

Residential Fire Safety

Design and flexibility

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Residential Means of Escape

Houses

- The options

Apartments

Within apartments

- Open plan and Inner room provisions
- Gallery floors
- MOE - Floor is not more than 4.5m above GL
- MOE – Floor more than 4.5m above GL

The Common parts



Houses

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Houses

- Single storey
- Two storey (top floor less than 4.5 metres from GL)
- Three storey (top floor more than 4.5 metres above GL)
- Four storey
- Basements

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Houses 2 storey

- **Means of escape**
Floors not more than 4.5m above GL
- **Ground floor:**
Direct access to an exit
or
Egress window for inner rooms
- **First floor:**
Egress window for habitable rooms
or
Internal protected stairway



Houses 3 & 4 storey

Means of escape – Internal planning
Floors more than 4.5m above GL
Protected escape route or open plan with suppression and smoke protected access to first floor escape window

Means of escape – Internal planning
Floors more than 7.5m above GL
Protected escape route plus alternative exit or suppression



See paras 2.1 to 2.6

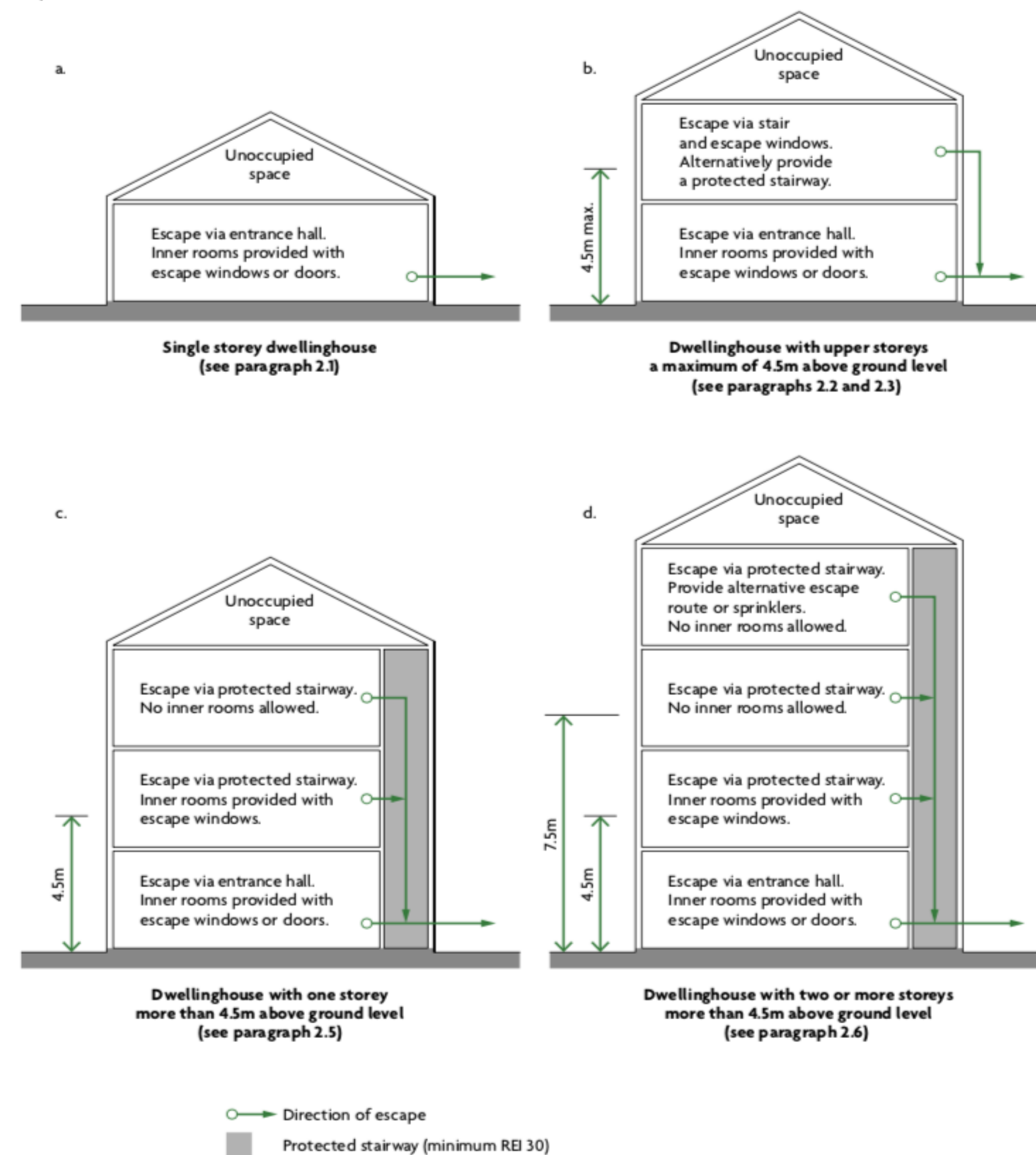


Diagram 2.1 Means of escape from dwellinghouses

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Houses

Inner rooms ADB

- Acceptable as a kitchen, laundry, utility, dressing room, bathroom or gallery
- Any room, not more than 4.5m above GL that has an egress window
- An inner-inner room may be acceptable if it falls under one of the above uses, and, not more than one door separates the room from an interlinked smoke alarm and none of the access rooms are a kitchen



Houses

Escape windows ADB

- Max height of cill 1100mm
- Min height 800mm or 600mm for a window in the roof
- Locks (with or without removable keys) can be fitted with a release catch which may be child resistant
- They should remain in the open position to allow persons escaping.

Basement lightwell escape

- Alternative escape via fixed non corrosive robust ladder (max 70 degree pitch) with stepped rungs and guarding accepted.





Houses – Open plan
ground floor

ADB options for three storey:

- Suppression to ground floor plus
- Separation of ground floor from first floor to allow top floor smoke free access to a first floor escape window plus
- Enhanced fire detection grade D2 LD1 plus
- Kitchen remote from escape route

Or

- Smoke curtain to protect escape route from habitable accommodation as far as the final exit plus
- Enhanced Fire detection grade D2 LD1



House Loft Conversions

Two storey house becoming three storey

Options for protected stairway ADB vol 1

- Replace existing doors to protect stairway with FD20 doors (including bathrooms if they include a heat producing appliance)

Or

- if the existing doors are robust solid doors at least 32mm thick and fit well in their frames these can be retained with enhanced fire detection Grade D LD1

Notes. All glass in doors to be fire resisting in both situations.



Apartments

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Within apartments

Internal planning where top floor is less than 4.5 metres from external GL

ADB vol 1

- Inner rooms are not an issue provided there are suitable escape windows from those rooms



Within apartments

Internal planning where top floor is more than 4.5 metres above GL

ADB Vol 1

- Maximum travel distance and layout guidance provided. Open plan is okay but no inner rooms permitted
- Gallery guidance



See para 3.18

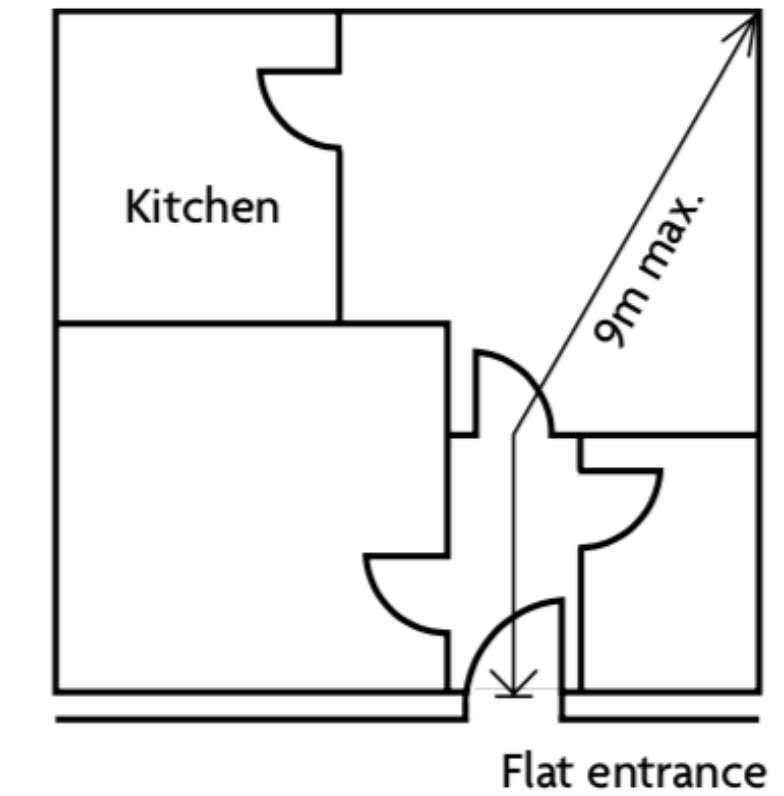
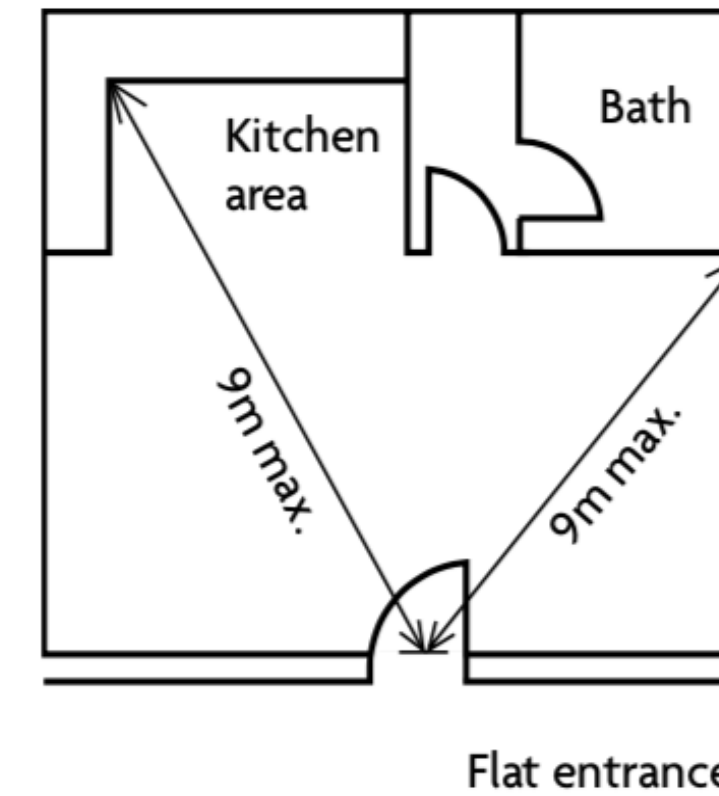
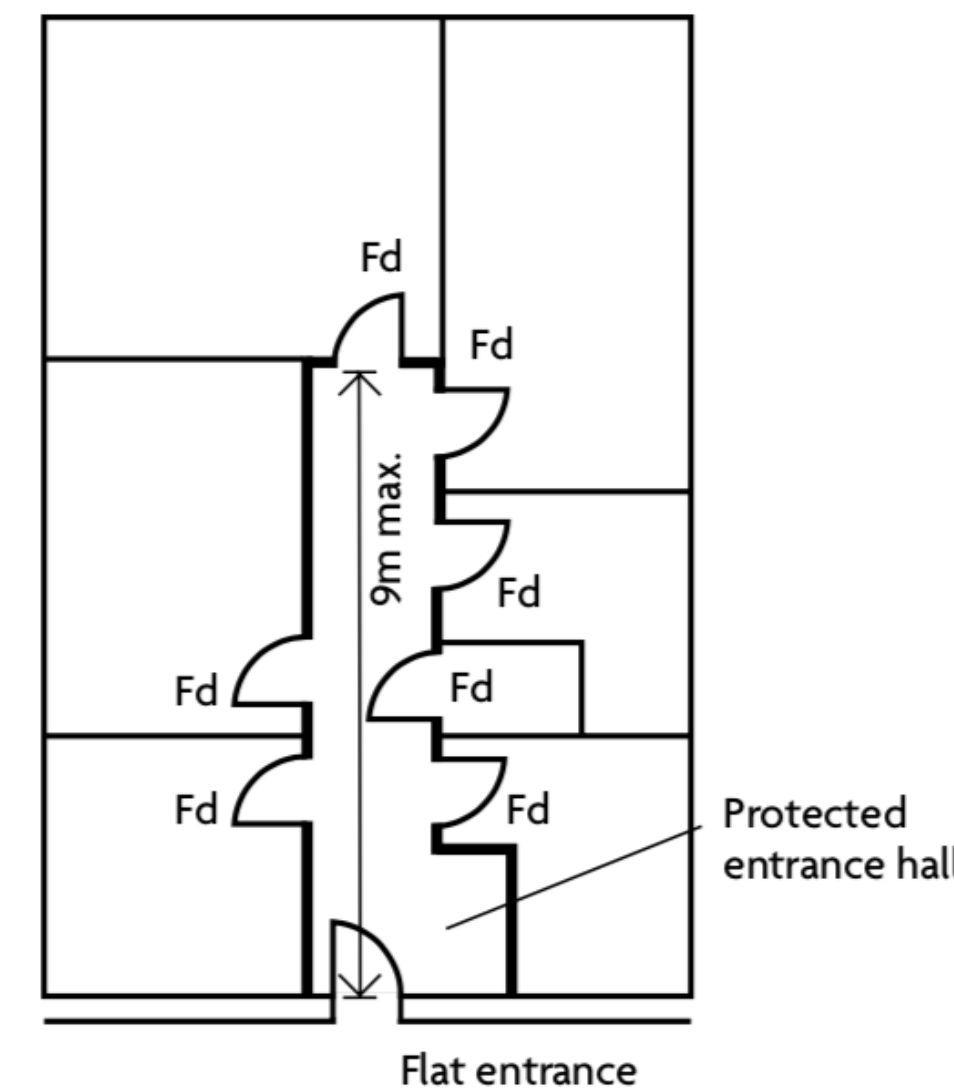


Diagram 3.3 Flat with restricted travel distance from furthest point to entrance



See para 3.18



NOTE: Bathrooms do not need to have fire doorsets provided that the bathroom is separated by fire resisting construction from the adjacent rooms.

Fd Fire doorset
— Fire resisting construction (minimum REI 30)

Diagram 3.2 Flat where all habitable rooms have direct access to an entrance hall



Galleries ADB

Should have an alternative exit or egress window if not more than 4.5m above GL

- If the gallery has neither of the above, it should comply with the following

Gallery Floors

Overlook 50% of the room below

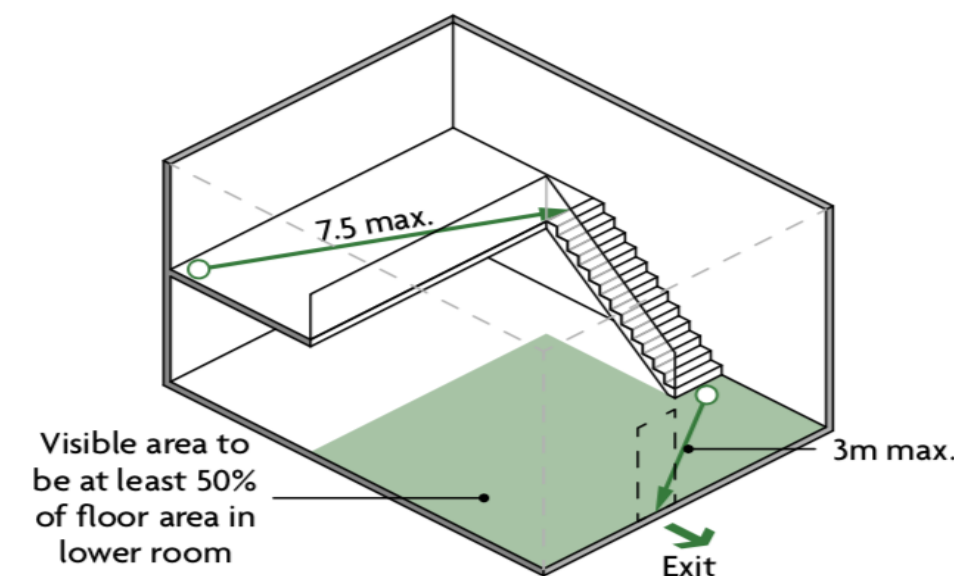
Max 3m from foot of access stair to room door

Max 7.5m across gallery to access stair

Cooking facilities in the access room should be remote or enclosed in FR construction



See para 3.13



NOTES:

1. This diagram does not apply where the gallery is provided with one of the following:
 - i. An alternative escape route
 - ii. An emergency escape window (where the gallery floor is not more than 4.5m above ground level).
2. Any cooking facilities within a room containing a gallery should comply with one of the following conditions:
 - i. Be enclosed with fire resisting construction
 - ii. Be remote from the stair to the gallery and positioned such that they do not prejudice escape from the gallery.

Diagram 3.1 Gallery floors with no alternative exit



Within apartments

Allowable variations without calculated Fire Engineering solutions

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Within apartments

BS 9991: 2015

Open plan flats – Para 9.7

- Open-plan flats that have bedrooms as inner rooms without alternative MOE, may be permitted provided that the flat is fitted with a sprinkler system and a Grade D LD1 alarm
- **Note** *Should not be used for sheltered housing or extra care housing*



Within apartments

BS9991 Open plan flats Conditions to allow inner rooms

- Size should not exceed 16m x 12m
- Single level only [**no gallery**]
- Minimum room height of 2.25m
- The kitchen should be enclosed if the area of the flat exceeds 8m x 4m

Note: Flats smaller than this should have cooking appliances remote from the flat entrance



BS9991 Open plan flat size flexibility with suppression

9.4.2 Flats entered on the same level as the flat

Flats having an entrance on the same level as the flat should meet one of the following recommendations:

- a) the total travel distance from any point of the flat to the entrance door of the flat should be limited to 9 m. This limit may be extended to 20 m if an AWFSS (see 11.2, Table 2) and an LD1 fire detection and fire alarm system in accordance with BS 5839-6:2013 are installed. Cooking facilities should be sited away from the flat entrance door and the internal escape route (see Figure 10); or
- b) a protected internal hallway should be provided that leads off to all habitable rooms having a travel distance not exceeding 9 m from the flat entrance door to the door of any habitable room (see Figure 11); or
- c) all habitable rooms should be accessible from an internal hallway and have an alternative exit from the flat [see Figure 12a)]; or
- d) a 30 min fire-resisting construction should be provided between the living and sleeping areas of the flat and an alternative exit from the bedroom area should also be provided [see Figure 12b)].



See para 3.21

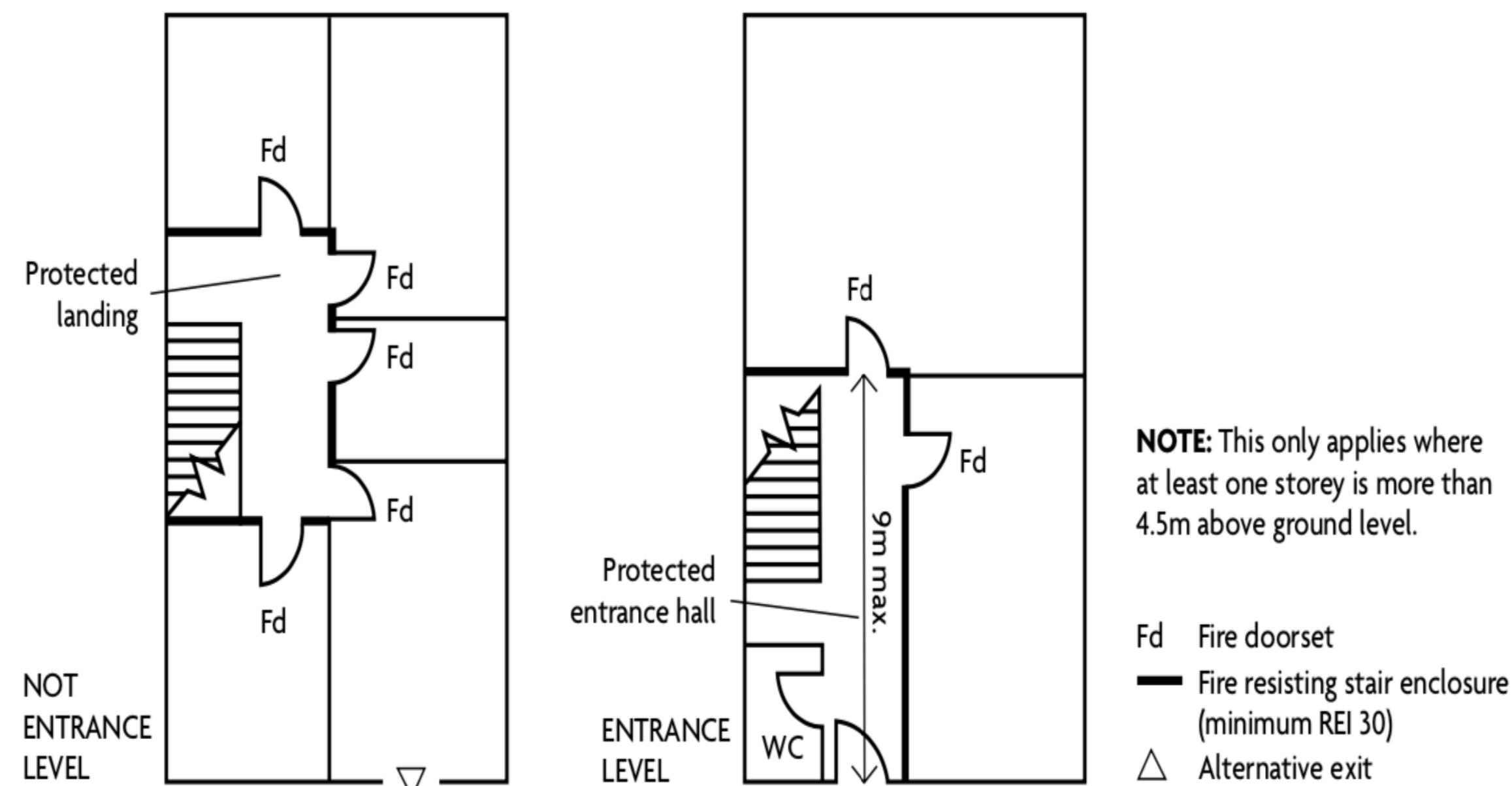


Diagram 3.6 Multi-storey flat with protected entrance hall and landing

Where the entrance floor level and the floors above/below do not exceed 7.5m, provide protected stairway, plus AFD in all habitable rooms and HD in the kitchen, or a protected staircase and sprinklers throughout.

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Apartments Common Escape

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Apartments common escape

- Single staircase guidance
- More than one staircase guidance

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Apartments common
escape

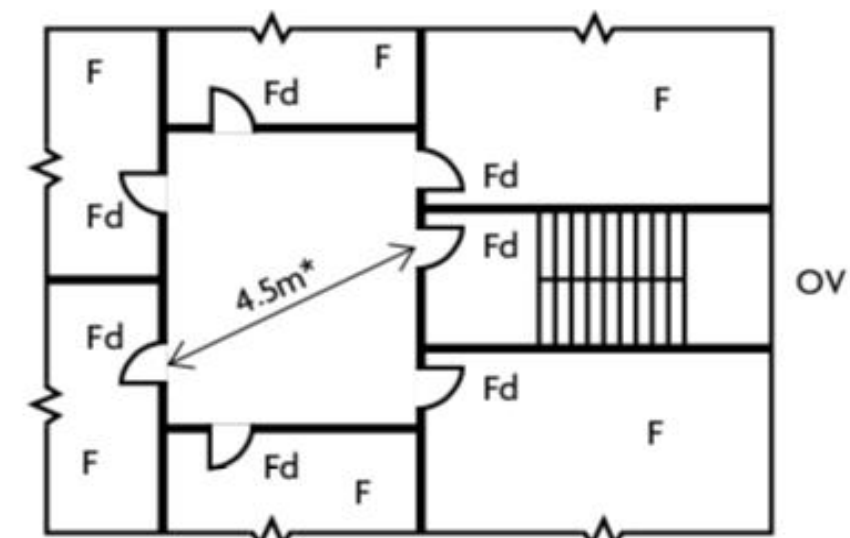
Small single-stair buildings

- Top floor not more than 11m above GL
- No more than 3 storeys above GL
- Does not connect to covered car park
- Does not serve ancillary accommodation unless protected with ventilated lobby
- High level 1.0m² OV at each floor, or single vent at head of stair operated at building access level



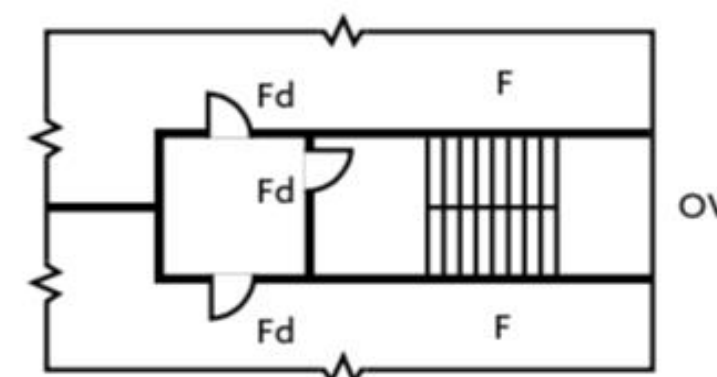
Apartments common escape

See para 3.28



a. SMALL SINGLE STAIR BUILDING

*If smoke control is provided in the lobby, the travel distance can be increased to 7.5m maximum (see Diagram 3.7, example b).



b. SMALL SINGLE STAIR BUILDING WITH NO MORE THAN TWO FLATS PER STOREY

The door between stair and lobby should be free from security fastenings.

If the flats have protected entrance halls, the lobby between the common stair and flat entrance is not essential.

NOTES:

1. The arrangements shown also apply to the top storey.
2. If the travel distance across the lobby in diagram (a) exceeds 4.5m, Diagram 3.7 applies.
3. Where, in Diagram (b), the lobby between the common stair and the dwelling is omitted in small single stair buildings, an automatic opening vent with a free area of at least 1m² is required at the top of the stair, which is operated automatically on detection of smoke at any storey in the stair.
4. For further guidance on the fire rating of the fire doorsets from the corridor to the flat and/or stairway refer to Appendix C, Table C1.

— Fire resisting construction

OV Openable vent at high level for fire service use (1.0m² minimum free area); see paragraph 3.28e

F Flat

Fd Fire doorset

Diagram 3.9 Common escape route in small single stair building

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Apartments common
escape

Single-stair but does not meet the definition for small single stair?

Diagram 3.7

- Note common lobby corridor smoke venting provisions and travel distances.
- BS 9991 provides flexibility on the travel distances in ventilated areas

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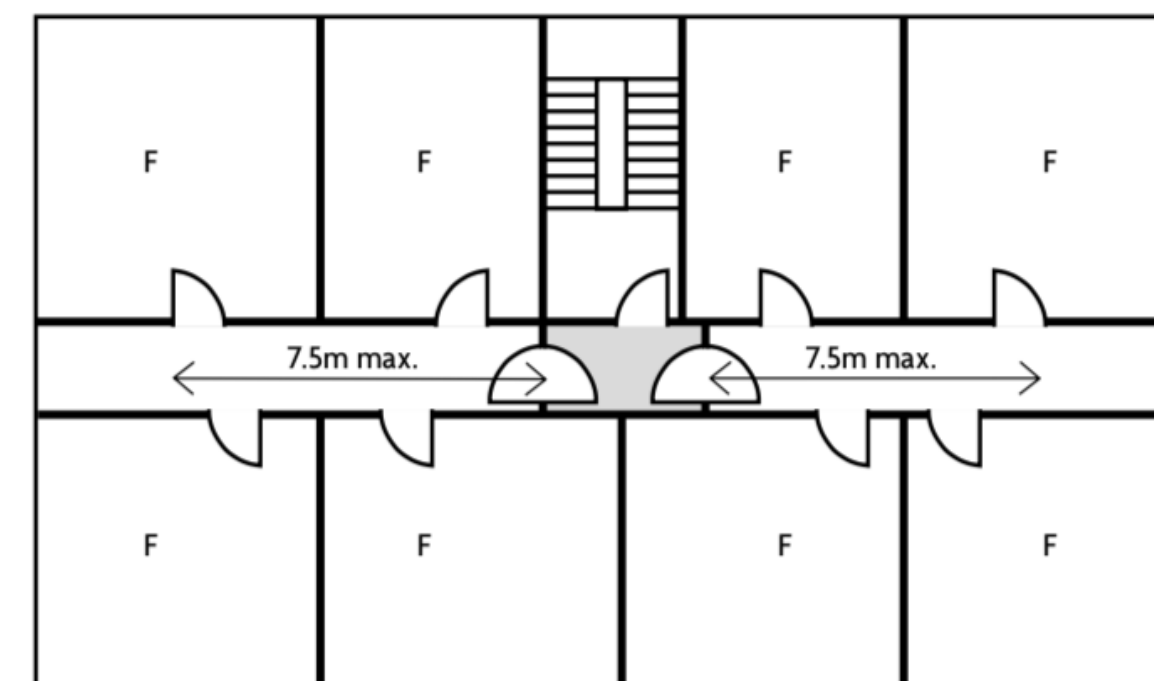


BS9991

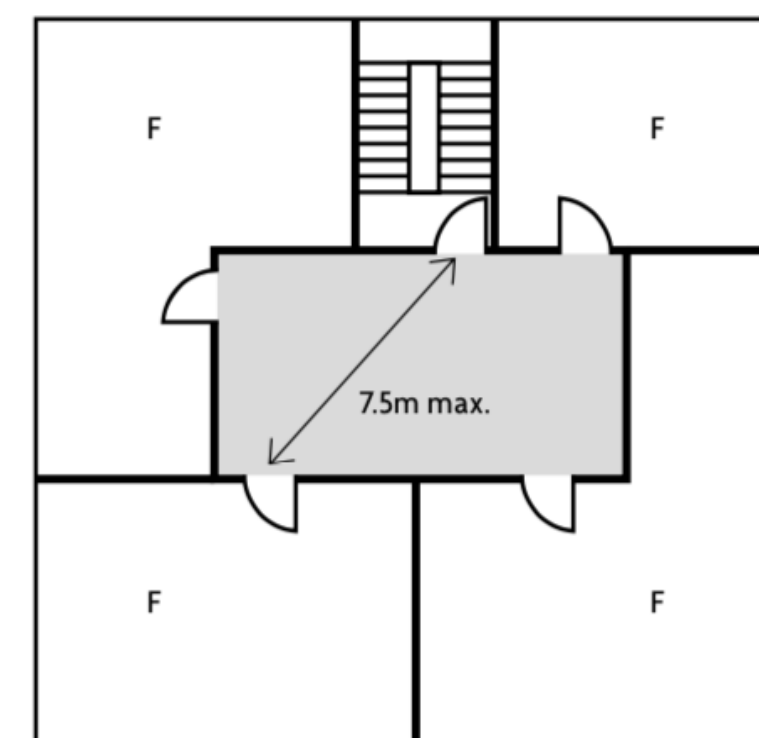
Max TD in Common Part 15m with sprinklers

See paras 3.27 and 3.36

a. CORRIDOR ACCESS FLATS



b. LOBBY ACCESS FLATS



NOTES:

1. The arrangements shown also apply to the top storey.
2. See Diagram 3.9 for small single stair buildings.
3. All doors shown are fire doorsets.
4. Where travel distance is measured to a stair lobby, the lobby must not provide direct access to any storage room, flat or other space containing a potential fire hazard.
5. For further guidance on the fire rating of the fire doorsets from the corridor to the flat and/or stairway refer to Appendix C, Table C1.

F Flat

■ Shaded areas indicate zones where ventilation should be provided in accordance with paragraphs 3.50 to 3.53 (An external wall vent or smoke shaft located anywhere in the shaded area)

Diagram 3.7 Flats served by one common stair

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See paras 3.27 and 3.36

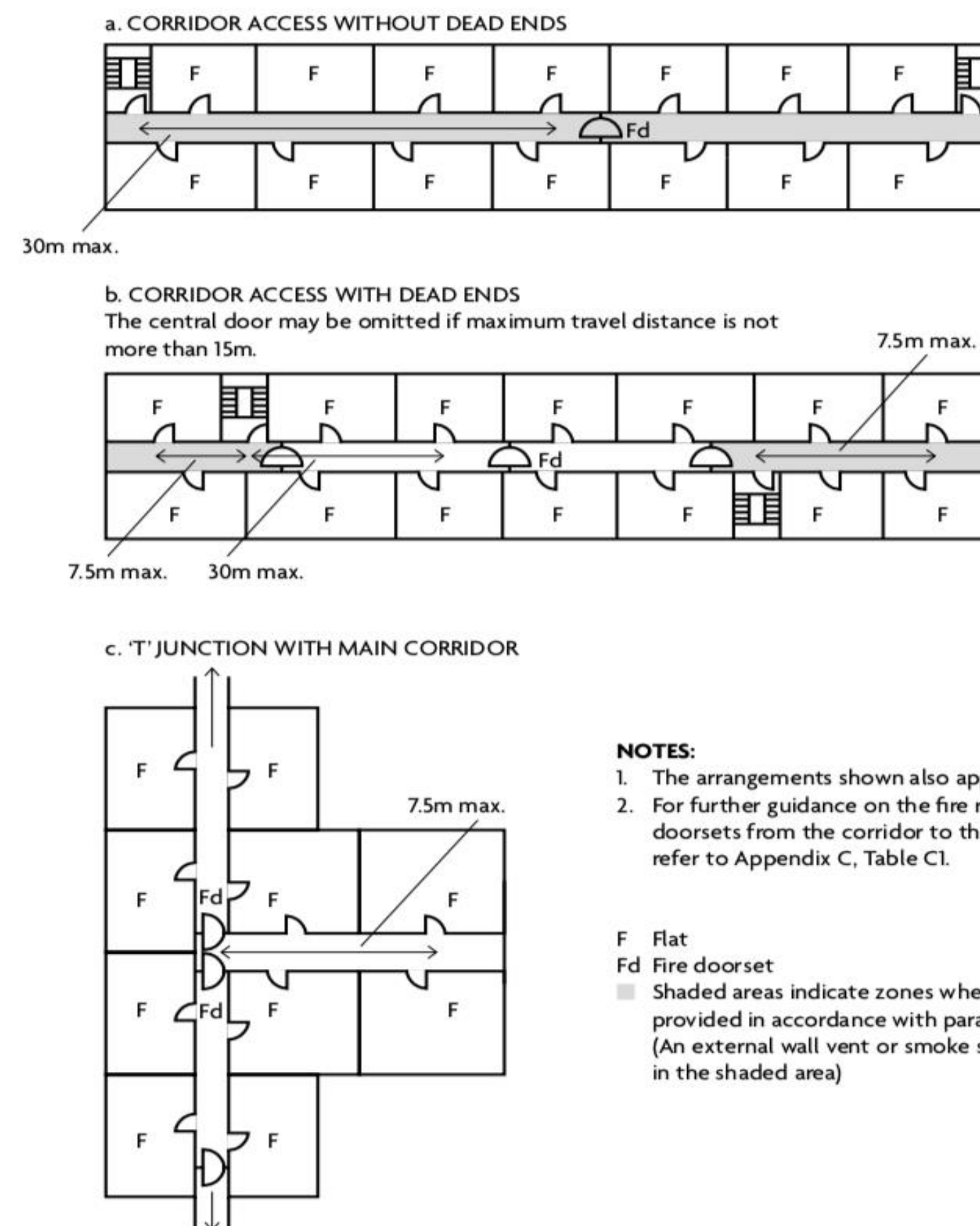


Diagram 3.8 Flats served by more than one common stair

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Smoke Venting Requirements

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Apartments common
escape

Smoke control in lobbies

- Locate as high as possible with top edge at least as high as the top of the stair door
- In **single stair buildings**, vents on the fire floor and at the head of the stair, should be actuated by AFD in the common parts
- Where there is **more than one stair**, the vent can be actuated manually, provided the vent at the head of the stair is opened before, or at the same time, as the vent on the fire floor



Apartments common
escape

Vent design

- Locate on external wall, free area 1.5m²
- Or
- Discharge into vertical smoke shaft



Apartments common
escape

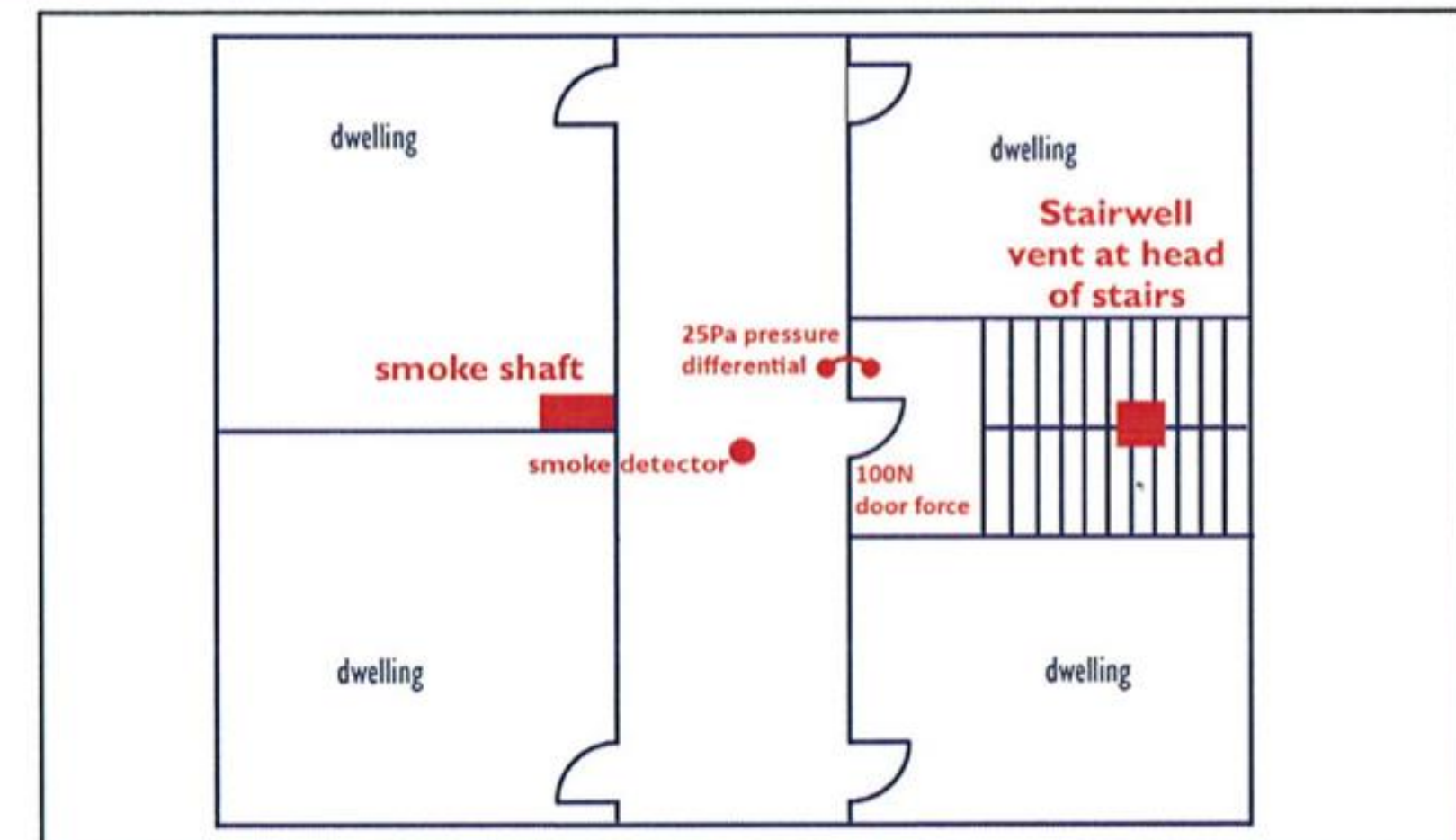
Min cross-sectional area 1.5m²
Min dimension 0.85m in any direction
Opening at roof at least 0.5m above adjacent structures
within 2.0m horizontally
Extend 2.5m above ceiling of highest storey
Non-combustible material
Vertical shaft with nmt 4m at an inclined max 30°
**Upon detection, the vent on the fire floor and at head
of staircase should open together (all other vents
should remain closed)**



Mechanical Smoke Vents-Make up Air

Replacement air

The automatic opening ventilator above the stairwell is used to provide replacement air for the smoke shaft. There is a risk of lobby depressurisation when using mechanical extract in confined spaces like residential buildings, which could make it difficult to open exit doors from the lobby. Common methods to overcome this are pressure sensing fan control, reverse hanging the stair/lobby door or automatically controlling the stair/lobby door.



Pressure sensing fan control monitors the pressure between the stair and lobby and controls the extract fan speed such that the maximum pressure difference remains within acceptable levels. Automatic opening of the stair/ lobby door uses a motorized actuator or door closer to open the stair door, usually a small distance, to ensure a flow of air into the lobby without allowing smoke to enter the stair.

It is possible to hang the stair/lobby door such that it opens into the lobby. When the extract system is operating the pressure difference is used to suck the door open allowing fresh air to enter the lobby. The pressure at which the door is pulled open is set by adjusting the door closer.

This can be a simple and effective solution if it is acceptable for the exit doors to open against the escape travel direction, but it is not suitable for buildings with extended travel distances where guaranteed replacement air is required.

To ensure effective smoke clearance, the extract shaft should be located as far away as practicable from the stairwell, which is the source of replacement air. This is particularly important in buildings with extended travel distance where the exhaust position would ideally be at least 5m away from the stairwell vent to prevent smoke being drawn into the building.

There is no risk of depressurisation with natural smoke shafts.

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Apartments common escape

Other relevant guidance

- Sub divide corridors that connect 2 or more exits
- No storage in single staircase buildings
- Escape over roof OK if not the only route
- For buildings with nmt -3 storeys stairs can serve other occupancies provided that they are separated with lobbies at all levels
- If more than 3 storeys, should be ancillary, have independent alternative escape and be lobbied



Apartments

B5 Access for fire fighting

Consider the height of the development

- The 45m rule applies from the pumping appliance to every point within the flats
- The hose laying distance is taken up the pitch of the flight and not vertically through the staircase enclosure
- Providing a dry rising main may be a suitable alternative

BS9991 allowances with suppression -Two storey 90m and Three storey 75m

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Height of top floor above external ground floor level 2020 changes

- > 11 metres? –
Mandatory suppression for Residential
Non-combustible walls
- > 18 metres? –
Dry Riser
Fire fighting shaft and lift required



Fire safety during construction

The CDM Regulations 2015
HSG 168 guide
UKTFA 16 steps guide

Identify the risks and mitigate

Maintaining Fire Safety after occupation
The Regulatory Reform (Fire Safety) Order 2005.

*Housekeeping, maintenance procedures
and Tolerable Risk*



Health and Safety
Executive

Fire safety in construction

Guidance for clients, designers and those managing and carrying out construction work involving significant fire risks



This is a free-to-download, web-friendly version of HSG168 (Second edition, published 2010). This version has been adapted for online use from HSE's current printed version.

You can buy the book at www.hsebooks.co.uk and most good bookshops.

ISBN 978 0 7176 6345 3
Price £10.95

Although the construction industry's performance has improved over the past decade, the rates of death, serious injury and ill health for construction site workers are still too high. When construction activities are not adequately controlled, children and other members of the public can also be killed or injured, and property adjacent to construction sites be put at risk – for example, from a site fire large enough to spread off-site.

The guidance will be extremely useful to all those who have a role in the development, management and application of fire safety standards on construction sites, ie clients, designers, contractors and CDM co-ordinators. It will also support those with legal responsibilities under the Construction (Design and Management) Regulations 2007, the Regulatory Reform (Fire Safety) Order 2006 and the Fire (Scotland) Act 2005, while assisting site managers in the day-to-day management of fire risks on site.



STRUCTURAL
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Specialised housing

- Cluster accommodation -BS9991
- Sheltered, Retirement, Assisted flats-BS9991
- Shared house -LaCors Guide
- Bedsits -LaCors guide

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Cluster accommodation

BS 9991:2015

BRITISH STANDARD

9.8 Cluster accommodation

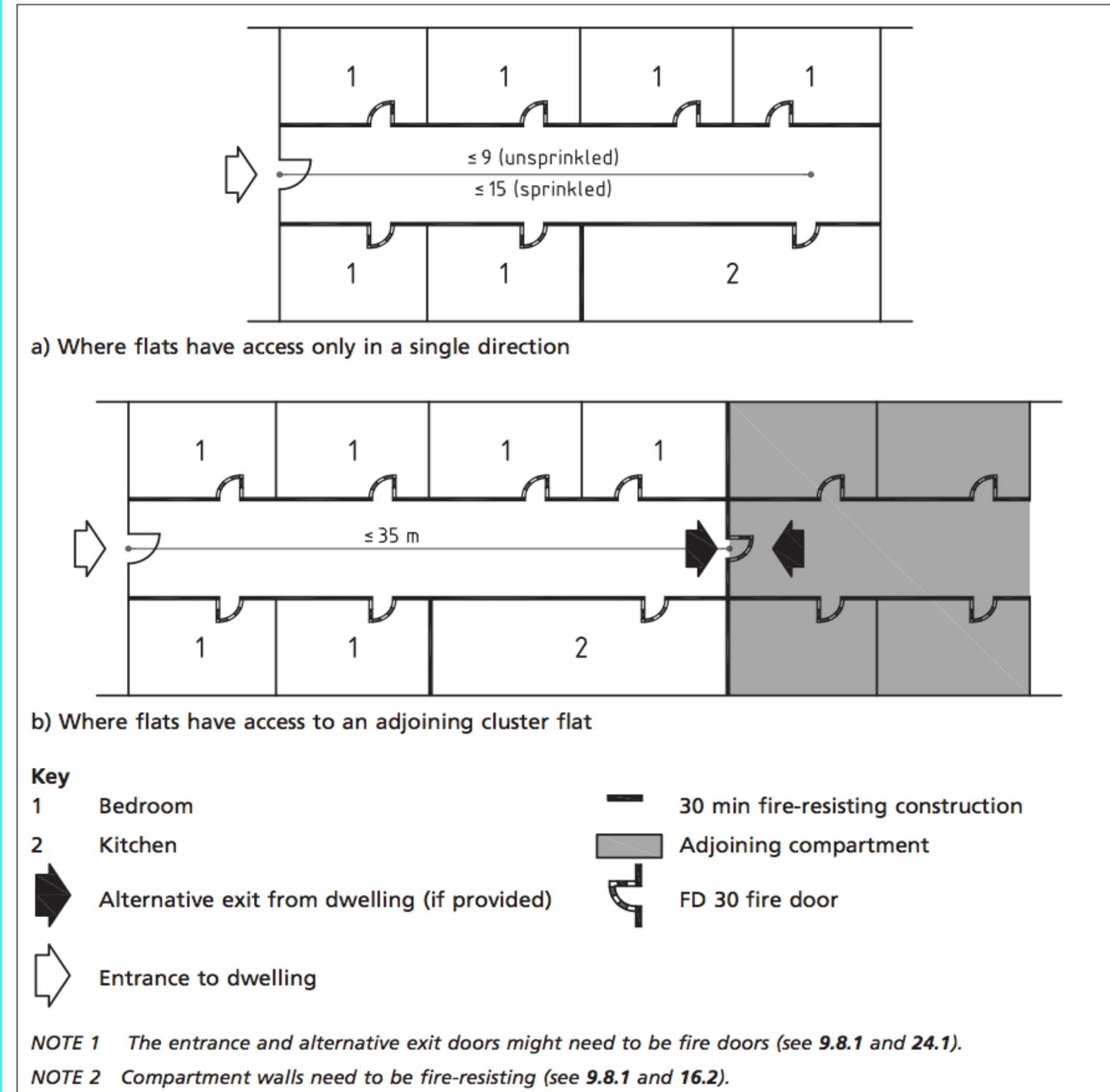
COMMENTARY ON 9.8

Clusters of flats are a common arrangement found in purpose-built modern student accommodation. They are similar in layout to flats but often have more bedrooms and no living spaces apart from a shared kitchen. A typical cluster accommodation layout is shown in Figure 16. Studio flats are not considered to be suitable for cluster accommodation and are to be treated as flats (see 9.4.2). For HMOs, refer to 0.3 for guidance.



Cluster accommodation

Figure 16 Typical cluster accommodation layout



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LaCors Guide

35. Shared houses



HMO shared house

- 35.1 There is no legal definition of a ‘shared house’ and so this term can sometimes cause confusion. Whilst shared houses fall within the legal definition of an HMO (see Appendix 1, paragraph A.32) and will be licensable where licensing criteria are met, it is recognised that they can often present a lower fire risk than traditional bedsit-type HMOs due to their characteristics.



HMO shared house

35.2 For the purposes of this guidance, shared houses are described as HMOs where the whole property has been rented out by an identifiable group of sharers such as students, work colleagues or friends as joint tenants. Each occupant normally has their own bedroom but they share the kitchen, dining facilities, bathroom, WC, living room and all other parts of the house.



HMO shared house

All the tenants will have exclusive legal possession and control of all parts of the house, including all the bedrooms. There is normally a significant degree of social interaction between the occupants and they will, in the main, have rented out the house as one group. There is a single joint tenancy agreement. In summary, the group will possess many of the characteristics of a single family household, although the property is still technically an HMO as the occupants are not all related.



LaCors case study example

figure D5: shared house, three or four storeys

Grade D, LD3 – see 22

30 minute FD30 fire doors to all risk rooms – no smoke seals

Simple multi-purpose fire extinguisher on each landing

30 minute fire resisting construction throughout escape routes



Walls and floors between rooms of sound traditional construction

Smoke detector in lounge

Heat detector in kitchen

Fire blankets in rooms with cooking facilities



HMO Bedsits

LaCors Guide

Bedsit-type HMOs

These are HMOs which have been converted into a number of separate non-self-contained bedsit lettings or floor-by-floor lets. Typically there will be individual cooking facilities within each bedsit, but alternatively there may be shared cooking facilities or a mixture of two. Toilets and bathing/washing facilities will mostly be shared. There is unlikely to be a communal living or dining room. Each bedsit or letting will be let to separate individuals who will live independently, with little or no communal living between tenants. Each letting will have its own individual tenancy agreement and there will usually be a lock on each individual letting door.



LaCors case study example

figure D8: bedsit-type HMO, three or four storeys

AFD mixed system Grade A, LD2 and grade D – see 22

Simple multi-purpose fire extinguisher in common parts on each floor

Emergency escape lighting in escape route if complex/dark

Fire exit sign indicates way out

Fire alarm panel on inside wall adjacent to exit door



Sound, traditional construction between units

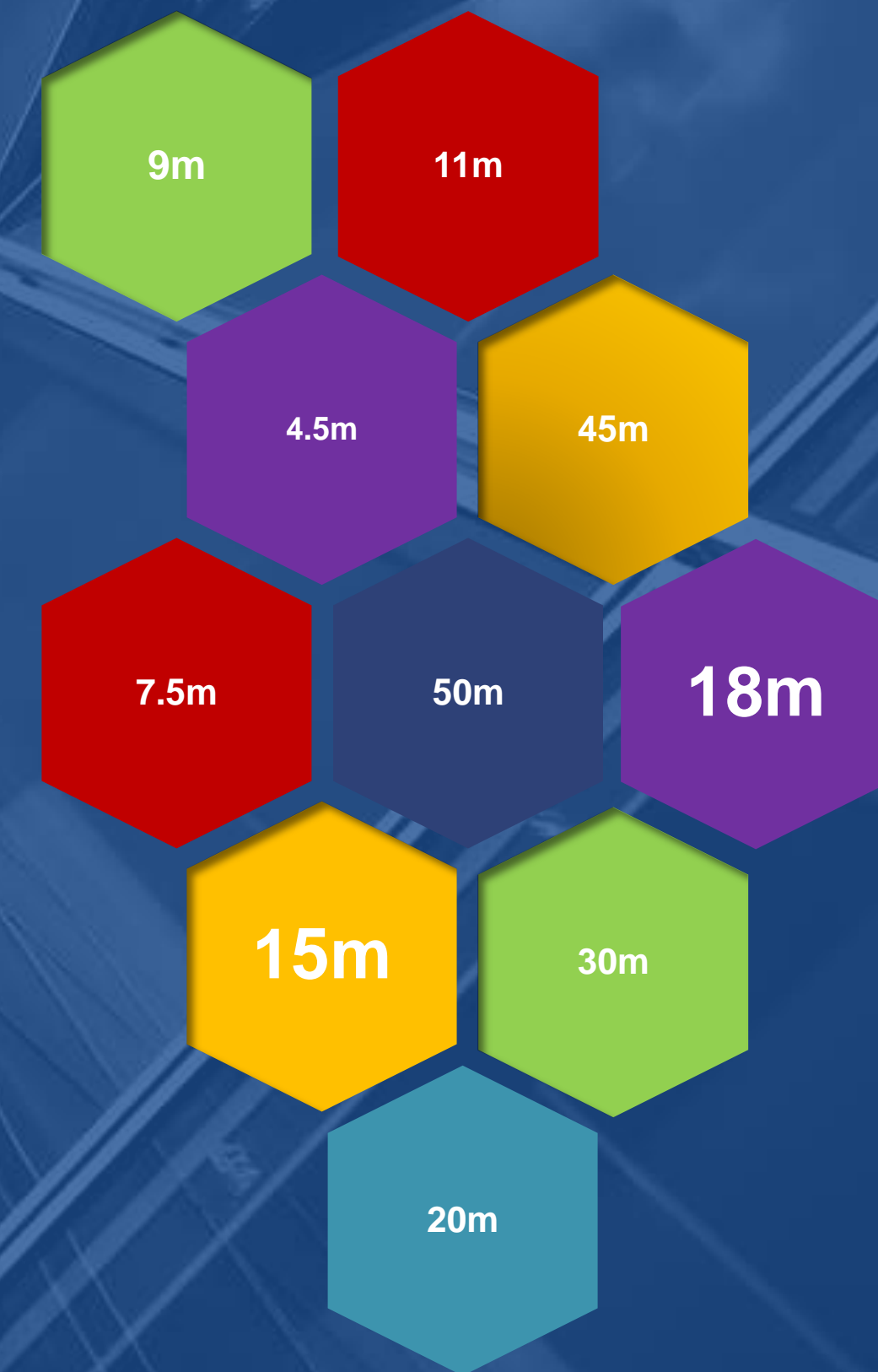
Additional grade D non-interlinked smoke detector in bedsits with cooking facilities

30 minute fire resisting construction throughout escape route

Fire blanket in rooms with cooking facilities

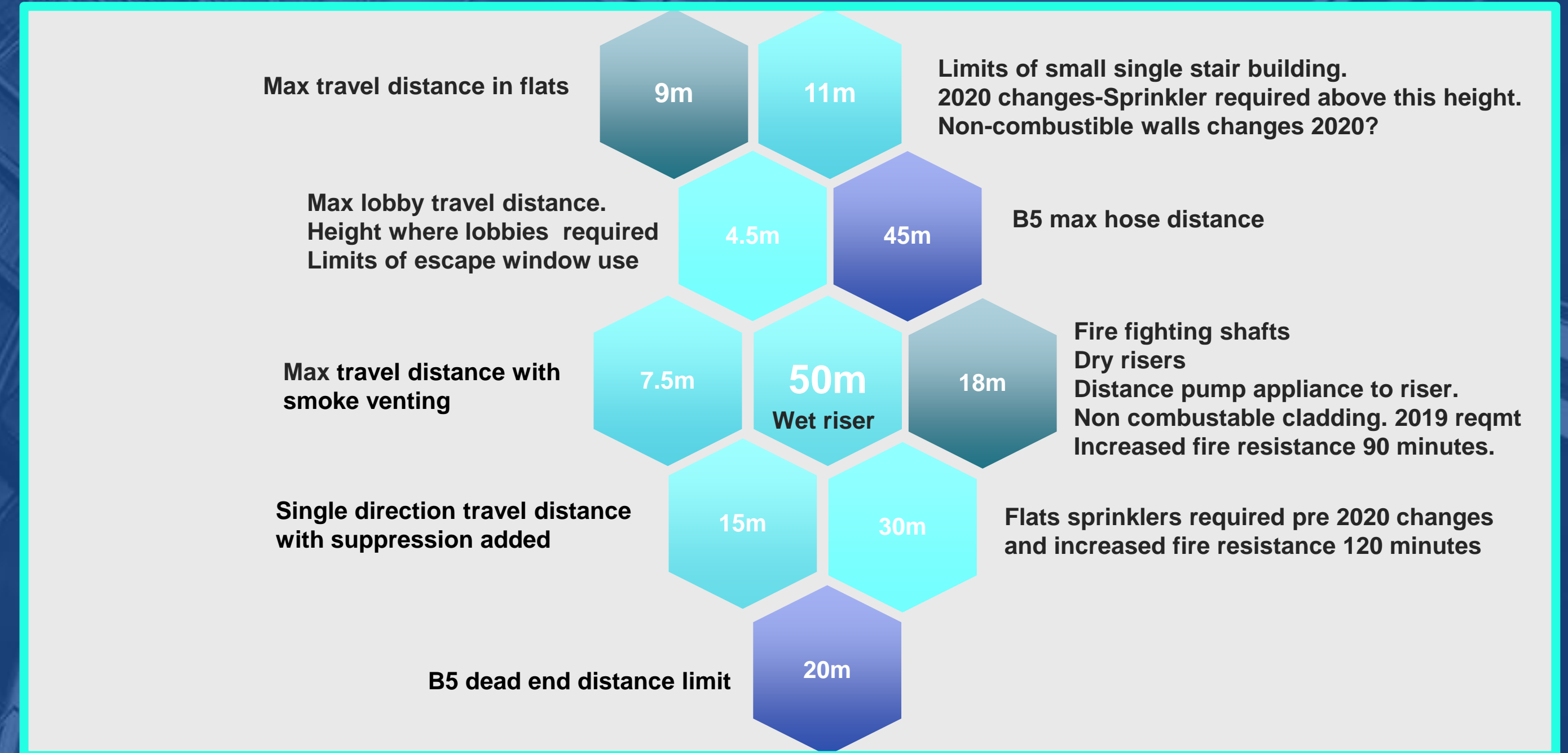
30 minute FD30S fire doors to all risk rooms

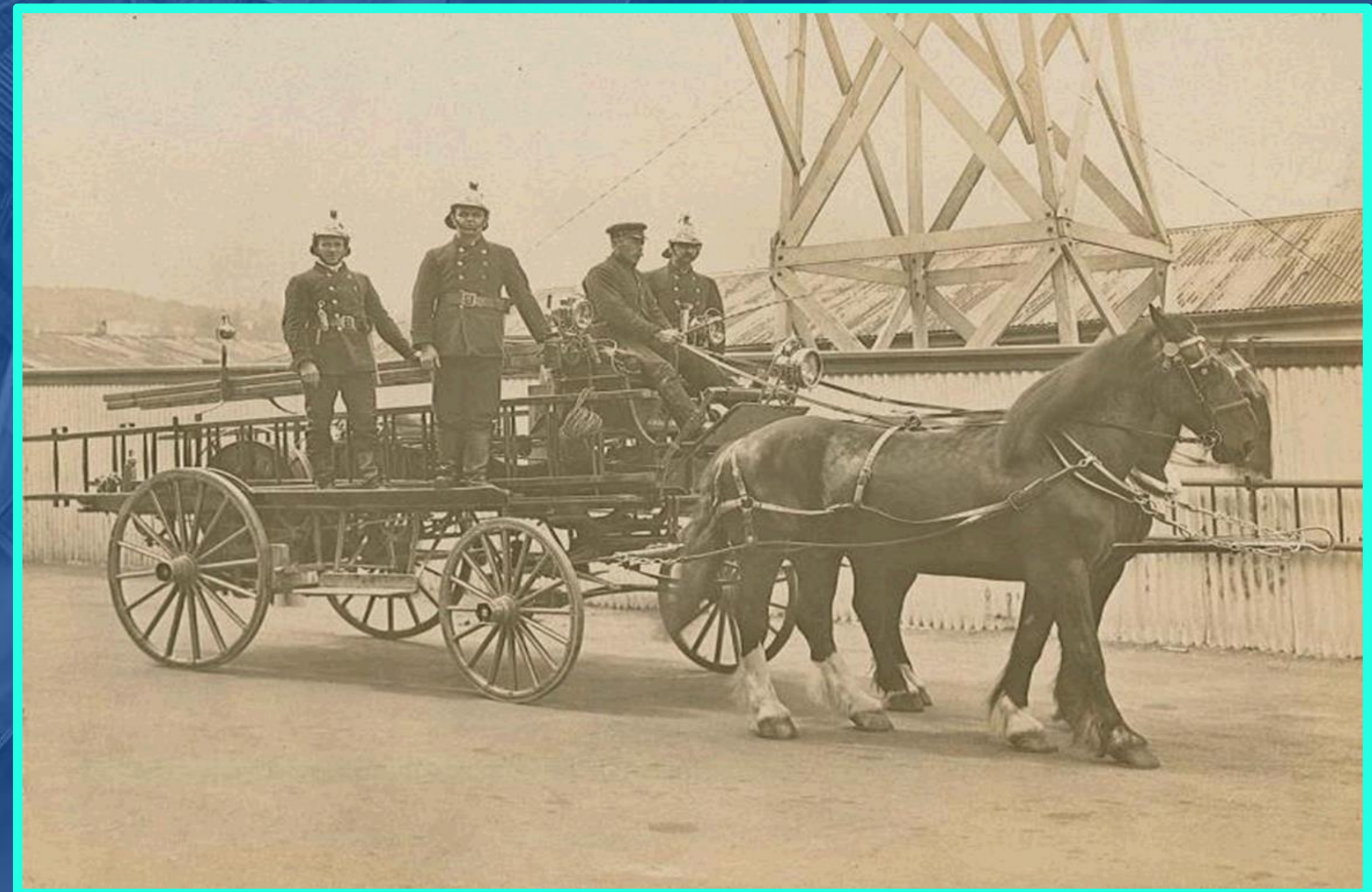
Heights and distances Design Change Points



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Heights and distances Design Change Points





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Any questions?



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Thank you for listening

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