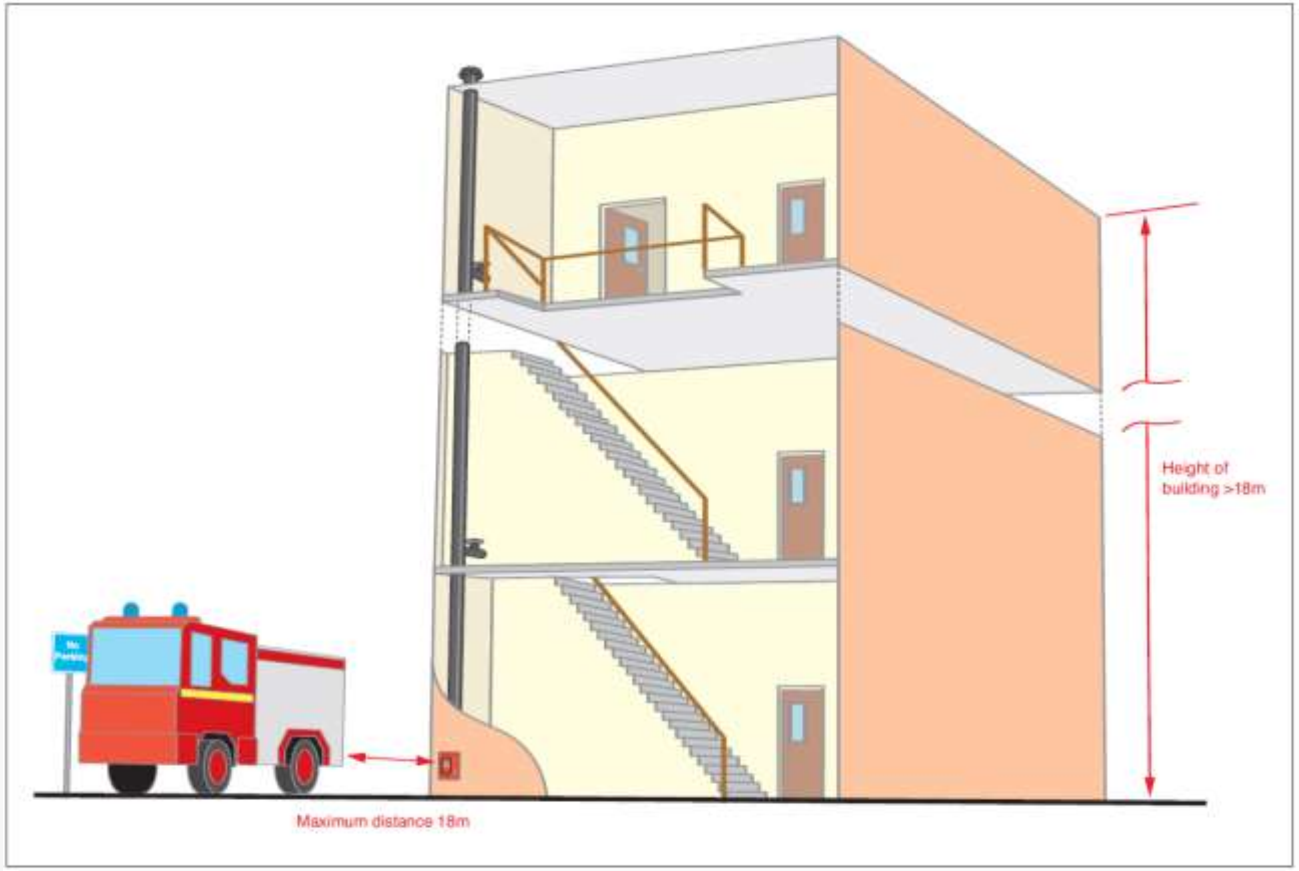
The notional boundary is assumed to exist in the space between the buildings.

This becomes an issue on existing sites where new builds impacting on the site boundaries, requiring fire rated façades.



Fire Fighter Access

We need to allow adequate designs in our buildings to allow ease of access to them for the Fire and Rescue Service



Perimeter Access

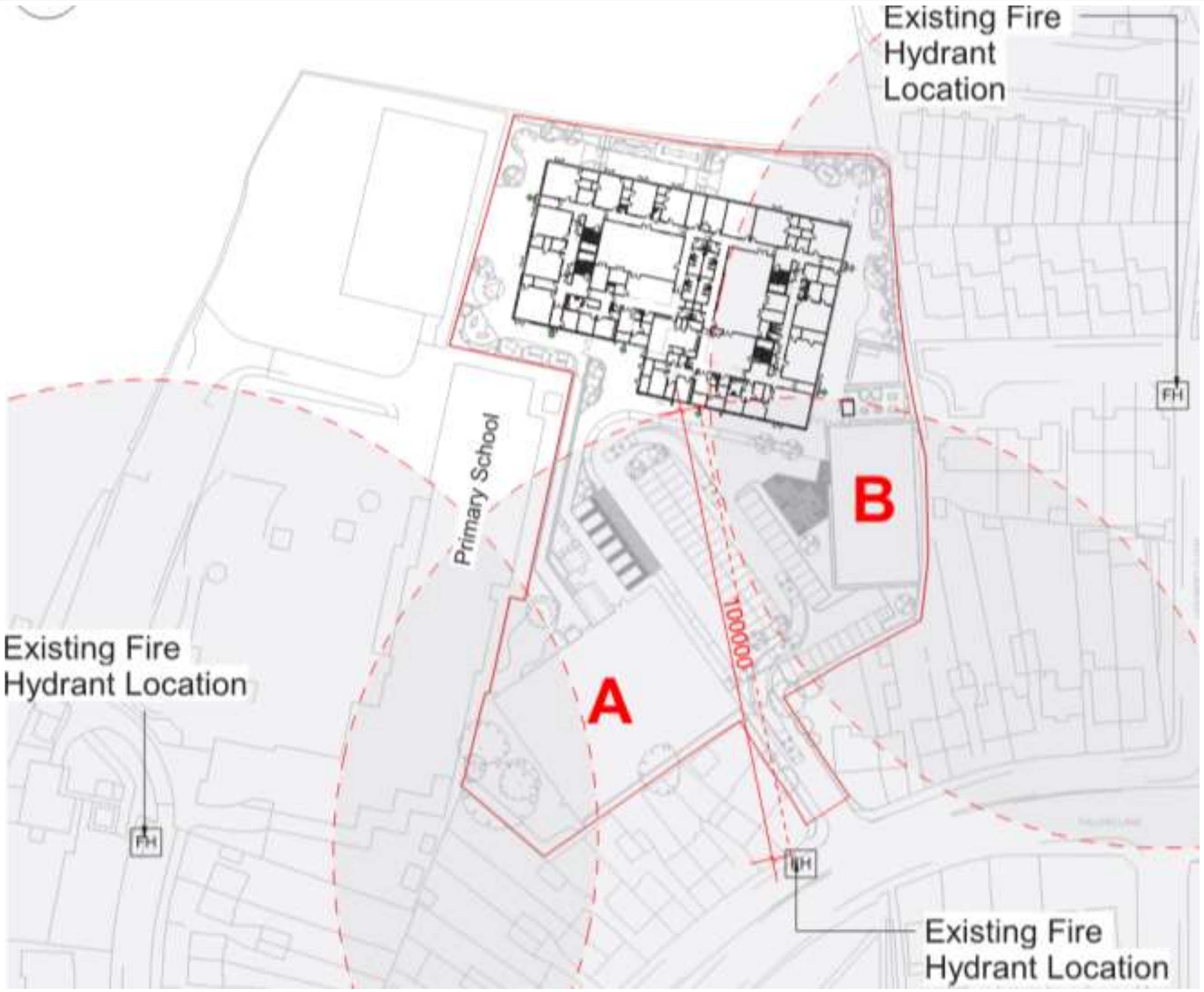
Table 18 Fire and Rescue Service vehicle access to school buildings not fitted with fire mains			
Total floor area[1] of building m²	Height of floor of top storey above ground	Provide vehicle access[2][4] to:	Type of Appliance
up to 2,000	Up to 11	See Note[3]	Pump
	Over 11	15% of perimeter[5]	High reach
2,000-8,000	Up to 11	15% of perimeter[5]	Pump
	Over 11	50% of perimeter[5]	High reach
8,000-16,000	Up to 11	50% of perimeter[5]	Pump
	Over 11	50% of perimeter[5]	High reach
16,000-24,000	Up to 11	75% of perimeter[5]	Pump
	Over 11	75% of perimeter[5]	High reach
over 24,000	Up to 11	100% of perimeter[5]	Pump
	Over 11	100% of perimeter[5]	High reach

Construction, Decanting and Demolition

This school requires 15% however, buildings A and B are being decanted and demolished.

Although the final product will be compliant, the demolition phase limits the access for the fire service.

Is the locations where flipped, then the construction would impact the existing.



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Thank You

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